August 25, 2010

083-82671.1

Mr. Larry Hatcher
Progress Energy Florida
Plant Manager
15760 West Powerline Street
Crystal River, FL 34428

RE: SUPPORTING TECHNICAL INFORMATION
ASH DISPOSAL AREA
PROPOSED VERTICAL EXPANSION
CRYSTAL RIVER, FLORIDA

Dear Mr. Hatcher:

Golder Associates Inc. (Golder) is pleased to submit four copies of supporting technical information for the proposed vertical expansion of the ash disposal area. I certify that the calculations and drawings associated with the proposed vertical expansion of the ash disposal area were performed under my direction and that I have checked them for completeness and accuracy. Specifically, this information includes:

1. Hydrogeological and Geotechnical Site Evaluation (dated 7/22/2010)
2. Vertical Expansion Stormwater Calculations (dated 7/22/2010)
3. Ash Storage/Disposal Area Vertical Expansion Drawings (dated 7/22/2010)

If there are any questions on any of the information presented herein, please contact us.

Sincerely,

GOLDER ASSOCIATES INC.

K. B. Karably

KENNETH B. KARABLY LICENSE No. 42366 STATE OF FLORIDA PROFESSIONAL ENGINEER

Kenneth B. Karably
Florida Professional Engineer No. 42366

Date: 8/25/2010

Enclosures

DEPARTMENT OF ENVIRONMENTAL PROTECTION
SEP 10 2010
SITING COORDINATION

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HYDROGEOLOGICAL AND GEOTECHNICAL SITE EVALUATION ASH STORAGE/DISPOSAL AREA VERTICAL EXPANSION

CRYSTAL RIVER ENERGY COMPLEX
CRYSTAL RIVER, FLORIDA

Prepared for: Progress Energy Florida, Inc.
15760 West Powerline Street
Crystal River, Florida 34428

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Date: 7/22/2010

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1.0 INTRODUCTION

1.1 Background

Progress Energy Florida (PEF) is planning to vertically expand the ash disposal area at the Crystal River Energy Complex (CREC) in Crystal River, Florida. The CREC consists of five generating units. Units 1, 2, 4 and 5 are coal-fired steam units and Unit 3 is nuclear power plant. Units 3, 4, and 5 are certified under PA77-09A2 (FDEP, August 28, 2008). Units 1 and 2 were built in the 1960s and, as such, pre-date the Power Plant Siting Act. The ash disposal area at CREC was originally certified under the Units 4 and 5 Conditions of Certifications for the disposal of spent fly ash and bottom ash from Units 4 and 5 and was subsequently modified to include spent fly ash and bottom ash from Units 1 and 2. The proposed vertical reconfiguration will include expanding the maximum storage height from 80 feet above grade to 120 feet above grade and a steepening of the side-slopes from 4 horizontal to 1 vertical (4H:1V) to 3 horizontal to 1 vertical (3H:1V).

PEF retained Golder Associates Inc. (Golder) to conduct a combined hydrogeological and geotechnical site evaluation for the vertical expansion of the ash disposal area, which is located in the northeast corner of the CREC property (see Figure 1). The scope of work was organized to substantially satisfy Florida Department of Environmental Protection (FDEP) requirements for hydrogeological and geotechnical investigations and vertical expansion requirements (including slope stability calculations, settlement calculations, stormwater management system design calculations and proposed final cover design) as outlined in Chapter 62-701, Florida Administrative Code (FAC).

1.2 Site Description

The CREC facility is located near the Gulf of Mexico in Citrus County, Florida. The CREC encompasses approximately 4,750 acres and is situated in portions of Sections 28 through 36, Townships 17 South, Range 16 East and Sections 3, 4, 5, 9, and 10, Township 18 South, Range 16 East (Golder, 2007). The center of the CREC is at approximately 28°57’50” latitude and 82°41’41” west longitude. Access to the Site is from West Powerline Street.

The ash disposal area is located in the northeastern corner of the CREC property and currently encompasses approximately 62 acres for coal combustion product (CCP) storage. The ash disposal area is comprised of separate storage piles for fly ash, high chloride ash, commingled materials, Units 1 and 2 bottom ash and Units 4 and 5 bottom ash. Figure 2 presents the October 2009 topographic survey of the ash disposal area.

1.3 Report Organization

This report is divided in six sections as follows:

- Section 1.0 presents general background information on the site and the proposed reconfiguration;
- Section 2.0 describes the various methods of investigation and the types of data collected with those methods;
- Section 3.0 describes the regional and site-specific geologic conditions;
- Section 4.0 describes the regional and site-specific hydrogeological conditions;
- Section 5.0 summarizes the findings of the geotechnical investigation and analyses of the Site;
- Section 6.0 summarizes the recommendations; and
- The appendices include field and laboratory data and calculations packages for the various analyses.

2.0 SITE INVESTIGATION

2.1 Scope of Investigation

The field investigation was designed to combine the data needs for both the hydrogeological and geotechnical studies. The field investigation was undertaken to characterize the geology, hydrogeology, and engineering properties of the foundation soils for the ash disposal area.

Specifically, the scope of work for the hydrogeological and geotechnical field program included: the drilling of soil borings sampled with standard penetration test (SPT) split spoons to determine subsurface stratigraphy and to obtain soil samples for geotechnical laboratory testing; the performance of cone penetrometer testing (CPT) to supplement strength characteristics obtained from SPT borings, the installation of temporary wells to determine groundwater flow characteristics; sampling of groundwater in temporary wells to determine groundwater quality conditions; the performance of in-situ slug/recovery tests to estimate the hydraulic conductivity of the various units screened by the temporary wells; and geotechnical laboratory testing to quantify soil properties. More detailed descriptions of the site investigation procedures used are included in the sections that follow.

2.2 SPT Borings

A total of thirteen (13) standard penetration test (SPT) soil borings were drilled and sampled in October 2009. Seven (7) perimeter SPT borings (PB-1, PB-2, PB-3, PB-4, PB-4B, PB-5 and PB-6) were advanced to depths ranging from 20 to 58 feet below ground surface (bgs) to obtain data from the foundation materials at the ash disposal area. In conjunction with the installation of temporary well TW-5, a boring was advanced to 20 feet bgs. An additional six (6) ash SPT borings (AB-1 through AB-6) were advanced through the ash storage piles and into the foundation materials at depths ranging from 65 to 100 feet bgs to obtain data on in-place ash and foundation materials. All of the soil borings were advanced using an all-terrain vehicle (ATV)-mounted drill rig supplied and operated by WPC, Inc (WPC) of Jacksonville, Florida. Mud rotary drilling techniques were used for borehole advancement, and SPT soil samples were collected in each of the borings using conventional split-spoon sampling equipment or Shelby tubes in general accordance with the procedures outlined by ASTM D-1586. The borings were sampled 5 feet on-center to the termination depth. The soil boring locations are shown on Figure 3. Boring logs are included in Appendix A.

All field work was monitored by a Golder engineer who located the subsurface exploration and temporary well locations in the field, logged the boreholes, recorded the results of the field testing, and cared for the samples obtained. Select samples recovered from the boreholes were transported to Golder's geotechnical laboratory in Atlanta, Georgia for further examination and testing.

2.3 Temporary Monitoring Well Installation

2.3.1 General

Four (4) temporary monitoring wells (designated TW-1 through TW-4) were installed by WPC around the perimeter of the ash disposal area in October 2009. After preliminary discussions with FDEP staff, a fifth temporary well, designated TW-5, was installed by WPC in December 2009. The locations of the temporary wells are shown on Figure 3. The temporary wells were installed to access groundwater conditions, including: groundwater elevations; upgradient and downgradient groundwater quality; and hydraulic conductivities in the Upper Floridian aquifer zone.

The temporary wells were installed using hollow stem auger drilling techniques to an approximate depth of 20 feet bgs. A summary of the temporary well construction details information is presented in Table 1. A field boring log for the boring adjacent to each of the temporary wells is provided in Appendix A. Temporary well installation logs are included in Appendix B.

2.3.2 Construction Details and Methods

The five temporary monitoring wells were installed at a depth of 20 feet bgs to within the Upper Floridian aquifer zone. The temporary wells were constructed inside a 4.25-inch inside diameter hollow stem auger that had been advanced to the design depth. The temporary monitoring wells were constructed using 2-inch diameter, Schedule 40 PVC with flush threaded joints and a 10-foot length of 0.010-inch machine slotted screen. In the temporary well, the sand filter pack was constructed using 20/30 grade silica sand to a depth of 2 to 3 feet above the top of the screened interval, followed by a 2 to 3 feet thick bentonite pellet seal. The remaining annular space for the temporary wells was filled with 20/30 grade silica sand to the ground surface.

The soil cuttings, development water, and drilling mud produced during drilling activities were spread out on the ground surface near the temporary well or boring location under the direction of PEF personnel. All drilling equipment associated with temporary well installation was decontaminated prior to each use. The decontamination process included a thorough pressure washing of all appropriate drilling equipment.

Following installation, the temporary wells were developed for a minimum of 30 minutes each. The temporary wells were pumped using the drill rig's piston displacement pump and tremie pipe extended to the bottom of the temporary well screen. Temporary monitoring well development was performed to remove relic effects of the drilling and temporary well installation process and to establish good hydraulic connection between the temporary well and the formation.

2.4 Cone Penetration Test Soundings

In order to collect detailed subsurface data for the ash storage piles that would complement SPT data and provide useful output that could be directly imported into settlement analyses, a total of eleven (11) cone penetration test (CPT) soundings were completed by WPC of North Charleston, South Carolina in October 2009 at the site. CPT has some advantages over SPT in that the output is continuous rather than discrete depth intervals often collected during SPT drilling, in general, the data is less subject to bias from equipment and human factors, and the testing procedure is generally quicker and less expensive on a per foot basis than SPT drilling. The limitation on CPT is that the probe cannot penetrate thick, hard layers in the subsurface that may exist within the natural soil profile. For these reasons, and also due to that large area that required investigation, both SPT and CPT methods were employed successfully to gather geotechnical data. The locations of the CPT soundings are presented on Figure 3. The first two locations (CPT-1 and CPT-2) were located adjacent to SPT borings for the purposes of correlating CPT data to known stratigraphy and checking CPT values against SPT results. WPC's track-mounted CPT rig advanced soundings to depths ranging from 10 to 59 feet bgs. During the soundings, the CPT operator continuously recorded depth, tip resistance, sleeve friction resistance, and dynamic pore pressure. Using these parameters, Robertson (1990) developed empirical relationships that can be used to identify the type of soil that the probe is penetrating at any given depth. This relationship (designated Soil Behavior Type or SBT) is presented as a description in the far right column of the CPT log. In addition to the lithologic interpretation, WPC provides an interpretation of the data using software that converts the CPT data to SPT values corrected for overburden pressure that can be imported to a spreadsheet for use in settlement analysis. The CPT soundings were conducted in general accordance with the procedures outlined by ASTM D-5778. All CPT field work was monitored by a Golder engineer who located the soundings in the field and observed the logging procedures. The results of the CPT tests are included in Appendix A.

2.5 Groundwater Sampling

In October 2009, groundwater samples were collected from the initial four temporary monitoring wells (TW-1 through TW-4). In January 2010, groundwater samples were collected from TW-5. The groundwater samples were analyzed for metals including aluminum, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, molybdenum, nickel, selenium, sodium, vanadium, and zinc by Method SW-846 6010; metals including antimony and thallium by Method SW-846 6020; ammonia by Method EPA 350.1, chloride by Method SM 4500-Cl-E; cyanide by Method SM 4500-CN-E; fluoride by Method EPA 300.0; gross alpha by Method EPA 900.0; nitrate and nitrite by Method SM 4500-NO3-F, radium 226 and 228 by Method EPA 903.1 and Ra-05; sulfate by Method EPA 375.4; total dissolved solids by Method EPA 160.1; total Kjeldahl nitrogen by Method EPA 3512 and total nitrogen.

Prior to purging each temporary well, the depth to groundwater was measured to determine the volume of water to be evacuated from each temporary well. Following determination of the appropriate purge volume, dedicated polyethylene tubing was installed in the temporary well to the screened interval or the top of the water column in the temporary well as required and a peristaltic pump was connected to the discharge end of the tubing. The temporary well was purged under low flow conditions until the required purge volume had been removed as per FDEP Standard Operating Procedures (SOPs) for groundwater sampling, in-situ water quality parameters stabilized, and turbidity values were below 20 NTUs, or until turbidity values were stabilized in three successive measurements taken with at least one well volume purged between measurements. In-situ water quality parameters were monitored during temporary well purging activities including specific conductance, pH, temperature, dissolved oxygen and turbidity. Field instruments were calibrated according to the manufacturer's instructions and FDEP SOP requirements. Groundwater sampling forms and equipment calibration logs are included in Appendix F.

Groundwater samples were collected directly from the effluent tubing under low flow conditions for samples to be analyzed for inorganics and metals analyses. All groundwater samples were placed directly into pre-preserved, decontaminated containers provided by Advanced Environmental Laboratories, Inc (AEL) of Jacksonville, Florida and the sample containers were immediately placed in a cooler packed with ice for sample preservation. The samples were hand delivered to AEL under appropriate chain-of-custody procedures within 48 hours of sample collection.

2.6 Hydraulic Conductivity Testing

Hydraulic conductivity (slug) tests were conducted by Golder in the temporary monitoring wells installed in October 2009 following well development. The slug tests were performed a minimum of three times on each temporary well. Slug tests involved placing a pressure transducer, which was connected to an electronic data logger, into a temporary well below the water table. After securing the transducer to the temporary well, a weighted cylinder (the “slug”) was inserted into the temporary well. The water level changes that occurred in the temporary well in response to inserting the slug were recorded by the data logger. The water level changes following removal of the slug from the temporary well were also recorded by the data logger.

Following completion of the slug tests, the data were downloaded from the data logger to a computer program for analysis. The raw data were configured into a specific format then loaded into a computer program, which calculated the value of hydraulic conductivity using the water level changes and temporary well construction information. The slug-in data (water level changes when the slug was inserted into the temporary well) and slug-out data (water level changes observed when the slug was removed from the temporary well) were plotted as a curve representing the change in water level versus the elapsed time of the test.

With the software program, the user selects a best fit straight line through the plotted data indicative of an idealized aquifer response using both the Hvorslev (1951) and Bouwer and Rice (1976) methods. The best fit straight line is interpreted to represent the response of the aquifer material in the vicinity of the well and excludes data points which were likely representative of the response of the sand filter pack. Using the water level response curve and performing a series of calculations, an estimated value for the hydraulic conductivity of the aquifer in the vicinity of the well was calculated. Output from the slug test analysis program is included in Appendix C.

2.7 Geotechnical Laboratory Testing

In order to check visual descriptions and determine physical properties of some of the soils present at the site, a geotechnical laboratory testing program was conducted on samples obtained from field borings. Select disturbed SPT sample laboratory testing included grain size distribution (sieve) and hydrometer analysis, and moisture content. Consolidated-drained triaxial shear tests were completed for undisturbed samples collected from the ash SPT borings. A summary of the tests performed and results are included in Section 5.0 of this report (Geotechnical Data Evaluation). Appendix D to this report includes the results of the geotechnical laboratory testing.

3.0 REGIONAL AND SITE-SPECIFIC GEOLOGY

3.1 Physiography

Citrus County is located within the Central or Mid-Peninsular Zone. The principal physiographic features within Citrus County are the Tsala Apopka Plain, Brooksville Ridge, and Gulf Coastal Lowlands (White, 1970). The Site is located in the Gulf Costal Lowlands which make up the western part of the county and consist of marine terraces and coastal swamps, including an area of paleokarst features which may be thinly covered by clastic sediments. Surface elevations of the lowlands range from sea level to 100 feet above sea level (USDA-SCS, 1988).

3.2 Climate

The climate in Citrus County is characterized by long, relatively humid summers and mild, dry winters. The mean temperature during July (the warmest of the summer months) is 81.5 degrees Fahrenheit (°F), while during January (the coldest of the winter months) the mean temperature is 56.9°F. During the summer, the average high temperature in July is 92.6°F and during the winter, the average low temperature in January is 44.0°F (National Weather Service, Inverness, Florida).

The majority of the rainfall in Citrus County occurs as short duration afternoon or early evening thundershowers, occurring most frequently in the summer months (June to September). Rainfall patterns can be affected by tropical disturbances, which can provide large amounts of rain in a short period of time. Precipitation in Citrus County occurs primarily as rainfall, with an average annual rainfall of 54.0 inches calculated from 1915 to 2008. The highest yearly rainfall total recorded during that time was 84.6 inches (in 1960) and lowest yearly rainfall total was 32.12 inches (in 1917) (Southwest Florida Water Management District rainfall data summary county totals).

3.3 Regional Geology

In the general area of the Site, the generalized geological profile within the top 500 feet of the subsurface, in descending order from land surface, consists of:

- Undifferentiated Pleistocene and Recent Deposits - Low-lying portions of the modern Florida peninsula were submerged during the Pleistocene series of sea level transgressions, which are believed to have been as much as 60 feet above the present sea level. The Pleistocene and Holocene (Recent) surficial deposits are undifferentiated and represented by a thin veneer of sand and shell, alternating with clayey sands and sandy clays. These sediments overlie most of Citrus County and their thickness may vary substantially, according to relict sea stands and the surface of the underlying limestone (Golder, 2007). The Gulf Costal Lowlands surface deposits are composed of light colored medium to fine grained poorly consolidated quartz sand and silt with local deposits of organic material in swamps and other depressions (Spencer, 1984).

- Upper Eocene Ocala Group Limestone - Late-Eocene limestone that is generally characterized as a tan to buff, soft, granular to massive, porous crystalline marine limestone (lower portion) to a white to cream weathered chalky massive marine limestone in boring (upper portion) (Randazzo and Jones, 1997). The Ocala Group limestone consisting of the Inglis Formation, Williston Formation and the Crystal River Formation is variable in thickness and may be as much as 200 feet thick (Golder, 2007).
- Tertiary Middle Eocene Avon Park Limestone - In Citrus County the Avon Park Limestone can be a dolomite, or limestone with varying degrees of dolomitization. Where the lithology is that of a dolomite the grain size varies from microcrystalline (silt-sized) to very fine grained. When the Avon Park is lithologically a limestone it is white or cream to brown and gray. The limestone is cryptocrystalline to very fine grained, thin bedded or laminated with organic flecks and seams (Spencer, 1984).

3.4 Site Geology

3.4.1 Geologic Investigation Methods and Data Review

The lithology at the site was interpreted primarily from the descriptions of subsurface samples, as reported on the soil boring logs from the October 2009 site investigation. Golder drilled seven (7) perimeter SPT soil borings (PB-1, PB-2, PB-3, PB-4, PB-4B, PB-5 and PB-6) to depths ranging from 20 to 58 feet bgs and advanced six ash SPT soil borings (AB-1 through AB-6) through the ash piles and into the foundation materials at depths ranging from approximately 16 to 66 feet below the base of the ash monofill.

Based on the review of the lithologic data collected during this investigation, it appears that the stratigraphic units penetrated by temporary wells and borings in the vicinity of the site include various types of ash, the undifferentiated Pleistocene to recent deposits and the Ocala Group limestone. Site-specific stratigraphic cross-sections were prepared using lithologic information from selected borings drilled at the Site. A plan showing the borings used and the cross-section locations is presented as Figure 3. Cross-section A-A', representing a north/south transect along the western portion of the Site, is shown as Figure 4. Cross-section B-B', representing a north/south transect along the eastern portion of the Site, is shown as Figure 5. Cross-section C-C', represents an east/west trending transect along the northern portion of the Site, is shown on Figure 6. Cross-section D-D', representing a generally east/west transect along the southern portion of the Site, is shown on Figure 7. Copies of the boring logs used for the site-specific cross sections are presented in Appendix A.

3.4.2 Coal Combustion Products

The ash borings were drilled in various types of coal combustion products stored in the ash disposal area, including: Units 1 and 2 bottom ash, high chloride ash, commingled materials, fly ash, and Units 4 and 5 bottom ash. The Units 1 and 2 bottom ash was encountered in boring AB-1 and was generally described as loose to compact, grey/dark grey/orange, fine to coarse sand. The high chloride ash was encountered in boring AB-2 and was generally described as loose to dense, dark grey/green, silty sand with sporadic gravel. The commingled materials were encountered in boring AB-3 and were described as very loose to compact, grey/brown fine to medium sand or dark grey silty sand. Borings AB-4 and AB-6 were

advanced through fly ash, which was generally described as very loose to compact, dark grey, fine sand, some clayey silt. The Units 4 and 5 bottom ash was encountered in boring AB-5 and was described as very loose to compact, dark grey fine sand. The interpreted base of the ash monofill ranged from approximately 99 to 105 feet elevation (site datum).

3.4.3 Undifferentiated Pleistocene and Recent Deposits

A unit of undifferentiated Pleistocene and recent deposits was encountered at all boring locations. The unit was described as loose to dense, brown/gray/brownish green, fine sand with varying amounts of silt clay; at times the unit was described as silty sand or clayey sand. Trace to some organic materials were also encountered sporadically in the borings. The thickness of the unit ranged from 5 to 20 feet with an average thickness of approximately 8.5 feet. The top of this unit was encountered at land surface or at the base of the ash monofill at elevations ranging from 105 feet to 96 feet (site datum). The lithology of the Pleistocene and recent deposits at the Site are consistent with descriptions in the geologic literature for this area.

3.4.4 Ocala Group Limestone

The Ocala Group limestone was encountered in each of the soil borings. This unit was generally described as loose to very dense, light tan/pale yellow, fine to coarse sand or gravel, with little to some limestone fragments, and trace to some silt and clay. In very dense limestone, the recovery was often limited to small pieces of limestone. Apparent filled voids were encountered in some of the borings, typically sampled as very loose to loose, tan/yellow/orange/brown fine sand. The thickness of this unit is unknown since the borings were terminated before the underlying unit was encountered. The top of the limestone unit was encountered at elevations ranging from 80 feet to 96 feet (site datum). The lithology of this unit was generally consistent with descriptions in the geologic literature for Ocala Group limestone in this area.

4.0 REGIONAL AND SITE-SPECIFIC HYDROGEOLOGY

4.1 Regional Hydrogeology

The principal source of groundwater in Citrus County is the Floridan Aquifer composed of Avon Park and Ocala Group limestone (Spencer, 1984). For much of Citrus County (including the Site area), the aquifer is described as unconfined and is found near the surface in the layered, heterogeneous, and somewhat cavernous limestone. The Floridan Aquifer is generally recharged by precipitation and groundwater flow. The direction of the groundwater flow in the area is generally toward the Gulf of Mexico. The top of the aquifer is at sea level or just below ground surface and the base of the aquifer is approximately at the point where evaporates constantly fill limestone and dolomite pore spaces. The Floridan Aquifer is generally considered a potable water source expect near the coastal region where saltwater encroachment has occurred (Spencer, 1984).

4.2 Site Hydrogeology

4.2.1 Upper Floridan Aquifer

The Upper Floridan Aquifer is the principal and uppermost water-bearing unit as the Site. Groundwater flow is generally to the southwest and discharges into the Gulf of Mexico or the manmade discharge canal (ESE, 1984). The Upper Floridan Aquifer at the Site is tidally influenced, responds rapidly to rainfall, and generally has an upward flow gradient (ESE, 1981). The approximate base of the Floridian Aquifer at the site is estimated at 476 feet based on past aquifer characteristic tests at CREC contained in a Southwest Florida Water Management District (SWFWMD) publication (1987). The Upper Floridian Aquifer has generally high transmissivity (227,000 ft^2/d) at the facility based on a partially penetrating (180 feet) test well (Golder, 2007).

4.2.2 Hydraulic Conductivities

Single-well hydraulic conductivity tests (slug tests) were conducted on the four temporary monitoring wells installed in the October 2009 field investigation. The slug tests were performed a minimum of three times on each temporary well. Hydraulic conductivity values obtained from the tests and hydraulic gradient data obtained from routine water level measurements were used in conjunction with aquifer lithology characteristics and an assumed effective porosity to estimate the linear groundwater flow velocity for the shallow surficial aquifer underlying the site.

The test results indicate that hydraulic conductivities for the temporary wells ranged from 6.65×10^{-3} to 4.23×10^{-4} centimeters per second (cm/sec) and had a mean value of 1.55×10^{-3} centimeters per second (cm/sec) or 4.4 feet/day. It should be noted that the hydraulic conductivity values were determined using the Bouwer and Rice (1976) method. A summary of slug test results is presented in Table 2 and the data is included in Appendix C.

4.2.3 Hydraulic Gradients

Hydraulic gradients were calculated from the groundwater elevation data collected on October 23 and October 29, 2009 from the wells in the vicinity of the ash disposal area. The potentiometric maps for October 23 and October 29, 2009 are presented on Figures 8 and 9, respectively. The potentiometric map for groundwater elevations recorded on January 19, 2010 is presented on Figure 10. The groundwater flow directions for these two events were nearly in opposite directions (tidal influence); therefore a composite hydraulic gradient was calculated for the various areas of the Site.

The horizontal hydraulic gradients for the northern portion of the site ranged from 0.00067 feet per foot (feet/foot) south southwest to 0.00033 feet/foot north northeast, with a composite gradient of 0.00023 feet/foot southwest. The horizontal hydraulic gradient for the north central portion of the site ranged from 0.00033 feet/foot west to 0.00014 feet/foot east, with a composite gradient of 0.00009 feet/foot southwest. The horizontal hydraulic gradients for the south central portion of the Site ranged from 0.00015 feet/foot east to 0.00023 feet west, with a composite hydraulic gradient of 0.00004 feet/foot south southeast. The horizontal hydraulic gradient for the southern portion of the site ranged from 0.00032 feet/foot west southwest to 0.00023 feet/foot south southeast, with a composite hydraulic gradient of 0.00005 feet/foot southwest. The overall site gradient (based on the average of these four regions) for the two dates in October 2009 was 0.00008 feet/foot. Horizontal hydraulic gradient calculations are presented in Appendix E.

4.2.4 Estimates of Groundwater Flow Velocity

Using Darcy's Law, the average linear groundwater velocity (v) beneath the ash disposal area was calculated to be 2 feet per year based on the equation:

$$V_h = \frac{K \bullet i_h}{n_e}$$

where:

- k = the hydraulic conductivity (average slug test values of 4.4 feet/day increased by one-half order of magnitude to 22 feet/day);
- i = the average horizontal hydraulic gradient (estimated at 0.00008 feet/foot); and
- n_e = the effective porosity (assumed to be 30% based on literature values).

Groundwater flow velocity calculations are presented in Appendix E.

4.2.5 Groundwater Quality

Baseline groundwater quality sampling was performed in October 2009 (wells TW-1 through TW-4) and January 2010 (TW-5). The results of the groundwater sampling are summarized in Table 3. Groundwater sample collection and field instrument calibration records are presented in Appendix F. The complete analytical laboratory reports are presented in Appendix G.

Field parameters such as temperature, dissolved oxygen, pH, specific conductance, turbidity, and oxidation-reduction potential (ORP) were recorded. Laboratory analyses of aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, molybdenum, nickel, selenium, sodium, thallium, vanadium, zinc, ammonia, chloride, cyanide , fluoride, gross alpha, nitrate, nitrite, radium 226/228, sulfate, total dissolved solids, total Kjeldahl nitrogen and total nitrogen were analyzed in the groundwater samples collected from temporary wells to establish background data for the vertical reconfiguration of the ash disposal area.

Some of the constituents of concern from the October 2009 and January 2010 baseline samples in relation to historical trends and leachability data included the following:

- Synthetic precipitation leaching procedure (SPLP) results for aluminum from the coal combustion products (CCP) stored in the ash disposal area ranged from 0.051 to 7.39 milligrams per liter (mg/L), with a geometric mean concentration of 0.047 mg/L (data from ECT, 2008). Aluminum was not detected in the temporary wells at concentration greater than 0.061 mg/L which is less than the Secondary Drinking Water Standard (Chapter 62-550, FAC) (SDWS) of 0.2 mg/L. Historically aluminum was not monitored as part of the Industrial Wastewater Permit (IWWP) requirements (FLA016960).
- Antimony SPLP results for ash disposal area CCPs ranged from 0.9 to 36 micrograms per liter (μg/L) and had a geometric mean concentration of 3.9 μg/L (data from ECT, 2008). Antimony concentrations in the temporary wells ranged from approximately 0.10 to 3.0 μg/L which was less than the Primary Drinking Water Standard (Chapter 62-550, FAC) (PDWS) of 6.0 μg/L. Historical antimony concentrations from wells in the vicinity of the ash disposal area (MWC-12R and MWI-2R/2R2) ranged from 0.5 to 1.0 μg/L, with a mean concentration of 0.52 μg/L (January 2007 to July 2009 data from IWWP monitoring).
- The arsenic SPLP concentrations of ash disposal CCPs ranged from 4.7 to 130 mg/L and had geometric mean concentration of 21.5 mg/L (data from ECT, 2008.) Arsenic was not detected in the temporary wells from the baseline sampling events above concentrations of 0.0085 mg/L, which is less than the PDWS of 0.010 mg/L. Historical concentrations of arsenic in the vicinity of the ash disposal area ranged from 0.5 to 240 mg/L with an average concentration of 14.1 mg/L (May 1997 to July 2009 data from IWWP monitoring). Baseline sampling results for arsenic in the vicinity of the ash disposal area ranged from less than 2 mg/l to 140 mg/L (ESE, 1984).
- SPLP results for boron from CCPs stored at the ash disposal area ranged from 0.0176 to 1.7 mg/L, with a geometric mean concentration of 0.16 mg/L (data from ECT, 2008). Boron concentrations in the temporary wells ranged from 0.31 to 7.5 mg/L. Boron exceeded the Groundwater Guidance Concentration (Chapter 62-777, FAC) (GGC) of 1.4 mg/L in TW-5 (7.5 mg/L). Boron was not historically monitored at the ash disposal area as part of IWWP monitoring.
- SPLP results from ash disposal CCPs for chloride ranged from 1.2 to 1,400 mg/L, with a geometric mean concentration of 12.6 mg/L (data from ECT, 2008). Chloride concentrations in the temporary wells ranged from 95 to 250 mg/L. Chloride exceeded the SDWS of 250 mg/L in TW-1. Historical chloride concentrations in the vicinity of the ash disposal area range from 11 to 290 mg/L, with a mean concentration of 60 mg/L (May 1997 to July 2009 data from IWWP monitoring).

- Fluoride SPLP results from ash disposal area CCPs ranged from 0.05 to 0.91 mg/L with a geometric mean concentration of 0.27 mg/L (data from ECT, 2008). Fluoride concentrations in the baseline samples collected from temporary monitoring wells ranged from approximately 0.063 to 2.2 mg/L which were all less than the PDWS of 4.0 mg/L. Historical concentrations of fluoride in the ash disposal area ranged from 0.010 to 0.65 mg/L and had a mean concentration of 0.20 mg/L (April 1997 to July 2009 IWWP monitoring data).
- SPLP results for Iron in CCPs stored in the ash disposal area range from 0.037 to 6.37 mg/L with a geometric mean concentration of 0.13 mg/L (data from ECT, 2008). Iron concentrations in temporary wells ranged from less than the method detection limit (MDL) of 0.038 to 11 mg/L. The iron concentration in TW-2 (2.9 mg/L) and TW-5 (11 mg/L) exceeded the SDWS of 0.3 mg/L. Historical iron concentrations in the vicinity of the ash disposal area have ranged from 0.008 to 8.56 mg/L, with a mean concentration of approximately 1.13 mg/L (May 1997 to July 2009 IWWP monitoring data). Baseline concentrations of iron near the ash disposal area ranged from less than 0.3 to 24.4 mg/L (ESE, 1984).
- The CCPs stored in the ash disposal area had SPLP concentrations of molybdenum ranging from 0.004 to 0.738 mg/L with a geometric mean concentration of 0.016 mg/L (ECT, 2008). Molybdenum concentrations in baseline samples collected from the temporary monitoring wells were all less than the GGC of 0.035 mg/L. Molybdenum concentrations ranged from less than the MDL of 0.0041 to 0.027 mg/L. Historical molybdenum concentrations in wells near the ash disposal area (MWC-12R and MWI-2R/2R2) have ranged from 0.002 to 0.22 mg/L and had a mean concentration of 0.007 mg/L (May 1997 to July 2009 IWWP groundwater monitoring data).
- SPLP results of selenium from ash disposal area CCPs ranged from 0.004 to 0.295 mg/L and had a geometric mean concentration of 0.019 mg/L (data from ECT, 2008). Selenium was not detected in any of the temporary wells at concentrations above the MDL of 0.0068 mg/L. Historically selenium has not been part of the required monitoring at the ash disposal area under IWWP requirements. Selenium concentrations were below the MDL in baseline sampling results for selenium in the vicinity of the ash disposal area (ESE, 1984).
- Sodium SPLP results from ash disposal area CPPs ranged from 4.24 to 823 mg/L and had a geometric mean concentration of 22 mg/L (data from ECT, 2008). Sodium concentrations from baseline temporary well samples ranged from 53 to 170 mg/L. The sodium concentration in TW-1 exceeded the SDWS of 160 mg/L. Historical sodium concentrations in the ash disposal area have ranged from 14 to 160 mg/L and have a mean concentration of 37 mg/L (May 1997 to July 2009 data from IWWP monitoring).
- SPLP concentrations of sulfate from ash disposal area CPPs ranged from 2.4 to 1,100 mg/L with a geometric mean concentration of 28 mg/L (ECT, 2008 data). Sulfate concentrations were below the SDWS of 250 mg/L in the baseline groundwater quality samples collected from the temporary monitoring wells. Temporary well sulfate concentrations ranged from 51 to 210 mg/L. Sulfate has not historically been monitoring per IWWP requirements in the vicinity of the ash disposal area.
- SPLP concentrations of total dissolved solids (TDS) in CCPs stored in the ash disposal area ranged from 44 to 230 mg/L with a geometric mean concentration of 195 mg/L (data from ECT, 2008). TDS concentrations exceeded the SDWS of 500 mg/L in each of the temporary monitoring well samples collected in October 2009 and January 2010. TDS historical concentrations near the ash disposal area have ranged from 265 to 1,100 mg/L with a mean concentration of 454 mg/L (May 1997 to July 2009 IWWP monitoring data for MWC-12R and MWI-2R/2R2).

- SPLP results of ash disposal CCPs for vanadium ranged from 0.0006 to 2.01 mg/L and had a geometric mean concentration of 0.041 mg/L (data from ECT, 2008). Vanadium concentrations in samples collected from temporary wells during the baseline sampling events ranged from approximately 0.00081 to 0.0059mg/L, less than the GGC of 0.049 mg/L in each of the wells. Historical concentrations of vanadium in the vicinity of the ash disposal area have ranged from 0.0005 to 0.011 mg/L, with a mean concentration of 0.005 mg/L (May 1997 to July 2009 IWWP monitoring data).

In summary, the results of leach testing (ECT, 2008), historical groundwater monitoring data, and groundwater sampling results from the TW-series wells indicate the following:

- Leach (SPLP) testing of the various CCPs indicated that some had average leach concentrations of PDWS metals above their respective standards, including: arsenic (most common), antimony (fly ash), and selenium (fly ash and high chloride ash). Other constituents that had maximum leach concentrations of PDWS metals above their respective standards included sodium and thallium (both in the high chloride ash).
- There were no exceedances of the PDWS for gross alpha in any of the SPLP samples
- Historical groundwater data reviewed for MW-12R, MW-2R/MW-2R2, and MW-21R indicated no exccedances of PDWS's for antimony (data available since 2007) or sodium (data available since 1997). It is noted that the sodium concentration in MW-2R2 was elevated to the standard (160 mg/L) in the July 2009 sample
- In the five temporary monitoring wells there were no exceedances of any PDWS's except for sodium (TW-1) and radium (TW-2). Radium is considered unrelated to the CCPs based on the SPLP data (for gross alpha). Sodium could be related to either natural background conditions (brackish groundwater) or the high chloride ash (the only CCP that leached sodium above the PDWS).
- The CCP leach testing conducted in 2008 indicated there were several metals that had the potential to leach concentrations in excess of their respective PDWS's. Of those, only arsenic has had multiple exceedances of its PDWS (in MW-2R/MW-2R2) in the historical groundwater monitoring data reviewed. However, baseline groundwater quality data indicated that arsenic was in fact present above the PDWS at that same location prior to the start of disposal activities. In addition, downgradient well (MW-21R) has not shown only reported four detections of arsenic in excess of the PDWS (11 µg/L in 1998-1999). In addition, vanadium which is typically a relatively mobile metal in groundwater, and which was detected above its GCTL in the SPLP testing of the high chloride ash and fly ash, has not been reported above its detection limit in any of the CCP disposal area wells since 1997.

Although not specifically evaluated, it is anticipated that the proposed modified configuration with more side-slope area and less crown area will have less infiltration post-closure than the currently permitted configuration. This reduction in infiltration may provide additional benefit to post-closure groundwater quality in the vicinity of the CCP disposal area.

4.2.6 Seasonal High Groundwater Water Level

An analysis of historical weather and groundwater elevation data was made to estimate the seasonal high groundwater elevation for the ash disposal area. The SWFWMD defines the seasonal high water level as "the elevation to which ground or surface water can be expected to rise due to a normal wet season." According to SWFWMD, the average wet season (June to September) for Citrus County is 30.64 inches from rainfall data from 1915 to 2008. The seasonal high groundwater elevation was calculated by

averaging the third and fourth quarter groundwater elevations from the five wet seasons with rainfall totals nearest the average wet season. The seasonal high groundwater elevation for the ash disposal area was estimated at 92.96 feet. Seasonal high groundwater level calculations are presented in Appendix H.

5.0 GEOTECHNICAL DATA EVALUATION

5.1 Slope Stability Analysis

Slope/W developed by Geo-Slope International Ltd. Was utilized for the slope stability analysis. Slope/W is formulated in terms of force and moment equilibrium factor of safety (FOS) equations. A slope stability analysis was initially performed for the currently permitted configuration (80 feet high with 4 horizontal to 1 vertical (4H:1V) side-slopes for the majority of the footprint. The analyses indicated a minimum FOS = 1.89 for the existing configuration. For the recently approved east sliver configuration (80-foot high, 4H:1V side-slopes) that includes a base layer of geosynthetic clay liner (GCL) approximately 100-feet wide along the eastern edge of the footprint the Slope/W analysis indicated a minimum FOS = 1.72.

For the proposed configuration (120 feet high, side-slopes of 3H:1V and side-slope benches every 30 feet in height) stability analyses were performed with and without the GCL base. The benches serve two purposes: first, they permit the incorporation of stormwater swales to improve drainage for the monofill and second, they proved an added measure of slope stability. For the east sliver, where the GCL base layer will be present, the minimum FOS = 1.67. For the area (the majority of the footprint) where the GCL will not be present the FOS = 1.78.

Thus, it appears that the proposed increase in height and slope angle only marginally decreases the factor of safety. A more detailed description of the stability analyses performed including the soil stratigraphy, strength parameters used and basis, technical references, and model input/output are included in Appendix I.

5.2 Bearing Capacity Analysis

Two methods of evaluating bearing capacity were utilized and yielded values ranging from 5 to greater than 20 times the expected contact pressure. The bearing capacity calculations are included in Appendix I.

5.3 Settlement Analysis

Three methods of estimating settlement were utilized and yielded values ranging from 0.07 to 0.20 inches. This minimal amount of settlement would not result in the byproducts (or the GCL in the East Sliver) to be below the water table given there is a differential of approximately 2 feet between the seasonal high water table and the base of the CCP disposal area. The settlement calculations are included in Appendix I.

5.4 Other Issues

5.4.1 Faults

In the geological literature reviewed, no mention of active faults in the area was noted.

5.4.2 Sinkholes

There were no active sinkholes identified in the immediate vicinity of the CCP disposal area during our site walkover, review of available aerial photographs, or in our discussions with site personnel involved with the operation of the CCP disposal area. Filled or partially filled cavities identified in the limestone bedrock (not sinkholes) during the geotechnical drilling program will be addressed with a compaction grouting program scheduled for August 2010. In addition, a punching failure analysis was performed to evaluate possible effects on the stability of the CCP disposal area from any unidentified cavities (see Appendix I). The punching failure analysis, which assumed varying thicknesses of cap rock overlying voids of varying diameter, indicated that for voids of 5 to 25 foot diameter, as little as 5 feet of cap rock could provide sufficient support for the proposed loads imposed by the 120-foot high byproduct disposal area (FOS = 2.2 for 5 feet of cap rock over 25 foot diameter void).

5.4.3 Muck-filled Areas

No muck filled areas have been observed in the CCP disposal area on the surface or in test borings drilled as part of this geotechnical assessment.

6.0 SUMMARY AND RECOMMENDATIONS

Based on the results of our hydrogeological and geotechnical field investigation and data evaluation, it is our opinion that the Site can be reconfigured as proposed (120 feet high with 3H:1V side-slopes) while providing for adequate slope stability (FOS>1.5), minimal foundation settlement, adequate foundation bearing capacity, and less post-closure infiltration (a potential benefit to groundwater quality).

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Project Engineer

Kenneth B. Karably, PE, PG
Principal

FN: G:\Projects\083\083-82\083-82671\083-82671.1 (Vertical Expansion)\Report\HG-GT Final_Jul10.docx

TABLE 1

Summary of Monitoring Well Construction and Groundwater Elevation Data

Crystal River Energy Complex Ash Disposal Area
Crystal River, Florida

Well ID	Date Installed	Northing	Easting	TOC Elevation (ft.-NGVD)	Well Depth (ft.-bgs)	Screen Interval Depth (ft.-bgs)	Groundwater Elevations		
							10/23/2009 (ft-NGVD)	10/29/2009 (ft-NGVD)	1/19/2010 (ft-NGVD)
TW-1	10/19/09	1685576.11	279664.10	99.49	20.0	10.0 - 20.0	**92.68**	**92.30**	**92.91**
TW-2	10/20/09	1683788.14	280723.80	99.62	20.0	10.0 - 20.0	**92.60**	**92.27**	**93.07**
TW-3	10/19/09	1683437.14	279714.58	101.45	20.0	10.0 - 20.0	**92.27**	**92.33**	**93.02**
TW-4	10/20/09	1684871.64	279533.80	102.15	20.0	10.0 - 20.0	**92.20**	**92.45**	**92.99**
TW-5	12/21/09	1683984.79	279563.30	100.59	19.5	9.5 - 19.5	**NM**	**NM**	**92.75**
MWI-2R2	5/21/08*	1684481.25	279561.56	100.36	20.0	10.0 - 20.0	**92.43**	**92.55**	**93.10**
MWC-12R	--	1685340.17	280809.33	98.88	20*	10.0 - 20.0*	**92.61**	**92.28**	**92.90**
MWC-21R	--	1683294.81	278230.18	99.70	20*	10.0 - 20.0*	**NM**	**92.50**	**92.94**
MWB-30	7/9/07*	1682363.04	280971.22	97.85	18.67*	8.4 - 18.4*	**NM**	**92.18**	**92.97**

Notes:
Northings and Eastings reported in NAD27.
ft-bgs = feet below ground surface
TOC = top of casing (elevations reported in site vertical datum)
DTW = Depth to Water below top of casing
* = Information from previous Groundwater Monitoring Plans for CREC
NM = Not Measured

Checked by: KBK

TABLE 2

Summary of Slug (Hydraulic Conductivity) Test Results

Crystal River Energy Complex Ash Disposal Area
Crystal River, Florida

Well ID	Date Test Performed	Total Depth (ft-btoc)	Screen Interval (ft-btoc)	Analytical Method	Rising or Falling Head	Hydraulic Conductivity	
						(cm/sec)	(ft/day)
TW-1-A	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Falling	2.82E-03	8.00
TW-1-B	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Falling	1.71E-03	4.86
TW-1-C	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Falling	1.34E-03	3.79
TW-1-A	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Rising	2.29E-03	6.49
TW-1-B	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Rising	2.25E-03	6.37
TW-1-C	10/23/2009	22.36	12.36-22.36	Bouwer & Rice	Rising	2.19E-03	6.20
TW-2-A	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Falling	4.46E-03	12.6
TW-2-B	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Falling	5.20E-03	14.7
TW-2-C	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Falling	4.26E-03	12.1
TW-2-A	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Rising	5.03E-03	15.1
TW-2-B	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Rising	6.02E-03	17.1
TW-2-C	10/23/2009	23.44	13.44-23.44	Bouwer & Rice	Rising	6.65E-03	18.8
TW-3-A	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Falling	1.57E-03	4.45
TW-3-B	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Falling	1.11E-03	3.13
TW-3-C	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Falling	9.83E-04	2.79
TW-3-A	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Rising	4.21E-04	1.19
TW-3-B	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Rising	4.71E-04	1.33
TW-3-C	10/23/2009	23.36	13.36-23.36	Bouwer & Rice	Rising	4.87E-04	1.38
TW-4-A	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Falling	1.16E-03	3.29
TW-4-B	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Falling	8.42E-04	2.39
TW-4-C	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Falling	8.56E-04	2.43
TW-4-A	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Rising	6.27E-04	1.78
TW-4-B	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Rising	6.87E-04	1.95
TW-4-C	10/23/2009	23.74	13.74-23.74	Bouwer & Rice	Rising	7.13E-04	2.02
Geometric Mean						1.58E-03	4.5

Notes:
cm/sec = centimeters per second
ft/day = feet per day
ft-bgs = feet below ground surface
A = 1st slug test run
B = 2nd slug test run
C = 3rd slug test run

Checked by: KBK

TABLE 3

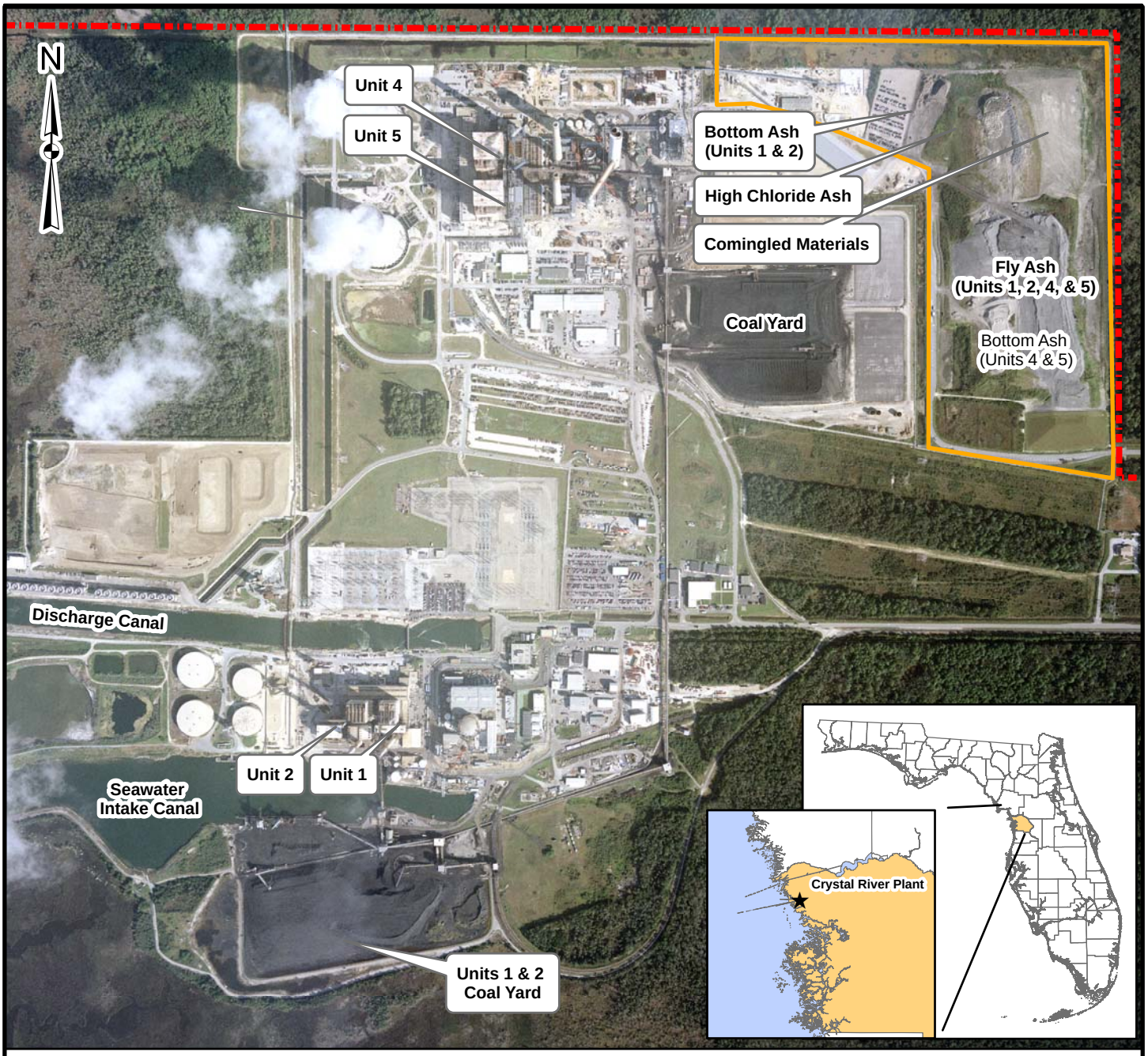
Summary of Temporary Well Baseline Sampling Results

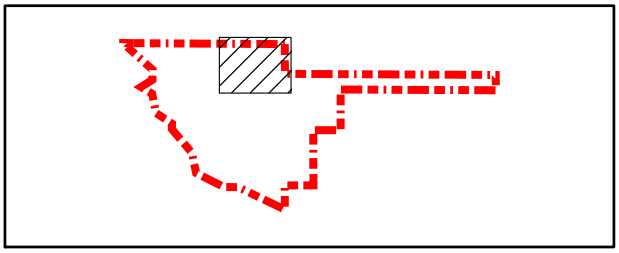
Crystal River Energy Complex Ash Disposal Area
Crystal River, Florida

Parameter	Units	Standard	TW-1	TW-2	TW-3	TW-4	TW-5
			10/22/09	10/22/09	10/22/09	10/22/09	01/19/10
Aluminum	mg/L	0.2 SDWS	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U
Antimony	µg/L	6 PDWS	1.0	0.30 I	3.0	0.57 I	0.10 I
Arsenic	mg/L	0.010 PDWS	0.0085 U	0.0085 U	0.0085 U	0.0085 U	0.0085 U
Barium	mg/L	2 PDWS	0.014	0.15	0.019	0.024	0.062
Beryllium	mg/L	0.004 PDWS	0.00013 U	0.00013 U	0.00013 U	0.00013 U	0.00013 U
Boron	mg/L	1.4 GCTL	0.99 V	1.1 V	0.90 V	0.31 V	7.5
Cadmium	mg/L	0.005 PDWS	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00062
Chromium	mg/L	0.1 PDWS	0.00050 U	0.00050 U	0.00050 U	0.00050 U	0.00077 I
Cobalt	mg/L	0.14 GCTL	0.00060 U	0.00060 U	0.00060 U	0.00060 U	0.00060 U
Copper	mg/L	1 SDWS	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
Iron	mg/L	0.3 SDWS	0.038 U	2.9	0.19 I	0.045 I	11
Lead	mg/L	0.015 PDWS	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
Mercury	mg/L	0.002 PDWS	0.000014 U	0.000014 U	0.000014 U	0.000014 U	0.000014 U
Molybdenum	mg/L	0.035 GCTL	0.0041 U	0.0041 U	0.027	0.0041 U	0.0041 U
Nickel	mg/L	0.1 PDWS	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U
Selenium	mg/L	0.05 PDWS	0.0068 U	0.0068 U	0.0068 U	0.0068 U	0.0068 U
Thallium	µg/L	2 PDWS	0.26	0.076 I	0.085 I	2.0	0.067 U
Vanadium	mg/L	0.049 GCTL	0.0023	0.00081 I	0.0059	0.0025	0.0011 I
Zinc	mg/L	5 SDWS	0.016	0.015	0.015	0.016	0.0014 I
Gross Alpha	pCi/L	15 PDWS	3.5 U	5.1	4.6	3.4 U	9.9 *
Radium 226	pCi/L	5 PDWS	2.3	4.2	3.0	2.3	3.5
Radium 228	pCi/L		0.9 U	0.9	0.9 U	0.8 U	1.8
Ammonia	mg/L	2.8 GCTL	0.010 U	0.58	0.010 U	1.0	8.6
Chloride	mg/L	250 SDWS	350	240	95	220	160
Cyanide	mg/L	0.2 PDWS	0.00097 U	0.00097 U	0.00097 U	0.0012 I	0.00097 U
Fluoride	mg/L	4.0 PDWS	0.063 I	0.13 I	0.092 I	0.064 I	2.2
Nitrate	mg/L	10 PDWS	0.048 U	0.048 U	0.048 U	0.048 U	0.055 U
Nitrogen, total	mg/L		0.47	2.7	0.46	7.3	12
Nitrogen, total Kjeldahl	mg/L		0.47	2.7	0.46	7.3	12
Sodium	mg/L	160 PDWS	170	120	53	100	130 V
Sulfate	mg/L	250 SDWS	150	81	130	51	210
Total Dissolved Solids	mg/L	500 SDWS	810	880	630	850	1100
pH	SU	6.5-8.5 SDWS	7.08	6.91	7.12	6.75	6.62
Conductivity	µS/cm		1673	1383	947	1426	1741
Dissolved Oxygen	mg/L		0.97	0.39	0.35	0.85	0.21
ORP	--		131.6	-305	63.1	125.4	1.1
Temperature	°C		29.0	26.3	24.8	26.2	22.2
Turbidity	NTU		9.41	4.94	5.72	13.3	2.71

Notes:
Samples were collected on October 22, 2009 and January 19, 2010 (TW-5) by Golder Associates Inc. and were analyzed by Advanced Environmental Laboratories, Inc. (AEL) except for radionuclides which were analyzed by Florida Radio Chemistry Services, Inc.
PDWS = Primary Drinking Water Standard
SDWS = Secondary Drinking Water Standard
GWGC = Groundwater Guidance Concentration
PDWS Exceedance =
SDWS Exceedance =
GWGC Exceedance =

Checked by: KBK





1,000 0 1,000
Feet

LEGEND

APPROXIMATE PROPERTY BOUNDARY

ASH STORAGE AREA

REFERENCES

1. AERIAL IMAGERY - SURVEY DATA, 2009

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW

PROJECT

PROGRESS ENERTGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX

TITLE

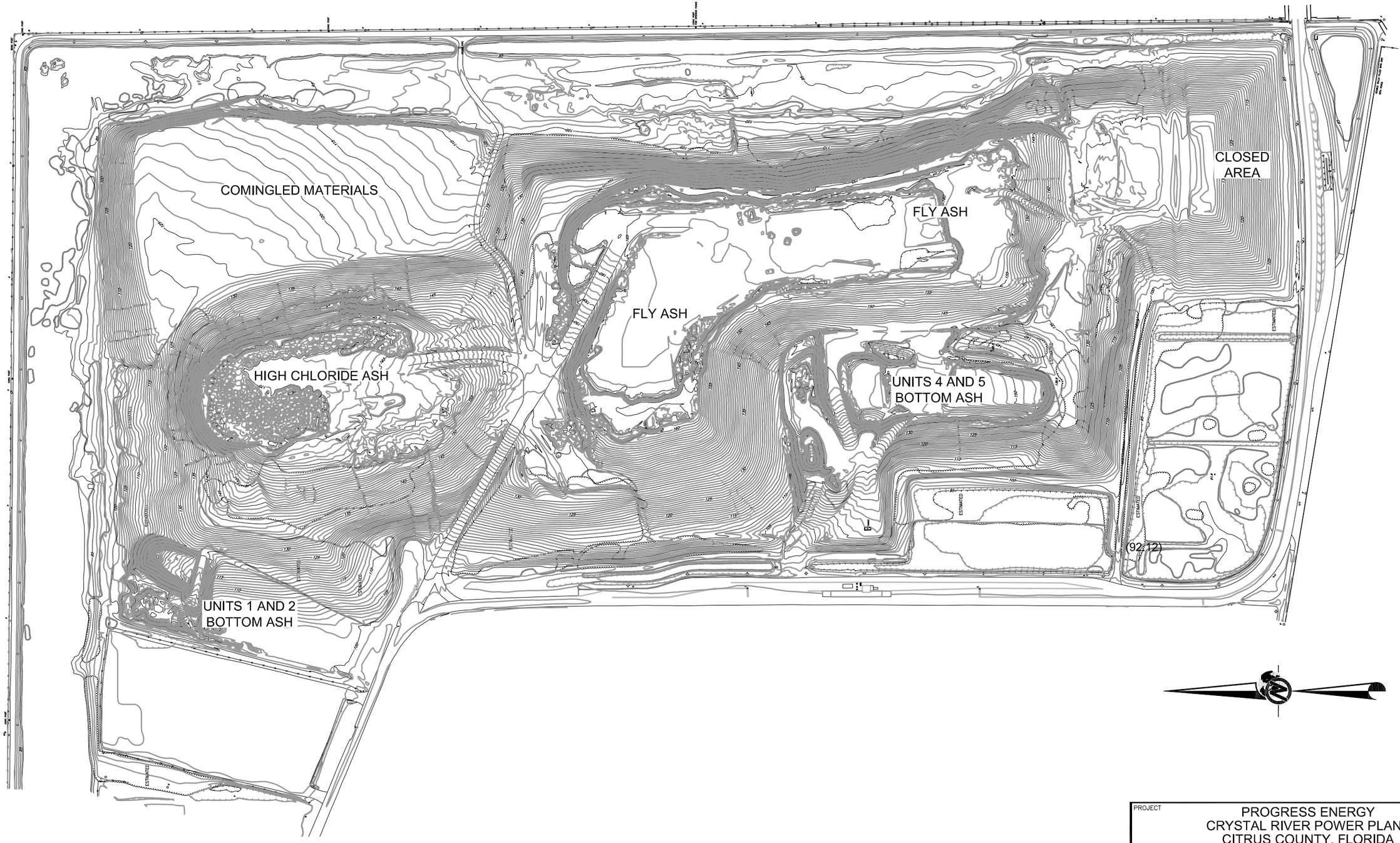
SITE LOCATION AND LAYOUT MAP

Progress Energy

PROJECT No.		08382671	FILE No.		08382671B004
DESIGN	KBK	10/31/2008	SCALE: AS SHOWN	REV.	0
GIS	JWT	12/15/2009			
CHECK	SFS	12/15/2009			
REVIEW	KBK	12/18/2009			

FIGURE 1

Map Document: N:\File\20080083-82671 PEF Crystal River CCP\B - GWMP\MapDocuments\08382671B004.mxd / Modified 12/18/2009 11:14:01 AM / Plotted 12/18/2009 11:14:08 AM by jthomas



REFERENCES

1.) CONTOURS BASED ON TOPOGRAPHIC SURVEY PRODUCED ON OCTOBER 13, 2009 BY SOUTHERN RESOURCE MAPPING, INC

200 0 200
SCALE FEET

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

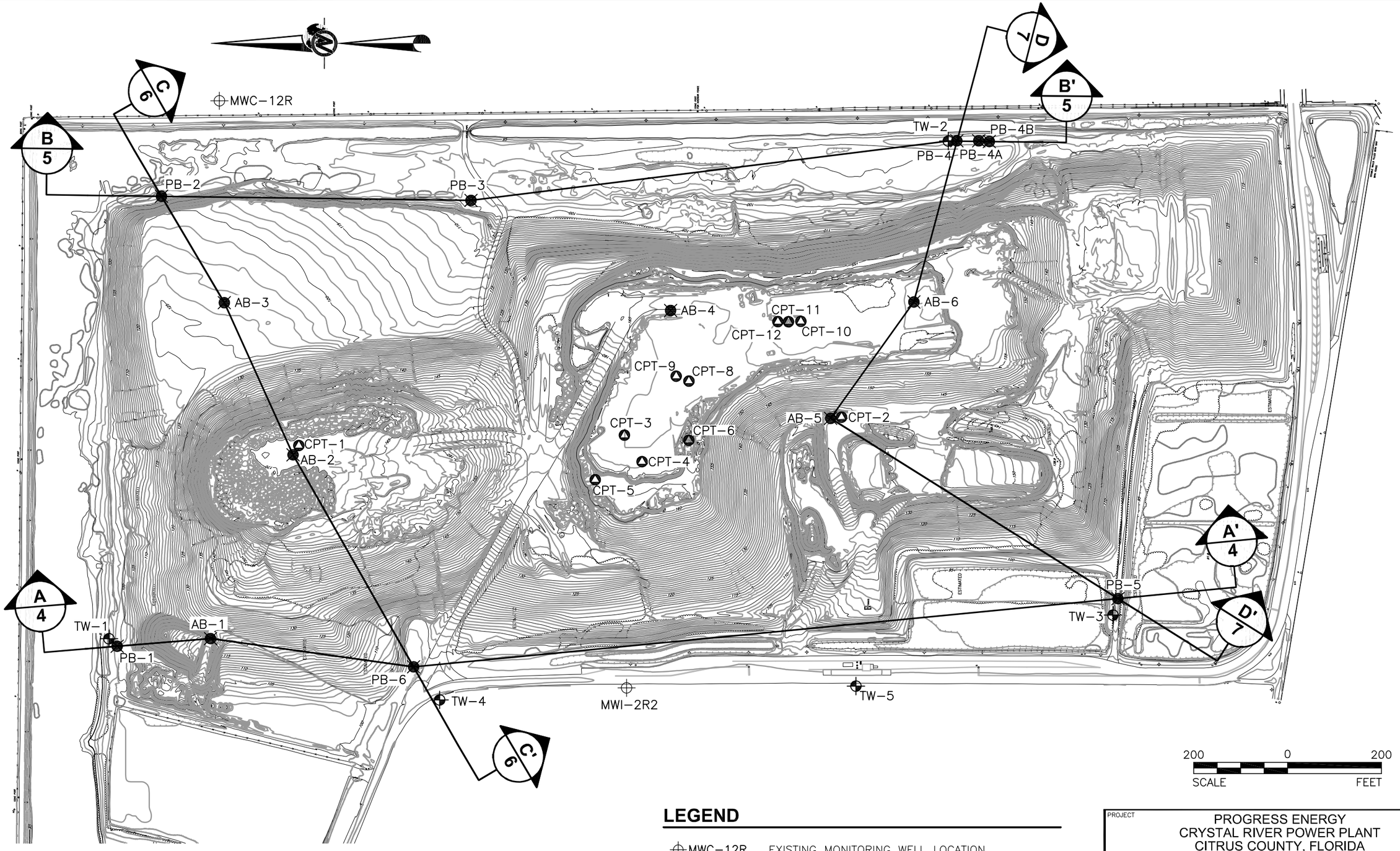
TITLE
TOPOGRAPHIC SURVEY

Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826711H002	
DESIGN	SFS	12/15/09	SCALE	AS SHOWN	REV. 0
CADD	SFS	12/15/09			
CHECK	KLH	12/18/09			
REVIEW	KBK	12/18/09			

FIGURE 2

Drawing file: 083826711H002.dwg Aug 24, 2010 - 3:18pm



LEGEND

MWC-12R	EXISTING MONITORING WELL LOCATION
TW-3	TEMPORARY MONITORING WELL LOCATION
PB-3	SPT SOIL BORING LOCATION
CPT-2	CONE PENTRATION TEST LOCATION

REFERENCES

1.) CONTOURS BASED ON TOPOGRAPHIC SURVEY PRODUCED ON OCTOBER 13, 2009 BY SOUTHERN RESOURCE MAPPING, INC

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

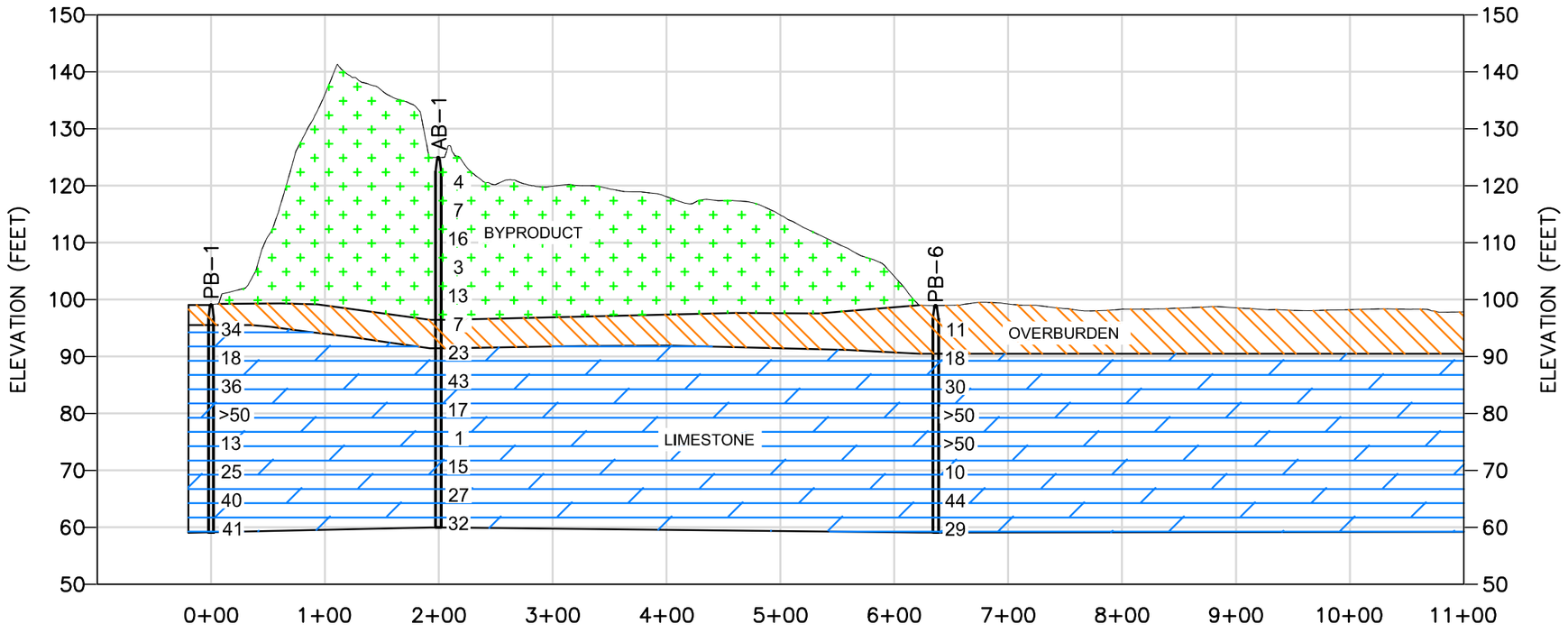
TITLE
SOIL BORING, CPT, MONITORING WELL, AND GEOLOGIC CROSS-SECTION LOCATION MAP

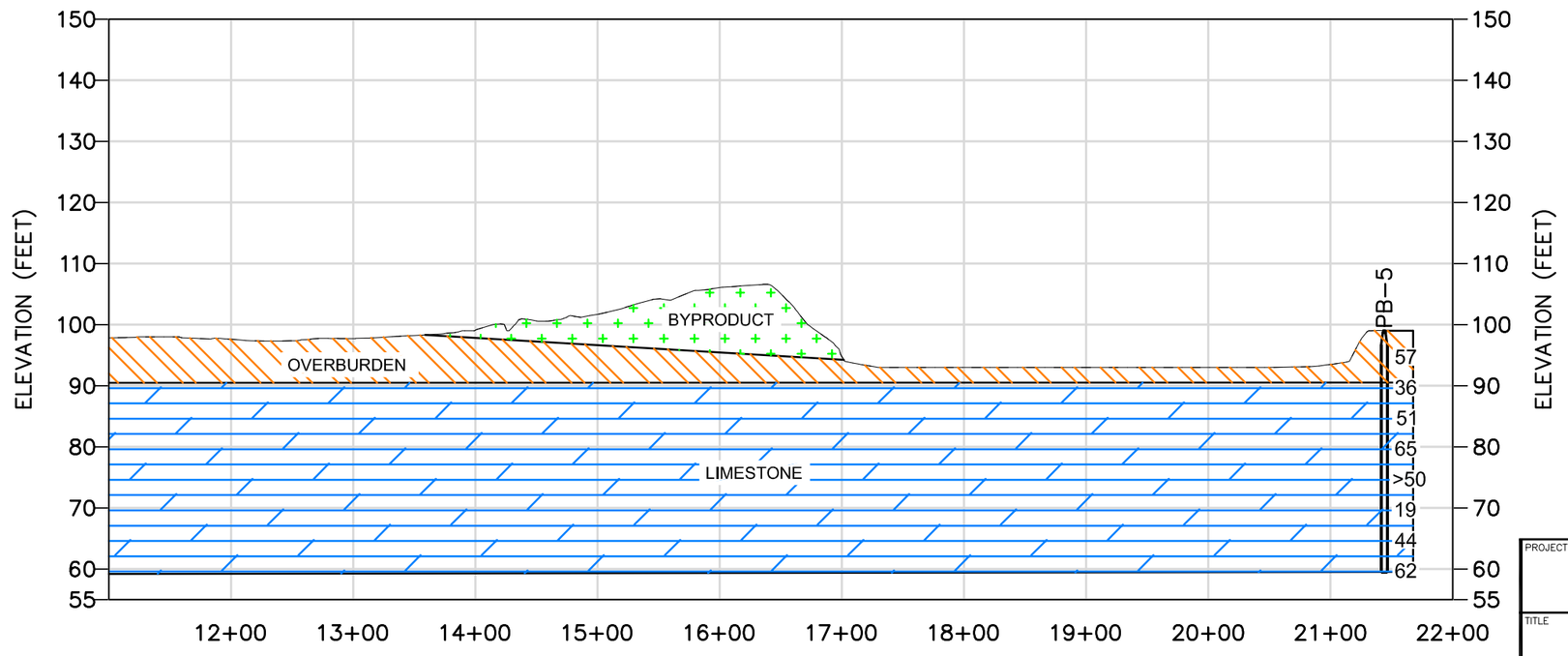
Golder Associates Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826711H003	
DESIGN	SFS	12/15/09	SCALE	AS SHOWN	REV. 0
CADD	BCL	02/01/10			
CHECK	SFS	02/01/10			
REVIEW	KBK	02/01/10			

FIGURE 3

Drawing file: 083826711H003.dwg Aug 24, 2010 - 3:18pm





SECTION A-A'

150 0 120

SCALE 120

VERTICAL SCALE EXAGGERATED 5X

PROJECT

PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

TITLE

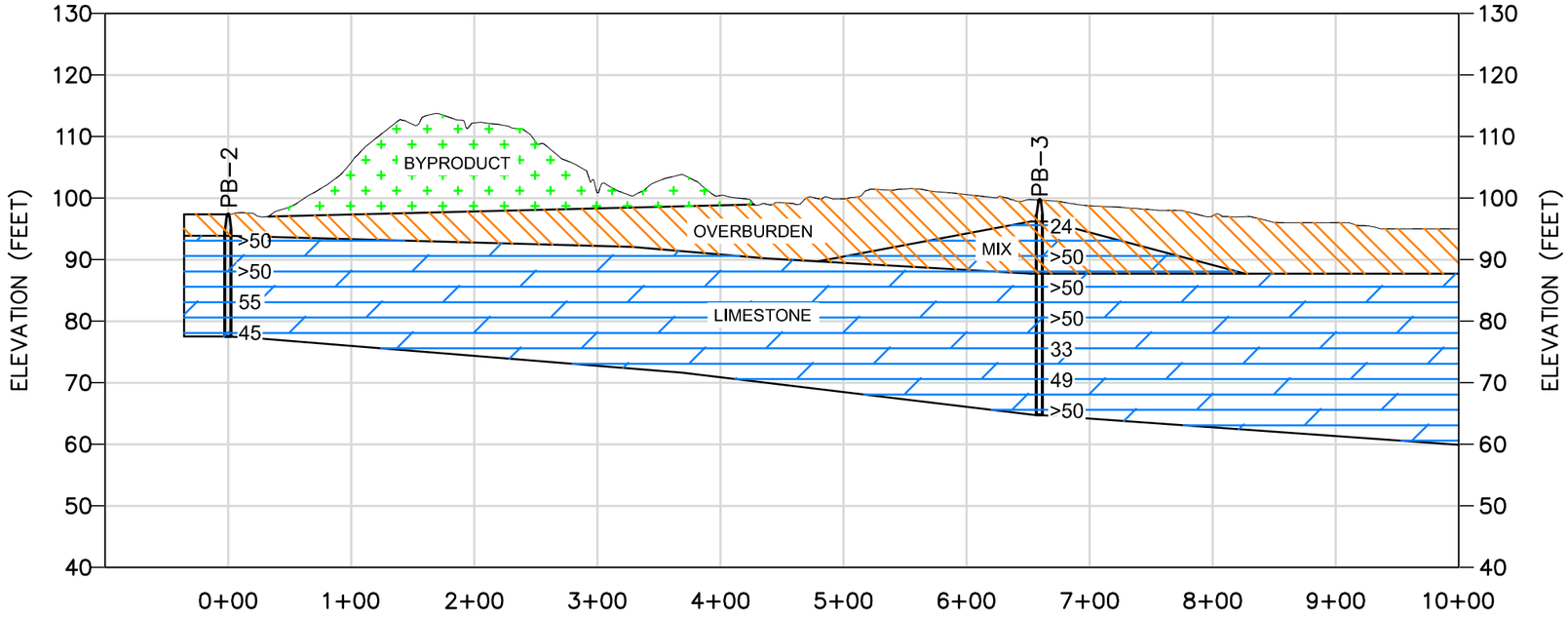
GEOLOGIC CROSS SECTION A-A'

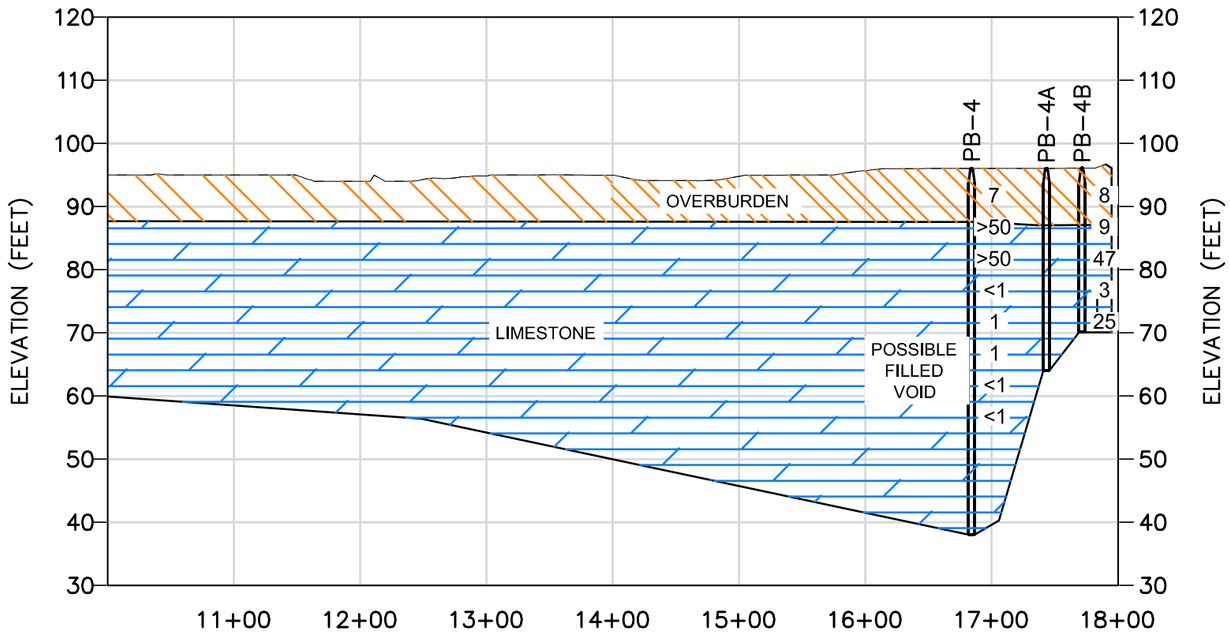
Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826711H004-7	
DESIGN	SFS	10/29/09	SCALE	AS SHOWN	REV. 0
CADD	SFS	12/15/09			
CHECK	KLH	12/18/09			
REVIEW	KBK	12/18/09			

FIGURE 4

Drawing file: 083826711H004-7.dwg Aug 24, 2010 - 3:17pm





SECTION B-B'

150 0 120

SCALE 120

VERTICAL SCALE EXAGGERATED 5X

PROJECT

PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

TITLE

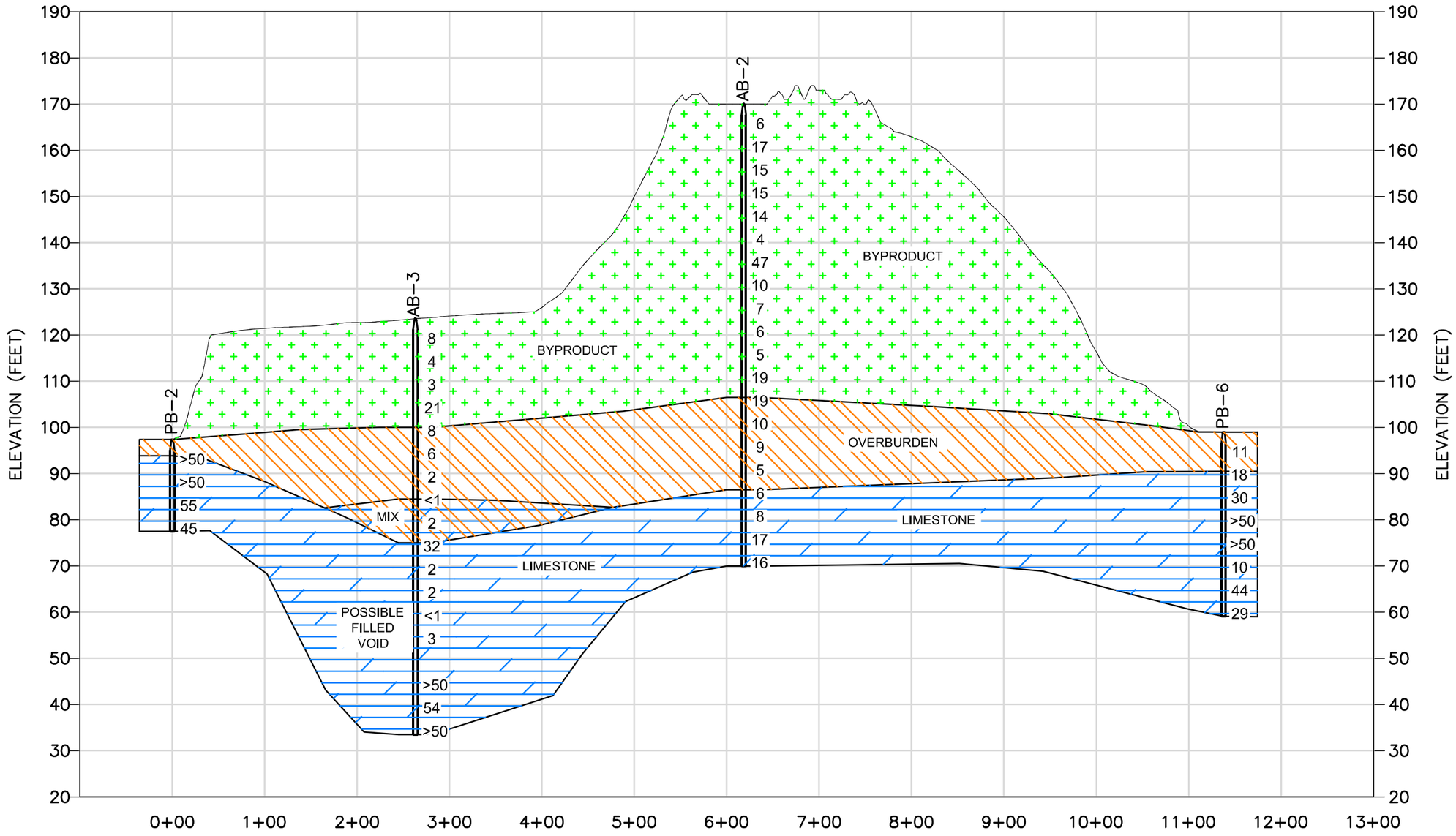
GEOLOGIC CROSS SECTION B-B'

Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826711H004-7	
DESIGN	SFS	10/29/09	SCALE	AS SHOWN	REV. 0
CADD	SFS	12/15/09			
CHECK	KLH	12/18/09			
REVIEW	KBK	12/18/09			

FIGURE 5

Drawing file: 083826711H004-7.dwg Aug 24, 2010 - 3:44pm



SECTION C-C'

120 0 120
SCALE FEET
VERTICAL SCALE EXAGGERATED 5X

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

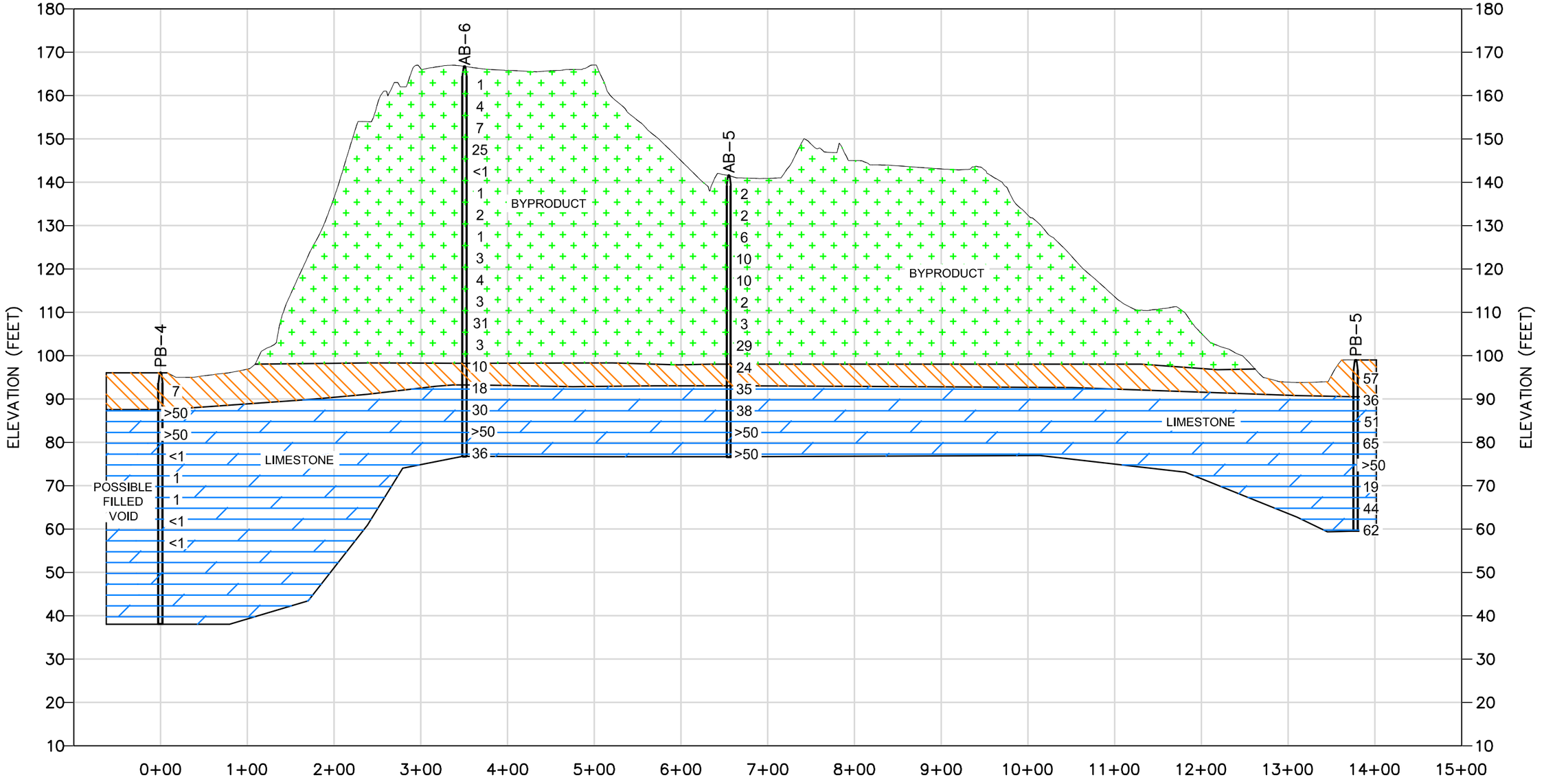
TITLE
GEOLOGIC CROSS SECTION C-C'

Golder Associates Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826711H004-7	
DESIGN	SFS	10/29/09	SCALE	AS SHOWN	REV. 0
CADD	SFS	12/15/09			
CHECK	KLH	12/18/09			
REVIEW	KBK	12/18/09			

FIGURE 6

Drawing file: 083826711H004-7.dwg Aug 24, 2010 - 3:17pm



SECTION D-D'

120 0 120
SCALE FEET
VERTICAL SCALE EXAGGERATED 5X

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

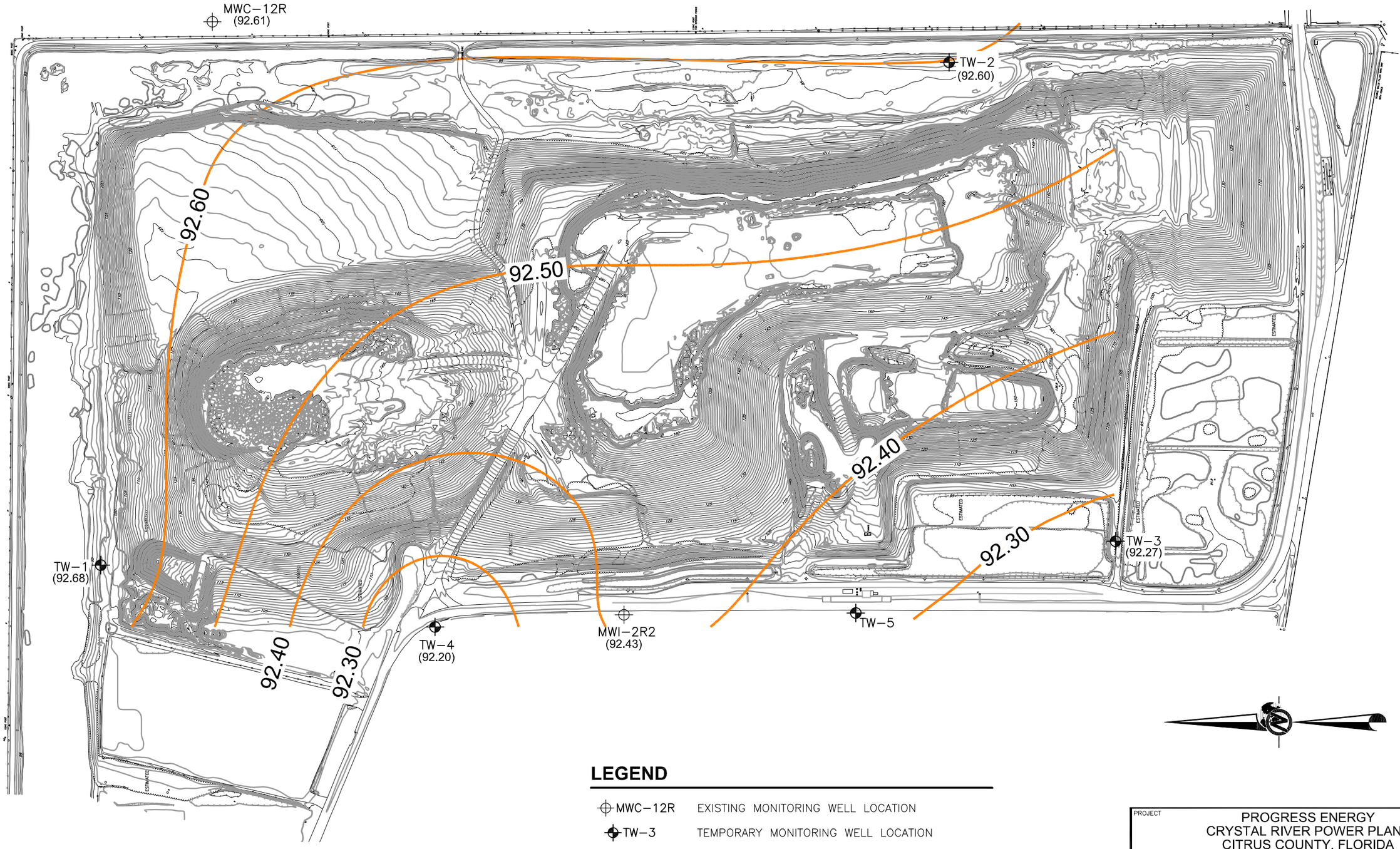
TITLE
GEOLOGIC CROSS SECTION D-D'

Golder Associates
Jacksonville, Florida

PROJECT No.	083–82671.1		FILE No.	083826711H004–7
DESIGN	SFS	10/29/09	SCALE AS SHOWN	REV. 0
CADD	SFS	12/15/09		
CHECK	KLH	12/18/09		
REVIEW	KBK	12/18/09		

FIGURE 7

Drawing file: 083826711H004–7.dwg Aug 24, 2010 – 3:16pm



LEGEND

MWC-12R	EXISTING MONITORING WELL LOCATION
TW-3	TEMPORARY MONITORING WELL LOCATION
(92.43)	GROUNDWATER ELEVATION (SITE VERTICAL DATUM)
92.40	GROUDNWATER ELEVATION CONTOUR

200 0 200
SCALE FEET

REFERENCES

1.) CONTOURS BASED ON TOPOGRAPHIC SURVEY PRODUCED ON OCTOBER 13, 2009 BY SOUTHERN RESOURCE MAPPING, INC

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

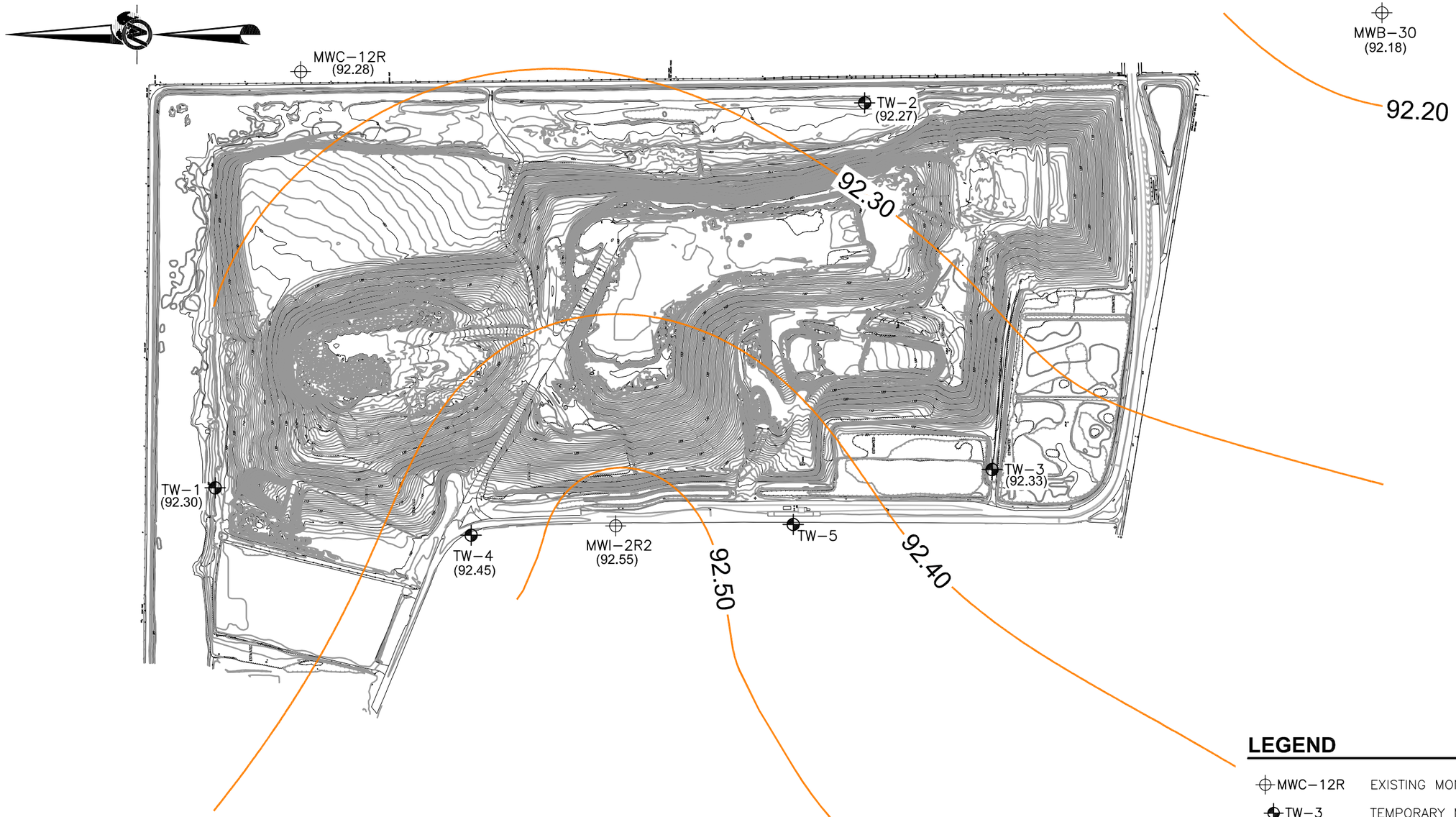
TITLE
POTENTIOMETRIC MAP
OCTOBER 23, 2009
MID-TIDE INCOMING

Golder Associates
Jacksonville, Florida

PROJECT No.		083-82671	FILE No.		083826711H008
DESIGN	SFS	12/15/09	SCALE	AS SHOWN	REV. 0
CADD	BCL	02/01/10			
CHECK	SFS	02/01/10			
REVIEW	KBK	02/01/10			

FIGURE 8

Drawing file: 083826711H008.dwg Aug 24, 2010 - 3:16pm



LEGEND

MWC-12R	EXISTING MONITORING WELL LOCATION
TW-3	TEMPORARY MONITORING WELL LOCATION
(92.55)	GROUNDWATER ELEVATION (SITE VERTICAL DATUM)
92.40	GROUDNWATER ELEVATION CONTOUR

REFERENCES

1.) CONTOURS BASED ON TOPOGRAPHIC SURVEY PRODUCED ON OCTOBER 13, 2009 BY SOUTHERN RESOURCE MAPPING, INC

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

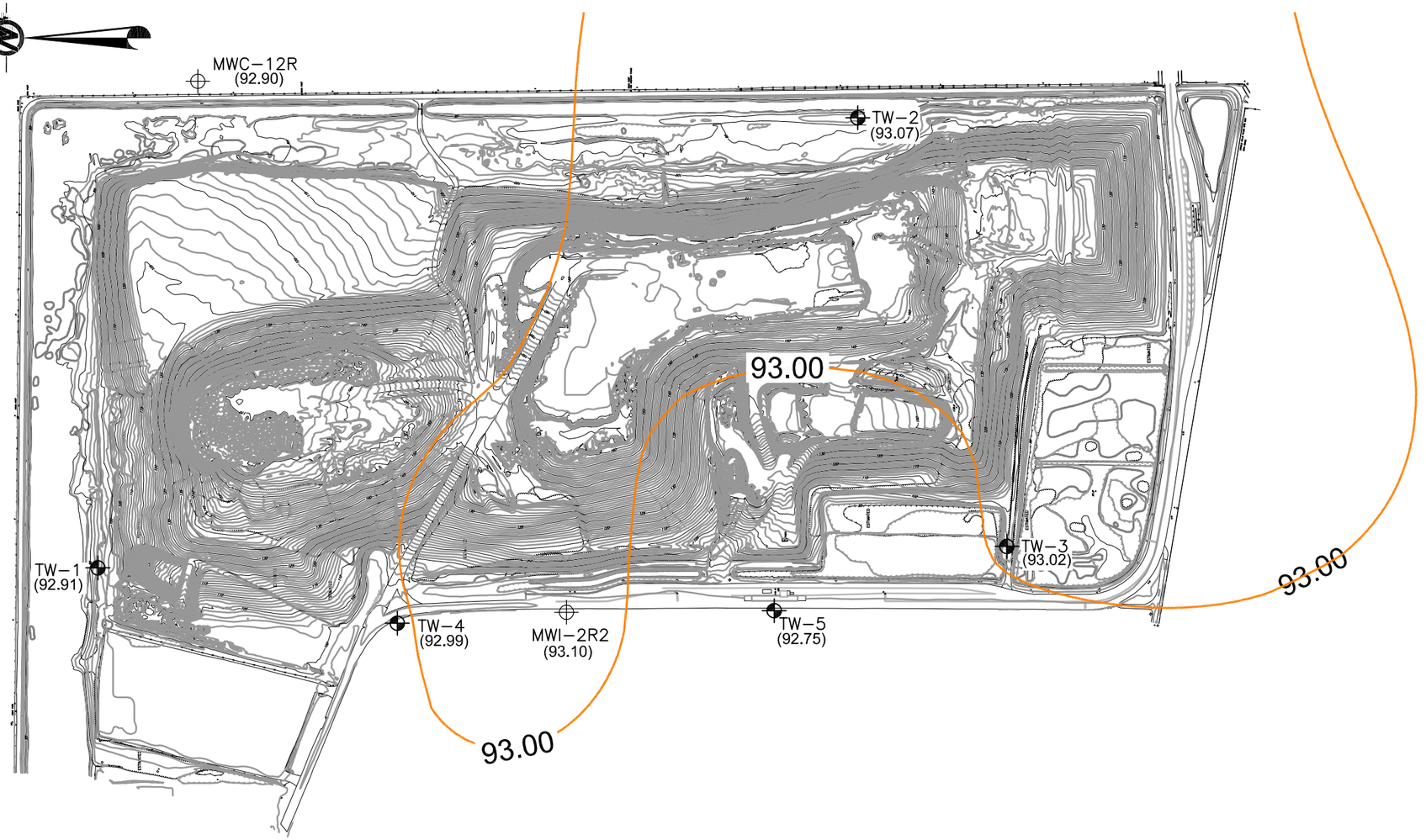
TITLE
POTENTIOMETIC MAP
OCTOBER 29, 2009
MID-TIDE OUTGOING

Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671		FILE No.	083826711H009	
DESIGN	SFS	12/15/09	SCALE AS SHOWN	REV.	0
CADD	BCL	02/01/10			
CHECK	SFS	02/01/10			
REVIEW	KBK	02/01/10			

FIGURE 9

Drawing file: 083826711H009.dwg Aug 24, 2010 - 3:15pm



LEGEND

MWC-12R	EXISTING MONITORING WELL LOCATION
TW-3	TEMPORARY MONITORING WELL LOCATION
(92.97)	GROUNDWATER ELEVATION (SITE VERTICAL DATUM)
93.00	GROUDNWATER ELEVATION CONTOUR

MWC-21R
(92.94)

300 0 300
SCALE FEET

REFERENCES

1.) CONTOURS BASED ON TOPOGRAPHIC SURVEY PRODUCED ON OCTOBER 13, 2009 BY SOUTHERN RESOURCE MAPPING, INC

PROJECT
PROGRESS ENERGY
CRYSTAL RIVER POWER PLANT
CITRUS COUNTY, FLORIDA

TITLE
POTENTIOMETIC MAP
JANUARY 19, 2010
MID-TIDE INCOMING

Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671		FILE No.	083826711H010	
DESIGN	SFS	01/22/10	SCALE AS SHOWN	REV.	0
CADD	BCL	02/01/10			
CHECK	SFS	02/01/10			
REVIEW	KBK	02/01/10			

FIGURE 10

Drawing file: 083826711H010.dwg Aug 24, 2010 - 3:15pm

APPENDIX A
SOIL BORING AND CPT LOGS

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. PB-1 (TW-1)

Golder Rep. Sam Stafford

Weather Sunny
Temperature 75°F

Started 1615, 10/26/2009
Completed 1715, 10/26/2009

Location 1,685,599 feet North, 279,648 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 99.89 feet
Depth to Water Not Measured
Total Depth of Boring 40 feet bgs

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Brown to very dark brown silty fine SAND					
4.0	Dense to very dense light tan fine to medium SAND (limestone fragments)	1	10 7 27	18/18	34	
9.0		2	10 8 10	18/18	18	
14.0	(less limestone fragments)	3	15 18 18	16/18	36	Moisture Content = 23.52%
19.0	(increasing limestone fragments)	4	50/3	<1/3	>50	
20.0						Driller notes hard drilling
22.0						Driller notes easier drilling
24.0	Compact to dense light tan fine to medium SAND, little clay, with some limestone fragments	5	8 7 6	18/18	13	
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-1 (TW-1)**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1615, 10/26/2009		
Completed	1715, 10/26/2009	**Surface Elevation**	99.89 feet
		Depth to Water	Not Measured
Location	1,685,599 feet North, 279,648 feet East	**Total Depth of Boring**	40 feet bgs

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0	Compact to dense light tan fine to medium SAND, little clay, with some limestone fragments					
29.0		6	24 15 10	16 18	25	
30.0						
31.0						
32.0						
33.0						
34.0		7	19 28 12	16 18	40	
35.0						
36.0						
37.0						
38.0						
39.0		8	7 8 33	16 18	41	
40.0						
	END OF BORING					Boring terminated at 40.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-2**
Golder Rep.	Sam Stafford		
Weather	Cloudy	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Soild Stem Auger
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1205, 10/26/2009		
Completed	1305, 10/26/2009	**Surface Elevation**	97.51 feet
		Depth to Water	Not Measured
Location	1,685,464 feet North, 280,606 feet East	**Total Depth of Boring**	20 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0						
	Brown to dark brown fine SAND some silt					
1.0						
2.0						
3.0						
4.0	Dense to very dense tan to light tan fine to medium silty SAND with limestone fragments	1	50/4	4/4	>50	
5.0						
6.0						
7.0						
8.0						
9.0	(very light tan limestone fragments)	2	50/5	5/5	>50	
10.0						
11.0						
12.0						
13.0						
14.0		3	23 33 22	18/18	55	Moisture Content = 20.16%
15.0						
16.0						
17.0						Easier drilling noted
18.0						
19.0	Dense light tan silty SAND with limestone fragments	4	7 20 25	18/18	45	Difficulty removing spoon
20.0						
	END OF BORING					Boring terminated at 20.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-3**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary, Solid Stem Auger to 20 feet bgs
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1412, 10/26/2009		
Completed	1540, 10/26/2009	**Surface Elevation**	99.31 feet
		Depth to Water	Not Measured
Location	1,684,805 feet North, 280,597 feet East	**Total Depth of Boring**	35 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0						
1.0	Brown to very dark brown fine SAND, little to some silt					
2.0						
3.0						
4.0	Compact dark brown fine SAND, some silt, with light tan limestone fragments	1	1 4 20	18/18	24	
5.0						
6.0						
7.0						
8.0						
9.0	Very dense light tan limestone fragments sampled as _____	2	50/4	2/4	>50	Limited recovery
10.0						Pale Yellow, COARSE TO FINE SAND, some clayey silt, some fine gravel. (SM)
11.0						
12.0						Hard drilling noted
13.0						
14.0		3	50/1	0/1	>50	
15.0						Drill cuttings in spoon
16.0						
17.0						
18.0						
19.0	Dense to very dense light tan fine to medium SAND with limestone fragments, little to some silt and clay	4	17 31 50/4	16/16	>50	
20.0						Start mud rotary drilling
21.0						
22.0						
23.0						
24.0		5	11 24 9	18/18	33	Moisture Content = 30.65%
25.0						
26.0						
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-3**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary, Solid Stem Auger to 20 feet bgs
		Drilling Rig	CME 55 ATV
Started	1412, 10/26/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1540, 10/26/2009	**Surface Elevation**	99.31 feet
		Depth to Water	Not Measured
Location	1,684,805 feet North, 280,597 feet East	**Total Depth of Boring**	35 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0	Dense to very dense light tan fine to medium SAND with limestone fragments, little to some silt and clay					
29.0	(more limestone fragments)	6	10 19 30	18/18	49	
30.0						
31.0						
32.0						
33.0						
34.0		7	50/0	0/0	>50	No recovery
35.0						

END OF BORING

Boring terminated at 35.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. PB-4

Golder Rep. Sam Stafford

Weather Sunny
Temperature 75°F

Started 1435, 10/20/2009
Completed 1755, 10/20/2009

Location 1,683,770 feet North, 280,724 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 96.56 feet
Depth to Water Not Measured
Total Depth of Boring 58 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Grey to brown silty SAND to fine SAND					
4.0	Loose brown to grey fine SAND	1	4 2 5	18/18	7	
9.0	Very dense light tan fine to medium SAND and GRAVEL with limestone and shell fragments, little clayey silt	2	50/6	6/6	>50	
14.0		3	50/3	3/3	>50	Some drilling debris noted in spoon
16.0						Driller notes easy drilling at 16 feet bgs
19.0	Very loose brown silty fine SAND	4	<1	18/18	<1	Weight of Hammer
24.0		5	1 1/12	18/18	1	Moisture Content = 19.30%
28.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-4**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1435, 10/20/2009		
Completed	1755, 10/20/2009	**Surface Elevation**	96.56 feet
		Depth to Water	Not Measured
Location	1,683,770 feet North, 280,724 feet East	**Total Depth of Boring**	58 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
29.0	Very loose brown fine SAND with some limestone fragments	6	2 1/12	18/18	1	
30.0						
31.0						
32.0						
33.0						
34.0	Very loose brown silty fine SAND		<1	18	<1	Weight of Hammer
35.0						
36.0						Spoon drops freely under weight of hammer
37.0						
38.0						
39.0		7	<1	18/18	<1	Weight of Hammer
40.0						
41.0						Drilling continued until hard material encountered
42.0						
43.0						
44.0						
45.0						
46.0						
47.0						
48.0						
49.0						
50.0						
51.0						
52.0						
53.0						
54.0						
55.0						
56.0						
57.0						
58.0	Dense material encountered at 58 feet bgs - boring terminated					

END OF BORING

Boring terminated at 58.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. PB-4A (TW-2)

Golder Rep. Sam Stafford

Weather Sunny
Temperature 70°F

Started 0855, 10/21/2009
Completed 1055, 10/22/2009

Location 1,683,723 feet North, 280,724 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method

Surface Elevation 96.91 feet
Depth to Water Not Measured
Total Depth of Boring 32 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0						
	Grey to brown silty to fine SAND					No samples obtained from PB-4A
1.0						
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0	Limestone encountered at 9 feet bgs - not sampled					Driller notes hard drilling
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						Wash sample obtained from with casing
16.0						
17.0						
18.0	Soft material encountered - not sampled					Driller notes easier drilling
19.0						
20.0						
21.0						
22.0						Casing set to 22 feet bgs
23.0						
24.0						
25.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-4A (TW-2)**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	0855, 10/21/2009	**Sampling Method**	
Completed	1055, 10/22/2009	**Surface Elevation**	96.91 feet
		Depth to Water	Not Measured
Location	1,683,723 feet North, 280,724 feet East	**Total Depth of Boring**	32 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
26.0	Hard material encountered - limestone					Driller notes harder drilling
27.0						
28.0						
29.0						
30.0						
31.0						
32.0	**END OF BORING**					Boring terminated at 32.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-4B**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	1035, 10/21/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1215, 10/21/2009	**Surface Elevation**	96.93 feet
		Depth to Water	Not Measured
Location	1,683,701 feet North, 280,723 feet East	**Total Depth of Boring**	26 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Loose grey fine silty SAND (possible fill)					
1.0						
2.0						
3.0						
4.0		1	1 3 5	18/18	8	
5.0						
6.0						
7.0						
8.0						
9.0	Loose tan to light tan/grey fine to coarse SAND and GRAVEL (limestone fragments) with grey fine SAND, some silt	2	3 5 4	18/18	9	
10.0						
11.0						
12.0						
13.0						
14.0	Dense very light tan fine to coarse SAND and GRAVEL (limestone fragments)	3	15 37 10	18/18	47	Moisture Content = 20.44%
15.0						
16.0						
17.0						
18.0						
19.0	limestone fragments - limited recovery	4	3 1 2	3/18	3	
20.0						
21.0						
22.0						
23.0						Hard drilling noted at 23 feet bgs
24.0	Compact yellow to light tan firn to corase SAND and GRAVEL, little to some silt (limestone fragments)	5	15 14 11	18/18	25	Moisture Content = 25.26%
25.0						
26.0	Very dense material encountered at 26 feet bgs, circulation lost, boring terminated					Casing installed to 25 feet bgs
	END OF BORING					Boring terminated at 26.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. PB-5 (TW-3)

Golder Rep. Sam Stafford

Weather Cloudy
Temperature 75°F

Started 0810, 10/27/2009
Completed 0915, 10/27/2009

Location 1,683,426 feet North, 279,750 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 99.02 feet
Depth to Water Not Measured
Total Depth of Boring 40 feet below groun surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Dense dark brown to brown fine SAND little to some silt					
4.0	Very dense dark brown fine SAND some silt with layers of light tan fine to coarse SAND (limestone fragments)	1	30 27 30	18/18	57	Moisture Content = 8.89%
9.0	Dense to very dense tan to light tan fine to coarse SAND (limestone fragments)	2	12 21 15	18/18	36	
14.0		3	10 12 39	18/18	51	
19.0		4	18 37 28	18/18	65	
21.0						Driller notes hard drilling
24.0	limestone fragment recovered	5	50/1	<1/1	>50	
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-5 (TW-3)**
Golder Rep.	Sam Stafford		
Weather	Cloudy	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	0810, 10/27/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	0915, 10/27/2009	**Surface Elevation**	99.02 feet
		Depth to Water	Not Measured
Location	1,683,426 feet North, 279,750 feet East	**Total Depth of Boring**	40 feet below groun surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Compact to very dense light tan, fine to medium SAND, little clayey SAND	6	9 9 10	18 18	19	Moisture Content = 26.59%
30.0						
31.0						
32.0						
33.0						
34.0	SAA (more limestone fragments)	7	20 24 20	18 18	44	
35.0						
36.0						
37.0						
38.0						
39.0	SAA	8	24 46 16	16 18	62	Difficulty removing spoon
40.0						

END OF BORING

Boring terminated at 40.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-6 (TW-4)**
Golder Rep.	Sam Stafford		
Weather	Partly Cloudy	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	0955, 10/27/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1055, 10/27/2009	**Surface Elevation**	98.45 feet
		Depth to Water	Not Measured
Location	1,684,927 feet North, 279,604 feet East	**Total Depth of Boring**	40 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Black to dark grey fine silty SAND (possible fill)					
4.0	Compact dark grey/black silty fine SAND with organic material (wood), transition to tan limestone fragments	1	3 3 8	18/18	11	
9.0	Compact to very dense light tan to tan fine to coarse SAND and GRAVEL (limestone fragments)	2	8 8 10	18/18	18	
14.0		3	10 10 20	18/18	30	Moisture Content = 25.86%
19.0		4	25 50/1	7/7	>50	
22.0						Hard drilling noted
24.0	limestone fragment	5	50/2	<1/2	>50	
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. PB-6 (TW-4)**
Golder Rep.	Sam Stafford		
Weather	Partly Cloudy	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	0955, 10/27/2009		
Completed	1055, 10/27/2009	**Surface Elevation**	98.45 feet
		Depth to Water	Not Measured
Location	1,684,927 feet North, 279,604 feet East	**Total Depth of Boring**	40 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Compact to dense tan to yellow tan fine to medium SAND with limestone fragments	6	3 4 6	14/18	10	
30.0						
31.0						
32.0						
33.0						
34.0		7	11 30 14	18/18	44	
35.0						
36.0						
37.0						
38.0						
39.0	Compact tan fine to medium SAND with little clay and layers of limestone fragments	8	24 17 12	16/18	29	Moisture Content = 24.99%
40.0	**END OF BORING**					Boring terminated at 40.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-1**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	1200, 10/29/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1350, 10/29/2009	**Surface Elevation**	124.29 feet
		Depth to Water	Not Measured
Location	1,685,360 feet North, 279,644 feet East	**Total Depth of Boring**	65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Dark grey medium to fine SAND with brown rock fragments (bottom ash with pyrite)					Ash - Gray, MEDIUM TO FINE SAND, and clayey silt, some coarse to fine gravel. (SM)
1.0						
2.0						
3.0						
4.0	Loose grey fine to medium SAND (bottom ash)	1	2 2 2	14/18	4	Moisture Content = 8.41%
5.0						
6.0						
7.0						
8.0						
9.0	Loose dark grey fine silty SAND (fly ash) with dark green and orange fine to coarse SAND (bottom ash)	2	3 3 4	14/18	7	
10.0						
11.0						
12.0						
13.0						
14.0	Compact dark grey fine to coarse SAND (bottom ash - some fly ash)	3	10 10 6	16/18	16	Moisture Content = 39.99%
15.0						
16.0						
17.0						
18.0						
19.0		4	2 1 2	16/18	3	
20.0						
21.0						
22.0						
23.0						
24.0	Compact dark grey silty SAND (fly ash)	5	4 3 10	16/18	13	Moisture Content = 36.43%
25.0						
26.0						
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-1**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1200, 10/29/2009		
Completed	1350, 10/29/2009	**Surface Elevation**	124.29 feet
		Depth to Water	Not Measured
Location	1,685,360 feet North, 279,644 feet East	**Total Depth of Boring**	65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						ESTIMATED BASE OF ASH MONOFILL
29.0	Loose dark green/orange fine clayey SAND	6	3 3 4	18/18	7	
30.0						
31.0						
32.0						
33.0						Driller notes hard drilling
34.0	Compact to dense light tan to tan fine to medium SAND with limestone fragments	7	20 9 14	16/18	23	
35.0						
36.0						
37.0						
38.0						
39.0		8	13 30 13	16/18	43	
40.0						
41.0						
42.0						
43.0						
44.0		9	10 10 7	16/18	17	
45.0						
46.0						Lost circulation
47.0						
48.0						
49.0	Very loose tan to orange brown fine to medium SAND with limestone fragments	10	2 1/12	10/18	1	
50.0						
51.0						
52.0						
53.0						
54.0		11	3 7 8	12/18	15	
55.0						
56.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-1**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	75°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	1200, 10/29/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1350, 10/29/2009	**Surface Elevation**	124.29 feet
		Depth to Water	Not Measured
Location	1,685,360 feet North, 279,644 feet East	**Total Depth of Boring**	65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0						No circulation
58.0						
59.0	Compact light tan fine to medium SAND	12	11 14 13	18 18	27	
60.0						
61.0						
62.0						
63.0						
64.0	Dense tan fine to medium SAND with limestone fragments	13	7 20 12	18 18	32	
65.0						
	END OF BORING					Boring terminated at 65.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-2**
Golder Rep.	Sam Stafford		
Weather	Partly Cloudy	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1210, 10/27/2009		
Completed	1605, 10/27/2009	**Surface Elevation**	168.84 feet
		Depth to Water	Not Measured
Location	1,685,184 feet North, 280,056 feet East	**Total Depth of Boring**	100 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Loose to compact dark grey silty SAND (fly ash/high chloride ash)					Ash - Gray, CLAYEY SILT, and medium to fine sand, trace fine gravel. (ML)
1.0						
2.0						
3.0						
4.0		1	2 3 3	18/18	6	Moisture Content = 22.91%
5.0						
6.0						
7.0						
8.0						
9.0	Compact dark grey silty SAND (ash) with scattered limestone material (fill)	2	5 7 10	18/18	17	
10.0						
11.0						
12.0						
13.0						
14.0	Compact dark grey/green silty SAND (ash) with intermittent fragments of limestone (fill)	3	4 7 8	18/18	15	
15.0						
16.0						Attempt Shelby Tube sample - no recovery
17.0						
18.0						
19.0	Compact dark grey/green silty SAND with some fine gravel and light grey silty SAND layer (fly ash)	4	8 8 7	18/18	15	
20.0						
21.0						
22.0						
23.0						
24.0	Loose to dense dark grey silty SAND, little clay (ash) with little limestone gravel (fill)	5	6 6 8	14/18	14	
25.0						
26.0						
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-2**
Golder Rep.	Sam Stafford		
Weather	Partly Cloudy	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	1210, 10/27/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1605, 10/27/2009	**Surface Elevation**	168.84 feet
		Depth to Water	Not Measured
Location	1,685,184 feet North, 280,056 feet East	**Total Depth of Boring**	100 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Loose to dense dark grey silty SAND, little clay (ash)	6	1 1 3	18/18	4	
30.0						Shelby Tube Sample - **AB-2 (30 to 32 feet bgs)**
31.0						Approximately 18" of 24" recovery
32.0						
33.0						
34.0		7	11 20 27	18/18	47	Moisture Content = 35.07%
35.0						
36.0						
37.0						
38.0						
39.0		8	3 5 5	18/18	10	
40.0						
41.0						
42.0						
43.0						
44.0		9	4 3 4	18/18	7	
45.0						
46.0						
47.0						
48.0						
49.0		10	3 3 3	18/18	6	
50.0						
51.0						
52.0						
53.0						
54.0		11	3 2 3	18/18	5	Moisture Content = 40.52%
55.0						
56.0						Attempt Shelby Tube sample - no recovery

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-2**
Golder Rep.	Sam Stafford		
Weather	Partly Cloudy	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	1210, 10/27/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1605, 10/27/2009	**Surface Elevation**	168.84 feet
		Depth to Water	Not Measured
Location	1,685,184 feet North, 280,056 feet East	**Total Depth of Boring**	100 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0						
58.0						Driller notes difficult drilling
59.0	Compact dark grey silty SAND, some clay, with limestone fragments	12	10 8 11	12/18	19	Moisture Content = 26.52%
60.0						
61.0						
62.0						
63.0						ESTIMATED BASE OF ASH MONOFILL
64.0	Compact light grey limestone fragments with organic material (wood) and black sandy SILT	13	40 13 6	16/18	19	Very hard first 3" of SPT
65.0						
66.0						
67.0						
68.0						
69.0	Loose green to brown fine SAND with some limestone fragments	14	5 5 5	16/18	10	
70.0						
71.0						
72.0						
73.0						
74.0	Loose dark brown silty SAND with some organic material (wood)	15	4 4 5	16/18	9	
75.0						
76.0						
77.0						
78.0						
79.0	Loose yellow to brown fine SAND little silty clay	16	8 2 3	18/18	5	
80.0						
81.0						
82.0						
83.0						
84.0	Loose to compact yellow tan to light tan fine to medium SAND with limestone fragments	17	4 4 2	18/18	6	
85.0						

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-2

Golder Rep. Sam Stafford

Weather Partly Cloudy

Temperature 80°F

Started 1210, 10/27/2009

Completed 1605, 10/27/2009

Location 1,685,184 feet North, 280,056 feet East

Drilling Company WPC

Drilling Method Mud Rotary

Drilling Rig CME 55 ATV

Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 168.84 feet

Depth to Water Not Measured

Total Depth of Boring 100 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
86.0						
87.0						
88.0						
89.0	Loose to compact yellow tan to light tan fine to medium SAND with limestone fragments	18	5 3 5	18 18	8	
90.0						
91.0						
92.0						
93.0						
94.0		19	4 5 12	18 18	17	
95.0						
96.0						
97.0						
98.0						
99.0	Compact brown to tan fine SAND with some limestone fragments	20	2 6 10	16 18	16	
100.0						

END OF BORING

Boring terminated at 100.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-3

Golder Rep. Sam Stafford

Weather Sunny
Temperature 80°F

Started 1230, 10/22/2009
Completed 1815, 10/22/2009

Location 1,685,330 feet north, 280,780 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 123.81 feet
Depth to Water Not Measured
Total Depth of Boring 90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Brown fine to medium SAND some gravel (fill)					Ash - Dark Gray and Pale Yellow, MEDIUM TO FINE SAND, and clayey silt, little fine gravel. (SM)
1.0						
2.0						
3.0	Loose dark grey fine silty SAND (apparent fly ash)					
4.0		1	5 5 3	18 18	8	Moisture Content = 30.22%
5.0						
6.0						Clayey material noted in drilling returns
7.0						
8.0						
9.0	Loose grey fine silty SAND	2	2 2 2	18 18	4	
10.0						
11.0						Driller noted harder drilling for 1 foot
12.0						
13.0						
14.0	Very loose dark gry silty fine SAND (apparently fly ash)	3	1 2 1	18 18	3	
15.0						
16.0						Coal pieces noted in drilling returns
17.0						
18.0						
19.0	Compact to loose brownish green and grey fine to medium SAND	4	10 10 11	18 18	21	Moisture Content = 15.21%
20.0						
21.0						
22.0						
23.0						
24.0	(trace organic material)	5	5 4 4	18 18	8	
25.0						
26.0						
27.0						

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-3

Golder Rep. Sam Stafford

Weather Sunny
Temperature 80°F

Started 1230, 10/22/2009
Completed 1815, 10/22/2009

Location 1,685,330 feet north, 280,780 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 123.81 feet
Depth to Water Not Measured
Total Depth of Boring 90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Loose dark grey/brown fine silty SAND, trace organic material	6	2 3 3	18/18	6	Gray, CLAYEY SILT, little fine sand. (ML) (11.5% organic content)
30.0						
31.0						Large quantities of wood cuttings noted in drilling returns pine odor - wash sample collected
32.0						
33.0						
34.0	Very loose black organic CLAYEY SILT	7	2 1 1	18/18	2	
35.0						
36.0						Lost circulation at 36 feet bgs
37.0						
38.0						
39.0	Very loose green brown fine silty SAND with few limestone fragments	8	<1	3/18	<1	Weight of Hammer
40.0						No Circulation
41.0						Casing installed to 40 feet bgs
42.0						Lost circulation at 42 feet bgs
43.0						
44.0	Very loose brown fine to medium sand with few limestone fragments	9	2 1 1	2/18	2	
45.0						
46.0						
47.0						
48.0						
49.0	Dense yellow to tan fine to medium SAND with limestone fragments	10	6 11 21	18/18	32	
50.0						Casing installed to 50 feet bgs
51.0						Lost circulation at 51 feet bgs
52.0						
53.0						
54.0	Very loose brown fine SAND some clayey silt	11	1 1 1	16/18	2	
55.0						Casing installed to 55 feet bgs
56.0						

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-3

Golder Rep. Sam Stafford

Weather Sunny
Temperature 80°F

Started 1230, 10/22/2009
Completed 1815, 10/22/2009

Location 1,685,330 feet north, 280,780 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 123.81 feet
Depth to Water Not Measured
Total Depth of Boring 90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0						
58.0						
59.0	Very loose yellow/tan fine SAND	12	1 1 1	18/18	2	
60.0						
61.0						
62.0						Lost circulation
63.0						
64.0						Spoon drops to 65 feet
65.0	Very loose yellow/tan fine SAND with some organge clayey SAND					
66.0		13	1/18	18/18	<1	
67.0						
68.0						Casing pused very easily
69.0	Very loose yellow/orange fine SAND with silty clay layers	14	1/12 3	18/18	3	
70.0						
71.0						Hard drilling noted by driller
72.0						
73.0						
74.0						Apparent void, rod drop to 74.5 feet, WPC wash down to 78.5 feet
75.0						Soft material noted at 75 feet bgs
76.0						Hard drilling noted at 76 feet bgs
77.0						Lost circulation
78.0						
79.0	Very dense light tan limesone fragments	15	50/0	0/18	>50	
80.0						
81.0						No circulation
82.0						
83.0						
84.0	Very dense tan/yellow silty SAND	16	7 19 35	18/18	54	
85.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-3**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1230, 10/22/2009		
Completed	1815, 10/22/2009	**Surface Elevation**	123.81 feet
		Depth to Water	Not Measured
Location	1,685,330 feet north, 280,780 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
86.0						
87.0						
88.0						
89.0		17	50/1	1/1	>50	
90.0						
	END OF BORING					Boring terminated at 90.0 ft-bgs

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-4**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	0740, 10/28/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1235, 10/28/2009	**Surface Elevation**	170.22 feet
		Depth to Water	Not Measured
Location	1,684,380 feet North, 280,363 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Very loose to compact dark grey fine SAND some clayey silt (fly ash)					
1.0						
2.0						
3.0						
4.0		1	4 4 6	18/18	10	Moisture Content = 18.65%
5.0						
6.0						
7.0						
8.0						
9.0		2	7 7 6	18/18	13	
10.0						
11.0						
12.0						
13.0						
14.0		3	1 3 8	16/18	11	
15.0						
16.0						
17.0						
18.0						
19.0		4	4 1 1	18/18	2	
20.0						
21.0						Shelby Tube Sample Collected - AB-4 (20 to 22 ft bgs) 16/24" recovery
22.0						
23.0						
24.0		5	5 9 7	18/18	16	Moisture Content = 45.91%
25.0						
26.0						
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-4**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	0740, 10/28/2009		
Completed	1235, 10/28/2009	**Surface Elevation**	170.22 feet
		Depth to Water	Not Measured
Location	1,684,380 feet North, 280,363 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Very loose to compact, dark grey fine SAND, some clayey silt (fly ash)	6	1/12 1	18/18	1	
30.0						
31.0						Shelby Tube Sample Collected - AB-4 (30 to 32 ft bgs) 14/24" recovery
32.0						
33.0						Lost circulation
34.0		7	1 1 4	16/18	5	
35.0						
36.0						Hole caved in at 30 feet, 35 feet of casing set, circulation
37.0						
38.0						
39.0		8	1 1 1	14/18	2	
40.0						
41.0						Lost circulation
42.0						
43.0						
44.0		9	1 1 1	18/18	2	
45.0						
46.0						Casing set to 45 feet bgs
47.0						
48.0						
49.0		10	10 9 7	14/18	16	Moisture Content = 40.51%
50.0						
51.0						
52.0						
53.0						
54.0		11	6 7 8	18/18	15	Moisture Content = 36.44%
55.0						
56.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-4**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
Started	0740, 10/28/2009	**Sampling Method**	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Completed	1235, 10/28/2009	**Surface Elevation**	170.22 feet
		Depth to Water	Not Measured
Location	1,684,380 feet North, 280,363 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0						
58.0						
59.0	Very loose to compact, dark grey fine SAND, some clayey silt (fly ash)	12	4 3 3	14/18	6	
60.0						
61.0						
62.0						
63.0						
64.0	Loose yellow grey fine silty SAND (ash mix)	13	4 5 4	14/18	9	
65.0						
66.0						
67.0						
68.0						
69.0	Loose dark grey silty SAND (fly ash)	14	3 3 3	12/18	6	
70.0						
71.0						
72.0						
73.0						ESTIMATED BASE OF ASH MONOFILL
74.0	Compact brown to dark brown silty fine SAND, trace organics and few limestone fragments	15	5 6 5	12/18	11	
75.0						
76.0						
77.0						
78.0						
79.0	Very dense tan to light tan fine to medium SAND with limestone fragments	16	10 25 38	12/18	63	
80.0						
81.0						
82.0						
83.0						
84.0	Light tan limestone	17	50/5	1/5	>50	
85.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-4**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	0740, 10/28/2009		
Completed	1235, 10/28/2009	**Surface Elevation**	170.22 feet
		Depth to Water	Not Measured
Location	1,684,380 feet North, 280,363 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
86.0	Very dense tan to light tan fine to medium SAND with limestone fragments					
87.0						
88.0						
89.0		18	50/4	0/4	>50	No recovery
90.0						
	END OF BORING					Boring terminated at 90.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-5

Golder Rep. Sam Stafford

Weather Sunny

Temperature 70°F

Started 1745, 10/21/2009

Completed 1000, 10/22/2009

Location 1,684,039 feet North, 280,133 feet East

Drilling Company WPC

Drilling Method Mud Rotary

Drilling Rig CME 55 ATV

Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 141.42 feet

Depth to Water Not Measured

Total Depth of Boring 65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Very loose to compact grey to dark grey fine SAND (bottom ash)					Ash - Gray, CLAYEY SILT, and fine sand, trace fine gravel. (ML)
1.0						
2.0						
3.0						
4.0		1	1 1 1	18/18	2	Moisture Content = 25.89%
5.0						
6.0						
7.0						
8.0						
9.0		2	1 1 1	12/18	2	
10.0						
11.0						
12.0						
13.0						
14.0		3	2 2 4	12/18	6	
15.0						
16.0						
17.0						
18.0						
19.0		4	4 5 5	18/18	10	
20.0						
21.0						
22.0						
23.0						
24.0		5	2 5 5	8/18	10	Moisture Content = 32.39%
25.0						
26.0						
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-5**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	70°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1745, 10/21/2009		
Completed	1000, 10/22/2009	**Surface Elevation**	141.42 feet
		Depth to Water	Not Measured
Location	1,684,039 feet North, 280,133 feet East	**Total Depth of Boring**	65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Very loose dark grey fine SAND (bottom ash)	6	1 1 1	2/18	2	
30.0						
31.0						Lost circulation
32.0						
33.0						
34.0	Very loose to compact dark grey silty SAND some clayey silt (fly ash)	7	1 2 1	14/18	3	
35.0						
36.0						Lost cirulcation
37.0						
38.0						
39.0		8	9 12 17	14/18	29	Moisture Content = 29.25%
40.0						
41.0						Driller notes difficult drilling at 41 feet bgs
42.0						Ciculation lost at 42 feet bgs
43.0						ESTIMATED BASE OF ASH MONOFILL
44.0	Compact dark brown/grey fine SAND, some dark grey silt, trace organics (odor)	9	15 13 11	12/18	24	
45.0						
46.0						Hard drilling noted at 46 feet bgs
47.0						
48.0						
49.0	Dense to very dense light tan fine to coarse SAND and GRAVEL with limestone fragments	10	22 20 15	18/18	35	
50.0						
51.0						
52.0						
53.0						
54.0	(more gravel content)	11	30 23 15	14/18	38	
55.0						
56.0						

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-5

Golder Rep. Sam Stafford

Weather Sunny
Temperature 70°F

Started 1745, 10/21/2009
Completed 1000, 10/22/2009

Location 1,684,039 feet North, 280,133 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 141.42 feet
Depth to Water Not Measured
Total Depth of Boring 65 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0	Dense to very dense light tan fine to coarse SAND and GRAVEL with limestone fragments					
58.0						
59.0			50/1	0/1	>50	No recovery
60.0						
61.0						
62.0						
63.0						
64.0	limestone fragments	12	50/1	<1/1	>50	Screened drill cuttings collected from 55 to 65 feet bgs
65.0						

END OF BORING

Boring terminated at 65.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-6

Golder Rep. Sam Stafford

Weather Sunny

Temperature 80°F

Started 1415, 10/28/2009

Completed 1000, 10/29/2009

Location 1,683,861 feet North, 280,381 feet East

Drilling Company WPC

Drilling Method Mud Rotary

Drilling Rig CME 55 ATV

Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 167.11 feet

Depth to Water Not Measured

Total Depth of Boring 90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Very loose to compact dark grey SAND some clayey silt (fly ash)					Ash - Gray, CLAYEY SILT, little fine sand. (ML)
4.0		1	1/12 1	14/18	1	Moisture Content = 34.58%
9.0		2	3 2 2	16/18	4	
14.0		3	2 3 4	18/18	7	
19.0		4	5 13 12	18/18	25	Moisture Content = 33.87%
24.0		5	1/18	12/18	<1	
25.0						Lost Circulation
27.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-6**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1415, 10/28/2009		
Completed	1000, 10/29/2009	**Surface Elevation**	167.11 feet
		Depth to Water	Not Measured
Location	1,683,861 feet North, 280,381 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
28.0						
29.0	Very loose to compact dark grey SAND some clayey silt (fly ash)	6	1/12 1	16/18	1	
30.0						4" dia. casing set to 30 feet bgs
31.0						
32.0						
33.0						
34.0		7	1 1 1	16/18	2	Moisture Content = 41.18%
35.0						
36.0						Lost Circulation
37.0						
38.0						
39.0		8	1/12 1	16/18	1	
40.0						
41.0						4" dia. casing set to 40 feet bgs
42.0						
43.0						
44.0		9	1 1 2	14/18	3	
45.0						
46.0						Attempt Shelby tube No Recovery
47.0						
48.0						Lost Circulation
49.0		10	1 2 2	16/18	4	
50.0						
51.0						4" dia. casing set to 50 feet bgs
52.0						
53.0						
54.0		11	1 2 1	16/18	3	
55.0						
56.0						Attempt Shelby tube **AB-6 (55 to 57 FT BGS)** 12/24" Recovery

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. AB-6

Golder Rep. Sam Stafford

Weather Sunny
Temperature 80°F

Started 1415, 10/28/2009
Completed 1000, 10/29/2009

Location 1,683,861 feet North, 280,381 feet East

Drilling Company WPC
Drilling Method Mud Rotary
Drilling Rig CME 55 ATV
Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation 167.11 feet
Depth to Water Not Measured
Total Depth of Boring 90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
57.0						
58.0	Very loose to compact dark grey SAND some clayey silt (fly ash)					Lost Circulation 4" dia. casing set to 55 feet bgs
59.0		12	15 17 14	16/18	31	Moisture Content = 18.24%
60.0						
61.0						
62.0						
63.0						
64.0		13	2 2 1	16/18	3	
65.0						
66.0						
67.0						
68.0						ESTIMATED BASE OF ASH MONOFILL
69.0	Compact dark grey/brown fine SAND some clayey silt with little organic material	14	5 4 6	14/18	10	
70.0						
71.0						
72.0						
73.0						
74.0	Compact to very dense light tan fine to coarse SAND with limestone fragments	15	7 8 10	16/18	18	
75.0						
76.0						
77.0						
78.0						
79.0		16	16 15 15	16/18	30	
80.0						
81.0						
82.0						
83.0						
84.0	limestone fragments	17	50/2	<1/2	>50	
85.0						
86.0						

Soil Boring Log

Job Name	PEF CREC/ASH DISPOSAL AREA/FL	**Job No.** 083-82671.1	**Boring No. AB-6**
Golder Rep.	Sam Stafford		
Weather	Sunny	**Drilling Company**	WPC
Temperature	80°F	**Drilling Method**	Mud Rotary
		Drilling Rig	CME 55 ATV
		Sampling Method	SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)
Started	1415, 10/28/2009		
Completed	1000, 10/29/2009	**Surface Elevation**	167.11 feet
		Depth to Water	Not Measured
Location	1,683,861 feet North, 280,381 feet East	**Total Depth of Boring**	90 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
87.0						
88.0						
89.0	Dense light tan fine SAND some clayey silt with limestone fragments	18	16 18 18	18 18	36	
90.0						
	END OF BORING					Boring terminated at 90.0 ft-bgs

Soil Boring Log

Job Name PEF CREC/ASH DISPOSAL AREA/FL

Job No. 083-82671.1

Boring No. TW-5

Golder Rep. K. Karably

Weather Clear

Temperature 60°F

Started 1355, 12/21/2010

Completed 1500, 12/21/2010

Location 1,683,985 feet North, 279,563 feet East

Drilling Company WPC

Drilling Method Mud Rotary & HAS

Drilling Rig CME 55 ATV

Sampling Method SPT, 140 lb. Hammer/30-inch drop (Auto Hammer)

Surface Elevation ~ 97.5 feet

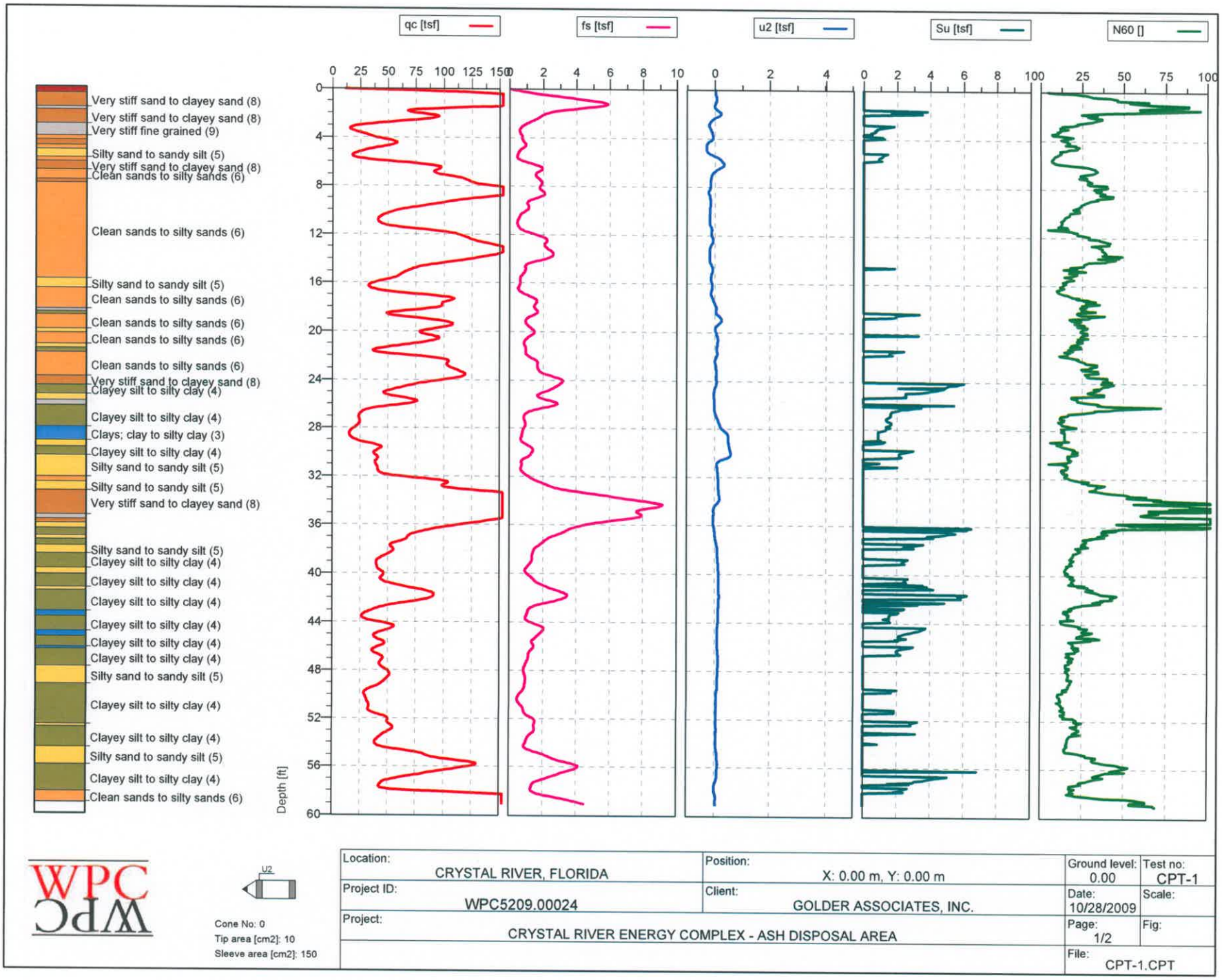
Depth to Water Not Measured

Total Depth of Boring 40 feet below ground surface

Depth (Feet)	Description	Sample ID	Blow Counts	Recovery	N-Value	Comments
0.0	Topsoil - Grey, fine SAND, some silt					
1.0	Firm/compact, tan to yellow brown, clayey silt and fine sand (ML-SM) with limestone	1	3 4 23 17	18/24	27	
2.0						
3.0	SAA	2	14 15 11 10	12/24	26	
4.0						
5.0						
6.0						
7.0						
8.0	Dense, light tan to white coarse to fine SAND, some clayey silt, little to some gravel (SW-SM) - with limestone	3	10 23 26 24	18/24	49	
9.0						
10.0						
11.0						
12.0						
13.0						
14.0	SAA, trace fine gravel (SM)	4	8 9 10 11	21/24	19	
15.0						
16.0						
17.0						
18.0						
19.0	SAA, more gravel	5	12 15 15 15	18/24	30	
20.0						

END OF BORING

Boring terminated at20.0 ft-bgs



WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-1
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/2	Fig:
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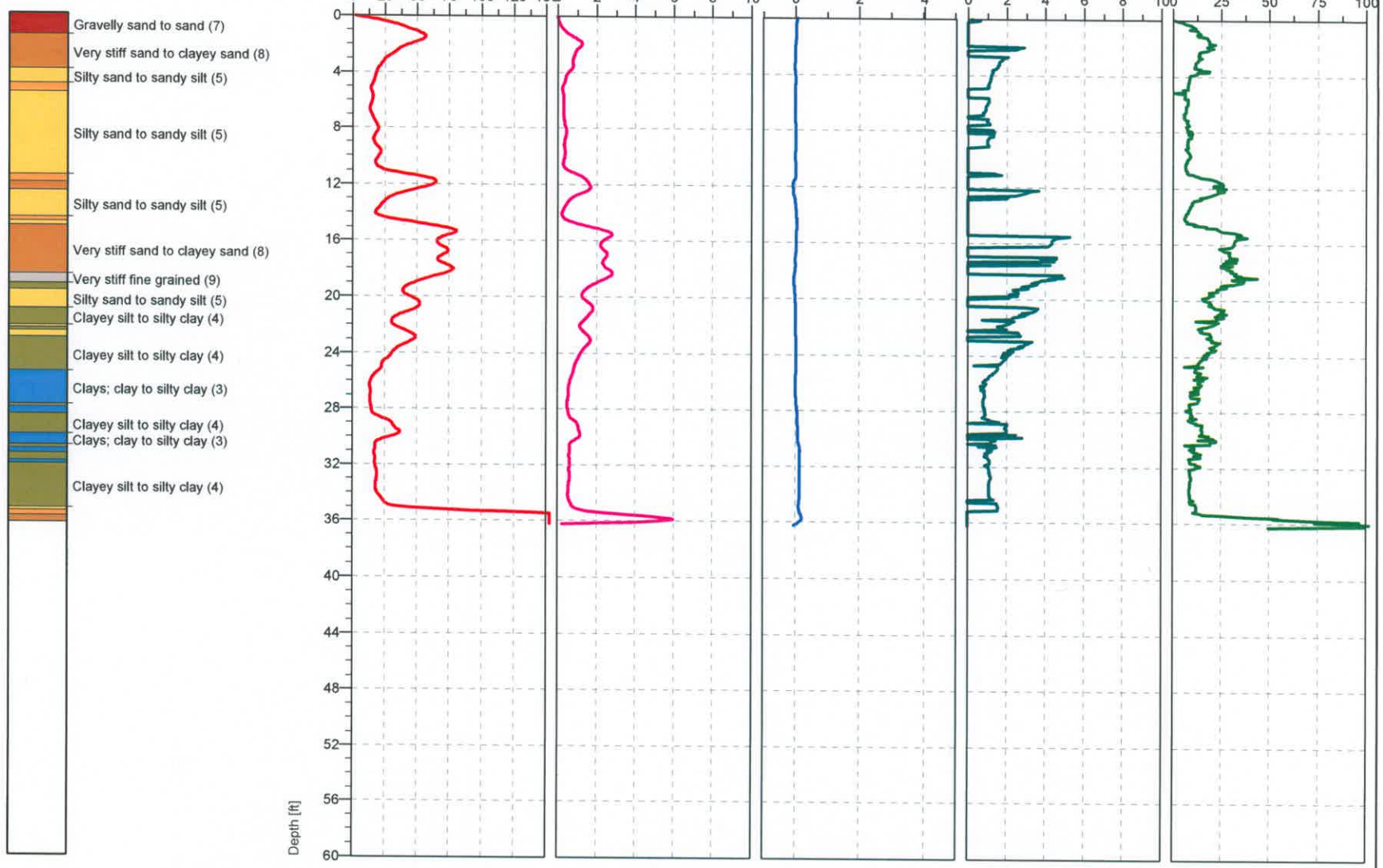
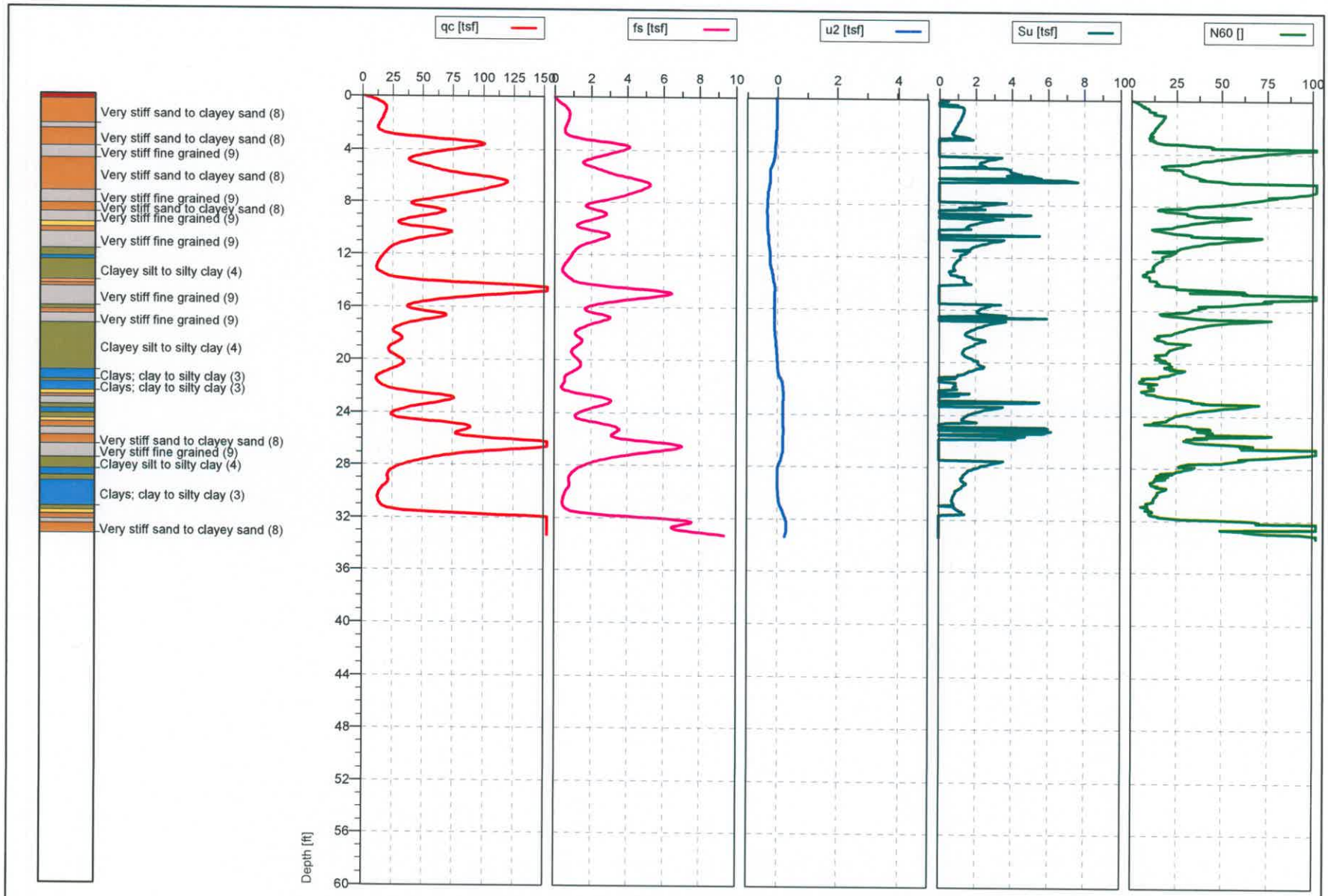


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-2
Project ID: WPC5209.00024	Client: GOLDER & ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-2.CPT	



WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-3
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
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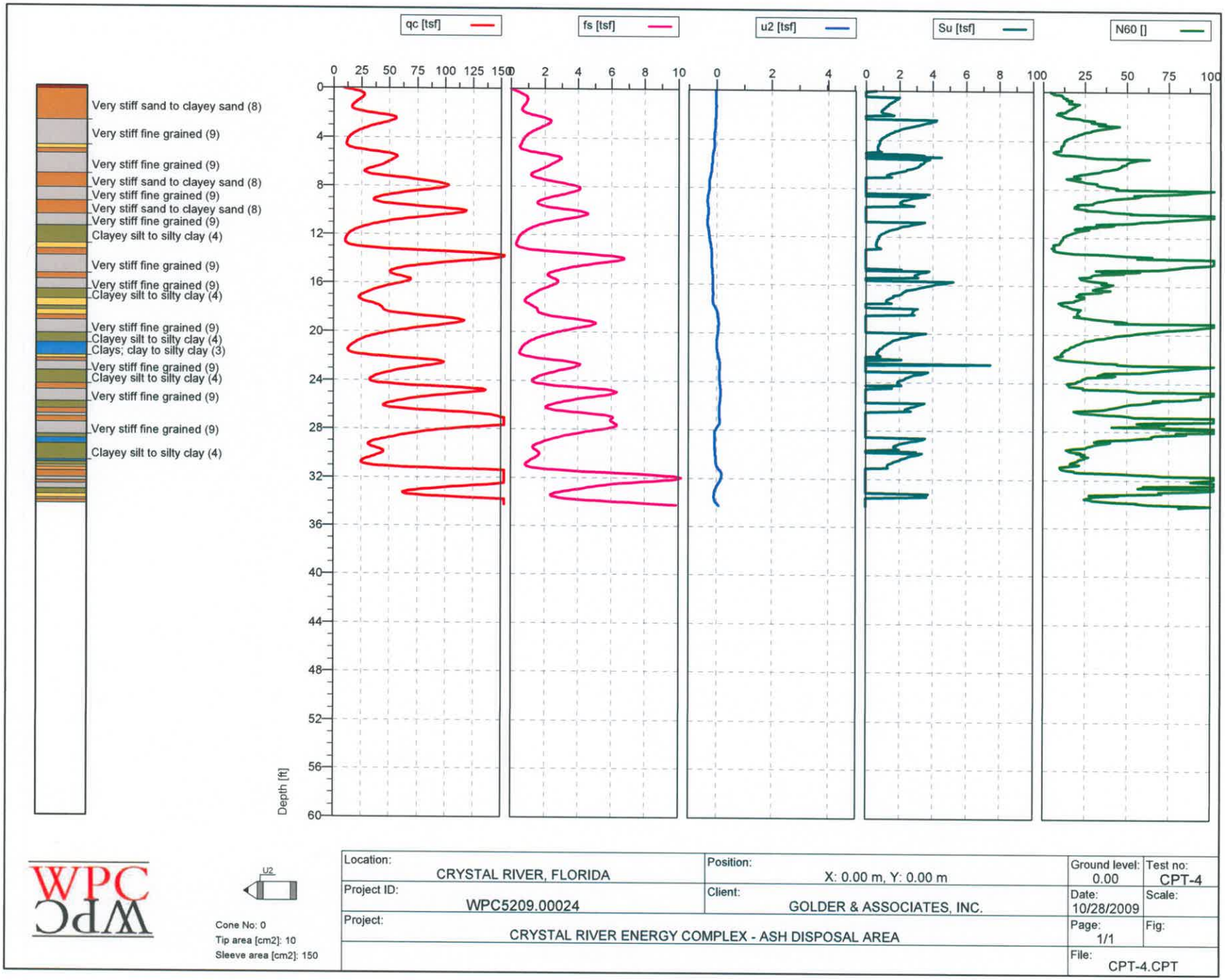
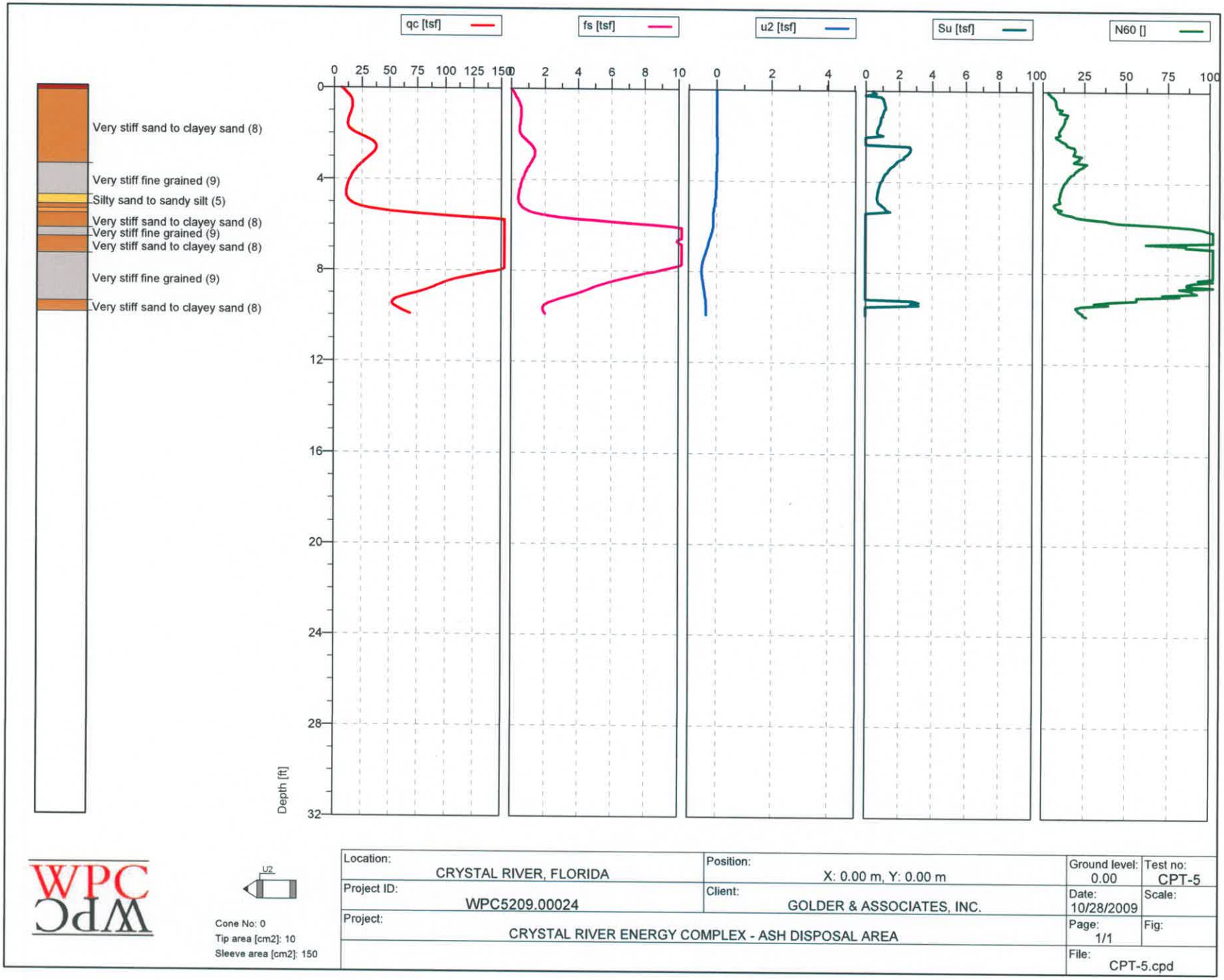


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-4
Project ID: WPC5209.00024	Client: GOLDER & ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-4.CPT	

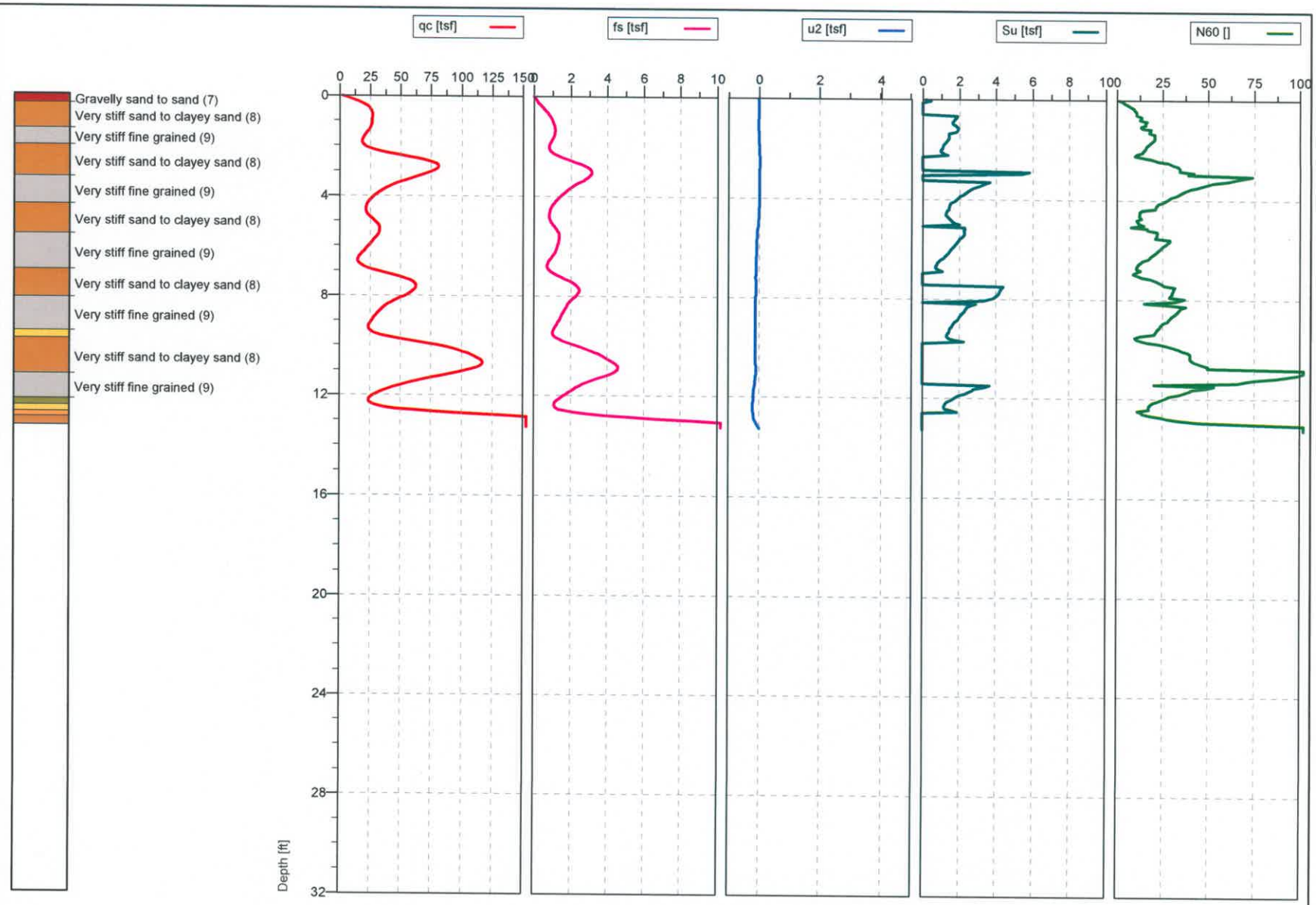


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-5
Project ID: WPC5209.00024	Client: GOLDER & ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-5.cpd	

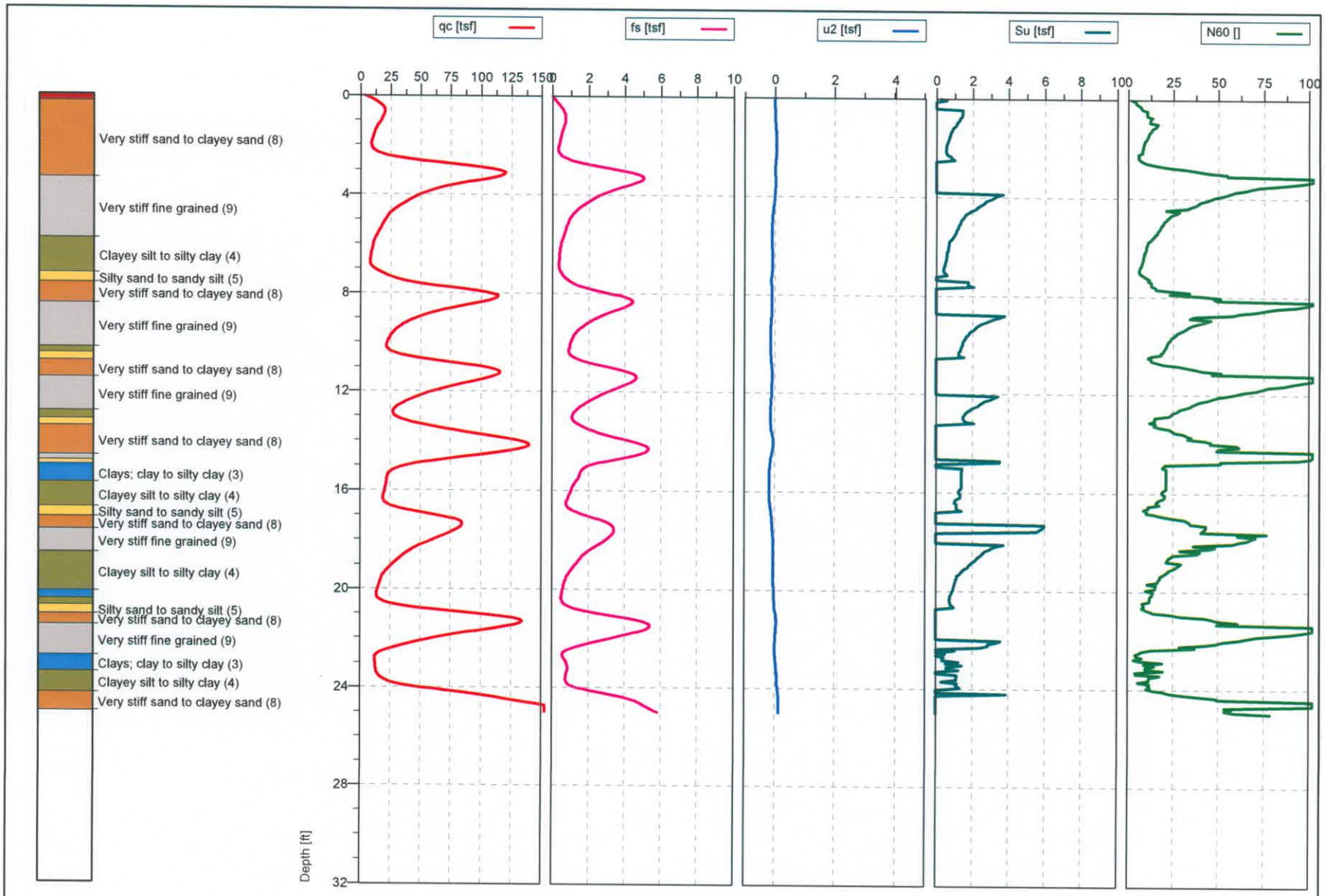


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-6
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-6.CPT	

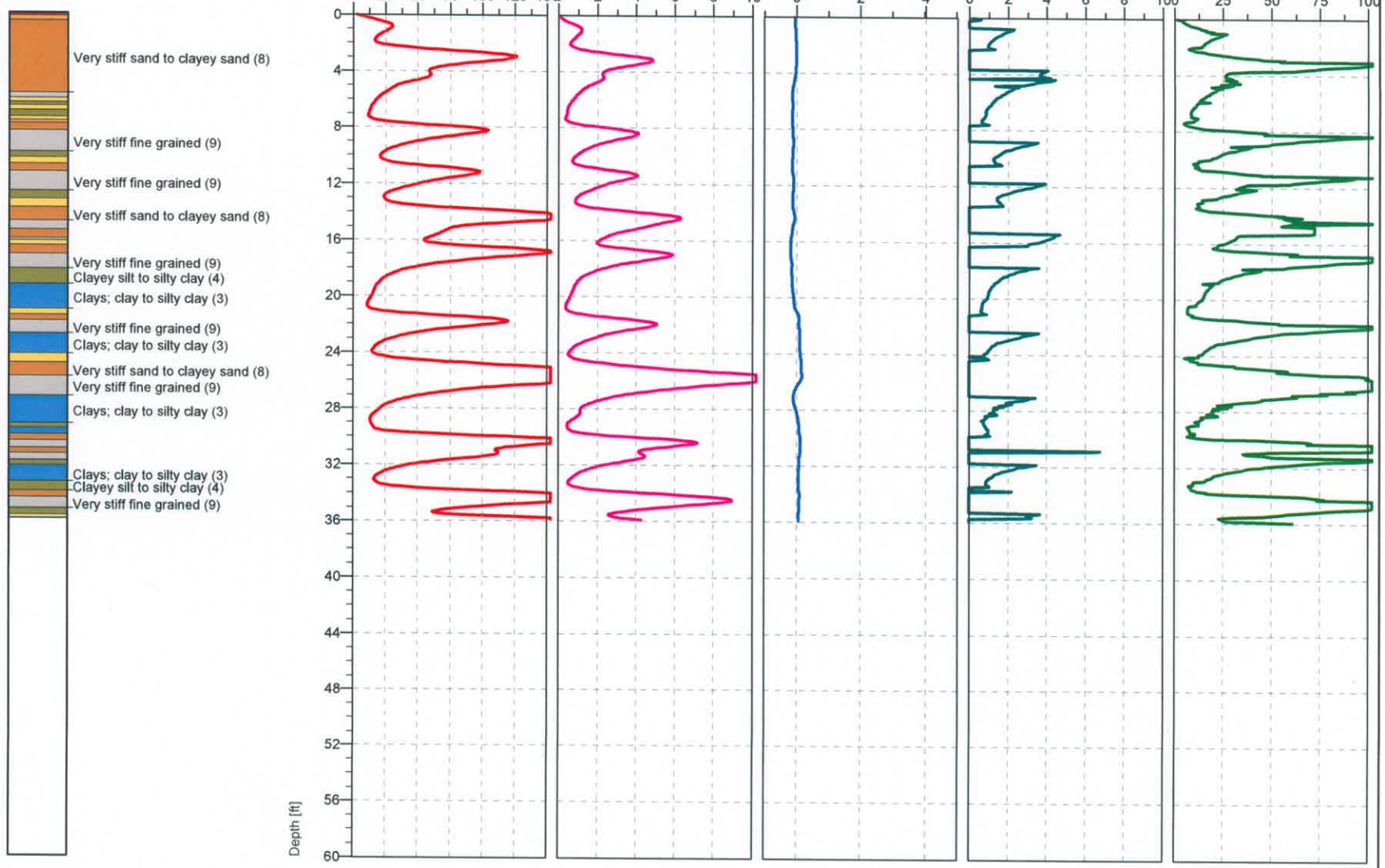


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-8
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-8.CPT	

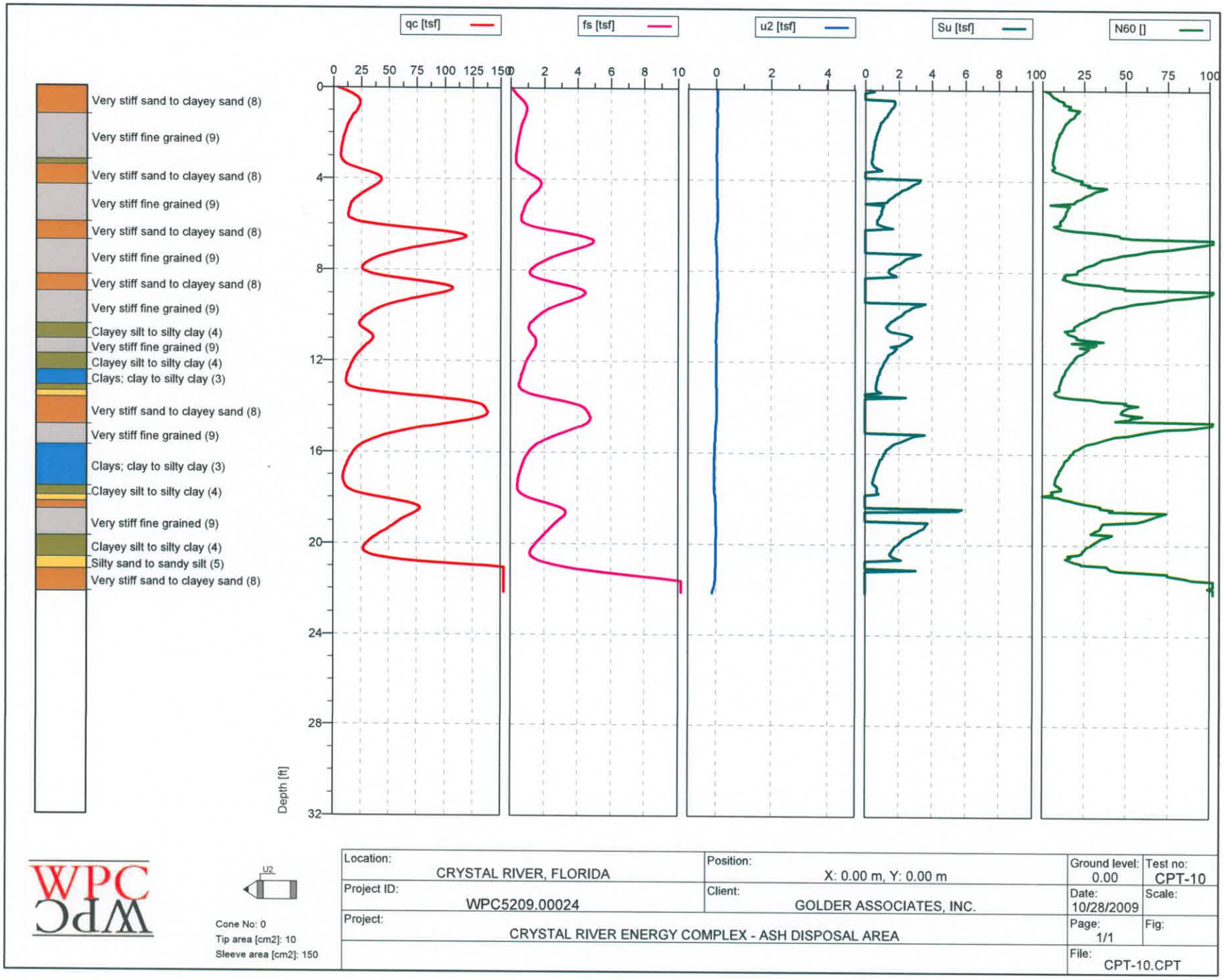


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-9
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-9.CPT	



WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-10
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
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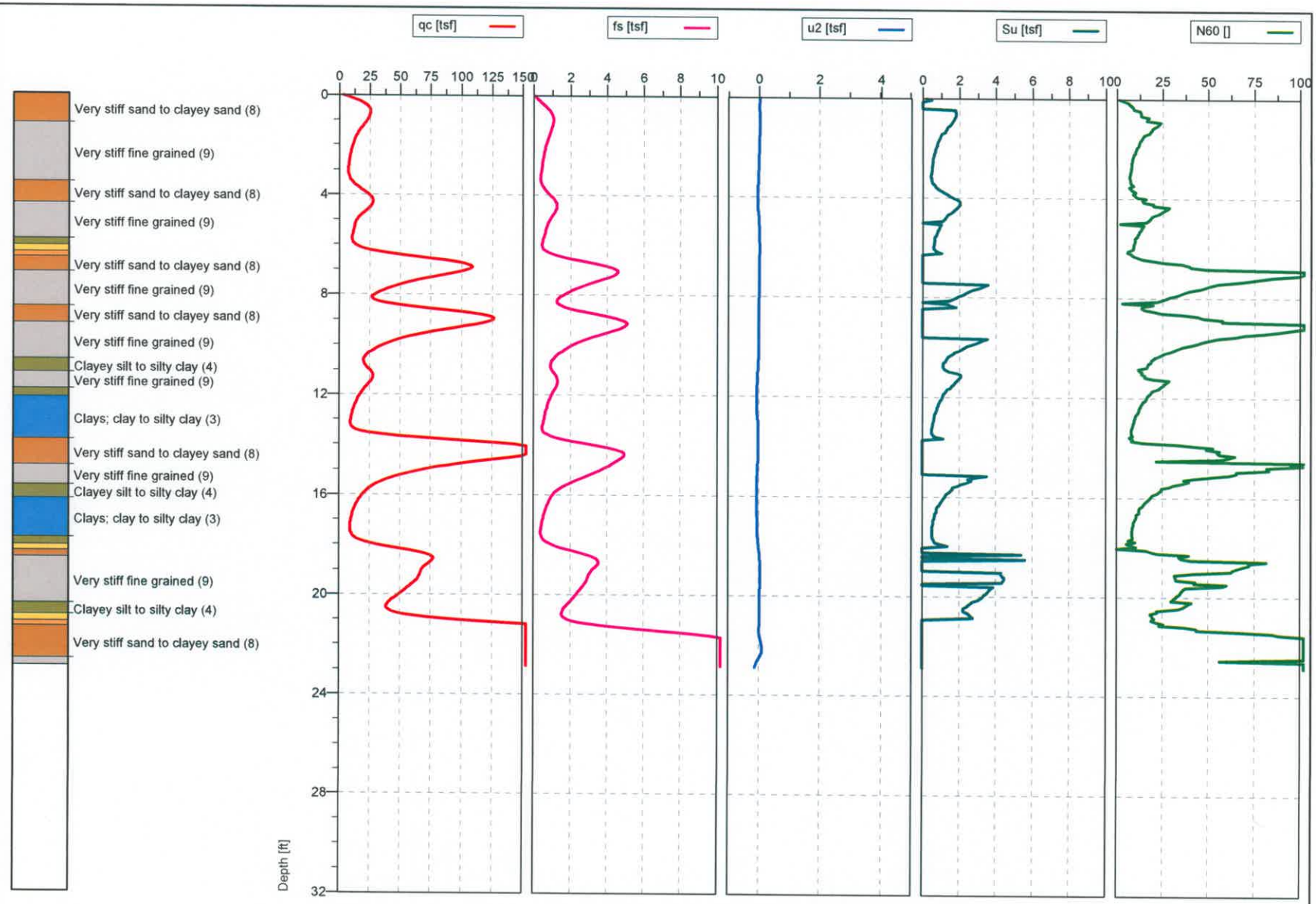
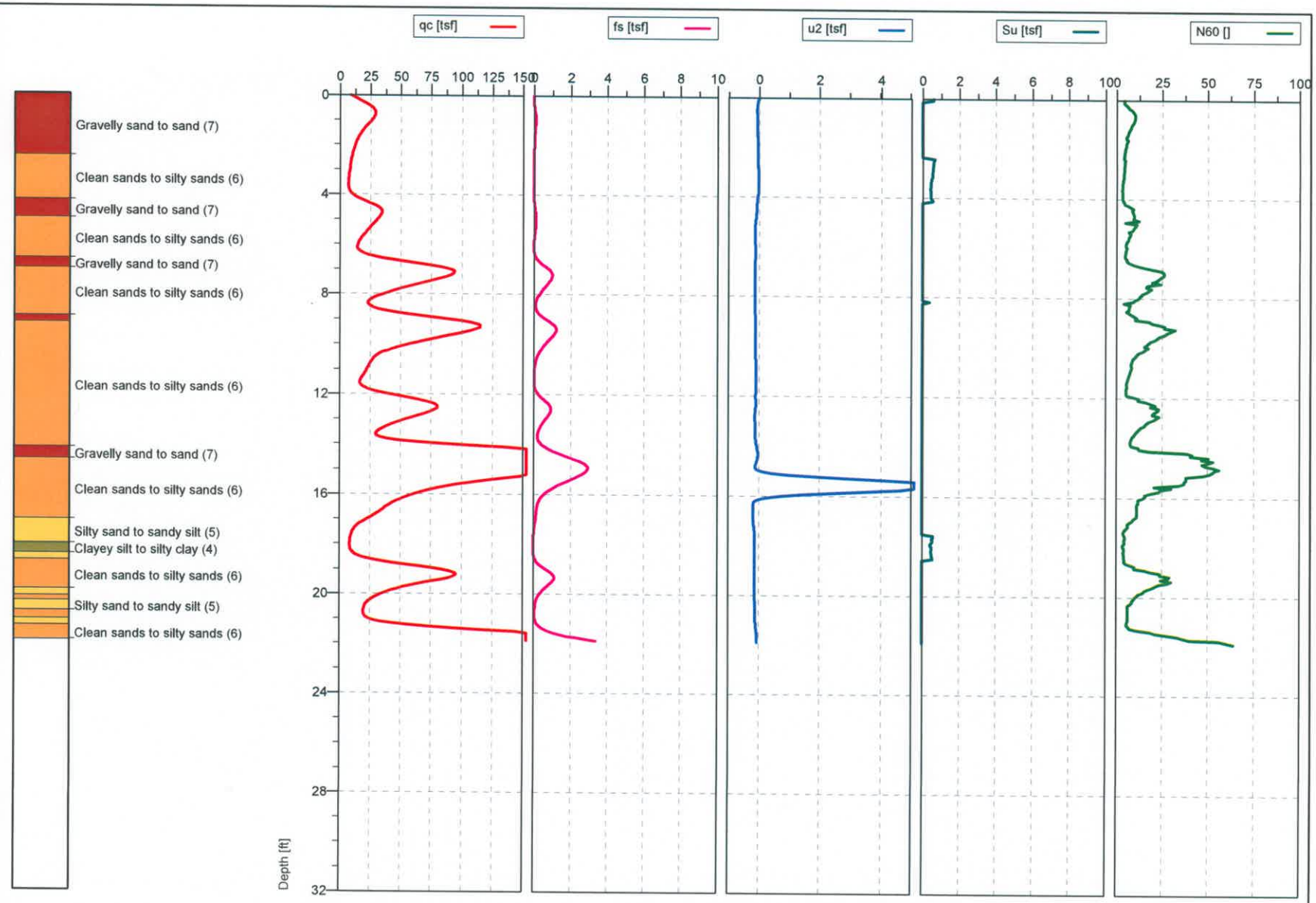


WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-11
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-11.CPT	



WPC

U2

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: CRYSTAL RIVER, FLORIDA	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-12
Project ID: WPC5209.00024	Client: GOLDER ASSOCIATES, INC.	Date: 10/28/2009	Scale:
Project: CRYSTAL RIVER ENERGY COMPLEX - ASH DISPOSAL AREA		Page: 1/1	Fig:
		File: CPT-12.CPT	

APPENDIX B
TEMPORARY MONITORING WELL INSTALLATION LOGS

MONITORING WELL INSTALLATION LOG

JOB NO. 083-82671.1	PROJECT PEF CREC/ASH VERTICAL EXPANSION/FL	WELL NO. TW-1	SHEET 1 OF 1
GAI INSP. SFS	DRILLING METHOD Hollow Stem Auger	GROUND ELEV NA	WATER ELEV. NA
WEATHER Sunny	DRILLING COMPANY WPC	COLLAR ELEV. 99.49	DATE/TIME NA
TEMI 60 °F	DRILL RIG CME 55 ATV DRILLER EV	STARTED 1305, 10/19/2009 TIME/DATE	COMPLETED 1445, 10/19/2009 TIME/DATE

MATERIALS INVENTORY

WELL CASING	2 in. dia. 13 l.f.	WELL SCREEN	2 in. dia. 10 l.f.	BENTONITE SEAL	1 bag Hole Plug 3/8 chips
CASING TYPE	Schedule 40 PVC	SCREEN TYPE	Schedule 40 PVC	INSTALLATION METHOD	Gravity Pour
JOINT TYPE	Flush-threaded	SLOT SIZE	0.010-inch slot	FILTER PACK QTY.	5 - 50 lb. bags
GROUT QUANTITY	None	CENTRALIZERS	None	FILTER PACK TYPE	20/30 Silica Sand
GROUT TYPE	None	DRILLING MUD TYPE	None	INSTALLATION METHOD	Gravity Pour

ELEV./ DEPTH	SOIL/ROCK DESCRIPTION	WELL SKETCH	INSTALLATION NOTES
3.0		Well Cap	Monitoring well set to 20.0 ft bgs, 10 ft Screen.
0.0	Ground Surface		Approximately 3' feet of riser above ground surface.
	See PB-1 soil boring log	20/30 Silica Sand Pack; 2" dia. Sch. 40 PVC	2.5 - 50 lb. bags of 20/30 silica sand used to fill remaining annular space
5.0		6.0	
		Bentonite Seal	
		8.0	
10.0		TOS = 10.0'	
15.0		2" dia. 0.010-inch slotted screen; 20/30 Sand Pack	
20.0		BOS = 20.0'	
	Boring Terminated at 21 feet bgs.	wood plug; End Cap	

WELL DEVELOPMENT NOTES

Date:	10/21/2009
Development Time:	43 min
Development Rate:	2 gpm
Purge Volume:	86 gal
Final Turbidity:	17.9 NTU

MONITORING WELL INSTALLATION LOG

JOB NO. 083-82671.1	PROJECT PEF CREC/ASH VERTICAL EXPANSION/FL	WELL NO. TW-2	SHEET 1 OF 1
GAI INSP. SFS	DRILLING METHOD Hollow Stem Auger	GROUND ELEV NA	WATER ELEV. NA
WEATHER Sunny	DRILLING COMPANY WPC	COLLAR ELEV. 99.62	DATE/TIME NA
TEMI 65 °F	DRILL RIG CME 55 ATV DRILLER EV	STARTED 1135, 10/20/2009 TIME/DATE	COMPLETED 1340, 10/20/2009 TIME/DATE

MATERIALS INVENTORY

WELL CASING	2 in. dia. 13 l.f.	WELL SCREEN	2 in. dia. 10 l.f.	BENTONITE SEAL	2 bags - Hole Plug 3/8 chips
CASING TYPE	Schedule 40 PVC	SCREEN TYPE	Schedule 40 PVC	INSTALLATION METHOD	Gravity Pour
JOINT TYPE	Flush-threaded	SLOT SIZE	0.010-inch slot	FILTER PACK QTY.	10 - 50 lb. Bags
GROUT QUANTITY	None	CENTRALIZERS	None	FILTER PACK TYPE	20/30 Silica Sand
GROUT TYPE	None	DRILLING MUD TYPE	None	INSTALLATION METHOD	Gravity Pour

ELEV./ DEPTH	SOIL/ROCK DESCRIPTION	WELL SKETCH	INSTALLATION NOTES
3.0		Well Cap	Monitoring well set to 20.0 ft bgs, 10 ft Screen.
0.0	Ground Surface		Approximately 3' feet of riser above ground surface.
	See PB-4 soil boring log	20/30 Silica Sand Pack; 2" dia. Sch. 40 PVC	6 - 50 lb. bags of 20/30 silica sand used to fill remaining annular space
5.0		4.5; Bentonite Seal; 7.0	
10.0		TOS = 10.0'	
15.0		2" dia. 0.010-inch slotted screen; 20/30 Sand Pack	
20.0		BOS = 20.0'; wood plug; End Cap	
	Boring Terminated at 24 feet bgs.		

WELL DEVELOPMENT NOTES

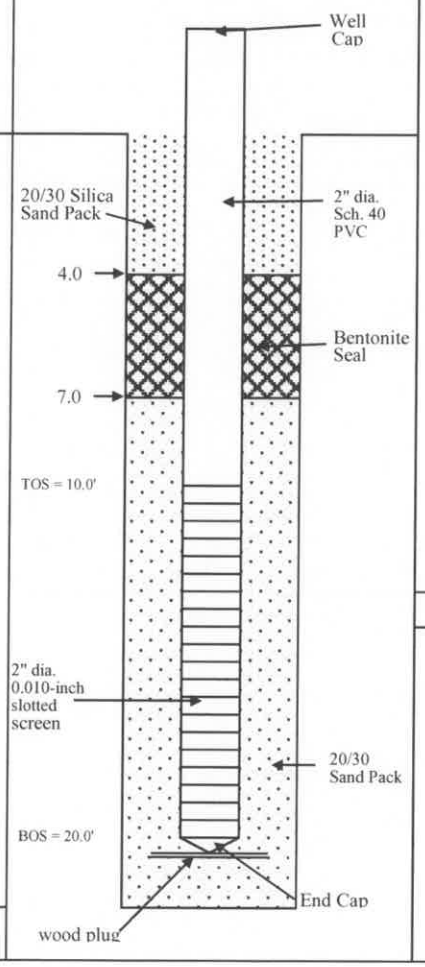
Date:	10/20/2009
Development Time:	30 minutes
Development Rate:	15 gpm
Purge Volume:	450 gallons
Final Turbidity:	6.45 NTU

MONITORING WELL INSTALLATION LOG

JOB NO.	083-82671.1	PROJECT	PEF CREC/ASH VERTICAL EXPANSION/FL	WELL NO.	TW-3	SHEET	1 OF 1
GAI INSP.	SFS	DRILLING METHOD	Hollow Stem Auger	GROUND ELEV	NA	WATER ELEV.	NA
WEATHER	Sunny	DRILLING COMPANY	WPC	COLLAR ELEV.	101.45	DATE/TIME	NA
TEMI	65 °F	DRILL RIG	CME 55 ATV DRILLER EV	STARTED	1545, 10/19/2009 TIME/DATE	COMPLETED	1650, 10/19/2009 TIME/DATE

MATERIALS INVENTORY

WELL CASING	2 in. dia. 13 l.f.	WELL SCREEN	2 in. dia. 10 l.f.	BENTONITE SEAL	2 bag Hole Plug 3/8 chips
CASING TYPE	Schedule 40 PVC	SCREEN TYPE	Schedule 40 PVC	INSTALLATION METHOD	Gravity Pour
JOINT TYPE	Flush-threaded	SLOT SIZE	0.010-inch slot	FILTER PACK QTY.	6 - 50 lb. bags
GROUT QUANTITY	None	CENTRALIZERS	None	FILTER PACK TYPE	20/30 Silica Sand
GROUT TYPE	None	DRILLING MUD TYPE	None	INSTALLATION METHOD	Gravity Pour

ELEV./ DEPTH	SOIL/ROCK DESCRIPTION	WELL SKETCH	INSTALLATION NOTES
3.0			Monitoring well set to 20.0 ft bgs, 10 ft Screen.
0.0	Ground Surface		Approximately 3' feet of riser above ground surface.
	See PB-5 soil boring log		3 - 50 lb. bags of 20/30 silica sand used to fill remaining annular space
5.0			
10.0			
15.0			
20.0			
	Boring Terminated at 22 feet bgs.		

WELL DEVELOPMENT NOTES

Date:	10/21/2009
Development Time:	55 minutes
Development Rate:	1 gpm
Purge Volume:	55 gallons
Final Turbidity:	50.3 NTU

MONITORING WELL INSTALLATION LOG

JOB NO. 083-82671.1	PROJECT PEF CREC/ASH VERTICAL EXPANSION/FL			WELL NO. TW-4		SHEET 1	OF 1
GAI INSP. SFS	DRILLING METHOD Hollow Stem Auger			GROUND ELEV NA		WATER ELEV.	NA
WEATHER Sunny	DRILLING COMPANY WPC			COLLAR ELEV. 101.45		DATE/TIME	NA
TEMI 55 °F	DRILL RIG CME 55 ATV	DRILLER EV		STARTED 0825, 10/20/2009 TIME/DATE		COMPLETED 0935, 10/20/2009 TIME/DATE	

MATERIALS INVENTORY

WELL CASING 2 in. dia. 13 l.f.	WELL SCREEN 2 in. dia. 10 l.f.	BENTONITE SEAL	1 bag Hole Plug 3/8 chips
CASING TYPE Schedule 40 PVC	SCREEN TYPE Schedule 40 PVC	INSTALLATION METHOD	Gravity Pour
JOINT TYPE Flush-threaded	SLOT SIZE 0.010-inch slot	FILTER PACK QTY.	5.5 - 50 lb. bags
GROUT QUANTITY None	CENTRALIZERS None	FILTER PACK TYPE	20/30 Silica Sand
GROUT TYPE None	DRILLING MUD TYPE None	INSTALLATION METHOD	Gravity Pour

ELEV./ DEPTH	SOIL/ROCK DESCRIPTION	WELL SKETCH	INSTALLATION NOTES
3.0		Well Cap	Monitoring well set to 20.0 ft bgs, 10 ft Screen.
0.0	Ground Surface		Approximately 3' feet of riser above ground surface.
	See PB-6 soil boring log	20/30 Silica Sand Pack; 2" dia. Sch. 40 PVC	3 - 50 lb. bags of 20/30 silica sand used to fill remaining annular space
4.0			
5.0		Bentonite Seal	
7.0			
10.0		TOS = 10.0'	
15.0		2" dia. 0.010-inch slotted screen; 20/30 Sand Pack	
20.0		BOS = 20.0'	
	Boring Terminated at 22 feet bgs.	wood plug; End Cap	

WELL DEVELOPMENT NOTES

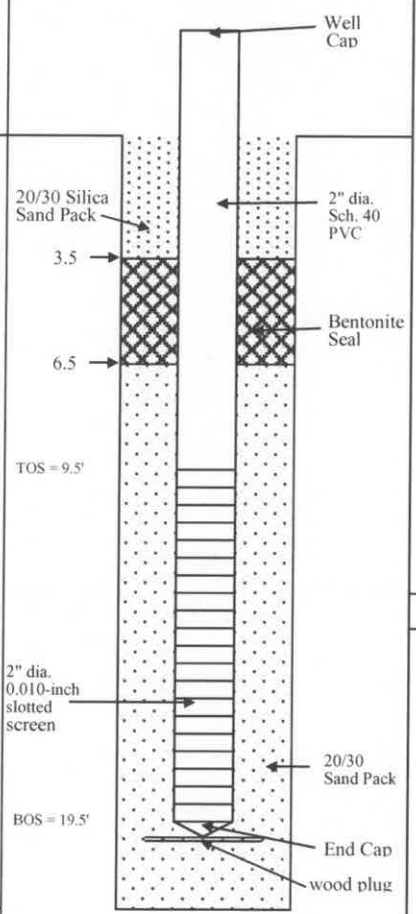
Date:	10/21/2009
Development Time:	46 minutes
Development Rate:	2 gpm
Purge Volume:	96 gallons
Final Turbidity:	50.9 NTU

MONITORING WELL INSTALLATION LOG

JOB NO. 083-82671.1	PROJECT PEF CREC/ASH VERTICAL EXPANSION/FL	WELL NO. TW-5	SHEET 1 OF 1
GAI INSP. KBK	DRILLING METHOD Hollow Stem Auger	GROUND ELEV NA	WATER ELEV. NA
WEATHER Clear	DRILLING COMPANY WPC	COLLAR ELEV. 100.59	DATE/TIME NA
TEMI 60 °F	DRILL RIG CME 55 ATV DRILLER D. Collier	STARTED 1510, 12/21/2009 TIME/DATE	COMPLETED 1630, 12/21/2009 TIME/DATE

MATERIALS INVENTORY

WELL CASING	2 in. dia. 13 l.f.	WELL SCREEN	2 in. dia. 10 l.f.	BENTONITE SEAL	1/2 bag Hole Plug 3/8 chips
CASING TYPE	Schedule 40 PVC	SCREEN TYPE	Schedule 40 PVC	INSTALLATION METHOD	Gravity Pour
JOINT TYPE	Flush-threaded	SLOT SIZE	0.010-inch slot	FILTER PACK QTY.	10 - 50 lb. bags
GROUT QUANTITY	None	CENTRALIZERS	None	FILTER PACK TYPE	20/30 Silica Sand
GROUT TYPE	None	DRILLING MUD TYPE	None	INSTALLATION METHOD	Gravity Pour

ELEV./ DEPTH	SOIL/ROCK DESCRIPTION	WELL SKETCH	INSTALLATION NOTES
3.0			Monitoring well set to 19.5 ft bgs, 10 ft Screen.
0.0	Ground Surface		Approximately 3' feet of riser above ground surface.
	See TW-5 soil boring log		3 - 50 lb. bags of 20/30 silica sand used to fill remaining annular space
5.0			
10.0			
15.0			
20.0	Boring Terminated at 22 feet bgs.		

WELL DEVELOPMENT NOTES

Date:	12/22/2009
Development Time:	30 minutes
Development Rate:	8 gpm
Purge Volume:	240 gallons
Final Turbidity:	10.1 NTU

Monitoring Well Permit

STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT, REPAIR, MODIFY, OR ABANDON A WELL

☑ Southwest
☐ Northwest
☐ St. Johns River
☐ South Florida
☐ Suwannee River

CHECK BOX FOR APPROPRIATE DISTRICT ADDRESS ON BACK OF PERMIT FORM

THIS FORM MUST BE FILLED OUT COMPLETELY.

The water well contractor is responsible for completing this form and forwarding the permit to the appropriate delegated county where applicable.

Permit No. 800276
Florida Unique I.D.
Permit Stipulations Required (See attached)
23, 39
62-524 Quad # Q4022 Delineation #
CUP/WUP Application No.

ABOVE THIS LINE FOR OFFICIAL USE ONLY

Fold at this line in order that address is visible through envelope window

1. Progress Energy | 15985 W. Power Line St. | Crystal River FL | 34428- 0000
Owner, Legal Name of Entity if Corportation | Address | City | Zip | Telephone Number

2. 15015 W POWER LINE ST, N/A
Well Location _ Address, Road Name or number, City
Parcel # (Pin) 16173310000

3. DONALD C. COLLIER, JR | 7364
Well Drilling Contractor | License No. | Telephone No.

3047 ST. JOHNS BLUFF ROAD S
Address

JACKSONVILLE | FL | 32246
City | State | Zip

4. ____ 1/4 of ____ 1/4 of Section 28
smallest | biggest
(Indicate Well on Chart)
5. Township 17 Range 16

6. CITRUS
County | Subdivision Name | Lot | Block | Unit

NW NE SW SE

7. Number of proposed wells 5 Check the use of well: (See back of permit for additional choices) ____ Domestic Monitor (type) ✓
____ Irrigation (Type) (See Back) Public Water Supply (type) ____ (See Back) List Other ____
Distance from septic system ____ ft. Description of facility ____ Estimated start of construction date 10/15/2009

8. Application for: ✓ New Construction ____ Repair/Modify ____ Abandonment ____ (Reason for Abandonment)

Date Stamp

9. Estimated: Well Depth 20 Casing Depth ____ Screen Interval from ____ to ____
Casing Material: ~~BK~~ / ~~St~~ / PVC Casing Diameter 2 smallest Seal Material ____

10. If applicable: Proposed Grouting Interval From ____ to ____ Seal Material ____
From ____ to ____ Seal Material ____
From ____ to ____ Seal Material ____

Received: Thursday, October 15, 2009

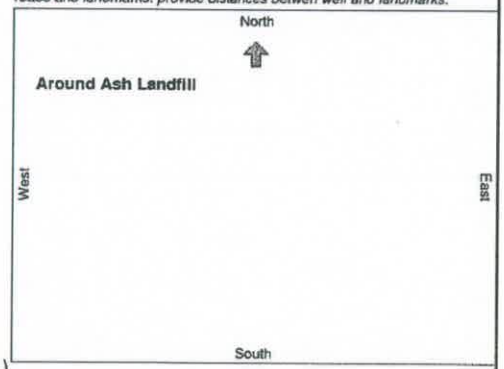
11. Telescope Casing ____ or Liner ____ (check one) Diameter ____
Blk-Steel / Galvanized / PVC Other (specify:) ____

12. Method of Construction: ____ Rotary ____ Cable Tool ____ Combination
✓ Auger ____ Other (specify:) ____

13. Indicate total No. of wells on site 3. List number of unused wells on site 0.

14. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Consumptive/Water Use Permit (CUP/WUP) or CUP/WUP Application? ✓ No ___ Yes
(IF YES, COMPLETE THE FOLLOWING) CUP/WUP No. ____
District well I.D. No. ____
Latitude 28° 57' 55.83" Longitude 82° 41' 12.96"
Data obtained from GPS ___ or map ___ or survey ___ (*map datum NAD 27__ NAD 83__*)

Draw a map of well location and indicate well site with an "X" identify known roads and landmarks: provide distances betwen well and landmarks.



15. I hereby certify that I will comply with the applicable rules of Title 40, Florida Administrative Code and that a water use permit or artificial recharge permit, if needed, has been or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling or the permit expiration, whichever occurs first.

Digitally Signed | 7364
Signature of Contractor | License No.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Digitally Signed
Owner's or Agent's Signature | Date

DO NOT WRITE BELOW THIS LINE - FOR OFFICIAL USE ONLY

Approval Granted By: Automatically Issued Issue Date: 10/15/2009 Hydrologist Approval ____ Initials

Owner Number: ____ Fee Received: $ 50.00 Receipt No.: IN10299908 Check No.: ____

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS. *This permit is valid for 90 days from the date of issue.*

FORM 41.10 - 410 (1) REV. 12/04

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

Recovery	Landscape Irrigation	Recreation Area Irrigation (ball fields, playgrounds)	Aquaculture (fish ponds)
Public Water Supply (DEP) Community Non-Community	Agricultural Irrigation (crops, sod, orchards, nursery stock)	Golf Course Irrigation	Class I Injection Well Class V Injection
Limited Use Public Supply (HRS	Nursery Irrigation (retail outlets only)	Heat Pump (AC Supply)	Test (temporary) WUP
Livestock	Pesticide Mixing & Loading	Heat Pump (AC Return)	Industrial

WELL SETBACK DISTANCES:

25 ft.	From a treated building slab.
75 ft.	Domestic – From on site septic system.
100 ft.	Public Supply and Limited Public Supply less than 2000 GPD Sewage Flow.
200 ft.	Public Supply and Limited Public Supply greater than 2000 GPD Sewage Flow.

These are common setback distances. ***However they are not all-inclusive.*** Refer to other applicable rules for additional setbacks.

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 800276.1 CUP/WUP#: _____ DID#: _____
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: _____

WATER WELL CONTRACTOR'S
SIGNATURE Digitally Signed License # 7364
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement:			
Bentonite:	1	0	10
(Other)			

WELL LOCATION: County _____
_____ 1/4 of _____ 1/4 of Section _____, Township _____, Range _____
Latitude: 28° 57' 55.83", Longitude: -82° 41' 12.96"

DATE STAMP
Nov 19 2009
Official Use Only

Sketch of well location on property

Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS ____ mg/l
Conductivity ____ umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

Form LEG-R.005.00(10/05)

OWNER'S NAME: Progress Energy
COMPLETION DATE: 10/20/2009 Florida Unique I.D.: _____
Parcel # (Pin): 16173310000
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [ ] Monitor
[ ] Injection [X] Other TEST WELL / PIEZOMETER

DRILL METHOD:
[ ] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [X] Auger [ ] Other _____

Measured Static Water Level: 6.90 Measured Pumping Water Level: _____
After ____ Hours at _____GPM. Measuring Pt. (Describe): _____
Which is _____ft. [ ] above [X] below land surface
Casing: [ ] Black Steel [ ] Galvanized [X] PVC [ ] Other: _____

[ ] Open Hole [X] Screen	Depth (feet)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones.
Casing Diameter and Depth (ft.)	From	To	*Color | Grain Size | Type of Material*
Diameter: 2	0	8.5	gray fine sand
From: 0	8.5	20	tan medium sand and limestone
To: 10			
Diameter: _____			
From: _____			
To: _____			
Liner [ ] or Casing [ ]			
Diameter: _____			
From: _____			
To: _____			

Driller's Name (print or type): _____

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 800276.2 CUP/WUP#: _____ DID#: _____
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: _____

WATER WELL CONTRACTOR'S
SIGNATURE Digitally Signed License # 7364
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement:			
Bentonite:	1	0	10
(Other)			

WELL LOCATION: County _____
_____ 1/4 of _____ 1/4 of Section _____, Township _____, Range _____
Latitude: 28° 57' 55.83", Longitude: -82° 41' 12.96"

DATE STAMP
Nov 19 2009
Official Use Only

Sketch of well location on property
Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS ____ mg/l
Conductivity ____ umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

Form LEG-R.005.00(10/05)

OWNER'S NAME: Progress Energy
COMPLETION DATE: 10/20/2009 Florida Unique I.D.: _____
Parcel # (Pin): 16173310000
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [ ] Monitor
[ ] Injection [X] Other TEST WELL / PIEZOMETER
DRILL METHOD:
[ ] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [X] Auger [ ] Other _____

Measured Static Water Level: 6.60 Measured Pumping Water Level: _____
After ____Hours at ____GPM. Measuring Pt. (Describe): _____
Which is ____ft. [ ] above [X] below land surface
Casing: [ ] Black Steel [ ] Galvanized [X] PVC [ ] Other: _____

[ ] Open Hole
[X] Screen

Casing Diameter and Depth (ft.)

Depth (feet) — From / To

DRILL CUTTINGS LOG
Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones.
Color | Grain Size | Type of Material

Casing Diameter and Depth (ft.)	From	To	DRILL CUTTINGS LOG
Diameter: 2 From: 0 To: 10	0	3.5	gray fine sand
	3.5	20	tan medium sand and limestone
Diameter: _____ From: _____ To: _____			
Liner [ ] or Casing [ ] Diameter: _____ From: _____ To: _____			

Driller's Name (print or type): _____

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 800276.3 CUP/WUP#: _____ DID#: _____
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: _____

WATER WELL CONTRACTOR'S
SIGNATURE Digitally Signed License # 7364
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement:			
Bentonite:	1	0	10
(Other)			

WELL LOCATION: County _____
_____ 1/4 of _____ 1/4 of Section _____, Township _____, Range _____
Latitude: 28° 57' 55.83", Longitude: -82° 41' 12.96"

DATE STAMP
Nov 19 2009
Official Use Only

Sketch of well location on property

Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS _____ mg/l
Conductivity _____ umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

Form LEG-R.005.00(10/05)

OWNER'S NAME: Progress Energy
COMPLETION DATE: 10/19/2009 Florida Unique I.D.: _____
Parcel # (Pin): 16173310000
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [ ] Monitor
[ ] Injection [X] Other TEST WELL / PIEZOMETER
DRILL METHOD:
[ ] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [X] Auger [ ] Other _____

Measured Static Water Level: 9.30 Measured Pumping Water Level: _____
After ____Hours at _____GPM. Measuring Pt. (Describe): _____
Which is _____ft. [ ] above [X] below land surface
Casing: [ ] Black Steel [ ] Galvanized [X] PVC [ ] Other: _____

[ ] Open Hole [X] Screen	Depth (feet)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones.
Casing Diameter and Depth (ft.)	From	To	*Color | Grain Size | Type of Material*
Diameter: 2	0	3.5	brown fine sand
From: 0	3.5	8.5	brown fine sand and limestone
To: 10	8.5	20	tan coarse sand and limestone
Diameter: _____			
From: _____			
To: _____			
Liner [ ] or Casing [ ]			
Diameter: _____			
From: _____			
To: _____			

Driller's Name (print or type): _____

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 800276.4 CUP/WUP#: _____ DID#: _____
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: _____

WATER WELL CONTRACTOR'S
SIGNATURE Digitally Signed License # 7364
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement:			
Bentonite:	1	0	10
(Other)			

WELL LOCATION: County _____
_____ 1/4 of _____ 1/4 of Section _____, Township _____, Range _____
Latitude: 28° 57' 55.83", Longitude: -82° 41' 12.96"

DATE STAMP
Nov 19 2009
Official Use Only

Sketch of well location on property

Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS _____ mg/l
Conductivity _____ umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

Form LEG-R.005.00(10/05)

OWNER'S NAME: Progress Energy
COMPLETION DATE: 10/20/2009 Florida Unique I.D.: _____
Parcel # (Pin): 16173310000
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [ ] Monitor
[ ] Injection [X] Other TEST WELL / PIEZOMETER

DRILL METHOD:
[ ] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [X] Auger [ ] Other _____

Measured Static Water Level: 10.20 Measured Pumping Water Level: _____
After ____Hours at _____GPM. Measuring Pt. (Describe): _____
Which is _____ft. [ ] above [X] below land surface
Casing: [ ] Black Steel [ ] Galvanized [X] PVC [ ] Other: _____

[ ] Open Hole
[X] Screen

Casing Diameter and Depth (ft.)

Depth (feet)

From	To
0	3.5
3.5	8.5
8.5	20

DRILL CUTTINGS LOG
Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones.
Color | Grain Size | Type of Material

Diameter: 2
From: 0
To: 10

0 3.5 gray fine sand
3.5 8.5 gray fine sand and limestone
8.5 20 tan coarse sand and limestone

Diameter: _____
From: _____
To: _____

Liner [ ] or Casing [ ]
Diameter: _____
From: _____
To: _____

Driller's Name (print or type): _____

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 801645.1 CUP/WUP#: _____ DID#: _____
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: _____

WATER WELL CONTRACTOR'S
SIGNATURE Digitally Signed License # 7364
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement:			
Bentonite:	1	0	10
(Other)			

WELL LOCATION: County _____
_____ 1/4 of _____ 1/4 of Section _____, Township _____, Range _____
Latitude: 28° 57' 55.83", Longitude: -82° 41' 12.96"

DATE STAMP
Jan 14 2010
Official Use Only

Sketch of well location on property

Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS _____mg/l
Conductivity _____umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

Form LEG-R.005.00(10/05)

OWNER'S NAME: Progress Energy
COMPLETION DATE: 12/21/2009 Florida Unique I.D.: _____
Parcel # (Pin): 161733 10000
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [ ] Monitor
[ ] Injection [X] Other TEST WELL / PIEZOMETER
DRILL METHOD:
[ ] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [X] Auger [ ] Other _____

Measured Static Water Level: 7.10 Measured Pumping Water Level: _____
After ____Hours at _____GPM. Measuring Pt. (Describe): _____
Which is _____ft. [ ] above [X] below land surface
Casing: [ ] Black Steel [ ] Galvanized [X] PVC [ ] Other: _____

[ ] Open Hole
[X] Screen

Casing Diameter and Depth (ft.)

Depth (feet) — From — To

DRILL CUTTINGS LOG
Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones.

Color	Grain Size	Type of Material

Diameter: 2
From: 0
To: 10

From	To	Color	Grain Size	Type of Material
0	4	gray	fine	sand
4	10	brown	medium	sand and limestone
10	20	tan	coarse	sand and limestone

Diameter: _____
From: _____
To: _____

Liner [ ] or Casing [ ]
Diameter: _____
From: _____
To: _____

Driller's Name (print or type): Donald C Collier

APPENDIX C
SLUG TEST DATA AND ANALYSIS

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

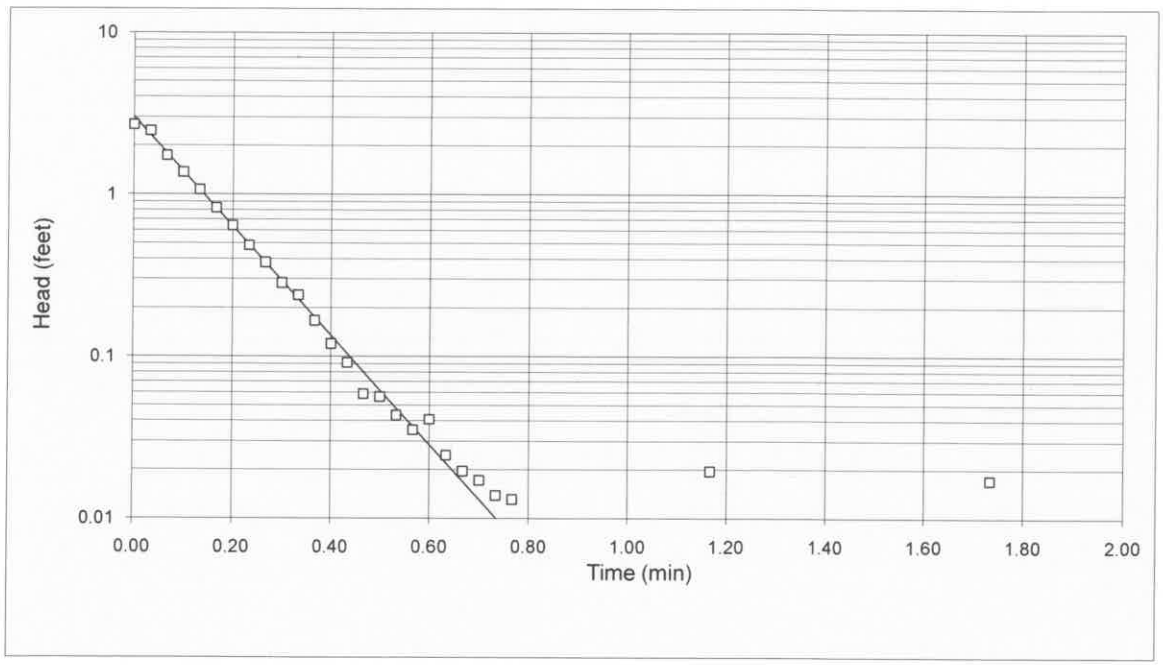
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.06
y_0 =	3.00
y_t =	0.01
t =	0.74

RESULTS

K=	2.82E-03	cm/sec
K=	8.00E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

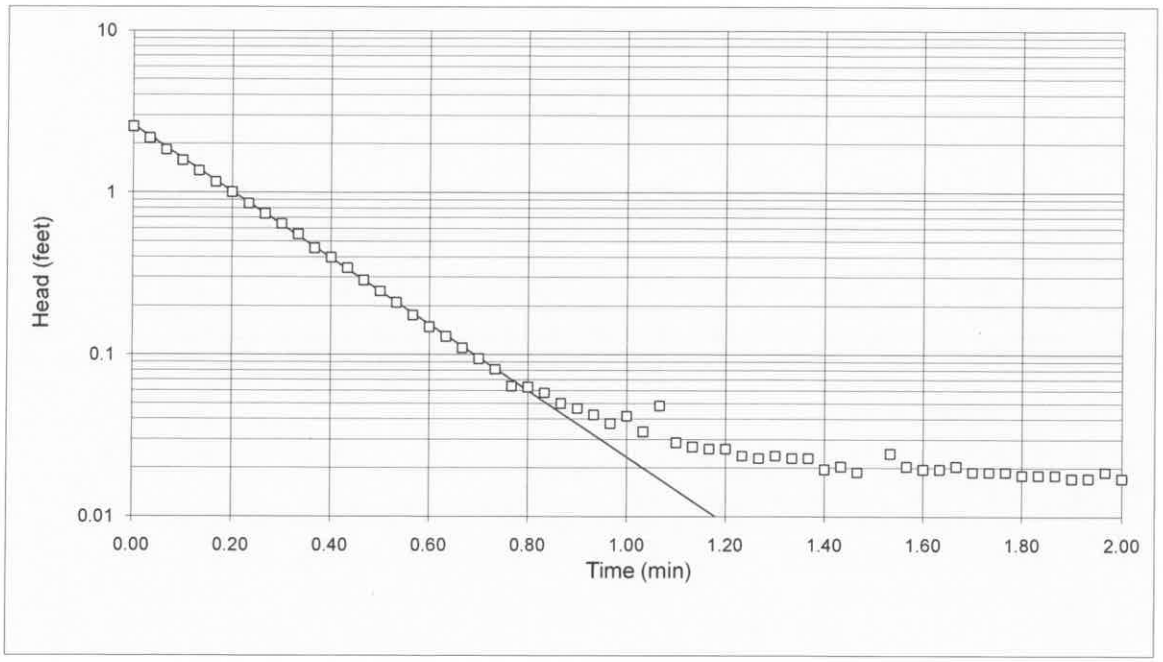
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.06
y_0 =	2.60
y_t =	0.01
t =	1.18

RESULTS

K=	1.71E-03	cm/sec
K=	4.86E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

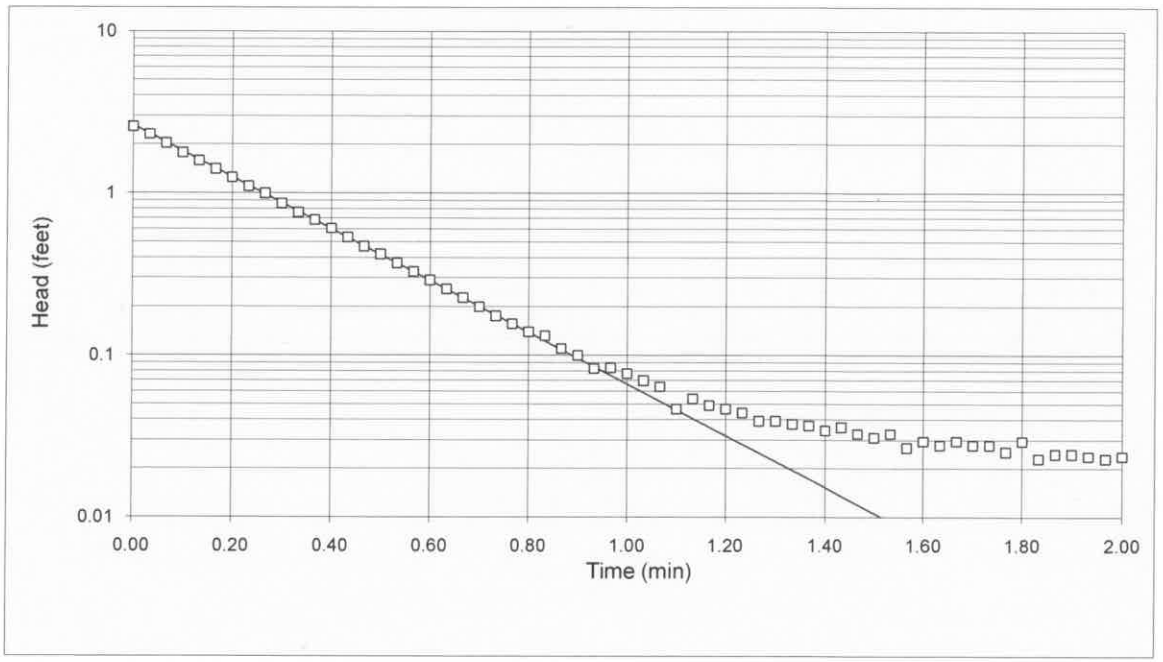
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.06
y_0 =	2.62
y_t =	0.01
t =	1.52

RESULTS

K=	1.34E-03	cm/sec
K=	3.79E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

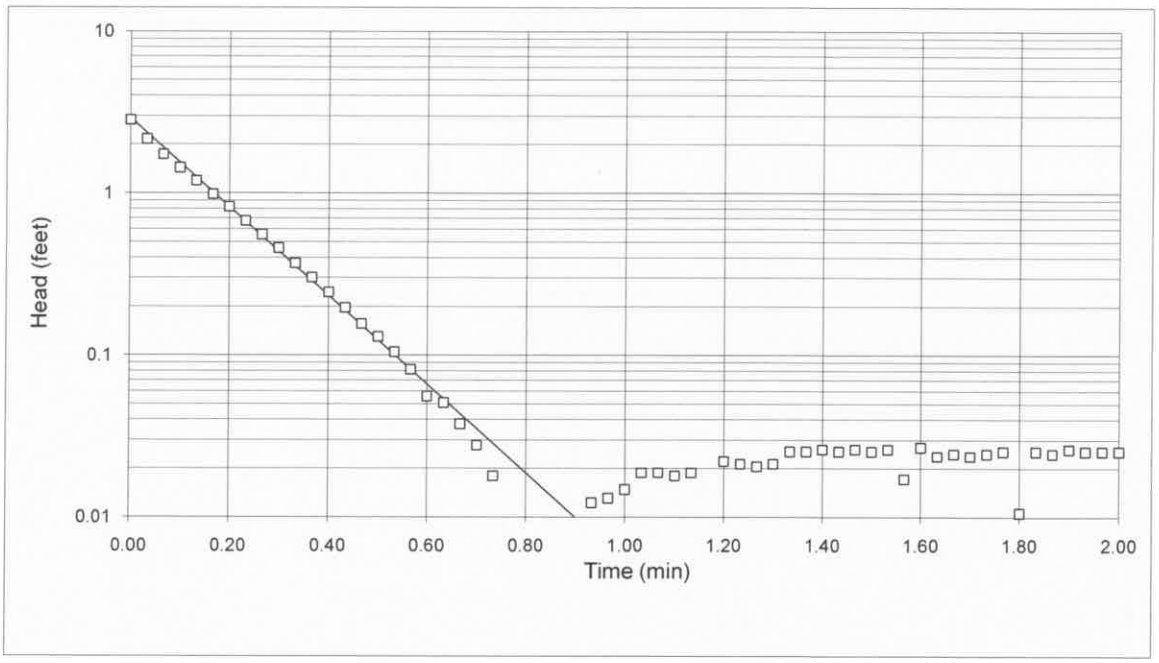
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.06
y_0 =	2.90
y_t =	0.01
t =	0.90

RESULTS

K=	2.29E-03	cm/sec
K=	6.49E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

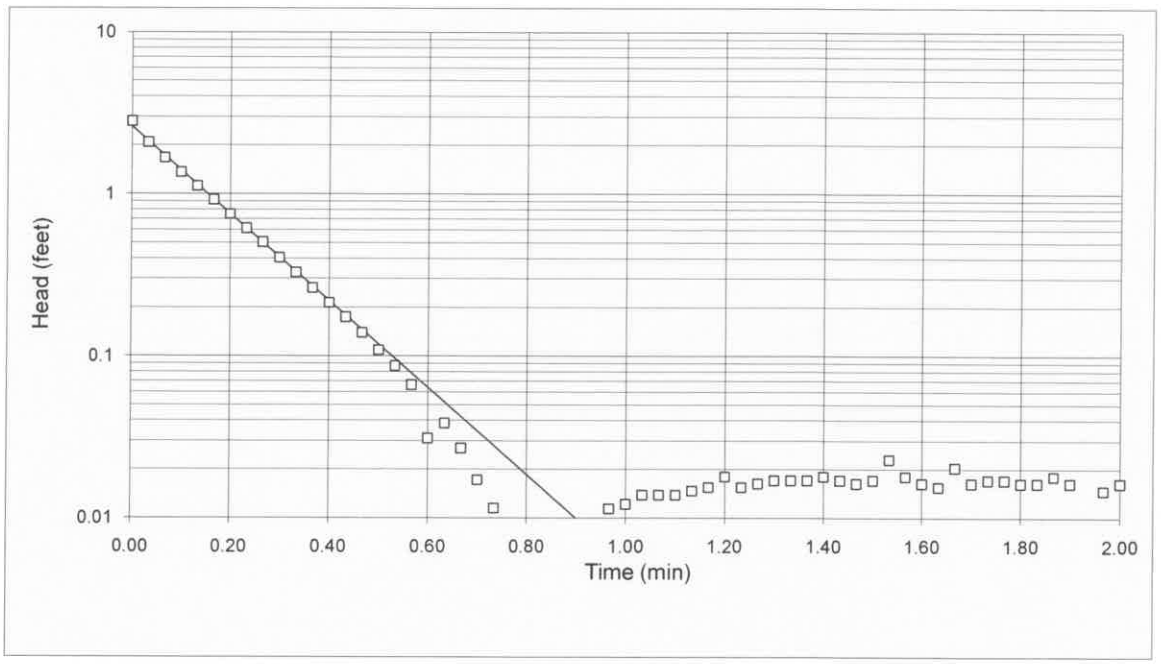
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.06
y_0 =	2.60
y_t =	0.01
t =	0.90

RESULTS

K=	2.25E-03	cm/sec
K=	6.37E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

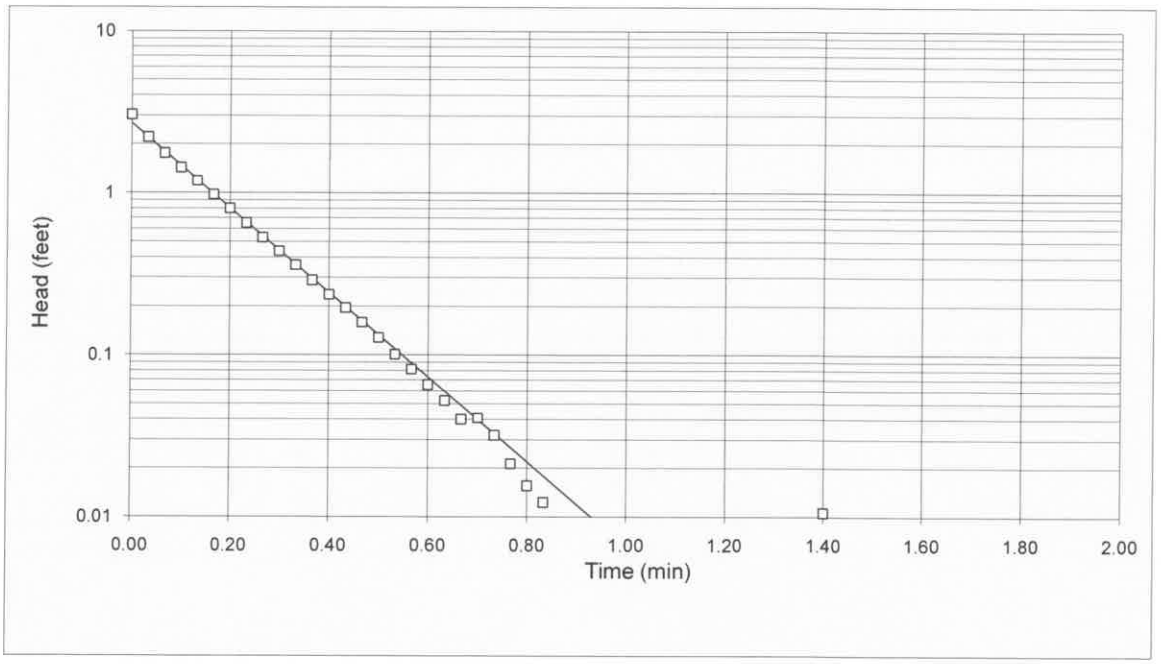
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-1

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.33			
L_e =	10	K=	2.19E-03	cm/sec
$\ln(R_e/r_w)$	2.06	K=	6.20E+00	ft/day
y_0 =	2.68			
y_t =	0.01			
t =	0.93			



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

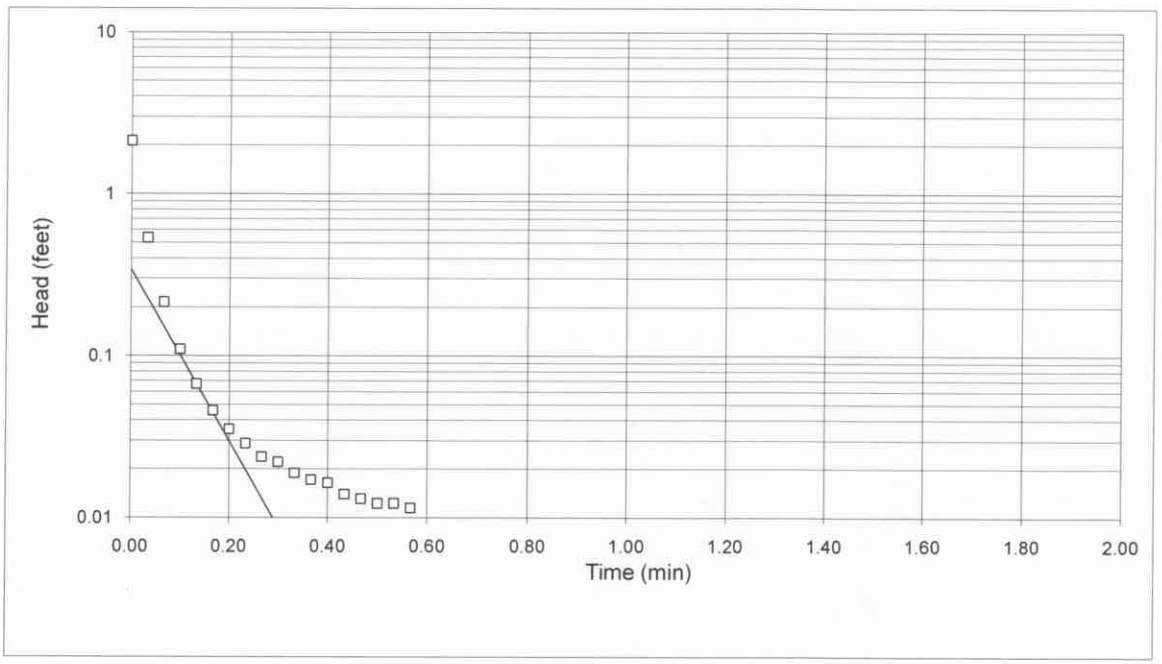
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	0.34
y_t =	0.01
t =	0.29

RESULTS

K=	4.46E-03	cm/sec
K=	1.26E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

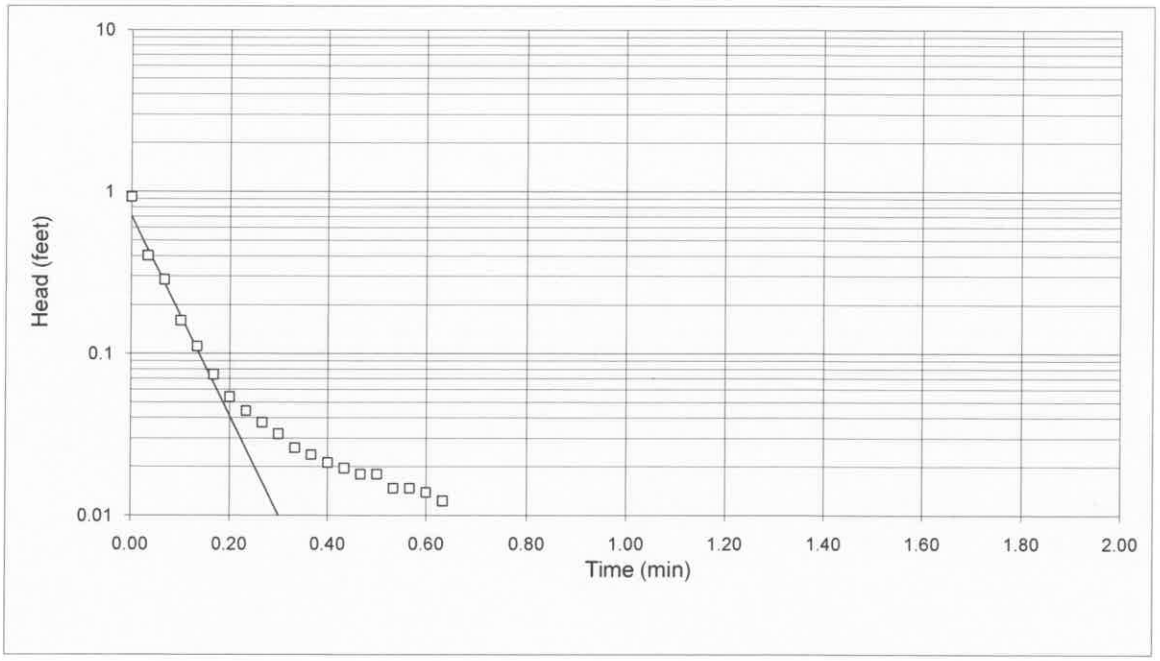
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	0.70
y_t =	0.01
t =	0.30

RESULTS

K=	5.20E-03	cm/sec
K=	1.47E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

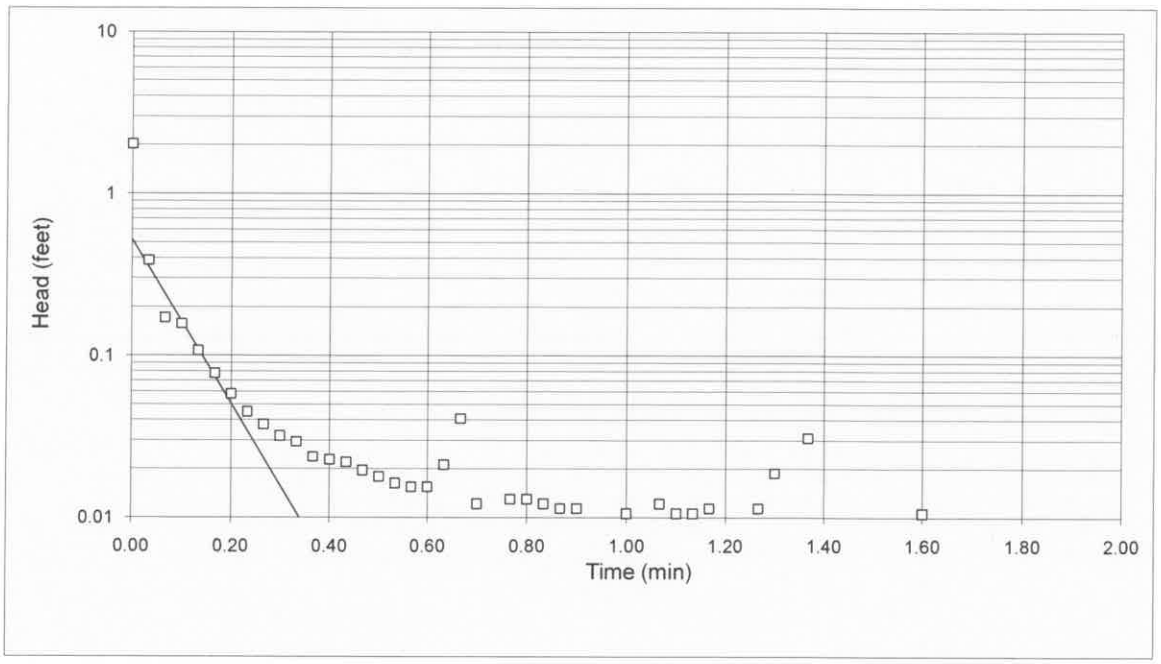
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	0.52
y_t =	0.01
t =	0.34

RESULTS

K=	4.26E-03	cm/sec
K=	1.21E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

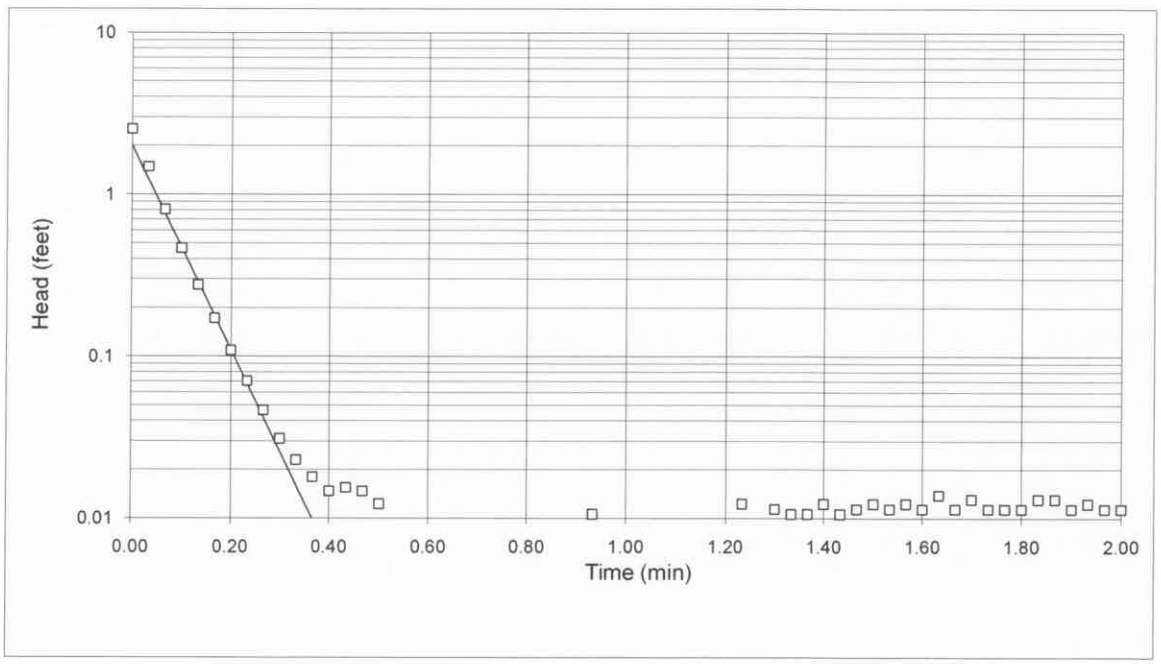
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	2.00
y_t =	0.01
t =	0.37

RESULTS

K=	5.33E-03	cm/sec
K=	1.51E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

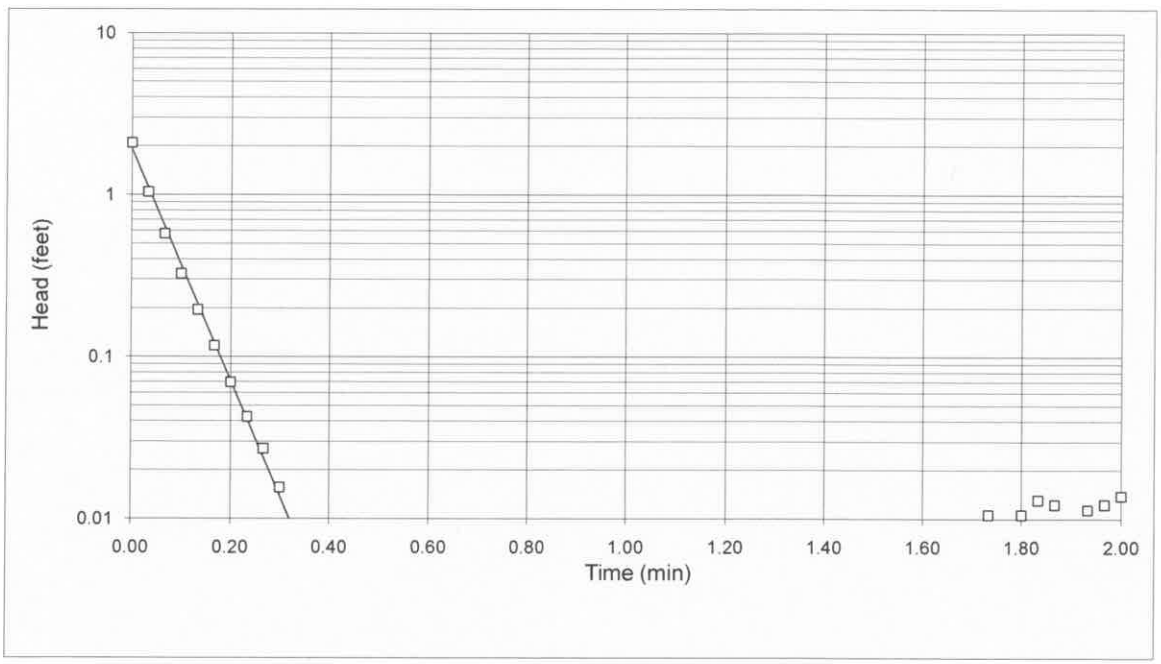
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	1.90
y_t =	0.01
t =	0.32

RESULTS

K=	6.02E-03	cm/sec
K=	1.71E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-2

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

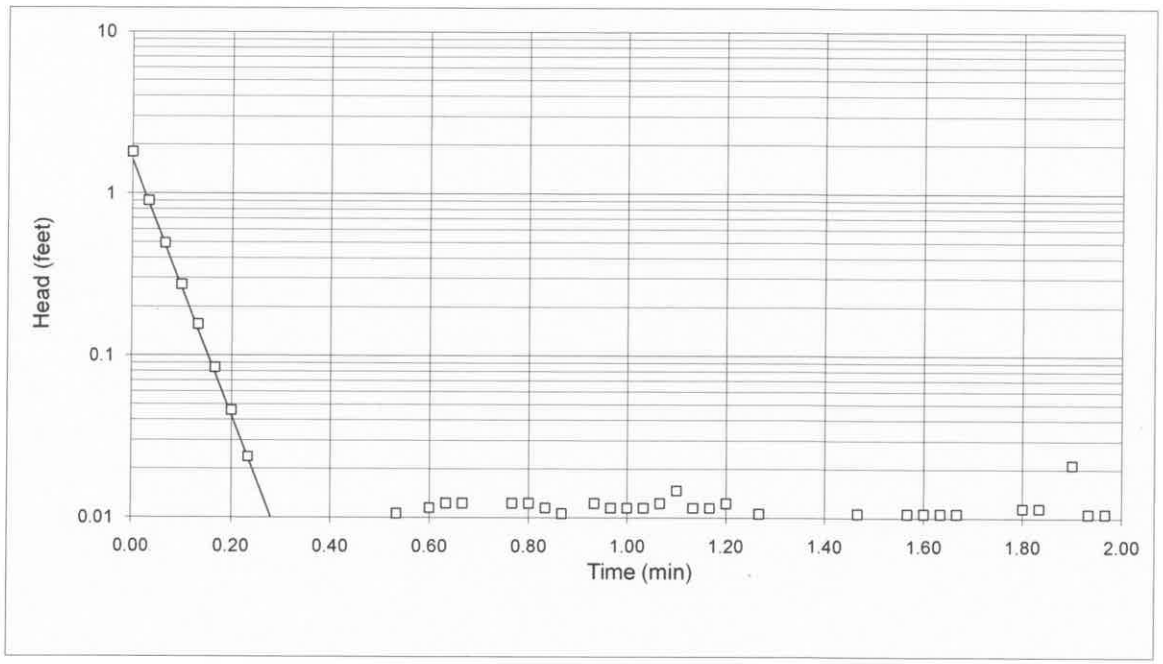
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.08
y_0 =	1.60
y_t =	0.01
t =	0.28

RESULTS

K=	6.65E-03	cm/sec
K=	1.88E+01	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

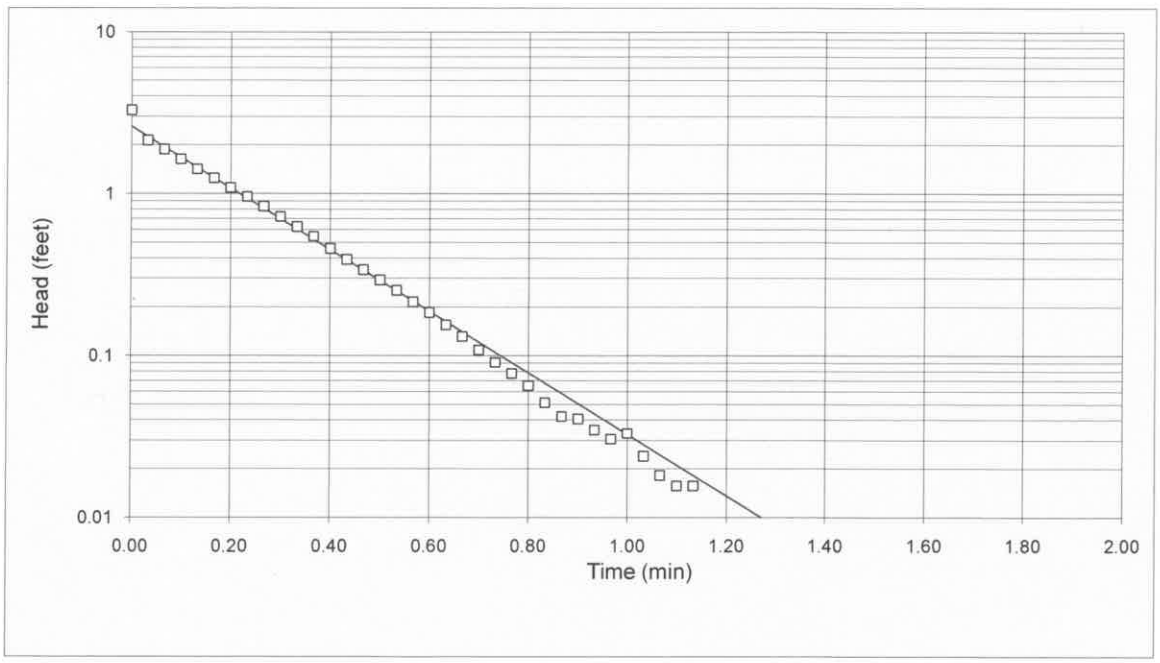
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.03
y_0 =	2.60
y_t =	0.01
t =	1.27

RESULTS

K=	1.57E-03	cm/sec
K=	4.45E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

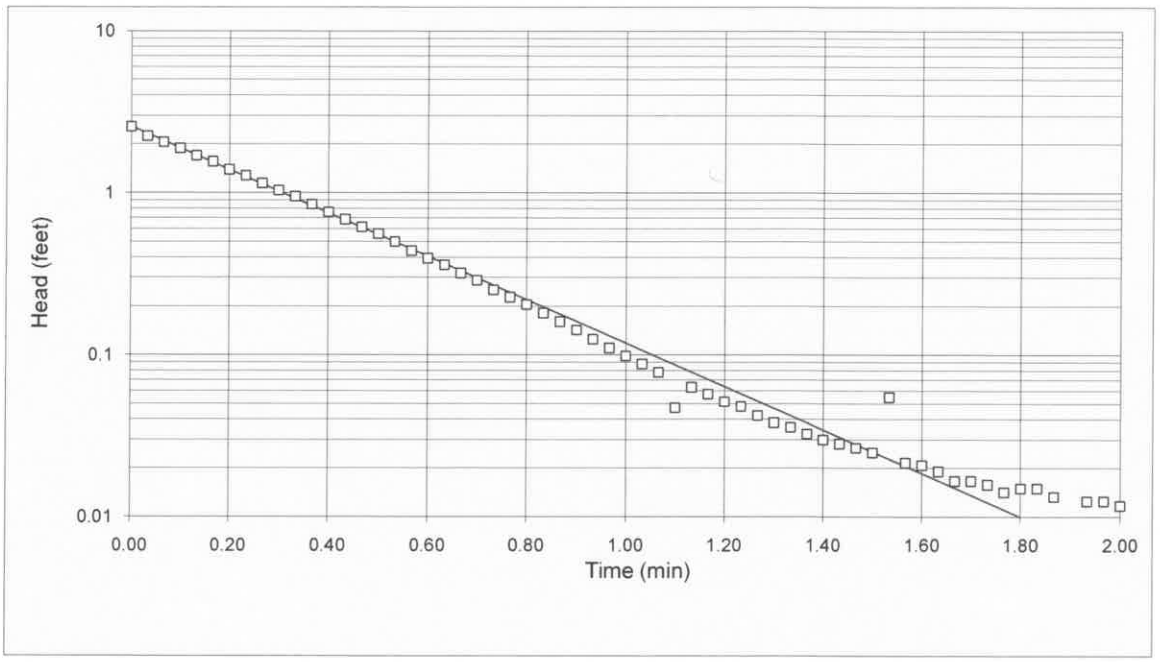
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.03
y_0 =	2.58
y_t =	0.01
t =	1.80

RESULTS

K=	1.11E-03	cm/sec
K=	3.13E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

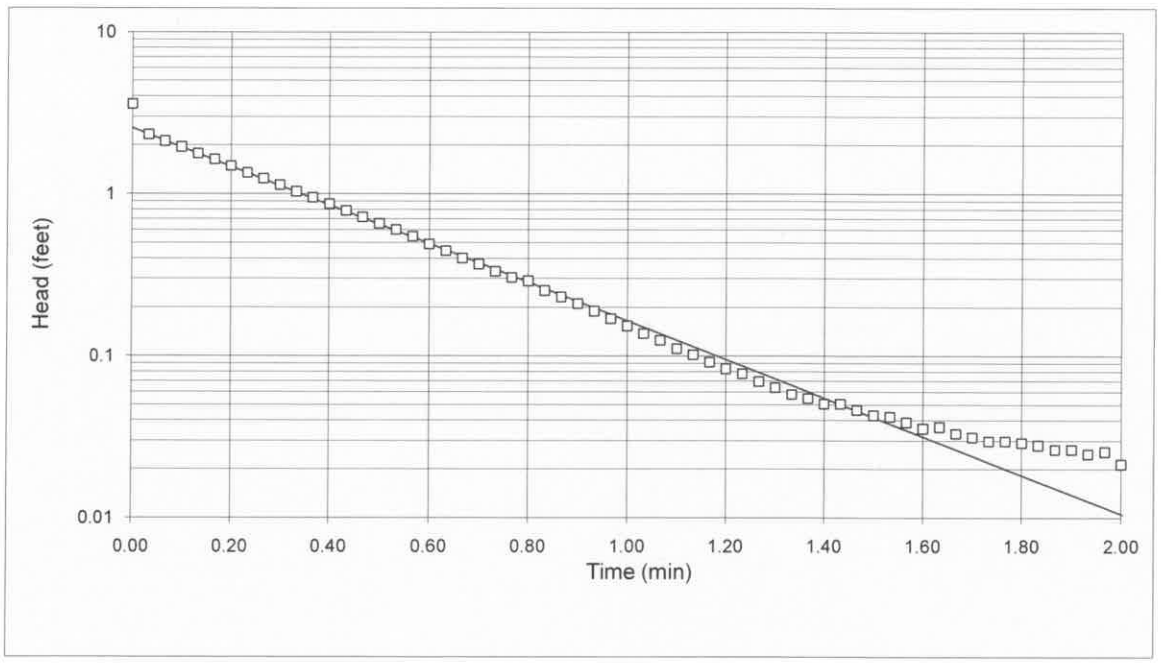
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$ =	2.03
y_0 =	2.55
y_t =	0.01
t =	2.02

RESULTS

K=	9.83E-04	cm/sec
K=	2.79E+00	ft/day



Project Name: CREC Crystal River
Project No.: 083-82671
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

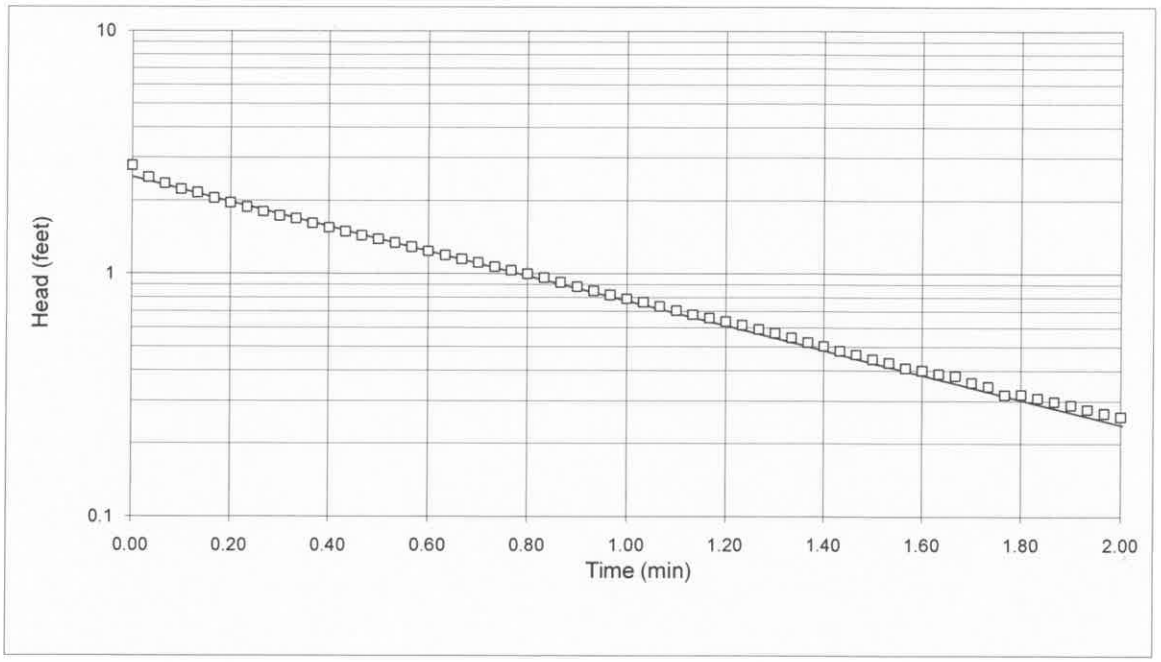
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.03
y_0 =	2.50
y_t =	0.01
t =	4.70

RESULTS

K=	4.21E-04	cm/sec
K=	1.19E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

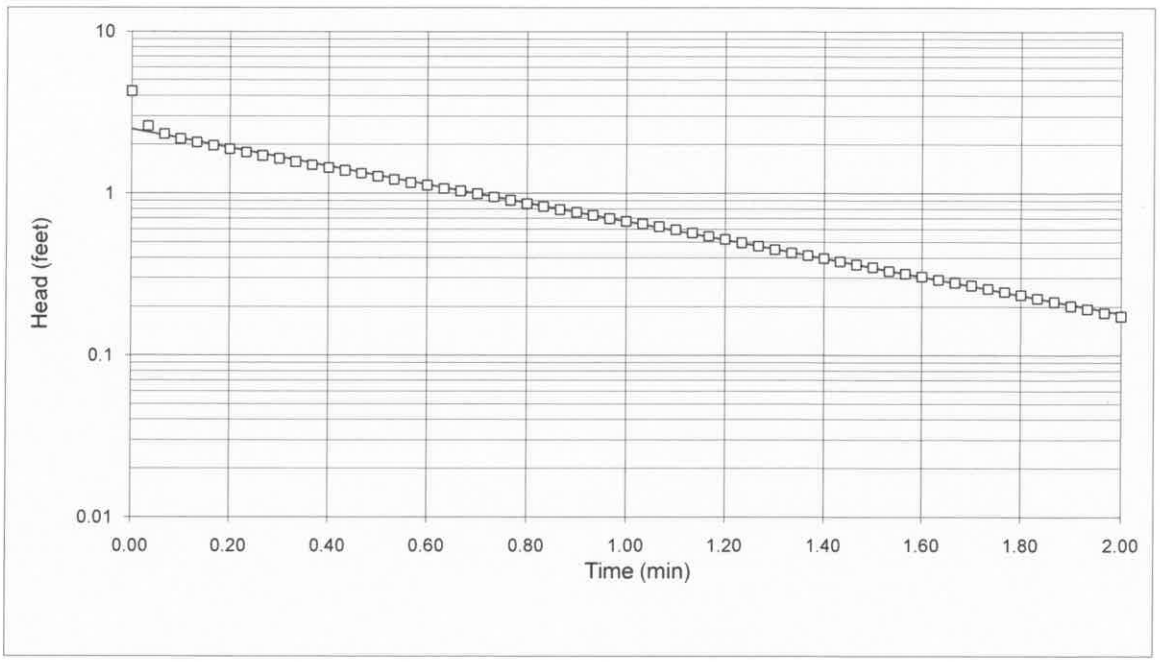
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.03
y_0 =	2.50
y_t =	0.01
t =	4.20

RESULTS

K=	4.71E-04	cm/sec
K=	1.33E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-3

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

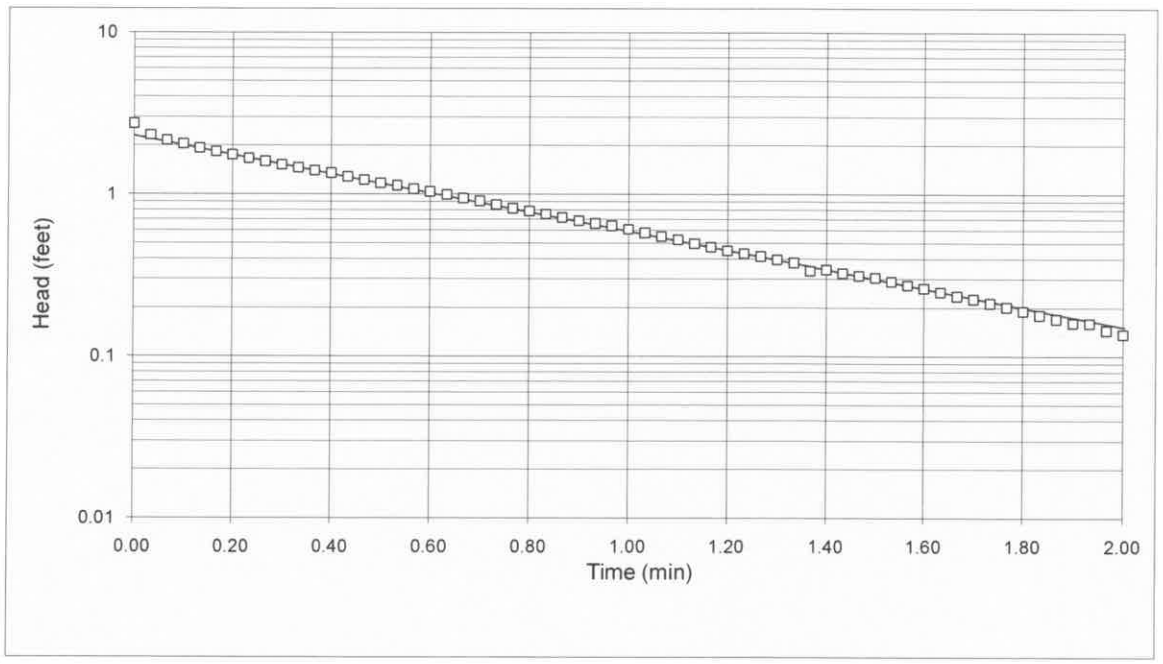
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.03
y_0 =	2.30
y_t =	0.01
t =	4.00

RESULTS

K=	4.87E-04	cm/sec
K=	1.38E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-4

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

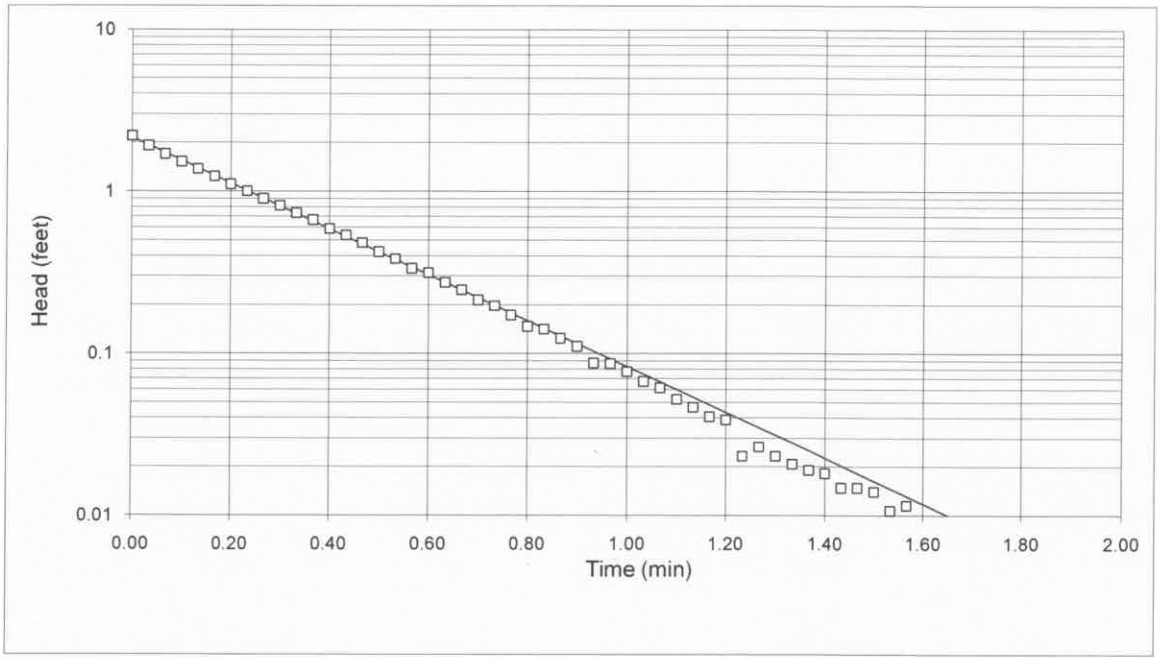
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.02
y_0 =	2.15
y_t =	0.01
t =	1.65

RESULTS

K=	1.16E-03	cm/sec
K=	3.29E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-4

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

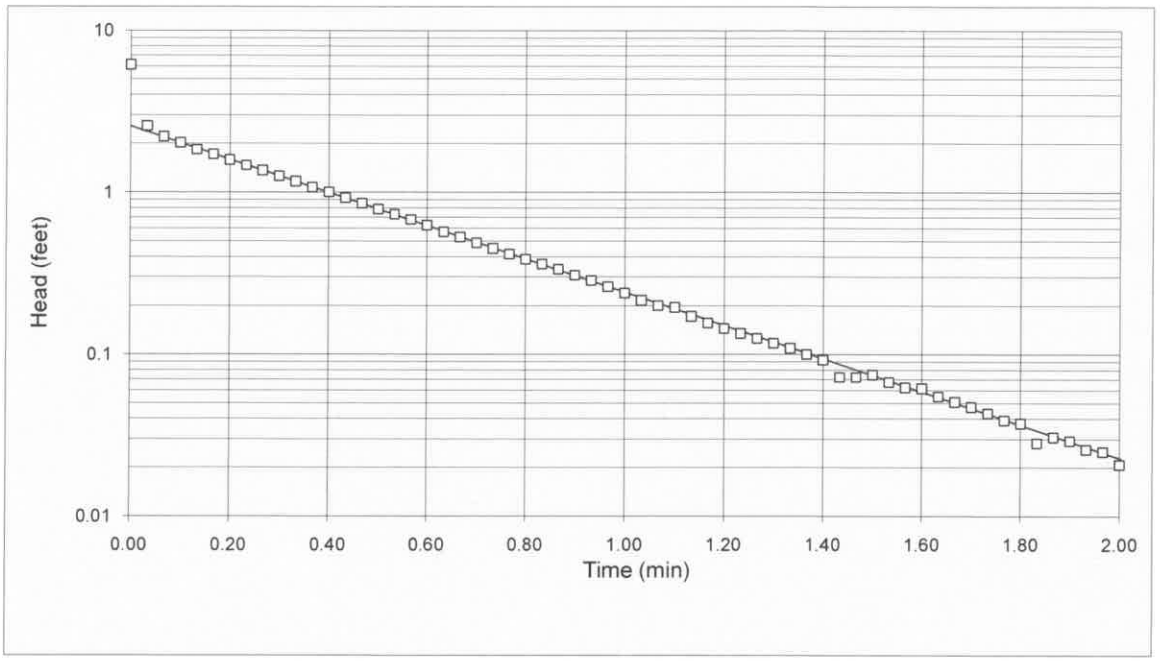
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.02
y_0 =	2.57
y_t =	0.01
t =	2.35

RESULTS

K=	8.42E-04	cm/sec
K=	2.39E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST TW-4

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

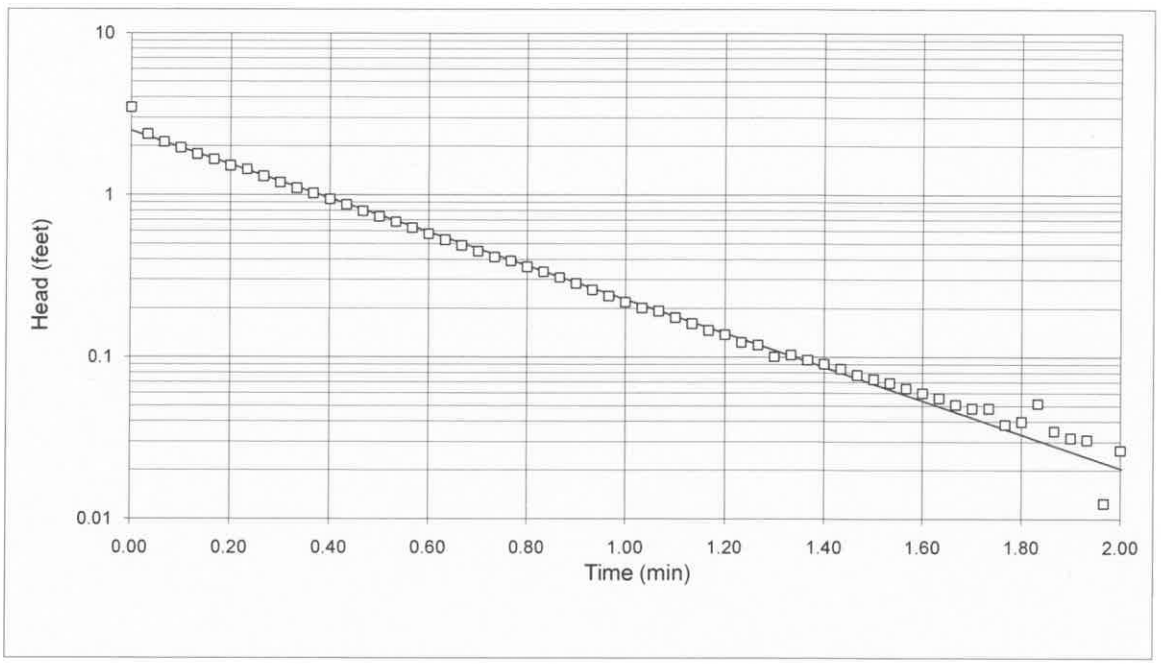
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.02
y_0 =	2.50
y_t =	0.01
t =	2.30

RESULTS

K=	8.56E-04	cm/sec
K=	2.43E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

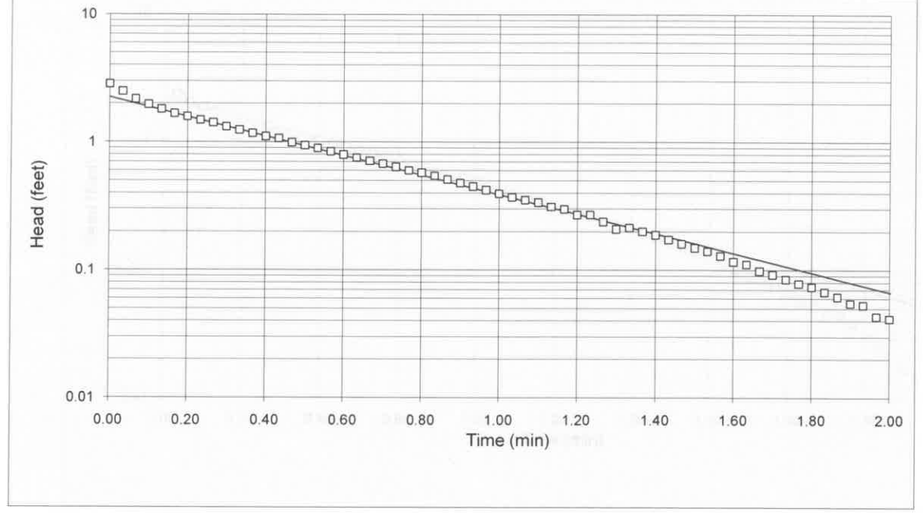
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-4

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.33			
L_e =	10	K=	6.27E-04	cm/sec
$\ln(R_e/r_w)$	2.02	K=	1.78E+00	ft/day
y_0 =	2.25			
y_t =	0.01			
t =	3.08			



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST TW-4

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

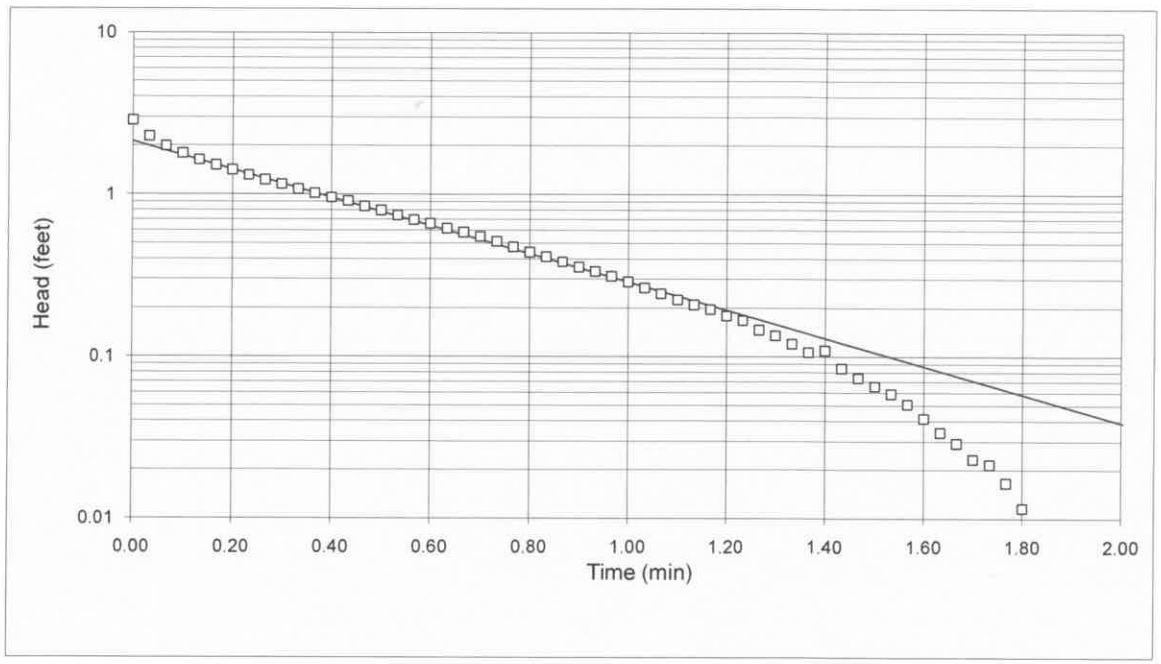
where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS	
r_c =	0.08
r_w =	0.33
L_e =	10
$\ln(R_e/r_w)$	2.02
y_0 =	2.12
y_t =	0.01
t =	2.68

RESULTS

K=	7.13E-04	cm/sec
K=	2.02E+00	ft/day



Project Name: CREC Ash Disposal Area
Project No.: 083-82671.1
Test Date: 10/23/09

Analysis By: MAH
Checked By: RWP
Analysis Date: 11/4/2009

APPENDIX D
GEOTECHNICAL LABORATORY TEST RESULTS

PEF/CREC CCP MGMT PLAN/FL
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classification	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Organic Content %	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (lb/cuft)		
AB-1	Bag	3.5-20.0'	(SM)	33.5	-	-	-	-	84.8	43.7	10.0	-	-	-	-	-	-	-	-
AB-2	Bag	3.5-45.0'	(ML)	29.5	-	-	-	-	95.6	60.4	19.0	-	-	-	-	-	-	-	-
AB-3	Bag	3.5-20.0'	(SM)	25.5	-	-	-	-	92.1	39.3	17.5	-	-	-	-	-	-	-	-
AB-3	Bag	28.5-35.0'	(ML)	73.7	-	-	-	-	-	-	-	-	-	-	11.5	-	-	-	-
AB-5	Bag	3.5-25.0'	(ML)	24.5	-	-	-	-	98.5	50.5	17.5	-	-	-	-	-	-	-	-
AB-6	Bag	3.5-45.0'	(ML)	35.2	-	-	-	-	100.0	93.4	17.0	-	-	-	-	-	-	-	-
PB-3	Bag	8.5-30.0'	(SM)	25.4	-	-	-	-	83.8	27.2	13.0	-	-	-	-	-	-	-	-
AB-1, MC-1	Bag	3.5-5.0'	-	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-1. MC-2	Bag	13.5-15.0'	-	40.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-1, MC-3	Bag	23.5-25.0'	-	36.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-2, MC-4	Bag	3.5-5.0'	-	22.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-2, MC-5	Bag	33.5-35.0'	-	35.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-2, MC-6	Bag	58.5-60.0'	-	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-3, MC-7	Bag	3.5-5.0'	-	30.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-3. MC-8	Bag	18.5-20.0'	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

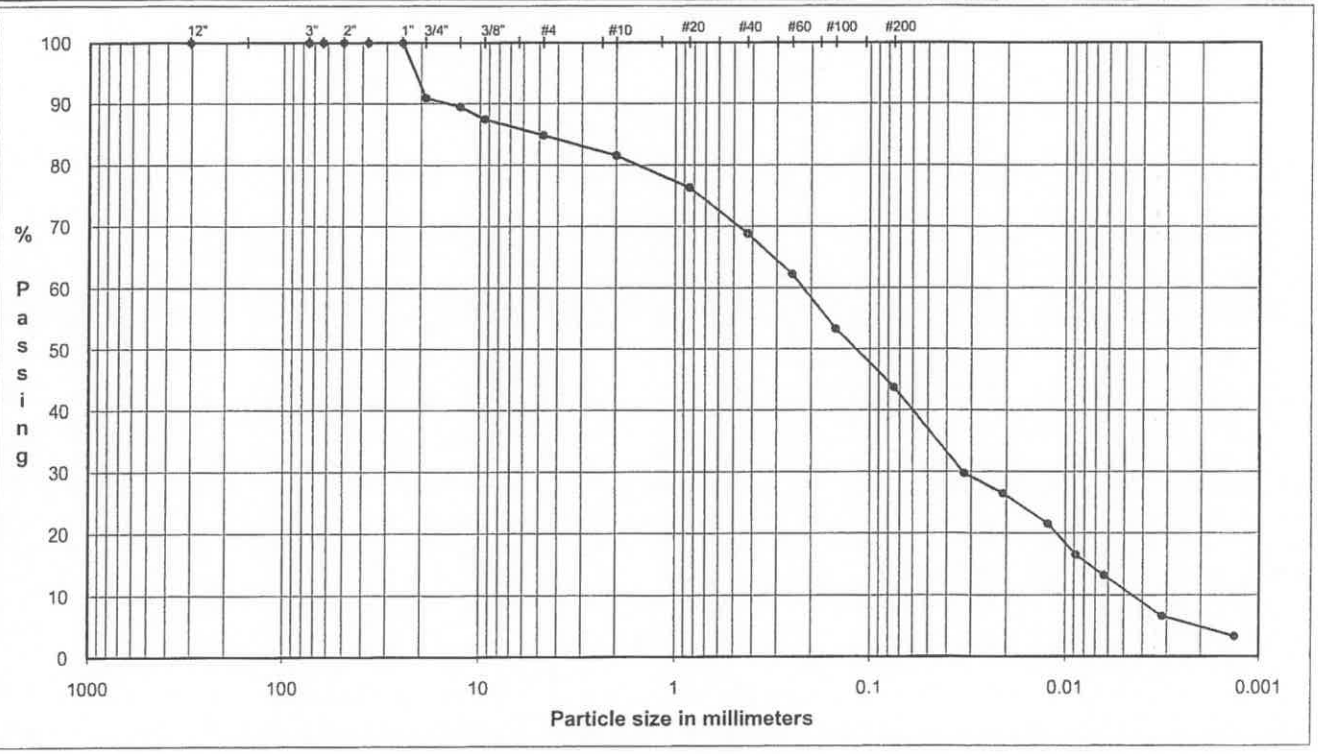
NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

NOVEMBER 2009 083-82671

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: PEF/CREC CCP MGMT PLAN/FL
SAMPLE ID: AB-1 Depth: 3.5 -20.0'
TYPE: Bag



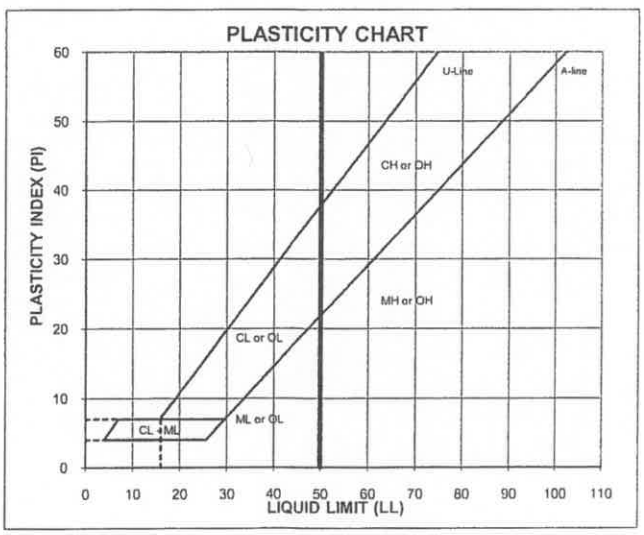
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	91.0	Coarse Gravel	9.04
0.50"	12.7	89.5		
0.375"	9.5	87.4		
#4	4.8	84.8	Fine Gravel	6.12
#10	2.00	81.6	Coarse Sand	3.24
#20	0.85	76.3		
#40	0.43	68.9	Medium Sand	12.74
#60	0.25	62.2		
#100	0.15	53.4		
#200	0.075	43.7	Fine Sand	25.15

Hydrometer Analysis

(mm)	%Finer		
0.033	29.7		
0.021	26.4		
0.012	21.5	Fines	
0.0089	16.5	Silt or Clay	43.70
0.0063	13.2		
0.0032	6.6		
0.0013	3.3		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
33.5				

LL (oven-dried) / < 0.75 – ORGANIC (OL/OH)

DESCRIPTION: Ash - Gray, MEDIUM TO FINE SAND, and clayey silt, some coarse to fine gravel.

USCS: (SM)

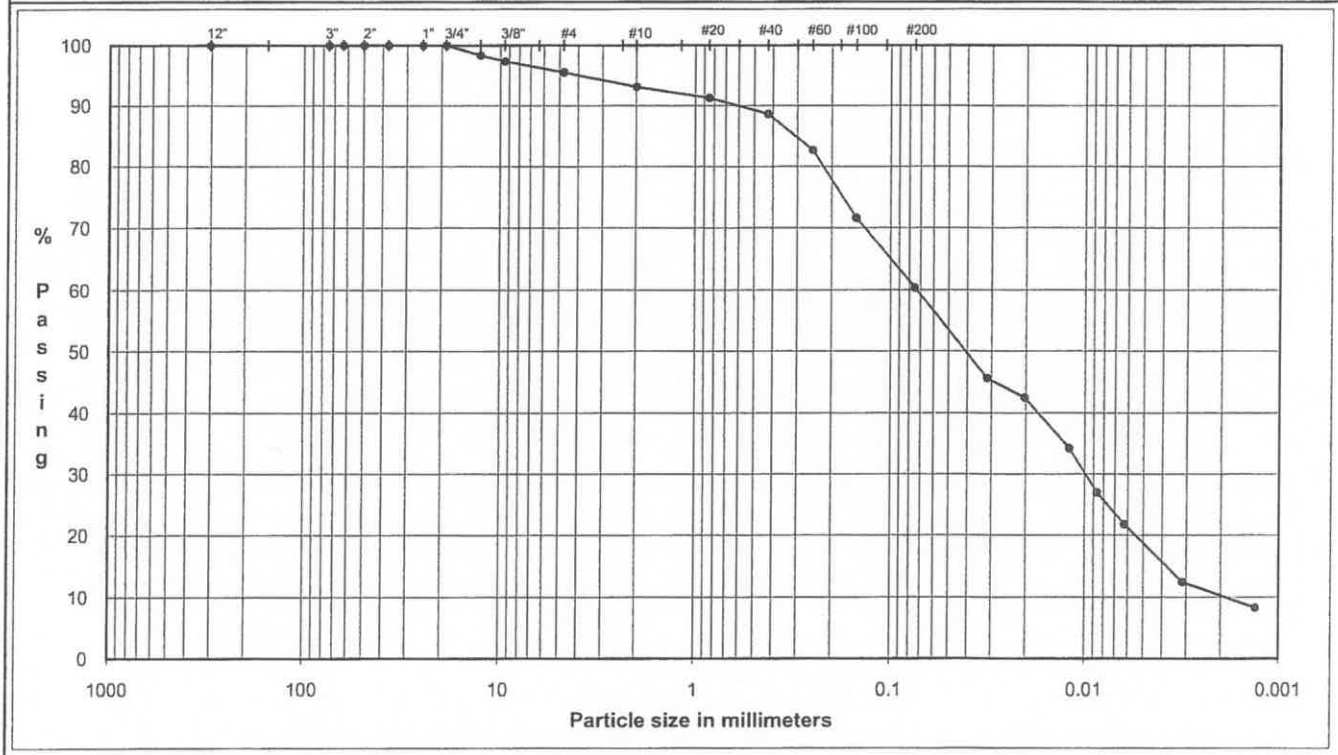
TECH	DW
DATE	11/13/09
CHECK	DA
REVIEW	

Golder Associates Inc.

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
SAMPLE ID: **AB-2** Depth: **3.5 -45.0'**
TYPE: **Bag**



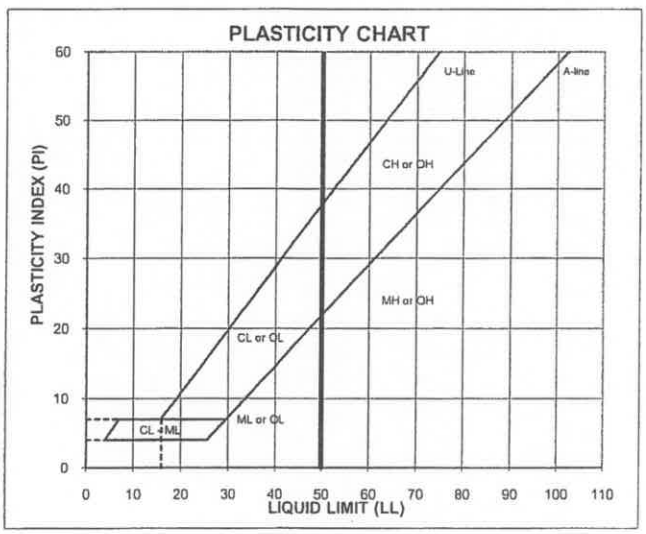
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.00**
0.50"	12.7	**98.4**		
0.375"	9.5	**97.4**		
#4	4.8	**95.6**	Fine Gravel	**4.40**
#10	2.00	**93.2**	Coarse Sand	**2.45**
#20	0.85	**91.3**		
#40	0.43	**88.6**	Medium Sand	**4.52**
#60	0.25	**82.7**		
#100	0.15	**71.6**		
#200	0.075	**60.4**	Fine Sand	**28.27**

Hydrometer Analysis

(mm)	%Finer		
0.032	**45.6**		
0.020	**42.5**		
0.012	**34.2**	Fines	
0.0087	**26.9**	Silt or Clay	**60.36**
0.0063	**21.8**		
0.0031	**12.4**		
0.0013	**8.3**		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_r	LL	PL	PI	LI
29.5				

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Ash - Gray, CLAYEY SILT, and medium to fine sand, trace fine gravel.

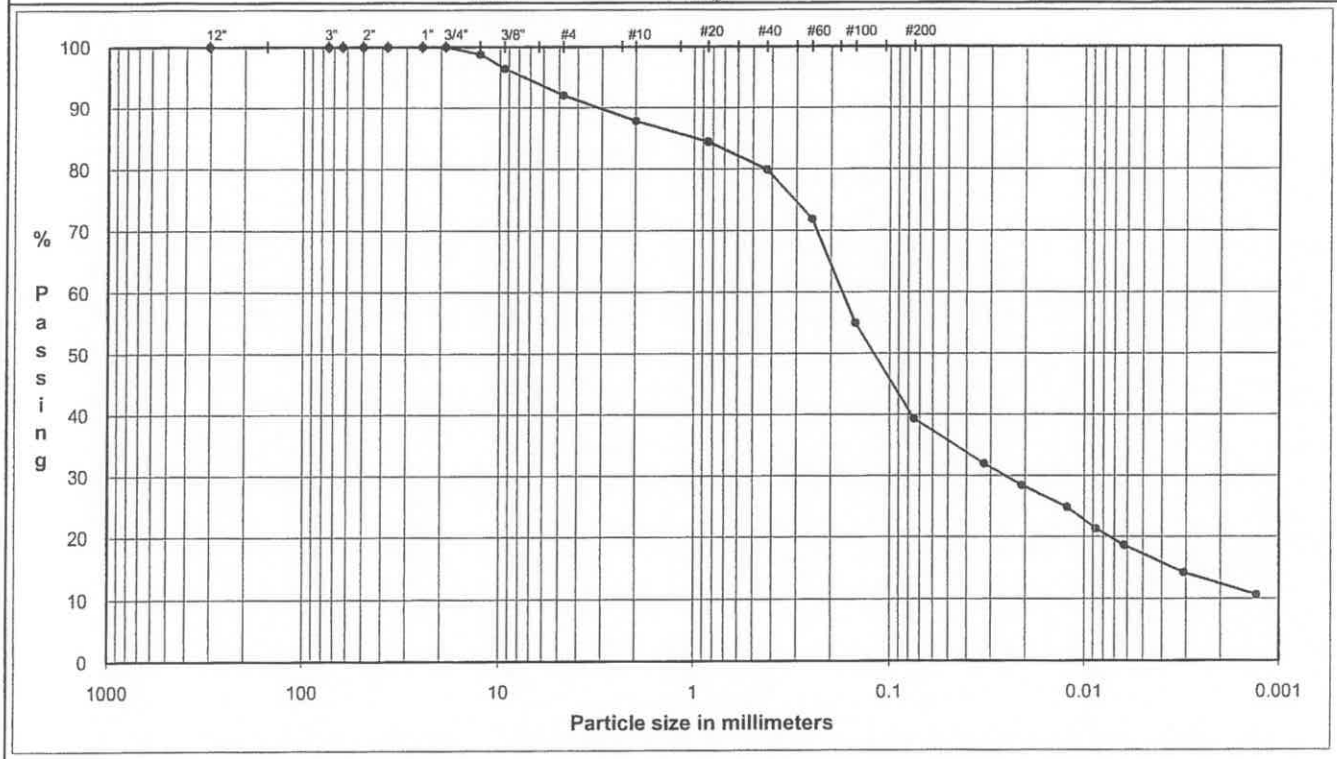
USCS: (ML)

TECH	DW
DATE	11/13/09
CHECK	DA
REVIEW	

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
SAMPLE ID: **AB-3** Depth: **3.5 -20.0'**
TYPE: **Bag**



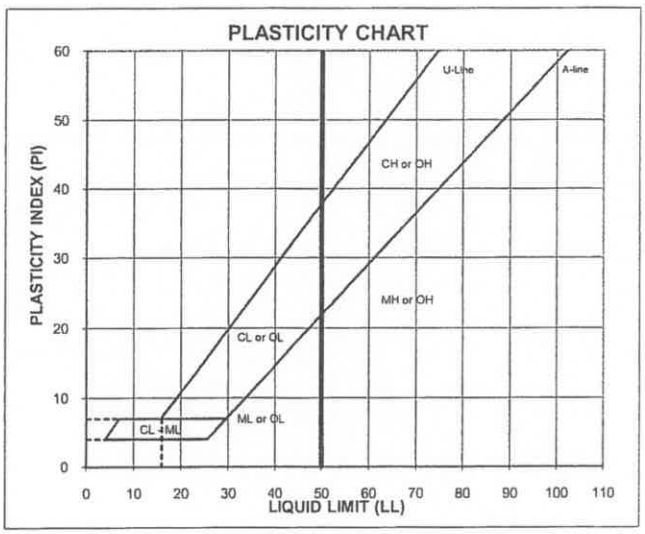
COBBLES	Coarse GRAVEL	Fine GRAVEL	Coarse SAND	Medium SAND	Fine SAND	Silt or Clay FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.00**
0.50"	12.7	**98.8**		
0.375"	9.5	**96.4**		
#4	4.8	**92.1**	Fine Gravel	**7.95**
#10	2.00	**87.8**	Coarse Sand	**4.26**
#20	0.85	**84.4**		
#40	0.43	**79.9**	Medium Sand	**7.88**
#60	0.25	**71.8**		
#100	0.15	**54.9**		
#200	0.075	**39.3**	Fine Sand	**40.62**

Hydrometer Analysis

(mm)	%Finer		
0.033	**32.0**		
0.021	**28.4**		
0.012	**24.9**	Fines	
0.0088	**21.3**	Silt or Clay	**39.29**
0.0063	**18.6**		
0.0031	**14.2**		
0.0013	**10.7**		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
25.5				

LL (oven-dried) / LL (not dried) < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Ash - Dark Gray and Pale Yellow, MEDIUM TO FINE SAND, and clayey silt, little fine gravel.

USCS: (SM)

TECH DW
DATE 11/13/09
CHECK
REVIEW

Golder Associates Inc.

ORGANIC CONTENT (PERCENT ORGANICS)

ASTM D 2974

Method C

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL	SAMPLE ID	AB-3
PROJECT NO.	083-82671	SAMPLE TYPE	Bag
REMARKS	-	SAMPLE DEPTH	28.5-35.0'

	Natural Moisture Content	Hygroscopic Moisture Content
Weight Of Wet Soil & Tare (gm)	157.97	68.87
Weight Of Dry Soil & Tare (gm)	94.50	68.67
Weight of Tare (gm)	8.35	51.70
Weight Of Water In (gm)	63.47	0.20
Weight Of Dry Soil (gm)	86.15	16.97
Moisture Content (%)	73.67	1.18

Weight Of Soil Dry & Crucible	(W1)	42.14	41.31	38.54
Weight After Burning & Crucible	(W2)	39.20	38.10	35.91
Weight Of Crucible	(W3)	16.72	17.28	17.54
Weight Of Soil Dry	(W4 = W1-W3)/Mc_H	25.12	23.75	20.76
Weight After Burning	(W5 = W2-W3)	22.48	20.82	18.37
Weight Lost	(W6=W4-W5)	2.64	2.93	2.39
Ash Percent	W7 = (W5/W4)*100	89.5%	87.7%	88.5%
Organics Percent	(W8 = 100-W7)	10.5%	12.3%	11.5%

ORGANIC CONTENT = **11.5%**

Description Gray, CLAYEY SILT, little fine sand.

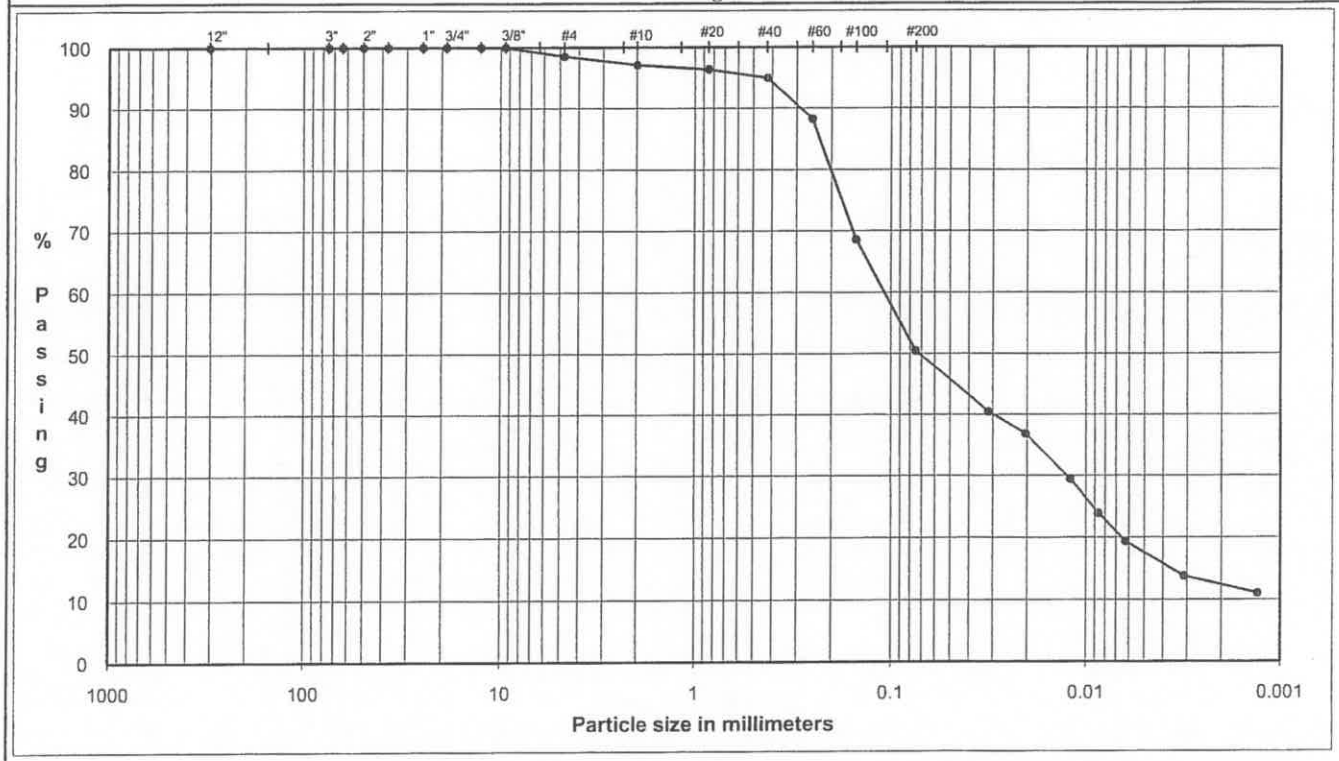
USCS (ML)

TECH	DA/TJ
DATE	11/14/09
CHECK	DA
REVIEW	TWM

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
SAMPLE ID: **AB-5** Depth: **3.5 -25.0'**
TYPE: **Bag**



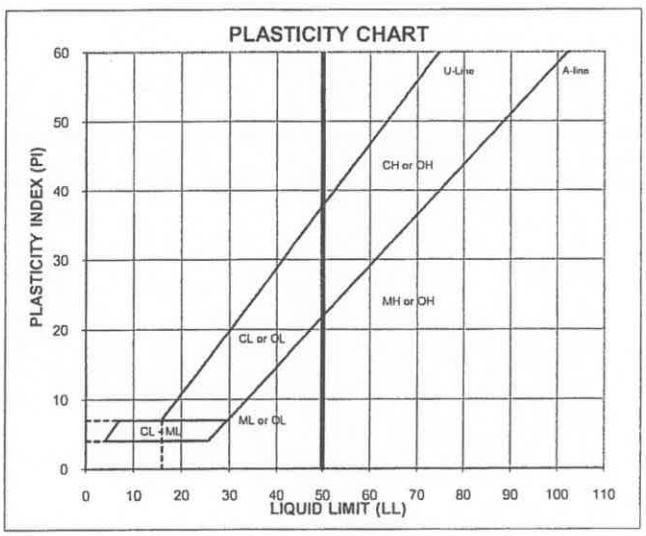
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.00**
0.50"	12.7	**100.0**		
0.375"	9.5	**100.0**		
#4	4.8	**98.5**	Fine Gravel	**1.46**
#10	2.00	**97.1**	Coarse Sand	**1.40**
#20	0.85	**96.4**		
#40	0.43	**94.9**	Medium Sand	**2.21**
#60	0.25	**88.2**		
#100	0.15	**68.6**		
#200	0.075	**50.5**	Fine Sand	**44.45**

Hydrometer Analysis

(mm)	%Finer		
0.032	**40.5**		
0.020	**36.8**		
0.012	**29.4**	Fines	
0.0087	**23.9**	Silt or Clay	**50.48**
0.0063	**19.3**		
0.0031	**13.8**		
0.0013	**11.0**		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_r	LL	PL	PI	LI
24.5				

LL (oven-dried) / <0.75 - ORGANIC (OL/OH)

DESCRIPTION: Ash - Gray, CLAYEY SILT, and fine sand, trace fine gravel.

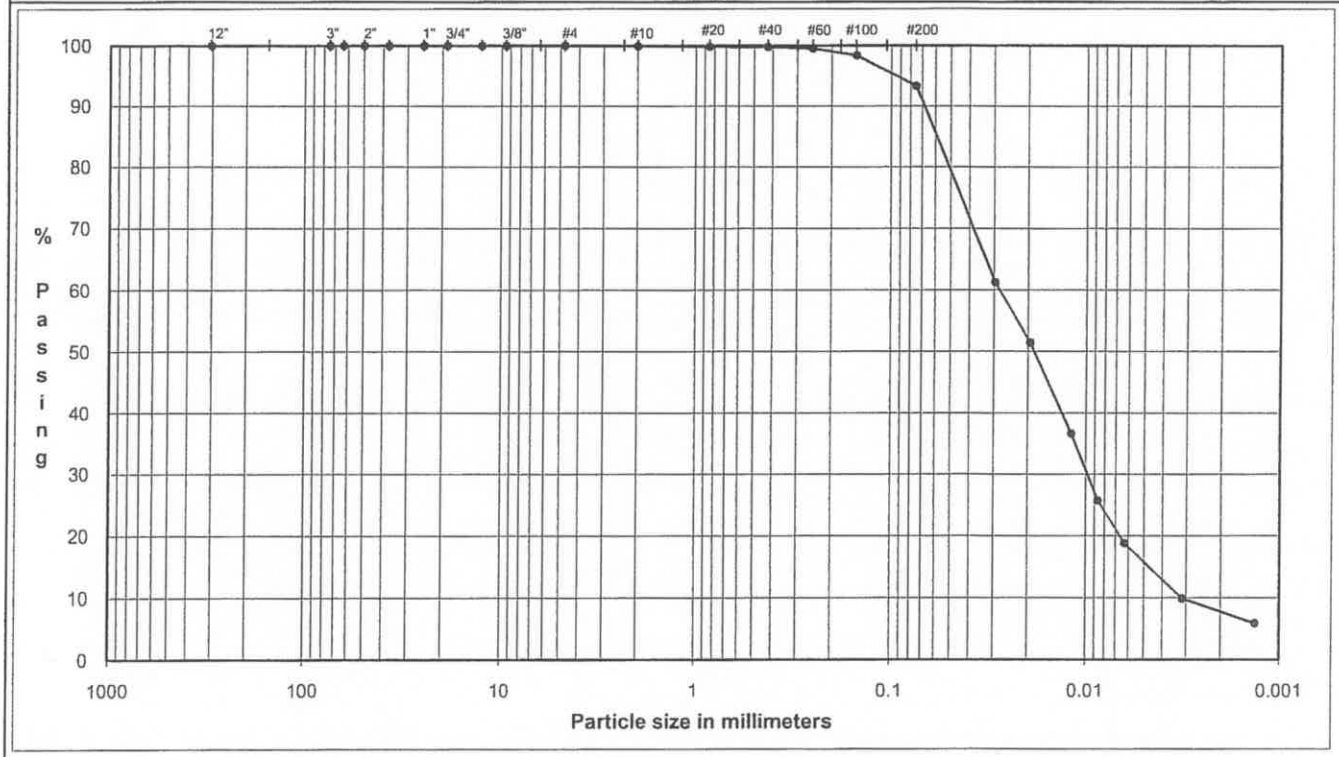
USCS: (ML)

TECH	DW
DATE	11/13/09
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
SAMPLE ID: **AB-6** Depth: **3.5-45.0'**
TYPE: **Bag**



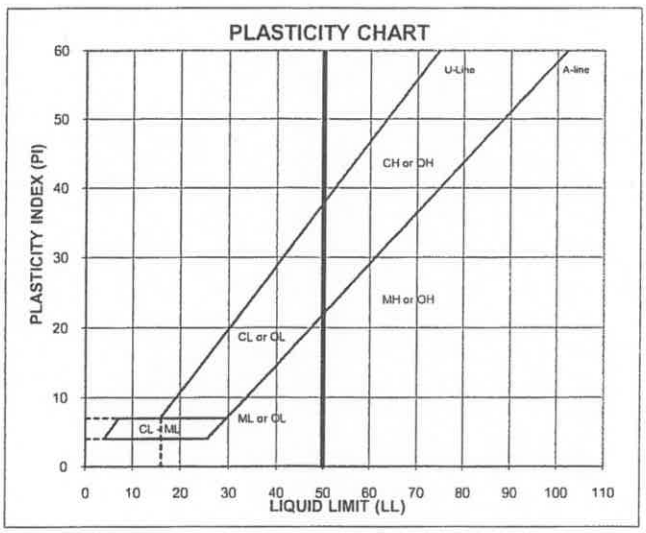
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**	Coarse Gravel	**0.00**
0.50"	12.7	**100.0**		
0.375"	9.5	**100.0**		
#4	4.8	**100.0**	Fine Gravel	**0.00**
#10	2.00	**99.9**	Coarse Sand	**0.06**
#20	0.85	**99.8**		
#40	0.43	**99.8**	Medium Sand	**0.18**
#60	0.25	**99.5**		
#100	0.15	**98.4**		
#200	0.075	**93.4**	Fine Sand	**6.41**

Hydrometer Analysis

(mm)	%Finer		
0.030	**61.3**		
0.019	**51.4**		
0.012	**36.6**	Fines	
0.0087	**25.7**	Silt or Clay	**93.35**
0.0063	**18.8**		
0.0032	**9.9**		
0.0013	**5.9**		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
35.2				

LL (oven-dried) / LL (not dried) < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Ash - Gray, CLAYEY SILT, little fine sand.

USCS: (ML)

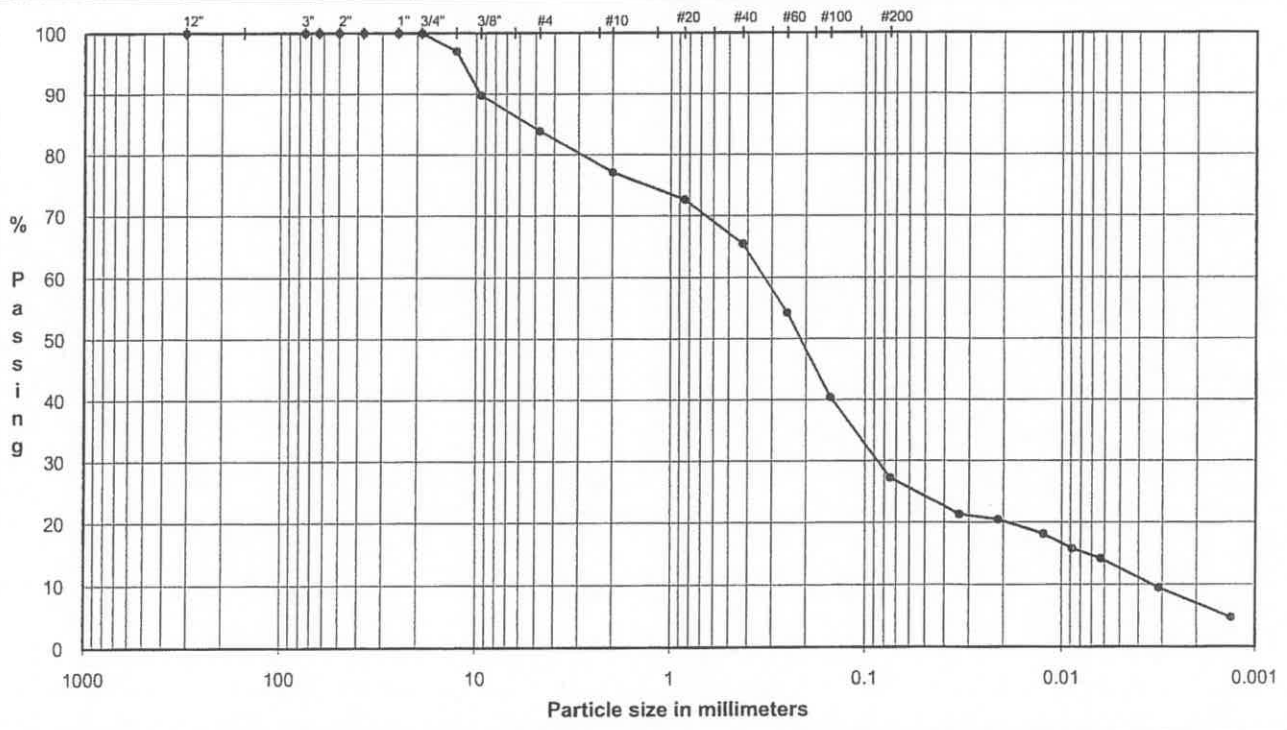
TECH DW
DATE 11/13/09
CHECK JDA
REVIEW

NOVEMBER 2009 083-82671

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: PEF/CREC CCP MGMT PLAN/FL
SAMPLE ID: PB-3 Depth: 8.5-30.0'
TYPE: Bulk



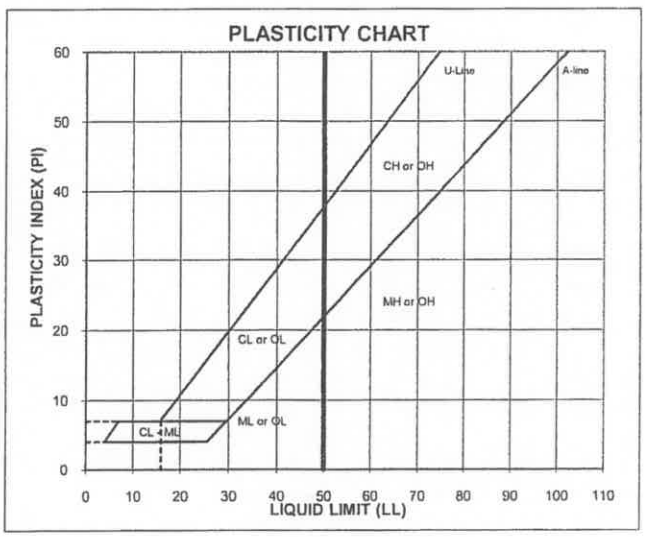
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.00
0.50"	12.7	97.0		
0.375"	9.5	89.8		
#4	4.8	83.8	Fine Gravel	16.16
#10	2.00	77.1	Coarse Sand	6.71
#20	0.85	72.6		
#40	0.43	65.5	Medium Sand	11.64
#60	0.25	54.3		
#100	0.15	40.4		
#200	0.075	27.2	Fine Sand	38.24

Hydrometer Analysis

(mm)	%Finer		
0.034	21.3		
0.021	20.5		
0.012	18.1	Fines	
0.0089	15.8	Silt or Clay	27.25
0.0063	14.2		
0.0031	9.5		
0.0013	4.7		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_r	LL	PL	PI	LI
25.4				

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: Pale Yellow, COARSE TO FINE SAND, some clayey silt, some fine gravel.

USCS: (SM)

TECH DW
DATE 11/13/09
CHECK DA
REVIEW

Golder Associates Inc.

WATER CONTENT DETERMINATION
ASTM D 2216

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
REMARKS	

Sample Type	Bag	Bag	Bag	Bag	Bag
Borehole Number	AB-1, MC-1	AB-1, MC-2	AB-1, MC-3	AB-2, MC-4	AB-2, MC-5
Sample Number	-	-	-	-	-
Depth of Sample (ft)	3.5-5.0'	13.5-15.0'	23.5-25.0'	3.5-5.0'	33.5-35.0'
Tare Number	-	-	-	-	-
Weight of Wet Soil + Tare (gm)	63.88	123.69	145.97	99.42	114.95
Weight of Dry Soil + Tare (gm)	59.57	90.74	109.22	82.44	87.26
Weight of Tare (gm)	8.32	8.35	8.33	8.34	8.30
Weight of Water (gm)	4.31	32.95	36.75	16.98	27.69
Weight of Dry Soil (gm)	51.25	82.39	100.89	74.10	78.96
Water Content (%)	8.41	39.99	36.43	22.91	35.07

Sample Type	Bag	Bag	Bag		
Borehole Number	AB-2, MC-6	AB-3, MC-7	AB-3, MC-8		
Sample Number	-	-	-		
Depth of Sample (ft)	58.5-60.0'	3.5-5.0'	18.5-20.0'		
Tare Number	-	-	-		
Weight of Wet Soil + Tare (gm)	78.71	81.37	134.77		
Weight of Dry Soil + Tare (gm)	63.98	64.42	118.09		
Weight of Tare (gm)	8.43	8.33	8.44		
Weight of Water (gm)	14.73	16.95	16.68		
Weight of Dry Soil (gm)	55.55	56.09	109.65		
Water Content (%)	26.52	30.22	15.21		

Sample Type					
Borehole Number					
Sample Number					
Depth of Sample (ft)					
Tare Number					
Weight of Wet Soil + Tare (gm)					
Weight of Dry Soil + Tare (gm)					
Weight of Tare (gm)					
Weight of Water (gm)					
Weight of Dry Soil (gm)					
Water Content (%)					

TECH	DW
DATE	11/13/09
CHECK	DA
REVIEW	AWM

PEF/CREC CCP MGMT PLAN/FL
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classification	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
AB-2	UD	30.0-32.0'	(ML)	22.6	-	-	-	-	-	-	-	-	-	2.51	22.6	94.3	-	T- CD
AB-4	UD	20.0-22.0'	(ML)	28.8	-	-	-	-	-	-	-	-	-	2.17	28.8	68.1	-	T- CD
AB-4	UD	30.0-32.0'	(ML)	24.8	-	-	-	-	-	-	-	-	-	2.21	24.8	61.1	-	T-CD
AB-6	UD	55.0-57.0'	(ML)	42.2	-	-	-	-	-	-	-	-	-	2.19	42.2	65.8	-	T-CD

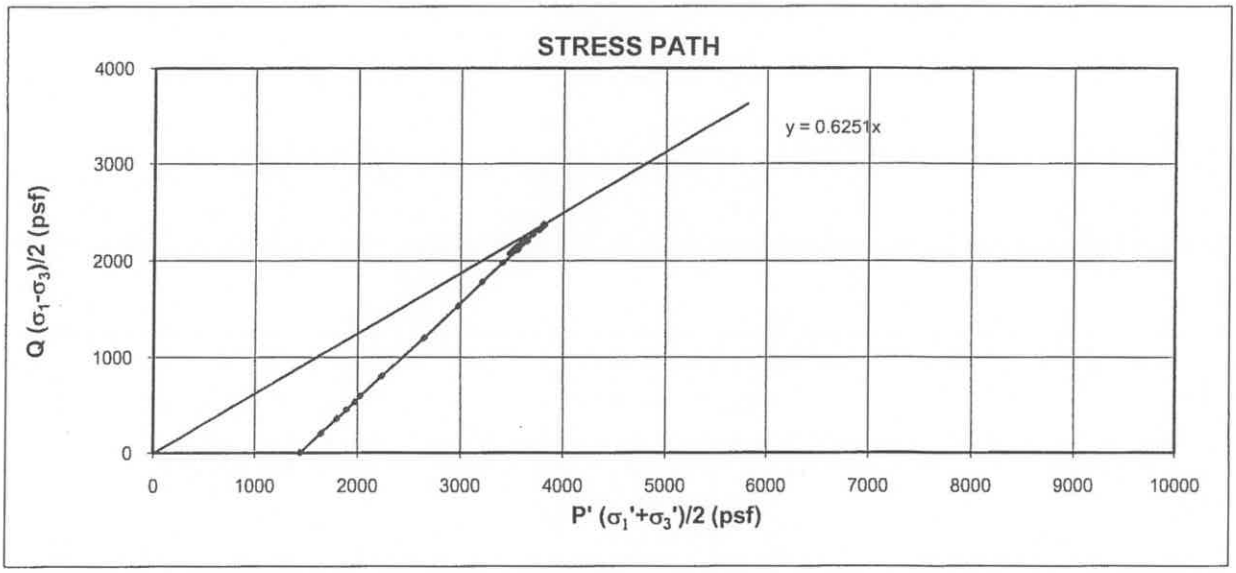
ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

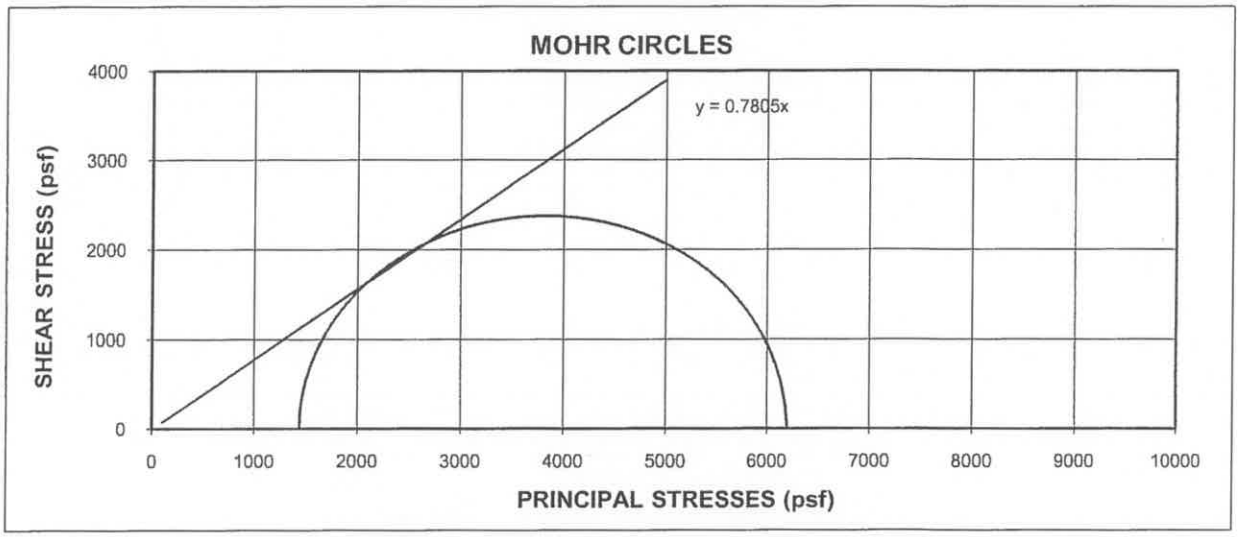
NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

NOVEMBER 2009 083-82671

TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	**PEF/CREC CCP MGMT PLAN/FL**				
PROJECT NUMBER	**083-82671**				
SAMPLE ID	**AB-2**	Depth	**30.0-32.0'**	Sample Type	**UD**





*EFFECTIVE STRENGTH PARAMETERS			
STRESS PATH		MOHR CIRCLES	
α =	31.6 °	ϕ =	38.0 °
a =	0.0 psf	C =	0.0 psf

		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	1440		
	INITIAL DRY DENSITY (pcf)	101.5		
	INITIAL WATER CONTENT %	21.6		
	INITIAL VOID RATIO	0.101		

DESCRIPTION: Ash - Dark Gray, CLAYEY SILT, some fine sand, trace fine gravel.

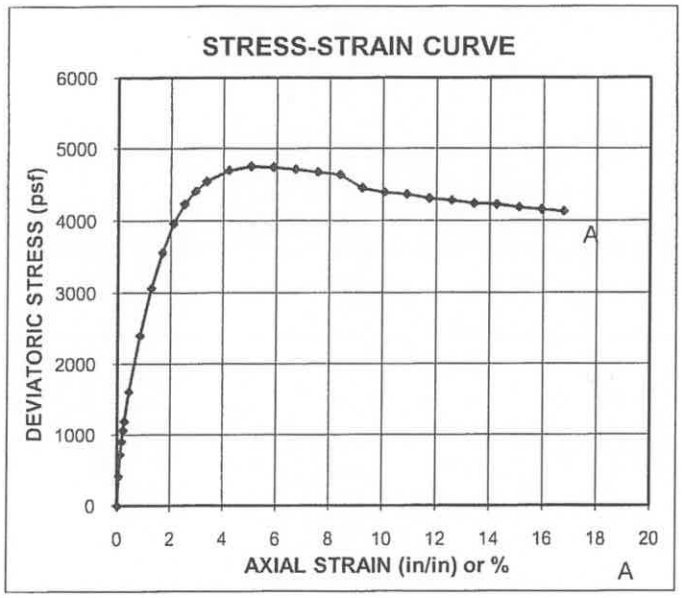
USCS: (ML)

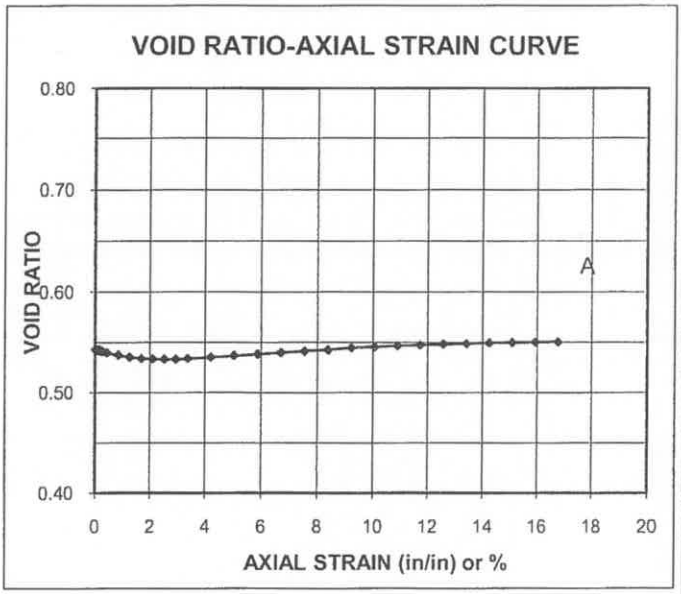
CHECKED AK
REVIEWED
APPROVED

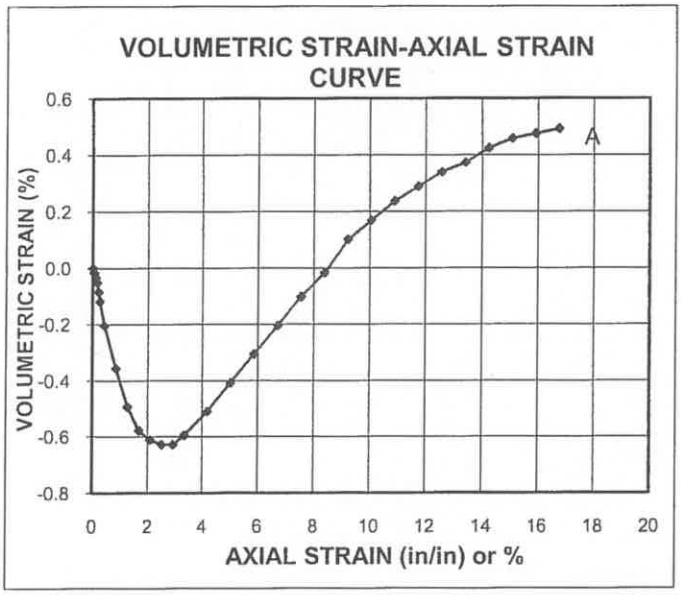
NOVEMBER 2009 083-82671

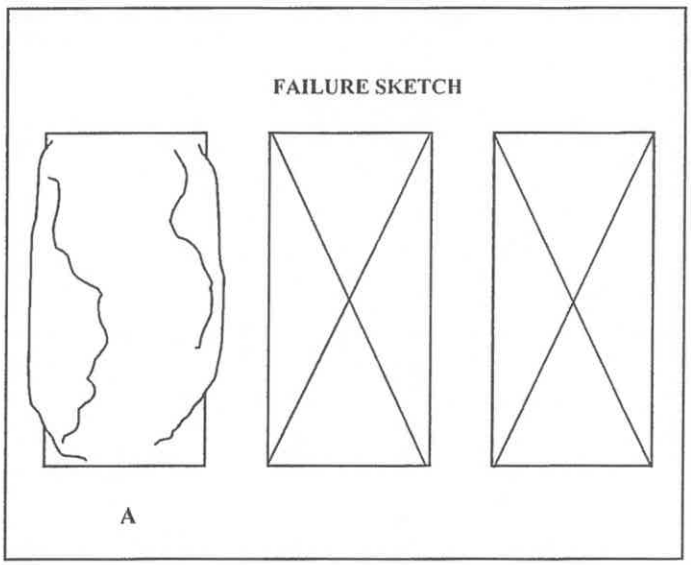
TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-2	Depth	30.0-32.0'	Sample Type	UD









		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	1440		
	DRY DENSITY (pcf)	101.5		
	WATER CONTENT (%)	21.6		
	VOID RATIO	0.543		
	SATURATION (%)	100.0		
	STRAIN RATE (%/min)	0.10		

LL	-
PL	-
PI	-
Gs	2.51

DESCRIPTION: Ash - Dark Gray, CLAYEY SILT, some fine sand, trace fine gravel.

USCS: (ML)

CHECKED	AK
REVIEWED	
APPROVED	

TRIAXIAL COMPRESSION TEST (EM - 1110-2-1906 APPENDIX X) CONSOLIDATED-DRAINED

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	AB-2
SAMPLE TYPE	UD
DEPTH INTERVAL	30.0-32.0'
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	90.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	10.0
PRESSURE, σ_3 (psf)	1440.0
FINAL "B" VALUE	1.00
t_{50} (minutes)	0.19

INITIAL SAMPLE DATA	cm	in	corrected	cm
HEIGHT	15.240	6.000	5.968	
DIAMETER	7.282	2.867	2.770	
AREA	41.65	6.46	6.03	
VOLUME	634.74	38.73	35.96	589.24
WEIGHT (g)	1175.50		1166.23	
% MOISTURE	22.6		21.63	
SPECIFIC GRAVITY	2.511			
MOIST DENSITY (pcf)	115.6			
DRY DENSITY, calc (pcf)	94.3			
VOLUME OF SOLIDS	381.86			
VOLUME OF VOIDS	252.88			
VOID RATIO	0.662			
SATURATION	85.7		100.00	

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	101.5
VOLUME OF SOLIDS	381.86
VOLUME OF VOIDS	207.38
VOID RATIO	0.543

WATER CONTENT	
WT SOIL & TARE, MOIST (g)	1166.23
WT SOIL & TARE, DRY (g)	958.85
WT TARE (g)	0.00
WT MOISTURE (g)	207.38
WT DRY SOIL (g)	958.85
% MOISTURE	21.63

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	BURETTE READING (cc)	VOLUME STRAIN (%)	PWP change DU (psf)	AXIAL STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEVIATOR STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	VOLUME CHANGE (cc)	VOID RATIO e
0.0	0.000	19	80.2	25.0	0.00	0.0	0.00	1.00	6.03	5.968	0.0	1440.0	1440.0	1440.0	1440.0	0.0	0.0	0.543
0.5	0.003	36	80.2	24.9	-0.02	0.0	0.05	1.00	6.03	5.965	408.6	1848.6	1848.6	1440.0	1644.3	204.3	-0.1	0.543
1.0	0.006	49	80.2	24.8	-0.03	0.0	0.10	1.00	6.03	5.962	716.5	2156.5	2156.5	1440.0	1798.3	358.3	-0.2	0.543
1.5	0.009	57	80.2	24.7	-0.05	0.0	0.15	1.00	6.03	5.959	900.1	2340.1	2340.1	1440.0	1890.1	450.1	-0.3	0.542
2.0	0.012	63	80.2	24.5	-0.08	0.0	0.20	1.00	6.03	5.956	1062.3	2502.3	2502.3	1440.0	1971.2	531.2	-0.5	0.542
2.5	0.015	69	80.3	24.3	-0.12	14.4	0.25	1.00	6.03	5.953	1191.0	2631.0	2616.6	1425.6	2021.1	595.5	-0.7	0.541
4.2	0.025	86	80.3	23.8	-0.20	14.4	0.42	1.00	6.04	5.943	1607.4	3047.4	3033.0	1425.6	2229.3	803.7	-1.2	0.540
8.3	0.050	120	80.2	22.9	-0.36	0.0	0.84	0.99	6.05	5.918	2402.2	3842.2	3842.2	1440.0	2641.1	1201.1	-2.1	0.538
12.5	0.075	148	80.2	22.1	-0.49	0.0	1.26	0.99	6.07	5.893	3064.2	4504.2	4504.2	1440.0	2972.1	1532.1	-2.9	0.535
16.7	0.100	169	80.3	21.6	-0.58	14.4	1.68	0.98	6.09	5.868	3559.6	4999.6	4985.2	1425.6	3205.4	1779.8	-3.4	0.534
20.8	0.125	187	80.3	21.4	-0.61	14.4	2.09	0.98	6.12	5.843	3960.0	5400.0	5385.6	1425.6	3405.6	1980.0	-3.6	0.534
25.0	0.150	199	80.2	21.3	-0.63	0.0	2.51	0.97	6.14	5.818	4229.8	5669.8	5669.8	1440.0	3554.9	2114.9	-3.7	0.533
29.2	0.175	208	80.2	21.3	-0.63	0.0	2.93	0.97	6.17	5.793	4407.7	5847.7	5847.7	1440.0	3643.8	2203.8	-3.7	0.533
33.3	0.200	214	80.3	21.5	-0.59	14.4	3.35	0.97	6.20	5.768	4545.2	5985.2	5970.8	1425.6	3698.2	2272.6	-3.5	0.534
41.7	0.250	223	80.2	22.0	-0.51	0.0	4.19	0.96	6.26	5.718	4695.3	6135.3	6135.3	1440.0	3787.6	2347.6	-3.0	0.535
50.0	0.300	227	80.3	22.6	-0.41	14.4	5.03	0.95	6.32	5.668	4754.3	6194.3	6179.9	1425.6	3802.7	2377.1	-2.4	0.537
58.3	0.350	229	80.2	23.2	-0.31	0.0	5.86	0.94	6.38	5.618	4741.4	6181.4	6181.4	1440.0	3810.7	2370.7	-1.8	0.538
66.7	0.400	230	80.2	23.8	-0.20	0.0	6.70	0.93	6.44	5.568	4712.3	6152.3	6152.3	1440.0	3796.1	2356.1	-1.2	0.540
75.0	0.450	230	80.2	24.4	-0.10	0.0	7.54	0.92	6.51	5.518	4674.0	6114.0	6114.0	1440.0	3777.0	2337.0	-0.6	0.542
83.3	0.500	231	80.2	24.9	-0.02	0.0	8.38	0.92	6.57	5.468	4636.5	6076.5	6076.5	1440.0	3758.3	2318.3	-0.1	0.543
91.7	0.550	224	80.5	25.6	0.10	43.2	9.22	0.91	6.64	5.418	4454.3	5894.3	5851.1	1396.8	3623.9	2227.1	0.6	0.545
100.0	0.600	224	80.5	26.0	0.17	43.2	10.05	0.90	6.71	5.368	4395.2	5835.2	5792.0	1396.8	3594.4	2197.6	1.0	0.546
108.3	0.650	224	80.5	26.4	0.24	43.2	10.89	0.89	6.78	5.318	4366.2	5806.2	5763.0	1396.8	3579.9	2183.1	1.4	0.547
116.7	0.700	224	80.5	26.7	0.29	43.2	11.73	0.88	6.85	5.268	4308.2	5748.2	5705.0	1396.8	3550.9	2154.1	1.7	0.548
125.0	0.750	224	80.5	27.0	0.34	43.2	12.57	0.87	6.91	5.218	4279.7	5719.7	5676.5	1396.8	3536.7	2139.9	2.0	0.548
133.3	0.800	224	80.5	27.2	0.37	43.2	13.40	0.87	6.98	5.168	4237.3	5677.3	5634.1	1396.8	3515.4	2118.6	2.2	0.549
141.7	0.850	226	80.5	27.5	0.42	43.2	14.24	0.86	7.06	5.118	4226.8	5666.8	5623.6	1396.8	3510.2	2113.4	2.5	0.550
150.0	0.900	226	80.5	27.7	0.46	43.2	15.08	0.85	7.13	5.068	4184.1	5624.1	5580.9	1396.8	3488.8	2092.0	2.7	0.550
158.3	0.950	227	80.5	27.8	0.48	43.2	15.92	0.84	7.20	5.018	4156.1	5596.1	5552.9	1396.8	3474.9	2078.1	2.8	0.550
166.7	1.000	227	80.4	27.9	0.49	28.8	16.76	0.83	7.27	4.968	4129.8	5569.8	5541.0	1411.2	3476.1	2064.9	2.9	0.551

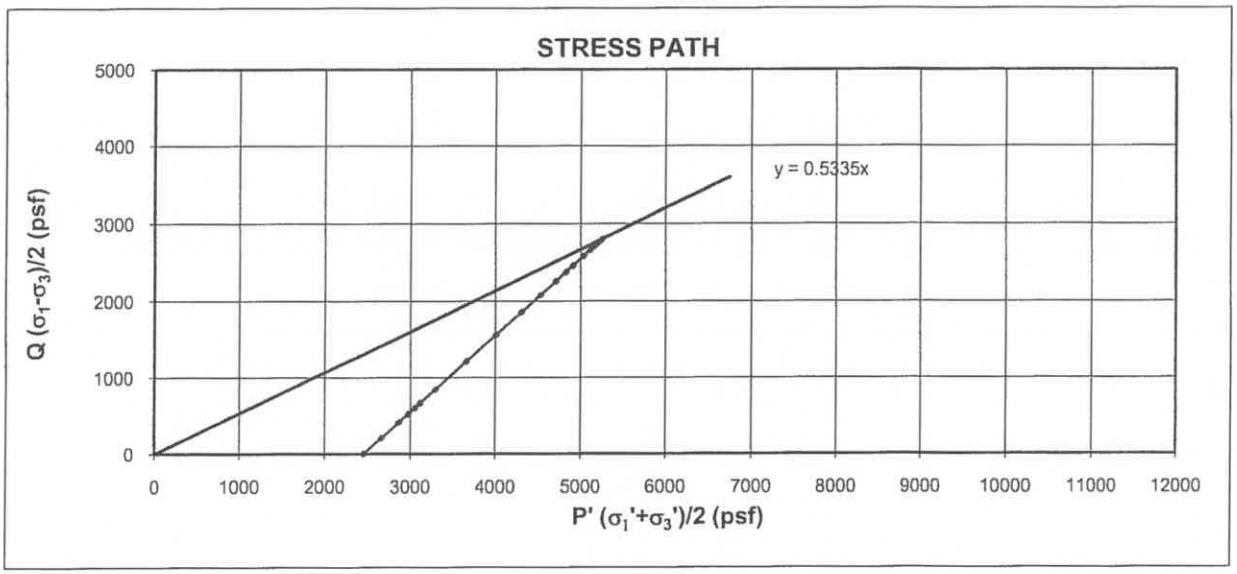
DEVIATORIC STRESS @ FAILURE 4754.3

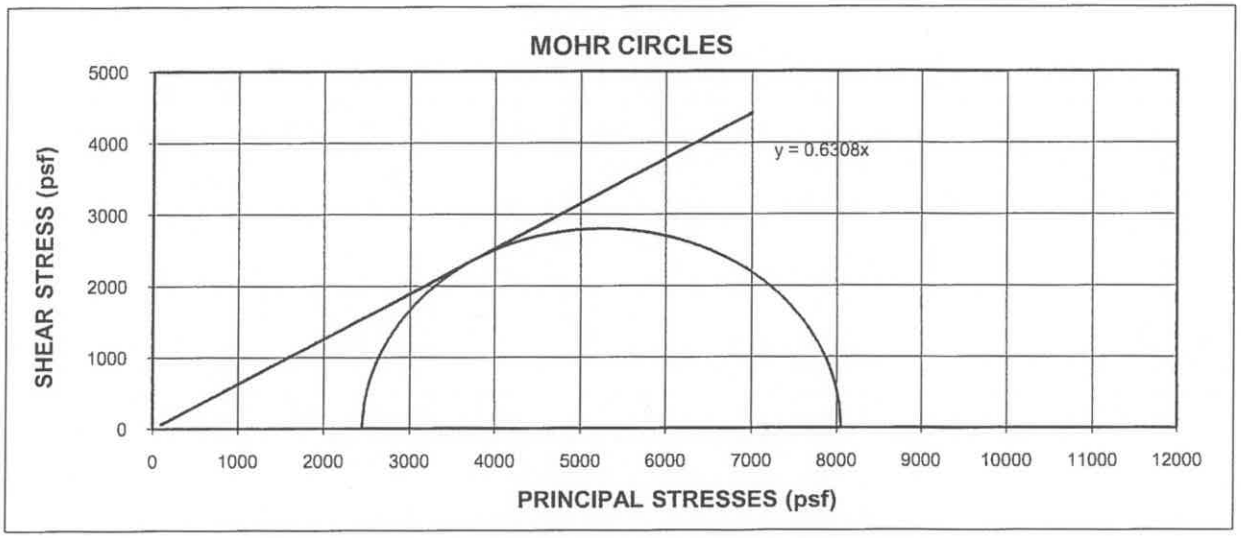
TECH	AK
DATE	11/22/09
CHECKED	AK
REVIEWED	
APPROVED	

NOVEMBER 2009 083-82671

TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-4	Depth	20.0-22.0'	Sample Type	UD





*EFFECTIVE STRENGTH PARAMETERS			
STRESS PATH		MOHR CIRCLES	
α =	28.1 °	ϕ =	32.2 °
a =	0.0 psf	C =	0.0 psf

		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	2448		
	INITIAL DRY DENSITY (pcf)	69.4		
	INITIAL WATER CONTENT %	41.7		
	INITIAL VOID RATIO	0.101		

DESCRIPTION: Ash - Gray, CLAYEY SILT, little fine sand.

USCS: (ML)

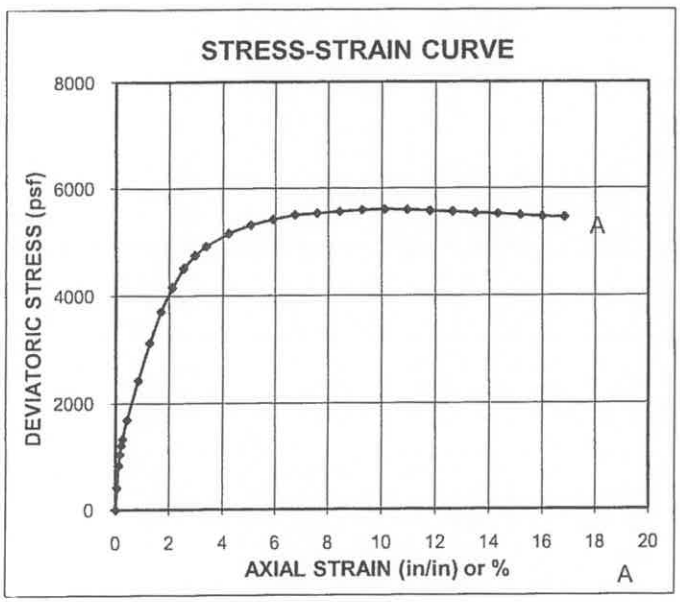
CHECKED AHL
REVIEWED PWM
APPROVED

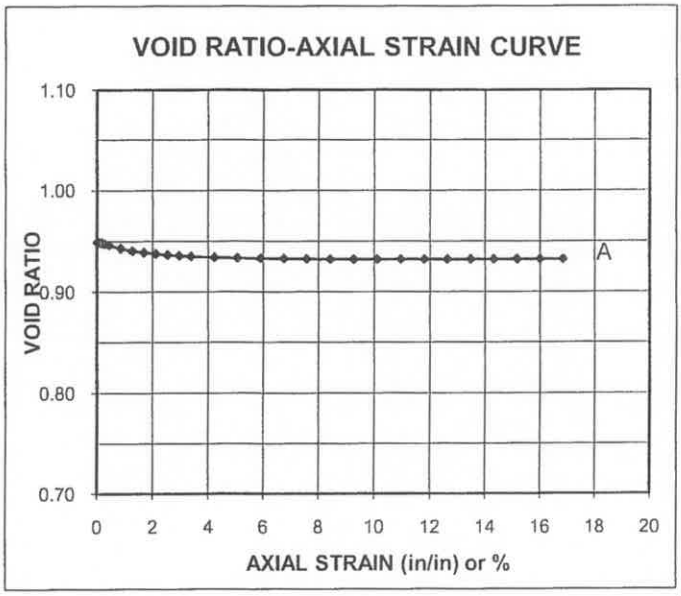
NOVEMBER 2009

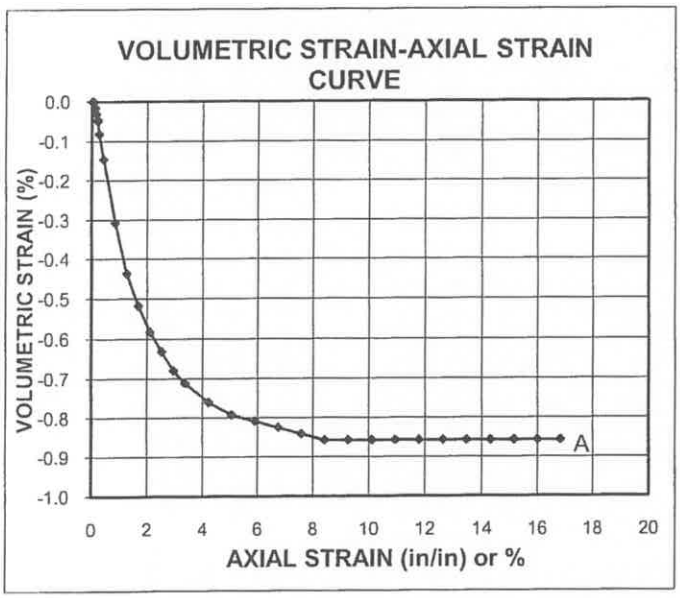
083-82671

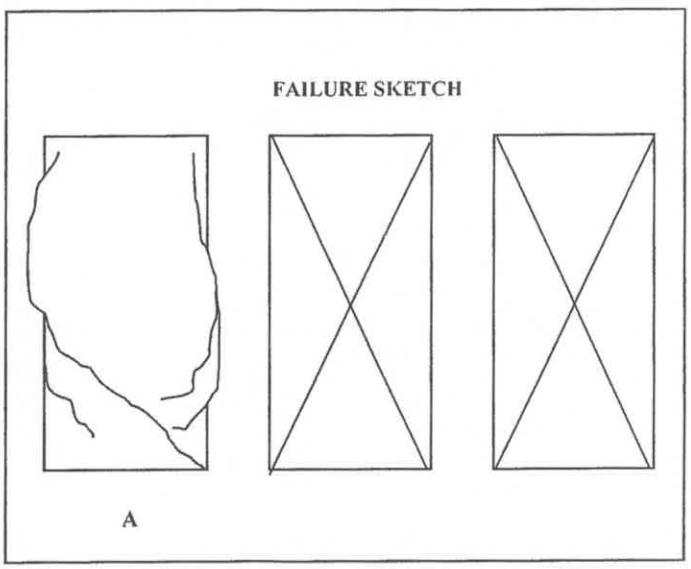
TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-4	Depth	20.0-22.0'	Sample Type	UD









		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	2448		
	DRY DENSITY (pcf)	69.4		
	WATER CONTENT (%)	41.7		
	VOID RATIO	0.949		
	SATURATION (%)	95.4		
	STRAIN RATE (%/min)	0.10		

LL	-
PL	-
PI	-
Gs	2.17

DESCRIPTION: Ash - Gray, CLAYEY SILT, little fine sand.

USCS: (ML)

CHECKED	MK
REVIEWED	[illegible]
APPROVED	

TRIAXIAL COMPRESSION TEST (EM - 1110-2-1906 APPENDIX X) CONSOLIDATED-DRAINED

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	AB-4
SAMPLE TYPE	UD
DEPTH INTERVAL	20.0-22.0'
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	97.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	17.0
PRESSURE, σ_3 (psf)	2448.0
FINAL "B" VALUE	0.96
t_{50} (minutes)	0.17

INITIAL SAMPLE DATA	cm	in	corrected	cm
HEIGHT	15.260	6.008	5.940	
DIAMETER	7.249	2.854	2.844	
AREA	41.27	6.40	6.35	
VOLUME	629.84	38.44	37.73	618.24
WEIGHT (g)	886.19		974.94	
% MOISTURE	28.8		41.75	
SPECIFIC GRAVITY	2.17			
MOIST DENSITY (pcf)	87.8			
DRY DENSITY, calc (pcf)	68.1			
VOLUME OF SOLIDS	317.25			
VOLUME OF VOIDS	312.59			
VOID RATIO	0.985			
SATURATION	63.5		95.40	

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	69.4
VOLUME OF SOLIDS	317.25
VOLUME OF VOIDS	300.99
VOID RATIO	0.949

WATER CONTENT	
WT SOIL & TARE, MOIST (g)	974.94
WT SOIL & TARE, DRY (g)	687.80
WT TARE (g)	0.00
WT MOISTURE (g)	287.14
WT DRY SOIL (g)	687.80
% MOISTURE	41.75

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	BURETTE READING (cc)	VOLUME STRAIN (%)	PWP change DU (psf)	AXIAL STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEVIATOR STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	VOLUME CHANGE (cc)	VOID RATIO e
0.0	0.000	17	80.3	25.0	0.00	0.0	0.00	1.00	6.35	5.940	0.0	2448.0	2448.0	2448.0	2448.0	0.0	0.0	0.949
0.5	0.003	35	80.3	25.0	0.00	0.0	0.05	1.00	6.35	5.937	414.7	2862.7	2862.7	2448.0	2655.3	207.3	0.0	0.949
1.0	0.006	53	80.3	24.9	-0.02	0.0	0.10	1.00	6.36	5.934	829.1	3277.1	3277.1	2448.0	2862.5	414.5	-0.1	0.948
1.5	0.009	63	80.3	24.8	-0.03	0.0	0.15	1.00	6.36	5.931	1041.7	3489.7	3489.7	2448.0	2968.8	520.8	-0.2	0.948
2.0	0.012	70	80.3	24.7	-0.05	0.0	0.20	1.00	6.36	5.928	1208.8	3656.8	3656.8	2448.0	3052.4	604.4	-0.3	0.948
2.5	0.015	76	80.3	24.5	-0.08	0.0	0.25	1.00	6.36	5.925	1330.8	3778.8	3778.8	2448.0	3113.4	665.4	-0.5	0.947
4.2	0.025	92	80.3	24.1	-0.15	0.0	0.42	1.00	6.37	5.915	1691.2	4139.2	4139.2	2448.0	3293.6	845.6	-0.9	0.946
8.3	0.050	124	80.3	23.1	-0.31	0.0	0.84	0.99	6.39	5.890	2426.5	4874.5	4874.5	2448.0	3661.2	1213.2	-1.9	0.943
12.5	0.075	156	80.3	22.3	-0.44	0.0	1.26	0.99	6.40	5.865	3123.1	5571.1	5571.1	2448.0	4009.5	1561.5	-2.7	0.940
16.7	0.100	182	80.3	21.8	-0.52	0.0	1.68	0.98	6.43	5.840	3710.5	6158.5	6158.5	2448.0	4303.3	1855.3	-3.2	0.939
20.8	0.125	203	80.3	21.4	-0.58	0.0	2.10	0.98	6.45	5.815	4156.9	6604.9	6604.9	2448.0	4526.5	2078.5	-3.6	0.937
25.0	0.150	220	80.3	21.1	-0.63	0.0	2.53	0.97	6.47	5.790	4514.7	6962.7	6962.7	2448.0	4705.4	2257.4	-3.9	0.936
29.2	0.175	231	80.3	20.8	-0.68	0.0	2.95	0.97	6.50	5.765	4750.0	7198.0	7198.0	2448.0	4823.0	2375.0	-4.2	0.935
33.3	0.200	240	80.3	20.6	-0.71	0.0	3.37	0.97	6.53	5.740	4916.3	7364.3	7364.3	2448.0	4906.1	2458.1	-4.4	0.935
41.7	0.250	253	80.3	20.3	-0.76	0.0	4.21	0.96	6.58	5.690	5160.3	7608.3	7608.3	2448.0	5028.2	2580.2	-4.7	0.934
50.0	0.300	262	80.3	20.1	-0.79	0.0	5.05	0.95	6.64	5.640	5314.1	7762.1	7762.1	2448.0	5105.1	2657.1	-4.9	0.933
58.3	0.350	269	80.3	20.0	-0.81	0.0	5.89	0.94	6.69	5.590	5416.3	7864.3	7864.3	2448.0	5156.1	2708.1	-5.0	0.933
66.7	0.400	275	80.3	19.9	-0.82	0.0	6.73	0.93	6.75	5.540	5498.8	7946.8	7946.8	2448.0	5197.4	2749.4	-5.1	0.933
75.0	0.450	279	80.3	19.8	-0.84	0.0	7.58	0.92	6.81	5.490	5530.3	7978.3	7978.3	2448.0	5213.2	2765.2	-5.2	0.932
83.3	0.500	282	80.3	19.7	-0.86	0.0	8.42	0.92	6.88	5.440	5560.5	8008.5	8008.5	2448.0	5228.2	2780.2	-5.3	0.932
91.7	0.550	286	80.3	19.7	-0.86	0.0	9.26	0.91	6.94	5.390	5590.3	8038.3	8038.3	2448.0	5243.1	2795.1	-5.3	0.932
100.0	0.600	289	80.3	19.7	-0.86	0.0	10.10	0.90	7.00	5.340	5600.1	8048.1	8048.1	2448.0	5248.0	2800.0	-5.3	0.932
108.3	0.650	292	80.3	19.7	-0.86	0.0	10.94	0.89	7.07	5.290	5594.5	8042.5	8042.5	2448.0	5245.3	2797.3	-5.3	0.932
116.7	0.700	293	80.3	19.7	-0.86	0.0	11.78	0.88	7.14	5.240	5571.9	8019.9	8019.9	2448.0	5233.9	2785.9	-5.3	0.932
125.0	0.750	295	80.3	19.7	-0.86	0.0	12.63	0.87	7.21	5.190	5560.7	8008.7	8008.7	2448.0	5228.3	2780.3	-5.3	0.932
133.3	0.800	296	80.3	19.7	-0.86	0.0	13.47	0.87	7.28	5.140	5530.9	7978.9	7978.9	2448.0	5213.4	2765.4	-5.3	0.932
141.7	0.850	298	80.3	19.7	-0.86	0.0	14.31	0.86	7.35	5.090	5518.2	7966.2	7966.2	2448.0	5207.1	2759.1	-5.3	0.932
150.0	0.900	300	80.3	19.7	-0.86	0.0	15.15	0.85	7.42	5.040	5493.1	7941.1	7941.1	2448.0	5194.5	2746.5	-5.3	0.932
158.3	0.950	301	80.3	19.7	-0.86	0.0	15.99	0.84	7.50	4.990	5467.4	7915.4	7915.4	2448.0	5181.7	2733.7	-5.3	0.932
166.7	1.000	304	80.3	19.7	-0.86	0.0	16.84	0.83	7.57	4.940	5456.4	7904.4	7904.4	2448.0	5176.2	2728.2	-5.3	0.932

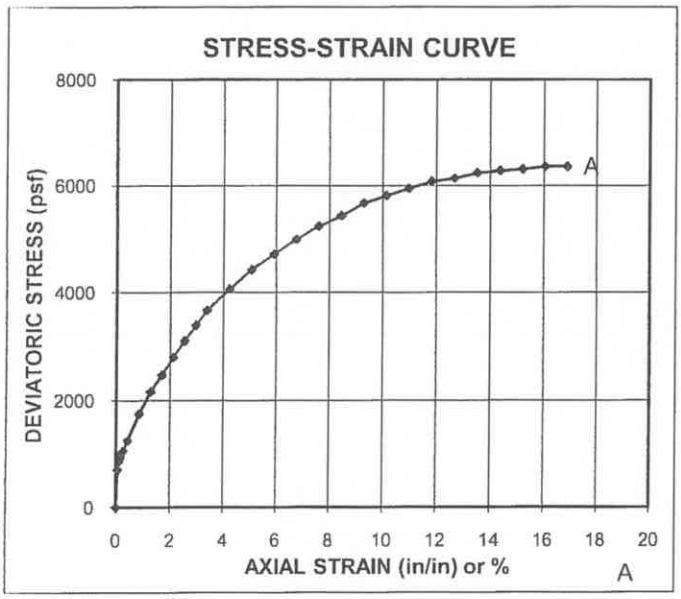
DEVIATORIC STRESS @ FAILURE 5600.1

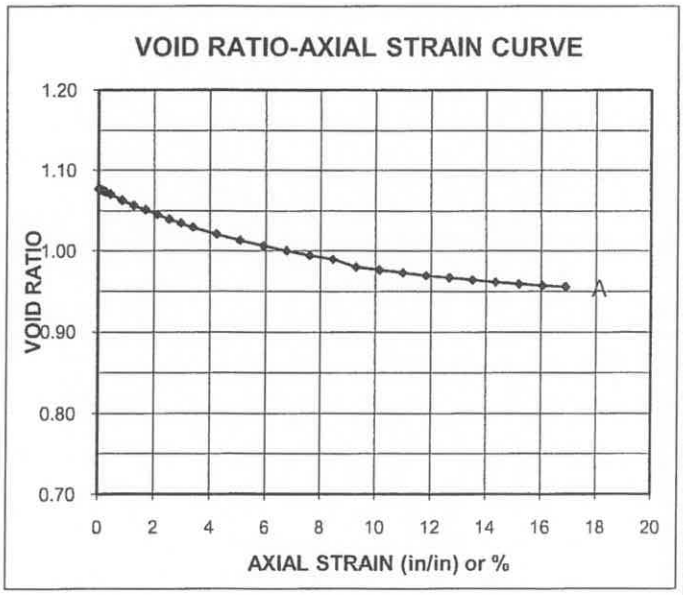
TECH	AK
DATE	11/22/09
CHECKED	AK
REVIEWED	
APPROVED	

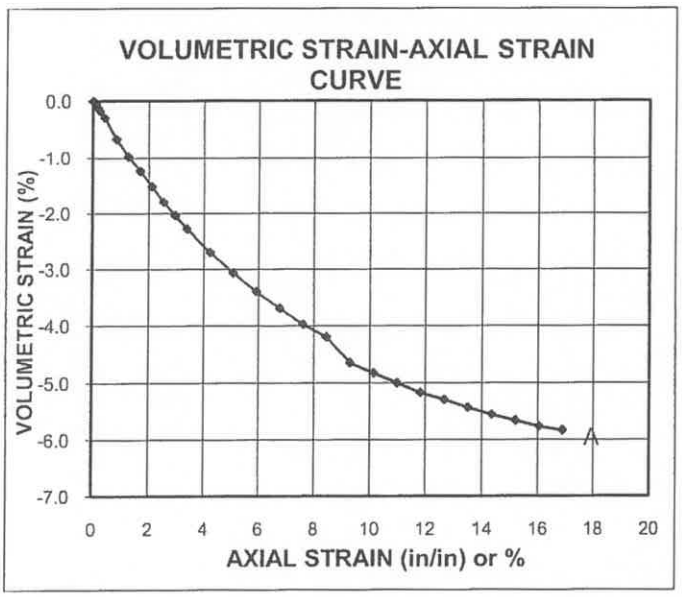
NOVEMBER 2009 083-82671

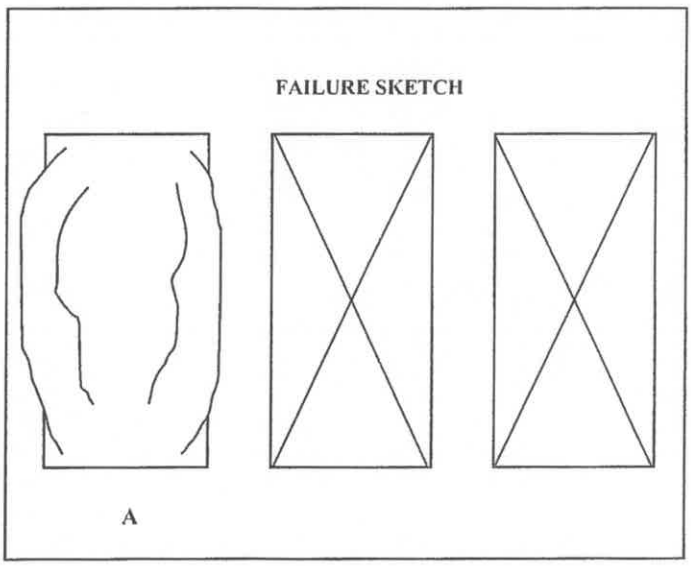
TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-4	Depth	30.0-32.0'	Sample Type	UD









		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	2880		
	DRY DENSITY (pcf)	66.2		
	WATER CONTENT (%)	45.2		
	VOID RATIO	1.077		
	SATURATION (%)	92.6		
	STRAIN RATE (%/min)	0.10		

LL	-
PL	-
PI	-
Gs	2.21

DESCRIPTION: Ash - Gray, CLAYEY SILT, little fine sand.

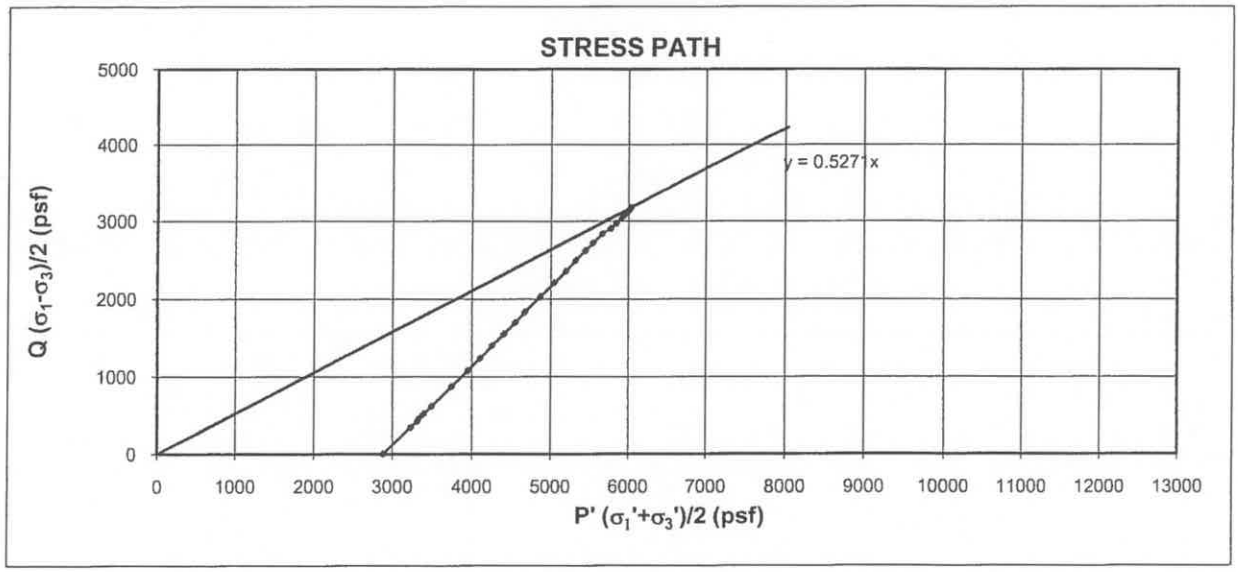
USCS: (ML)

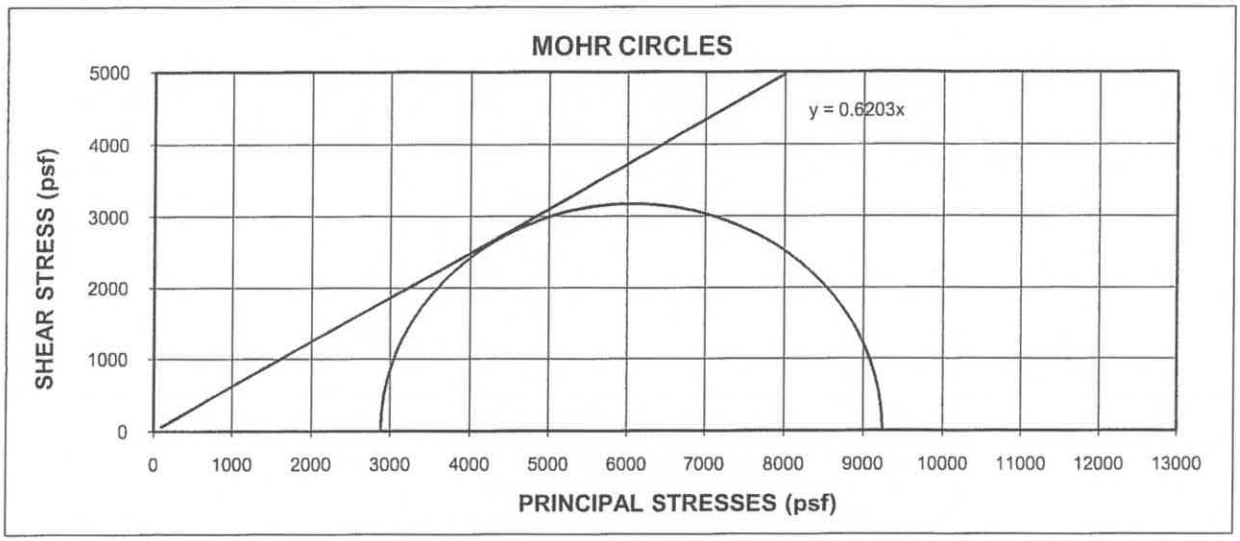
CHECKED
REVIEWED
APPROVED

NOVEMBER 2009 083-82671

TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	**PEF/CREC CCP MGMT PLAN/FL**				
PROJECT NUMBER	**083-82671**				
SAMPLE ID	**AB-4**	Depth	**30.0-32.0'**	Sample Type	**UD**





*EFFECTIVE STRENGTH PARAMETERS			
STRESS PATH		MOHR CIRCLES	
α =	27.8 °	ϕ =	31.8 °
a =	0.0 psf	C =	0.0 psf

		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	2880		
	INITIAL DRY DENSITY (pcf)	66.2		
	INITIAL WATER CONTENT %	45.2		
	INITIAL VOID RATIO	0.101		

DESCRIPTION: Ash - Gray, CLAYEY SILT, little fine sand.

USCS: (ML)

CHECKED AK
REVIEWED
APPROVED

TRIAXIAL COMPRESSION TEST (EM - 1110-2-1906 APPENDIX X) CONSOLIDATED-DRAINED

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	AB-4
SAMPLE TYPE	UD
DEPTH INTERVAL	30.0-32.0'
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	100.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	20.0
PRESSURE, σ_3 (psf)	2880.0
FINAL "B" VALUE	0.96
t_{50} (minutes)	0.16

INITIAL SAMPLE DATA	cm	in	corrected	cm
HEIGHT	15.243	6.001	5.924	
DIAMETER	7.211	2.839	2.745	
AREA	40.84	6.33	5.92	
VOLUME	622.51	37.99	35.05	574.31
WEIGHT (g)	760.74		885.34	
% MOISTURE	24.8		45.20	
SPECIFIC GRAVITY	2.21			
MOIST DENSITY (pcf)	76.3			
DRY DENSITY, calc (pcf)	61.1			
VOLUME OF SOLIDS	276.52			
VOLUME OF VOIDS	345.99			
VOID RATIO	1.251			
SATURATION	43.6		92.55	

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	66.2
VOLUME OF SOLIDS	276.52
VOLUME OF VOIDS	297.79
VOID RATIO	1.077

WATER CONTENT	
WT SOIL & TARE, MOIST (g)	885.34
WT SOIL & TARE, DRY (g)	609.72
WT TARE (g)	0.00
WT MOISTURE (g)	275.62
WT DRY SOIL (g)	609.72
% MOISTURE	45.20

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	BURETTE READING (cc)	VOLUME STRAIN (%)	PWP change DU (psf)	AXIAL STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEVIATOR STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	VOLUME CHANGE (cc)	VOID RATIO e
0.0	0.000	16	80.4	25.0	0.00	0.0	0.00	1.00	5.92	5.924	0.0	2880.0	2880.0	2880.0	2880.0	0.0	0.0	1.077
0.5	0.003	45	80.4	24.9	-0.02	0.0	0.05	1.00	5.92	5.921	700.8	3580.8	3580.8	2880.0	3230.4	350.4	-0.1	1.077
1.0	0.006	52	80.4	24.7	-0.05	0.0	0.10	1.00	5.92	5.918	863.7	3743.7	3743.7	2880.0	3311.8	431.8	-0.3	1.076
1.5	0.009	54	80.5	24.4	-0.10	14.4	0.15	1.00	5.92	5.915	926.9	3806.9	3792.5	2865.6	3329.1	463.5	-0.6	1.075
2.0	0.012	58	80.5	24.2	-0.14	14.4	0.20	1.00	5.92	5.912	1026.5	3906.5	3892.1	2865.6	3378.9	513.3	-0.8	1.074
2.5	0.015	60	80.5	24.0	-0.17	14.4	0.25	1.00	5.92	5.909	1053.1	3933.1	3918.7	2865.6	3392.2	526.6	-1.0	1.073
4.2	0.025	68	80.5	23.3	-0.30	14.4	0.42	1.00	5.92	5.899	1252.0	4132.0	4117.6	2865.6	3491.6	626.0	-1.7	1.071
8.3	0.050	88	80.5	21.2	-0.66	14.4	0.84	0.99	5.93	5.874	1749.3	4629.3	4614.9	2865.6	3740.3	874.7	-3.8	1.063
12.5	0.075	105	80.5	19.4	-0.98	14.4	1.27	0.99	5.93	5.849	2162.4	5042.4	5028.0	2865.6	3946.8	1081.2	-5.6	1.057
16.7	0.100	118	80.5	17.9	-1.24	14.4	1.69	0.98	5.94	5.824	2473.8	5353.8	5339.4	2865.6	4102.5	1236.9	-7.1	1.051
20.8	0.125	132	80.6	16.3	-1.51	28.8	2.11	0.98	5.95	5.799	2804.0	5684.0	5655.2	2851.2	4253.2	1402.0	-8.7	1.045
25.0	0.150	145	80.6	14.7	-1.79	28.8	2.53	0.97	5.96	5.774	3104.3	5984.3	5955.5	2851.2	4403.3	1552.1	-10.3	1.040
29.2	0.175	157	80.6	13.3	-2.04	28.8	2.95	0.97	5.97	5.749	3395.1	6275.1	6246.3	2851.2	4548.7	1697.5	-11.7	1.035
33.3	0.200	169	80.7	11.9	-2.28	43.2	3.38	0.97	5.98	5.724	3668.0	6548.0	6504.8	2836.8	4670.8	1834.0	-13.1	1.030
41.7	0.250	186	80.7	9.5	-2.70	43.2	4.22	0.96	6.01	5.674	4061.2	6941.2	6898.0	2836.8	4867.4	2030.6	-15.5	1.021
50.0	0.300	202	80.7	7.4	-3.06	43.2	5.06	0.95	6.04	5.624	4422.1	7302.1	7258.9	2836.8	5047.8	2211.0	-17.6	1.013
58.3	0.350	215	80.7	5.5	-3.40	43.2	5.91	0.94	6.07	5.574	4715.4	7595.4	7552.2	2836.8	5194.5	2357.7	-19.5	1.006
66.7	0.400	228	80.8	3.8	-3.69	57.6	6.75	0.93	6.11	5.524	4993.9	7873.9	7816.3	2822.4	5319.3	2496.9	-21.2	1.000
75.0	0.450	240	80.8	2.2	-3.97	57.6	7.60	0.92	6.15	5.474	5241.7	8121.7	8064.1	2822.4	5443.3	2620.9	-22.8	0.994
83.3	0.500	250	80.8	0.9	-4.20	57.6	8.44	0.92	6.19	5.424	5436.4	8316.4	8258.8	2822.4	5540.6	2718.2	-24.1	0.990
91.7	0.550	261	80.8	-1.7	-4.65	57.6	9.28	0.91	6.22	5.374	5673.6	8553.6	8496.0	2822.4	5659.2	2836.8	-26.7	0.980
100.0	0.600	269	80.5	-2.7	-4.82	14.4	10.13	0.90	6.27	5.324	5812.6	8692.6	8678.2	2865.6	5771.9	2906.3	-27.7	0.977
108.3	0.650	277	80.5	-3.7	-5.00	14.4	10.97	0.89	6.31	5.274	5946.5	8826.5	8812.1	2865.6	5838.9	2973.3	-28.7	0.973
116.7	0.700	285	80.5	-4.7	-5.17	14.4	11.82	0.88	6.36	5.224	6077.5	8957.5	8943.1	2865.6	5904.4	3038.8	-29.7	0.970
125.0	0.750	290	80.5	-5.4	-5.29	14.4	12.66	0.87	6.42	5.174	6137.1	9017.1	9002.7	2865.6	5934.1	3068.5	-30.4	0.967
133.3	0.800	296	80.5	-6.2	-5.43	14.4	13.50	0.86	6.47	5.124	6235.9	9115.9	9101.5	2865.6	5983.5	3117.9	-31.2	0.964
141.7	0.850	301	80.5	-6.9	-5.55	14.4	14.35	0.86	6.52	5.074	6277.9	9157.9	9143.5	2865.6	6004.6	3139.0	-31.9	0.962
150.0	0.900	304	80.6	-7.5	-5.66	28.8	15.19	0.85	6.58	5.024	6306.1	9186.1	9157.3	2851.2	6004.3	3153.1	-32.5	0.959
158.3	0.950	309	80.6	-8.1	-5.76	28.8	16.04	0.84	6.64	4.974	6356.5	9236.5	9207.7	2851.2	6029.5	3178.3	-33.1	0.957
166.7	1.000	312	80.6	-8.5	-5.83	28.8	16.88	0.83	6.70	4.924	6353.2	9233.2	9204.4	2851.2	6027.8	3176.6	-33.5	0.956

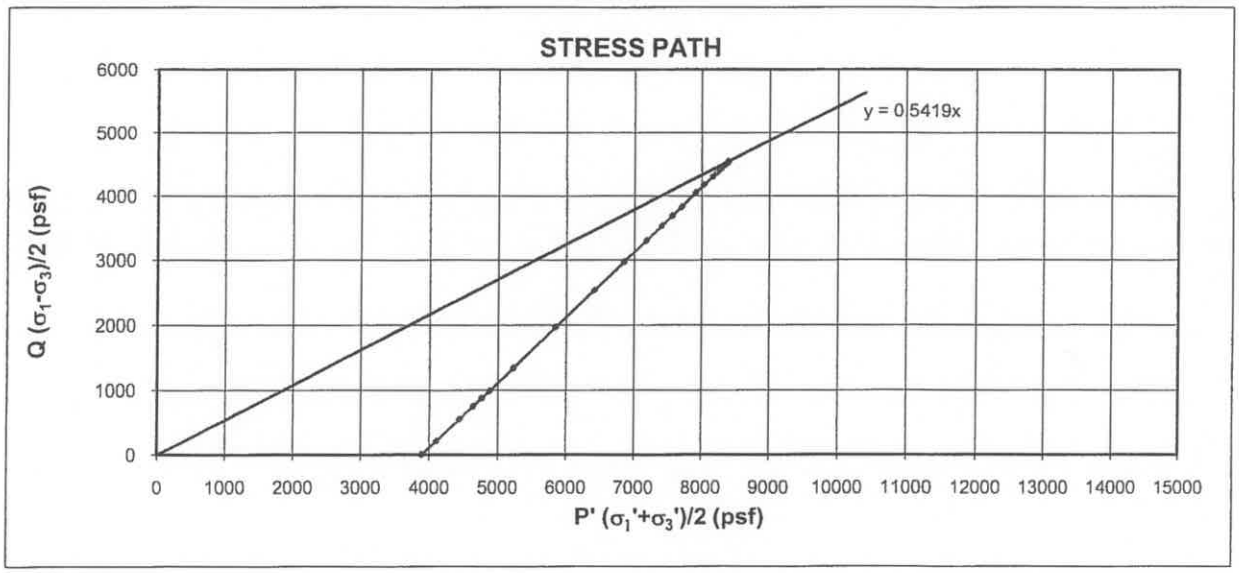
DEVIATORIC STRESS @ FAILURE: 6356.5

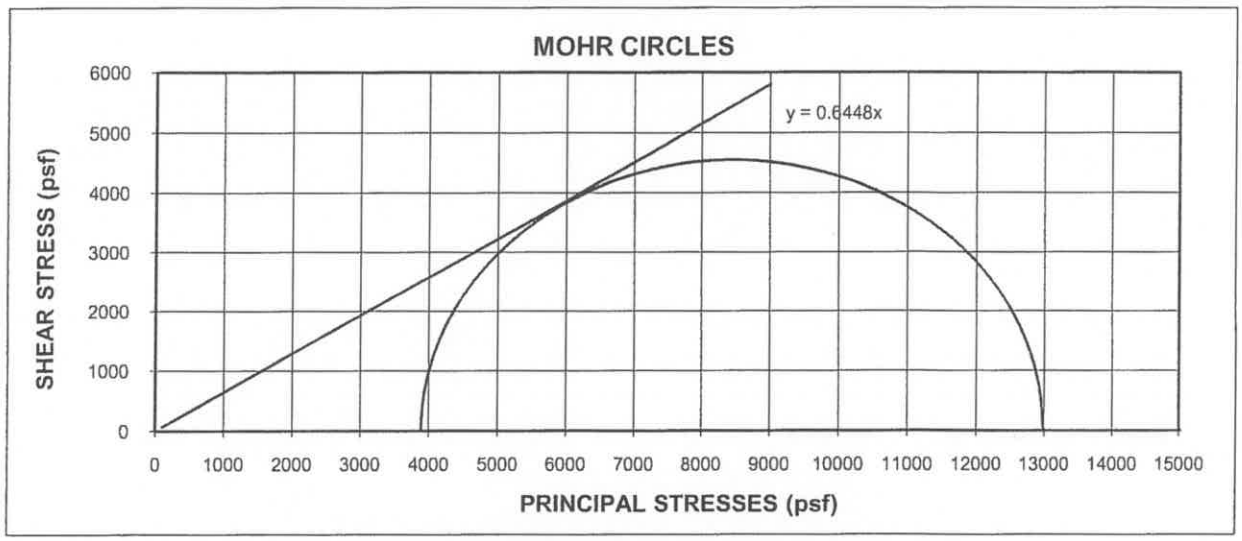
TECH	AK
DATE	11/22/09
CHECKED	AS
REVIEWED	PWM
APPROVED	

NOVEMBER 2009 083-82671

TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-6	Depth	55.0-57.0'	Sample Type	UD





*EFFECTIVE STRENGTH PARAMETERS			
STRESS PATH		MOHR CIRCLES	
α =	28.5 ^{0}	ϕ =	32.8 ^{0}
a =	0.0 psf	C =	0.0 psf

		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	3888		
	INITIAL DRY DENSITY (pcf)	68.6		
	INITIAL WATER CONTENT %	44.5		
	INITIAL VOID RATIO	0.100		

DESCRIPTION: Ash - Gray, CLAYEY SILT, some fine sand.

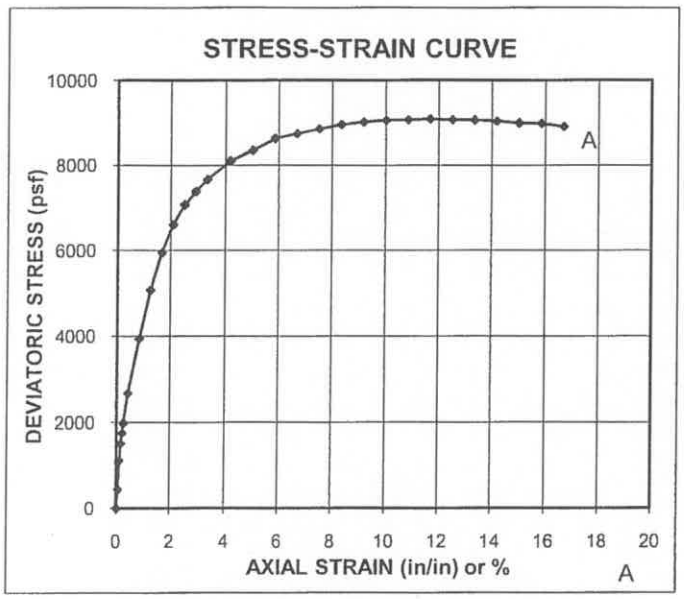
USCS: (ML)

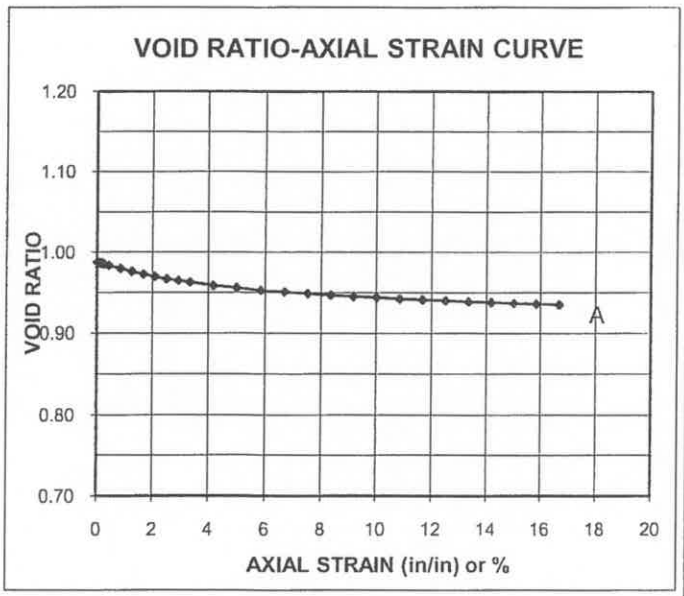
CHECKED BK
REVIEWED
APPROVED

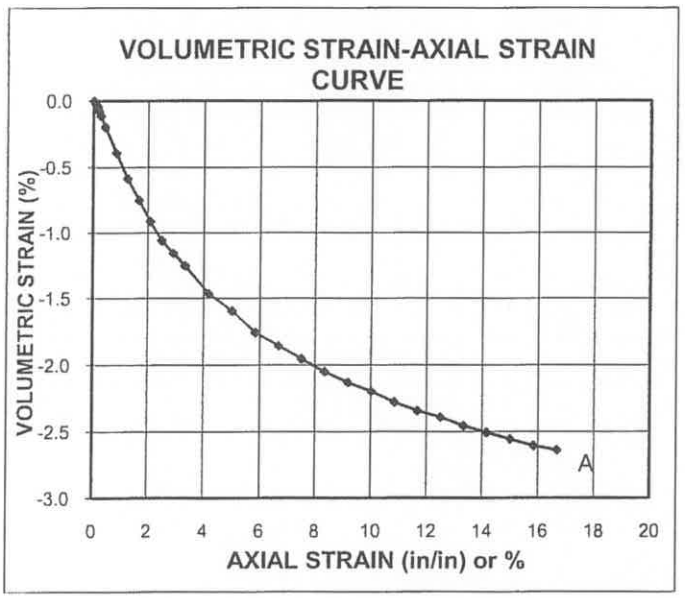
NOVEMBER 2009 083-82671

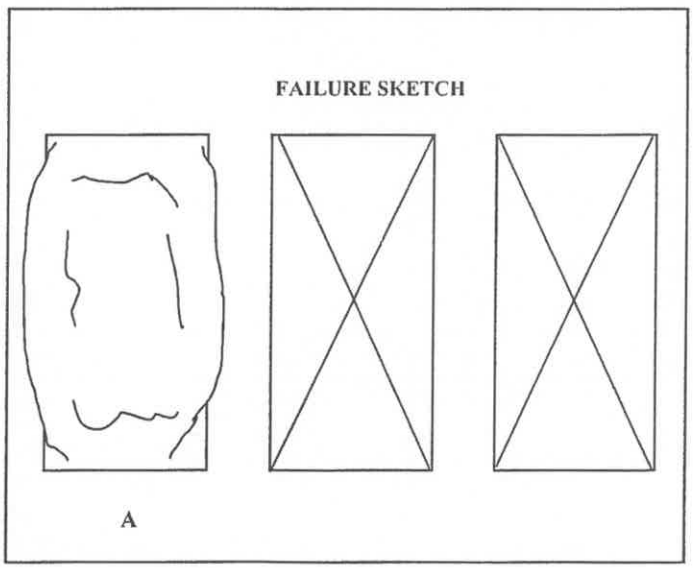
TRIAXIAL COMPRESSION TEST - CONSOLIDATED-DRAINED
EM - 1110-2-1906 APPENDIX X

PROJECT NAME	PEF/CREC CCP MGMT PLAN/FL				
PROJECT NUMBER	083-82671				
SAMPLE ID	AB-6	Depth	55.0-57.0'	Sample Type	UD









		A	B	C
BEFORE SHEAR CONDITIONS	EFFECTIVE CONSOLIDATION PRESS (psf)	3888		
	DRY DENSITY (pcf)	68.6		
	WATER CONTENT (%)	44.5		
	VOID RATIO	0.988		
	SATURATION (%)	98.5		
	STRAIN RATE (%/min)	0.10		

LL	-
PL	-
PI	-
Gs	2.19

DESCRIPTION: Ash - Gray, CLAYEY SILT, some fine sand.

USCS: (ML)

CHECKED	AK
REVIEWED	PWA
APPROVED	

TRIAXIAL COMPRESSION TEST (EM - 1110-2-1906 APPENDIX X) CONSOLIDATED-DRAINED

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	AB-6
SAMPLE TYPE	UD
DEPTH INTERVAL	55.0-57.0'
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	107.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	27.0
PRESSURE, σ_3 (psf)	3888.0
FINAL "B" VALUE	0.99
t_{50} (minutes)	0.18

INITIAL SAMPLE DATA	cm	in	corrected	cm
HEIGHT	15.344	6.041	5.998	
DIAMETER	7.292	2.871	2.822	
AREA	41.77	6.47	6.25	
VOLUME	640.86	39.11	37.50	614.56
WEIGHT (g)	960.70		976.40	
% MOISTURE	42.2		44.54	
SPECIFIC GRAVITY	2.19			
MOIST DENSITY (pcf)	93.5			
DRY DENSITY, calc (pcf)	65.8			
VOLUME OF SOLIDS	309.17			
VOLUME OF VOIDS	331.69			
VOID RATIO	1.073			
SATURATION	86.0		98.52	

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	68.6
VOLUME OF SOLIDS	309.17
VOLUME OF VOIDS	305.39
VOID RATIO	0.988

WATER CONTENT	
WT SOIL & TARE, MOIST (g)	976.40
WT SOIL & TARE, DRY (g)	675.54
WT TARE (g)	0.00
WT MOISTURE (g)	300.86
WT DRY SOIL (g)	675.54
% MOISTURE	44.54

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	BURETTE READING (cc)	VOLUME STRAIN (%)	PWP change DU (psf)	AXIAL STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEVIATOR STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	VOLUME CHANGE (cc)	VOID RATIO e
0.0	0.000	19	80.3	25.0	0.00	0.0	0.00	1.00	6.25	5.998	0.0	3888.0	3888.0	3888.0	3888.0	0.0	0.0	0.988
0.5	0.003	38	80.3	24.9	-0.02	0.0	0.05	1.00	6.25	5.995	435.1	4323.1	4323.1	3888.0	4105.6	217.6	-0.1	0.987
1.0	0.006	67	80.3	24.8	-0.03	0.0	0.10	1.00	6.26	5.992	1111.6	4999.6	4999.6	3888.0	4443.8	555.8	-0.2	0.987
1.5	0.009	84	80.3	24.7	-0.05	0.0	0.15	1.00	6.26	5.989	1507.0	5395.0	5395.0	3888.0	4641.5	753.5	-0.3	0.987
2.0	0.012	95	80.3	24.5	-0.08	0.0	0.20	1.00	6.26	5.986	1755.1	5643.1	5643.1	3888.0	4765.6	877.6	-0.5	0.986
2.5	0.015	105	80.3	24.3	-0.11	0.0	0.25	1.00	6.26	5.983	1984.8	5872.8	5872.8	3888.0	4880.4	992.4	-0.7	0.986
4.2	0.025	135	80.3	23.8	-0.20	0.0	0.42	1.00	6.27	5.973	2684.0	6572.0	6572.0	3888.0	5230.0	1342.0	-1.2	0.984
8.3	0.050	191	80.4	22.6	-0.39	14.4	0.83	0.99	6.28	5.948	3941.3	7829.3	7814.9	3873.6	5844.3	1970.7	-2.4	0.980
12.5	0.075	240	80.4	21.4	-0.59	14.4	1.25	0.99	6.29	5.923	5074.0	8962.0	8947.6	3873.6	6410.6	2537.0	-3.6	0.976
16.7	0.100	280	80.4	20.4	-0.75	14.4	1.67	0.98	6.31	5.898	5953.0	9841.0	9826.6	3873.6	6850.1	2976.5	-4.6	0.973
20.8	0.125	309	80.4	19.4	-0.91	14.4	2.08	0.98	6.33	5.873	6606.6	10494.6	10480.2	3873.6	7176.9	3303.3	-5.6	0.970
25.0	0.150	330	80.4	18.5	-1.06	14.4	2.50	0.97	6.35	5.848	7069.3	10957.3	10942.9	3873.6	7408.3	3534.7	-6.5	0.967
29.2	0.175	345	80.4	17.9	-1.16	14.4	2.92	0.97	6.37	5.823	7383.1	11271.1	11256.7	3873.6	7565.2	3691.6	-7.1	0.965
33.3	0.200	358	80.4	17.3	-1.25	14.4	3.33	0.97	6.39	5.798	7660.8	11548.8	11534.4	3873.6	7704.0	3830.4	-7.7	0.963
41.7	0.250	380	80.5	16.0	-1.46	28.8	4.17	0.96	6.43	5.748	8103.8	11991.8	11963.0	3859.2	7911.1	4051.9	-9.0	0.959
50.0	0.300	394	80.5	15.2	-1.59	28.8	5.00	0.95	6.48	5.698	8350.7	12238.7	12209.9	3859.2	8034.6	4175.4	-9.8	0.956
58.3	0.350	409	80.5	14.2	-1.76	28.8	5.84	0.94	6.52	5.648	8626.7	12514.7	12485.9	3859.2	8172.6	4313.4	-10.8	0.953
66.7	0.400	418	80.5	13.6	-1.85	28.8	6.67	0.93	6.58	5.598	8738.4	12626.4	12597.6	3859.2	8228.4	4369.2	-11.4	0.951
75.0	0.450	426	80.5	13.0	-1.95	28.8	7.50	0.92	6.63	5.548	8855.9	12743.9	12715.1	3859.2	8287.1	4427.9	-12.0	0.949
83.3	0.500	434	80.6	12.4	-2.05	43.2	8.34	0.92	6.68	5.498	8961.5	12849.5	12806.3	3844.8	8325.6	4480.8	-12.6	0.947
91.7	0.550	441	80.5	11.9	-2.13	28.8	9.17	0.91	6.74	5.448	9022.1	12910.1	12881.3	3859.2	8370.2	4511.0	-13.1	0.945
100.0	0.600	446	80.6	11.5	-2.20	43.2	10.00	0.90	6.79	5.398	9063.9	12951.9	12908.7	3844.8	8376.7	4531.9	-13.5	0.944
108.3	0.650	450	80.5	11.0	-2.28	28.8	10.84	0.89	6.85	5.348	9073.6	12961.6	12932.8	3859.2	8396.0	4536.8	-14.0	0.942
116.7	0.700	455	80.6	10.6	-2.34	43.2	11.67	0.88	6.91	5.298	9094.7	12982.7	12939.5	3844.8	8392.2	4547.4	-14.4	0.941
125.0	0.750	458	80.5	10.3	-2.39	28.8	12.50	0.87	6.98	5.248	9075.3	12963.3	12934.5	3859.2	8396.9	4537.7	-14.7	0.940
133.3	0.800	462	80.6	9.9	-2.46	43.2	13.34	0.87	7.04	5.198	9070.6	12958.6	12915.4	3844.8	8380.1	4535.3	-15.1	0.939
141.7	0.850	465	80.5	9.6	-2.51	28.8	14.17	0.86	7.10	5.148	9040.5	12928.5	12899.7	3859.2	8379.5	4520.3	-15.4	0.938
150.0	0.900	467	80.6	9.3	-2.55	43.2	15.01	0.85	7.17	5.098	9001.4	12889.4	12846.2	3844.8	8345.5	4500.7	-15.7	0.937
158.3	0.950	470	80.5	9.0	-2.60	28.8	15.84	0.84	7.24	5.048	8985.2	12873.2	12844.4	3859.2	8351.8	4492.6	-16.0	0.936
166.7	1.000	471	80.6	8.8	-2.64	43.2	16.67	0.83	7.31	4.998	8913.0	12801.0	12757.8	3844.8	8301.3	4456.5	-16.2	0.935

DEVIATORIC STRESS @ FAILURE 9094.7

TECH	AK
DATE	11/22/09
CHECKED	AK
REVIEWED	PWM
APPROVED	

PEF/CREC CCP MGMT PLAN/FL
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Organic Content %	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (lb/cuft)		
AB-4, MC-9	Bag	3.5-5.0'	-	18.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-4, MC-10	Bag	23.5-25.0'	-	45.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-4, MC-11	Bag	48.5-50.0'	-	40.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-4, MC-12	Bag	53.5-55.0'	-	36.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-5, MC-13	Bag	3.5-5.0'	-	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-5, MC-14	Bag	23.5-25.0'	-	32.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-5, MC-15	Bag	38.5-40.0'	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-6, MC-16	Bag	3.5-5.0'	-	34.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-6, MC-17	Bag	18.5-20.0'	-	33.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-6, MC-18	Bag	33.5-35.0'	-	41.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-6, MC-19	Bag	58.5-60.0'	-	18.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-2, MC-20	Bag	53.5-55.0'	-	40.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-1, MC-21	Bag	13.5-15.0'	-	23.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-2, MC-22	Bag	13.5-15.0'	-	20.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-3, MC-23	Bag	23.5-25.0'	-	30.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

WATER CONTENT DETERMINATION
ASTM D 2216

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
REMARKS	

Sample Type	Bag	Bag	Bag	Bag	Bag
Borehole Number	AB-4, MC-9	AB-4, MC-10	AB-4, MC-11	AB-4, MC-12	AB-5, MC-13
Sample Number	-	-	-	-	-
Depth of Sample (ft)	3.5-5.0'	23.5-25.0'	48.5-50.0'	53.5-55.0'	3.5-5.0'
Tare Number	-	-	-	-	-
Weight of Wet Soil + Tare (gm)	54.93	94.91	147.36	92.72	92.63
Weight of Dry Soil + Tare (gm)	47.62	67.67	107.28	70.19	75.30
Weight of Tare (gm)	8.42	8.34	8.35	8.37	8.37
Weight of Water (gm)	7.31	27.24	40.08	22.53	17.33
Weight of Dry Soil (gm)	39.20	59.33	98.93	61.82	66.93
Water Content (%)	18.65	45.91	40.51	36.44	25.89

Sample Type	Bag	Bag	Bag	Bag	Bag
Borehole Number	AB-5, MC-14	AB-5, MC-15	AB-6, MC-16	AB-6, MC-17	AB-6, MC-18
Sample Number	-	-	-	-	-
Depth of Sample (ft)	23.5-25.0'	38.5-40.0'	3.5-5.0'	18.5-20.0'	33.5-35.0'
Tare Number	-	-	-	-	-
Weight of Wet Soil + Tare (gm)	68.62	110.71	79.08	120.23	71.97
Weight of Dry Soil + Tare (gm)	53.89	87.53	60.93	91.93	53.41
Weight of Tare (gm)	8.42	8.29	8.44	8.38	8.34
Weight of Water (gm)	14.73	23.18	18.15	28.30	18.56
Weight of Dry Soil (gm)	45.47	79.24	52.49	83.55	45.07
Water Content (%)	32.39	29.25	34.58	33.87	41.18

Sample Type	Bag	Bag	Bag	Bag	Bag
Borehole Number	AB-6, MC-19	AB-2, MC-20	PB-1, MC-21	PB-2, MC-22	PB-3, MC-23
Sample Number	-	-	-	-	-
Depth of Sample (ft)	58.5-60.0'	53.5-55.0'	13.5-15.0'	13.5-15.0'	23.5-25.0'
Tare Number	-	-	-	-	-
Weight of Wet Soil + Tare (gm)	45.39	123.18	109.80	114.57	117.50
Weight of Dry Soil + Tare (gm)	39.70	90.16	90.49	96.75	91.92
Weight of Tare (gm)	8.50	8.67	8.38	8.34	8.45
Weight of Water (gm)	5.69	33.02	19.31	17.82	25.58
Weight of Dry Soil (gm)	31.20	81.49	82.11	88.41	83.47
Water Content (%)	18.24	40.52	23.52	20.16	30.65

TECH	DW
DATE	11/13/09
CHECK	
REVIEW	

PEF/CREC CCP MGMT PLAN/FL
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classification	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Organic Content %	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (lb/cuft)		
PB-4, MC-24	Bag	23.5-25.0'	-	19.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-4B, MC-25	Bag	13.5-15.0'	-	20.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-4B, MC-26	Bag	23.5-25.0'	-	25.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-5, MC-27	Bag	3.5-5.0'	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-5, MC-28	Bag	28.5-30.0'	-	26.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-6, MC-29	Bag	13.5-15.0'	-	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB-7, MC-30	Bag	38.5-40.0'	-	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS:
- LIQUID LIMIT (LL)
- PLASTIC LIMIT (PL)
- PLASTICITY INDEX (PI)
- LIQUIDITY INDEX (LI)
- SPECIFIC GRAVITY (Gs)
- MOISTURE (Mc)

NOTES:
- T = TRIAXIAL TEST
- U = UNCONFINED COMPRESSION TEST
- C = CONSOLIDATION TEST
- DS = DIRECT SHEAR TEST
- O = ORGANIC CONTENT
- P = pH

WATER CONTENT DETERMINATION
ASTM D 2216

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
REMARKS	

Sample Type	Bag	Bag	Bag	Bag	Bag
Borehole Number	PB-4, MC-24	PB-4B, MC-25	PB-4B, MC-26	PB-5, MC-27	PB-5, MC-28
Sample Number	-	-	-	-	-
Depth of Sample (ft)	23.5-25.0'	13.5-15.0'	23.5-25.0'	3.5-5.0'	28.5-30.0'
Tare Number	-	-	-	-	-
Weight of Wet Soil + Tare (gm)	134.06	101.49	107.06	110.53	123.48
Weight of Dry Soil + Tare (gm)	113.75	85.69	87.15	102.19	99.35
Weight of Tare (gm)	8.52	8.39	8.33	8.35	8.61
Weight of Water (gm)	20.31	15.80	19.91	8.34	24.13
Weight of Dry Soil (gm)	105.23	77.30	78.82	93.84	90.74
Water Content (%)	19.30	20.44	25.26	8.89	26.59

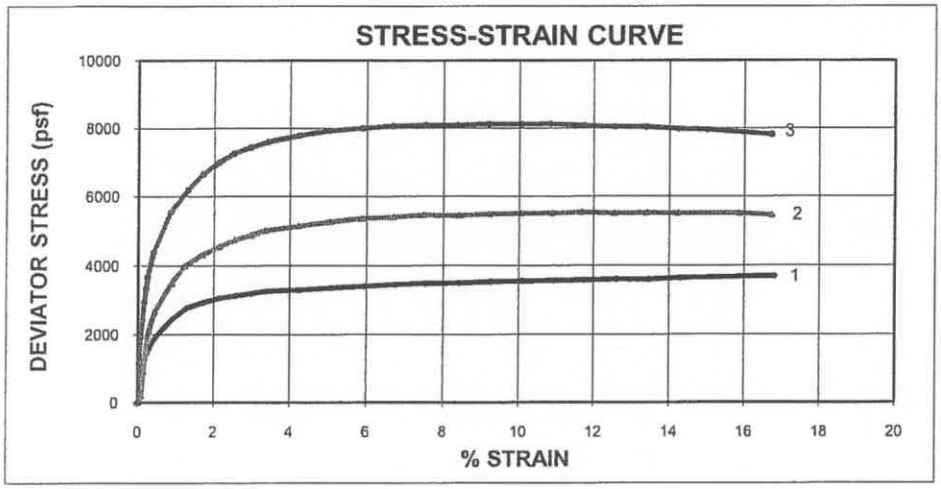
Sample Type	Bag	Bag
Borehole Number	PB-6, MC-29	PB-7, MC-30
Sample Number	-	-
Depth of Sample (ft)	13.5-15.0'	38.5-40.0'
Tare Number	-	-
Weight of Wet Soil + Tare (gm)	128.21	150.56
Weight of Dry Soil + Tare (gm)	103.58	122.12
Weight of Tare (gm)	8.33	8.31
Weight of Water (gm)	24.63	28.44
Weight of Dry Soil (gm)	95.25	113.81
Water Content (%)	25.86	24.99

Sample Type	
Borehole Number	
Sample Number	
Depth of Sample (ft)	
Tare Number	
Weight of Wet Soil + Tare (gm)	
Weight of Dry Soil + Tare (gm)	
Weight of Tare (gm)	
Weight of Water (gm)	
Weight of Dry Soil (gm)	
Water Content (%)	

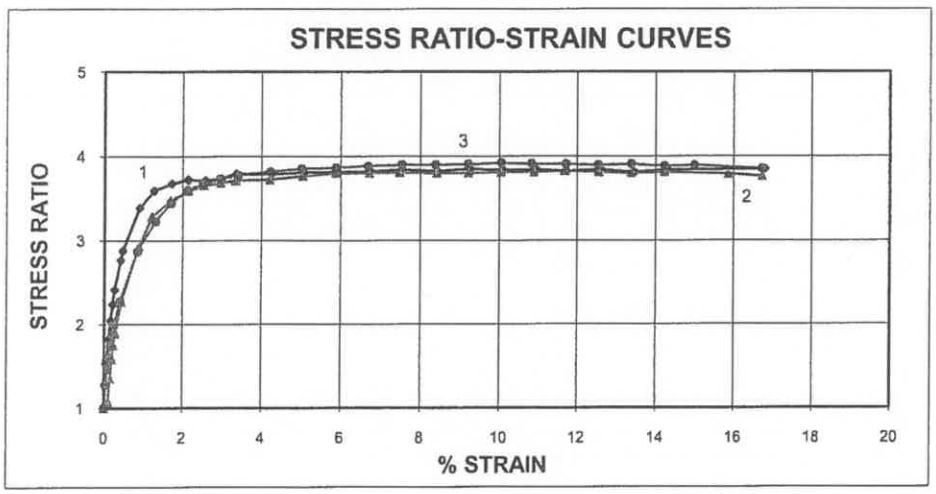
TECH	DW
DATE	11/13/09
CHECK	
REVIEW	

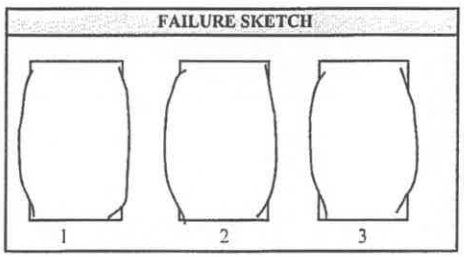
TRIAXIAL COMPRESSION TEST - CONSOLIDATED UNDRAINED WITH PORE PRESSURE
ASTM D 4767

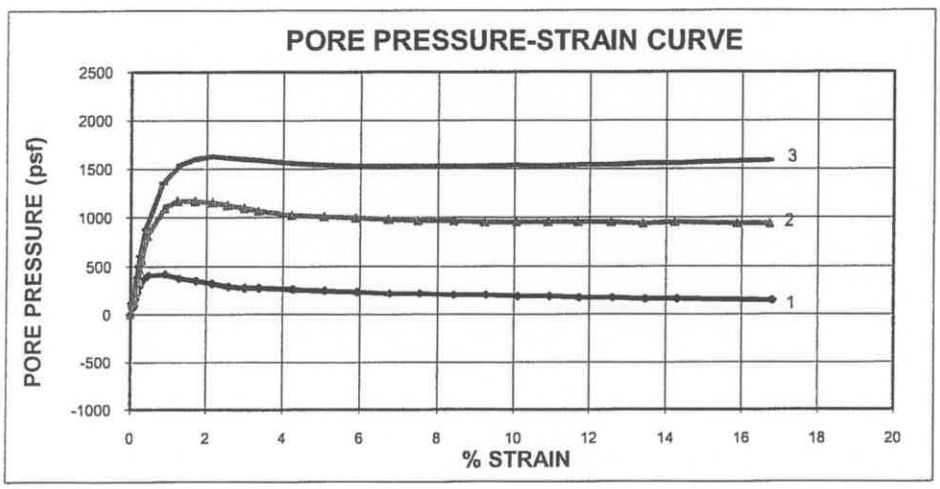
PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
PROJECT NUMBER: **083-82671**
SAMPLE ID: **Comingled Material** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1440	99.0	18.4
2	2909	99.2	18.2
3	4320	99.2	18.2
	Average	**99.1**	**18.3**







Soil Description

Yellowish Brown, MEDIUM TO FINE SAND, some clayey silt, little coarse to fine gravel, trace cobbles.

USCS (SM)

LL	PL	PI
-	-	-

Comments

Sample was remolded to approx. 95% of the Max. Dry Density, @ Opt. Moisture Content+3.5%.

*** Failure based on effective stress ratio or 15% strain.**

CHECK
REVIEW

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Comingled Material
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	80.0
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	10.0
PRESSURE, σ_3 (psf)	1440.0
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.09
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.232	5.997	5.974
DIAMETER	7.087	2.790	2.788
AREA	39.44	6.11	6.10
VOLUME	600.80	36.66	36.46
WEIGHT (g)	1128.46		1167.66
% MOISTURE	18.4		22.54
SPECIFIC GRAVITY	2.57		
MOIST DENSITY (pcf)	117.2		
DRY DENSITY, calc (pcf)	99.0		
VOLUME OF SOLIDS	371.50		
VOLUME OF VOIDS	229.30		
VOID RATIO	0.617		
SATURATION	76.6		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	99.5
VOLUME OF SOLIDS	371.50
VOLUME OF VOIDS	226.00
VOID RATIO	0.608

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1167.66
WT SOIL & TARE, DRY (g)	952.90
WT TARE (g)	0.00
WT MOISTURE (g)	214.76
WT DRY SOIL (g)	952.90
% MOISTURE	22.54

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	14	70.5	0.0	0.00	1.00	6.10	5.974	0.0	1440.0	1440.0	1440.0	1.00	1440.0	0.0	0.00
0.5	0.003	45	71.0	72.0	0.05	1.00	6.11	5.971	723.9	2163.9	2091.9	1368.0	1.53	1730.0	362.0	0.10
0.7	0.004	47	71.0	72.0	0.07	1.00	6.11	5.970	778.1	2218.1	2146.1	1368.0	1.57	1757.0	389.0	0.09
1.2	0.007	59	71.6	158.4	0.12	1.00	6.11	5.967	1058.1	2498.1	2339.7	1281.6	1.83	1810.6	529.0	0.15
1.7	0.010	68	72.1	230.4	0.17	1.00	6.11	5.964	1267.2	2707.2	2476.8	1209.6	2.05	1843.2	633.6	0.18
2.2	0.013	74	72.5	288.0	0.22	1.00	6.12	5.961	1424.3	2864.3	2576.3	1152.0	2.24	1864.1	712.1	0.20
2.7	0.016	80	72.8	331.2	0.27	1.00	6.12	5.958	1564.7	3004.7	2673.5	1108.8	2.41	1891.2	782.4	0.21
4.2	0.025	93	73.2	388.8	0.42	1.00	6.13	5.949	1858.4	3298.4	2909.6	1051.2	2.77	1980.4	929.2	0.21
4.7	0.028	97	73.3	403.2	0.47	1.00	6.13	5.946	1946.7	3386.7	2983.5	1036.8	2.88	2010.2	973.4	0.21
9.0	0.054	118	73.4	417.6	0.90	0.99	6.16	5.920	2443.2	3883.2	3465.6	1022.4	3.39	2244.0	1221.6	0.17
12.7	0.076	132	73.1	374.4	1.27	0.99	6.18	5.898	2762.6	4202.6	3828.2	1065.6	3.59	2446.9	1381.3	0.14
17.2	0.103	140	72.9	345.6	1.72	0.98	6.21	5.871	2930.8	4370.8	4025.2	1094.4	3.68	2559.8	1465.4	0.12
21.3	0.128	146	72.7	316.8	2.14	0.98	6.24	5.846	3056.8	4496.8	4180.0	1123.2	3.72	2651.6	1528.4	0.10
25.7	0.154	150	72.5	288.0	2.58	0.97	6.26	5.820	3128.3	4568.3	4280.3	1152.0	3.72	2716.1	1564.1	0.09
29.8	0.179	153	72.4	273.6	3.00	0.97	6.29	5.795	3190.4	4630.4	4356.8	1166.4	3.74	2761.6	1595.2	0.09
33.5	0.201	157	72.4	273.6	3.36	0.97	6.32	5.773	3255.8	4695.8	4422.2	1166.4	3.79	2794.3	1627.9	0.08
42.3	0.254	160	72.3	259.2	4.25	0.96	6.37	5.720	3293.6	4733.6	4474.4	1180.8	3.79	2827.6	1646.8	0.08
50.5	0.303	164	72.2	244.8	5.07	0.95	6.43	5.671	3357.2	4797.2	4552.4	1195.2	3.81	2873.8	1678.6	0.07
59.0	0.354	167	72.1	230.4	5.93	0.94	6.49	5.620	3400.3	4840.3	4609.9	1209.6	3.81	2909.7	1700.1	0.07
67.3	0.404	171	72.0	216.0	6.76	0.93	6.55	5.570	3451.4	4891.4	4675.4	1224.0	3.82	2949.7	1725.7	0.06
75.0	0.450	173	72.0	216.0	7.53	0.92	6.60	5.524	3479.7	4919.7	4703.7	1224.0	3.84	2963.8	1739.8	0.06
83.8	0.503	176	71.9	201.6	8.42	0.92	6.66	5.471	3496.0	4936.0	4734.4	1238.4	3.82	2986.4	1748.0	0.06
92.2	0.553	179	71.9	201.6	9.26	0.91	6.73	5.421	3528.2	4968.2	4766.6	1238.4	3.85	3002.5	1764.1	0.06
100.5	0.603	181	71.8	187.2	10.09	0.90	6.79	5.371	3550.9	4990.9	4803.7	1252.8	3.83	3028.2	1775.4	0.05
109.0	0.654	183	71.8	187.2	10.95	0.89	6.85	5.320	3563.4	5003.4	4816.2	1252.8	3.84	3034.5	1781.7	0.05
116.8	0.701	186	71.7	172.8	11.73	0.88	6.91	5.273	3577.7	5017.7	4844.9	1267.2	3.82	3056.0	1788.8	0.05
125.5	0.753	189	71.7	172.8	12.60	0.87	6.98	5.221	3604.3	5044.3	4871.5	1267.2	3.84	3069.3	1802.1	0.05
134.0	0.804	190	71.6	158.4	13.46	0.87	7.05	5.170	3599.7	5039.7	4881.3	1281.6	3.81	3081.4	1799.8	0.04
142.3	0.854	194	71.6	158.4	14.30	0.86	7.12	5.120	3639.7	5079.7	4921.3	1281.6	3.84	3101.4	1819.8	0.04
167.3	1.004	202	71.5	144.0	16.81	0.83	7.34	4.970	3694.0	5134.0	4990.0	1296.0	3.85	3143.0	1847.0	0.04

DU @ FAILURE	316.8	DEVIATORIC STRESS @ FAILURE	3056.8	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.72

TECH	AK
DATE	8/28/09
CHECKED	AK
REVIEWED	[illegible]

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Comingled Material
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	90.2
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	20.2
PRESSURE, σ_3 (psf)	2908.8
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.16
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.227	5.995	5.984
DIAMETER	7.087	2.790	2.776
AREA	39.44	6.11	6.05
VOLUME	600.60	36.65	36.22
WEIGHT (g)	1128.57		1166.07
% MOISTURE	18.2		22.13
SPECIFIC GRAVITY	2.57		
MOIST DENSITY (pcf)	117.3		
DRY DENSITY, calc (pcf)	99.2		
VOLUME OF SOLIDS	372.24		
VOLUME OF VOIDS	228.36		
VOID RATIO	0.613		
SATURATION	76.1		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	100.4
VOLUME OF SOLIDS	372.24
VOLUME OF VOIDS	221.36
VOID RATIO	0.595

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1166.07
WT SOIL & TARE, DRY (g)	954.80
WT TARE (g)	0.00
WT MOISTURE (g)	211.27
WT DRY SOIL (g)	954.80
% MOISTURE	22.13

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	12	70.5	0.0	0.00	1.00	6.05	5.984	0.0	2908.8	2908.8	2908.8	1.00	2908.8	0.0	0.00
0.5	0.003	19	71.4	129.6	0.05	1.00	6.06	5.981	159.3	3068.1	2938.5	2779.2	1.06	2858.8	79.6	0.81
1.0	0.006	20	71.4	129.6	0.10	1.00	6.06	5.978	204.4	3113.2	2983.6	2779.2	1.07	2881.4	102.2	0.63
1.5	0.009	51	72.1	230.4	0.15	1.00	6.06	5.975	935.8	3844.6	3614.2	2678.4	1.35	3146.3	467.9	0.25
2.0	0.012	74	72.9	345.6	0.20	1.00	6.07	5.972	1483.8	4392.6	4047.0	2563.2	1.58	3305.1	741.9	0.23
2.3	0.014	89	73.7	460.8	0.23	1.00	6.07	5.970	1827.4	4736.2	4275.4	2448.0	1.75	3361.7	913.7	0.25
2.8	0.017	100	74.4	561.6	0.28	1.00	6.07	5.967	2092.1	5000.9	4439.3	2347.2	1.89	3393.3	1046.1	0.27
4.3	0.026	124	76.1	806.4	0.43	1.00	6.08	5.958	2662.2	5571.0	4764.6	2102.4	2.27	3433.5	1331.1	0.30
8.8	0.053	160	78.1	1094.4	0.89	0.99	6.11	5.931	3491.8	6400.6	5306.2	1814.4	2.92	3560.3	1745.9	0.31
12.2	0.073	181	78.6	1166.4	1.22	0.99	6.13	5.911	3980.5	6889.3	5722.9	1742.4	3.28	3732.7	1990.3	0.29
16.8	0.101	196	78.6	1166.4	1.69	0.98	6.16	5.883	4310.1	7218.9	6052.5	1742.4	3.47	3897.5	2155.1	0.27
21.3	0.128	207	78.5	1152.0	2.14	0.98	6.19	5.856	4539.4	7448.2	6296.2	1756.8	3.58	4026.5	2269.7	0.25
25.3	0.152	216	78.3	1123.2	2.54	0.97	6.21	5.832	4738.8	7647.6	6524.4	1785.6	3.65	4155.0	2369.4	0.24
29.7	0.178	223	78.1	1094.4	2.97	0.97	6.24	5.806	4872.3	7781.1	6686.7	1814.4	3.69	4250.5	2436.1	0.22
33.3	0.200	230	77.9	1065.6	3.34	0.97	6.26	5.784	5007.9	7916.7	6851.1	1843.2	3.72	4347.1	2503.9	0.21
42.0	0.252	237	77.6	1022.4	4.21	0.96	6.32	5.732	5140.6	8049.4	7027.0	1886.4	3.73	4456.7	2570.3	0.20
50.3	0.302	244	77.5	1008.0	5.05	0.95	6.38	5.682	5253.8	8162.6	7154.6	1900.8	3.76	4527.7	2626.9	0.19
58.7	0.352	251	77.4	993.6	5.88	0.94	6.43	5.632	5357.6	8266.4	7272.8	1915.2	3.80	4594.0	2678.8	0.19
67.0	0.402	255	77.3	979.2	6.72	0.93	6.49	5.582	5401.0	8309.8	7330.6	1929.6	3.80	4630.1	2700.5	0.18
74.7	0.448	260	77.2	964.8	7.49	0.93	6.54	5.536	5455.6	8364.4	7399.6	1944.0	3.81	4671.8	2727.8	0.18
83.8	0.503	262	77.2	964.8	8.41	0.92	6.61	5.481	5442.8	8351.6	7386.8	1944.0	3.80	4665.4	2721.4	0.18
91.8	0.551	266	77.1	950.4	9.21	0.91	6.67	5.433	5483.6	8392.4	7442.0	1958.4	3.80	4700.2	2741.8	0.17
100.2	0.601	269	77.1	950.4	10.04	0.90	6.73	5.383	5503.8	8412.6	7462.2	1958.4	3.81	4710.3	2751.9	0.17
108.7	0.652	272	77.1	950.4	10.90	0.89	6.79	5.332	5506.8	8415.6	7465.2	1958.4	3.81	4711.8	2753.4	0.17
116.5	0.699	275	77.1	950.4	11.68	0.88	6.85	5.285	5535.9	8444.7	7494.3	1958.4	3.83	4726.4	2768.0	0.17
125.2	0.751	277	77.1	950.4	12.55	0.87	6.92	5.233	5506.4	8415.2	7464.8	1958.4	3.81	4711.6	2753.2	0.17
133.5	0.801	280	77.0	936.0	13.39	0.87	6.99	5.183	5521.8	8430.6	7494.6	1972.8	3.80	4733.7	2760.9	0.17
141.8	0.851	282	77.1	950.4	14.22	0.86	7.06	5.133	5507.3	8416.1	7465.7	1958.4	3.81	4712.1	2753.7	0.17
158.2	0.949	287	77.0	936.0	15.86	0.84	7.19	5.035	5506.3	8415.1	7479.1	1972.8	3.79	4725.9	2753.1	0.17
166.8	1.001	287	77.0	936.0	16.73	0.83	7.27	4.983	5449.4	8358.2	7422.2	1972.8	3.76	4697.5	2724.7	0.17

DU @ FAILURE	993.6	DEVIATORIC STRESS @ FAILURE	5357.6	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.80

TECH	AK
DATE	8/28/09
CHECKED	AC
REVIEWED	JWL

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Comingled Material
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	100.0
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	30.0
PRESSURE, σ_3 (psf)	4320.0
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.17
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.235	5.998	5.980
DIAMETER	7.087	2.790	2.767
AREA	39.44	6.11	6.01
VOLUME	600.91	36.67	35.97
WEIGHT (g)	1128.92		1162.42
% MOISTURE	18.2		21.66
SPECIFIC GRAVITY	2.57		
MOIST DENSITY (pcf)	117.2		
DRY DENSITY, calc (pcf)	99.2		
VOLUME OF SOLIDS	372.51		
VOLUME OF VOIDS	228.39		
VOID RATIO	0.613		
SATURATION	75.9		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	101.2
VOLUME OF SOLIDS	372.51
VOLUME OF VOIDS	216.89
VOID RATIO	0.582

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1162.42
WT SOIL & TARE, DRY (g)	955.49
WT TARE (g)	0.00
WT MOISTURE (g)	206.93
WT DRY SOIL (g)	955.49
% MOISTURE	21.66

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	15	70.4	0.0	0.00	1.00	6.01	5.980	0.0	4320.0	4320.0	4320.0	1.00	4320.0	0.0	0
0.3	0.002	64	71.2	115.2	0.03	1.00	6.02	5.978	1165.6	5485.6	5370.4	4204.8	1.28	4787.6	582.8	0.10
0.8	0.005	97	71.8	201.6	0.08	1.00	6.02	5.975	1959.2	6279.2	6077.6	4118.4	1.48	5098.0	979.6	0.10
1.2	0.007	116	72.4	288.0	0.12	1.00	6.02	5.973	2429.6	6749.6	6461.6	4032.0	1.60	5246.8	1214.8	0.12
1.7	0.010	138	73.1	388.8	0.17	1.00	6.02	5.970	2954.2	7274.2	6885.4	3931.2	1.75	5408.3	1477.1	0.13
2.2	0.013	155	73.9	504.0	0.22	1.00	6.03	5.967	3351.7	7671.7	7167.7	3816.0	1.88	5491.8	1675.8	0.15
2.5	0.015	169	74.6	604.8	0.25	1.00	6.03	5.965	3670.6	7990.6	7385.8	3715.2	1.99	5550.5	1835.3	0.16
4.0	0.024	199	76.5	878.4	0.40	1.00	6.04	5.956	4385.2	8705.2	7826.8	3441.6	2.27	5634.2	2192.6	0.20
8.5	0.051	248	79.8	1353.6	0.85	0.99	6.07	5.929	5540.3	9860.3	8506.7	2966.4	2.87	5736.5	2770.1	0.24
13.0	0.078	277	81.1	1540.8	1.30	0.99	6.09	5.902	6190.8	10510.8	8970.0	2779.2	3.23	5874.6	3095.4	0.25
17.0	0.102	298	81.5	1598.4	1.71	0.98	6.12	5.878	6657.5	10977.5	9379.1	2721.6	3.45	6050.4	3328.8	0.24
21.3	0.128	314	81.7	1627.2	2.14	0.98	6.15	5.852	7002.9	11322.9	9695.7	2692.8	3.60	6194.3	3501.5	0.23
25.2	0.151	326	81.6	1612.8	2.53	0.97	6.17	5.829	7253.1	11573.1	9960.3	2707.2	3.68	6333.8	3626.6	0.22
29.5	0.177	335	81.5	1598.4	2.96	0.97	6.20	5.803	7436.8	11756.8	10158.4	2721.6	3.73	6440.0	3718.4	0.21
34.0	0.204	344	81.4	1584.0	3.41	0.97	6.23	5.776	7601.1	11921.1	10337.1	2736.0	3.78	6536.6	3800.6	0.21
42.2	0.253	355	81.2	1555.2	4.23	0.96	6.28	5.727	7791.1	12111.1	10555.9	2764.8	3.82	6660.4	3895.6	0.20
50.0	0.300	364	81.1	1540.8	5.02	0.95	6.33	5.680	7931.9	12251.9	10711.1	2779.2	3.85	6745.1	3965.9	0.19
58.7	0.352	370	81.0	1526.4	5.89	0.94	6.39	5.628	8001.2	12321.2	10794.8	2793.6	3.86	6794.2	4000.6	0.19
66.7	0.400	376	81.0	1526.4	6.69	0.93	6.45	5.580	8064.8	12384.8	10858.4	2793.6	3.89	6826.0	4032.4	0.19
75.2	0.451	381	81.0	1526.4	7.54	0.92	6.51	5.529	8099.5	12419.5	10893.1	2793.6	3.90	6843.4	4049.8	0.19
83.5	0.501	384	81.0	1526.4	8.38	0.92	6.56	5.479	8098.7	12418.7	10892.3	2793.6	3.90	6842.9	4049.3	0.19
91.7	0.550	389	81.0	1526.4	9.20	0.91	6.62	5.430	8124.1	12444.1	10917.7	2793.6	3.91	6855.6	4062.0	0.19
100.2	0.601	392	81.1	1540.8	10.05	0.90	6.69	5.379	8121.0	12441.0	10900.2	2779.2	3.92	6839.7	4060.5	0.19
108.0	0.648	396	81.0	1526.4	10.84	0.89	6.75	5.332	8135.4	12455.4	10929.0	2793.6	3.91	6861.3	4067.7	0.19
116.8	0.701	397	81.1	1540.8	11.72	0.88	6.81	5.279	8086.2	12406.2	10865.4	2779.2	3.91	6822.3	4043.1	0.19
125.0	0.750	399	81.1	1540.8	12.54	0.87	6.88	5.230	8051.0	12371.0	10830.2	2779.2	3.90	6804.7	4025.5	0.19
133.3	0.800	402	81.2	1555.2	13.38	0.87	6.94	5.180	8036.2	12356.2	10801.0	2764.8	3.91	6782.9	4018.1	0.19
141.8	0.851	403	81.2	1555.2	14.23	0.86	7.01	5.129	7979.7	12299.7	10744.5	2764.8	3.89	6754.6	3989.8	0.19
149.5	0.897	406	81.3	1569.6	15.00	0.85	7.08	5.083	7961.0	12281.0	10711.4	2750.4	3.89	6730.9	3980.5	0.20
166.7	1.000	407	81.4	1584.0	16.72	0.83	7.22	4.980	7813.7	12133.7	10549.7	2736.0	3.86	6642.8	3906.8	0.20

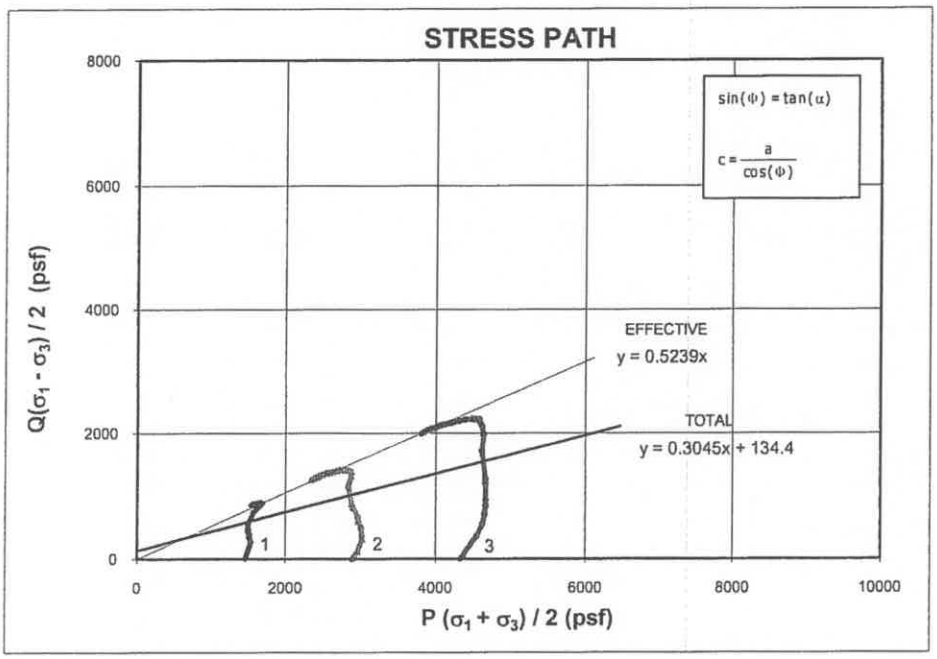
DU @ FAILURE	1526.4	DEVIATORIC STRESS @ FAILURE	8099.5	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.90

TECH	AK
DATE	8/28/09
CHECKED	AC
REVIEWED	PWM

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST - CONSOLIDATED UNDRAINED WITH PORE PRESSURE
ASTM D 4767

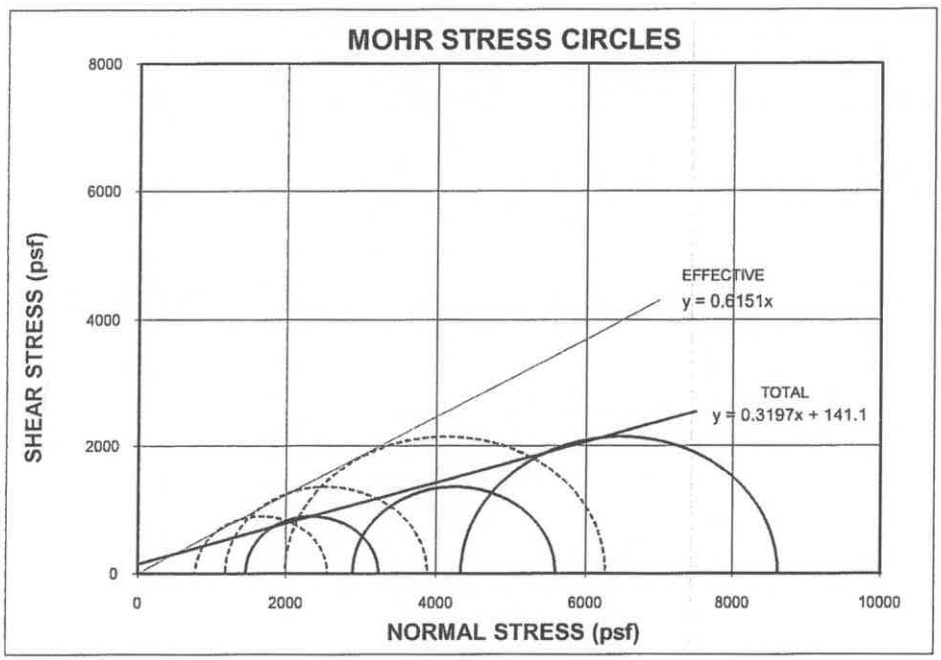
PROJECT NAME: PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER: 083-82671
SAMPLE ID: Fly Ash DEPTH: - Sample Type: Bulk



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1454	71.2	32.6
2	2894	71.2	32.6
3	4334.4	71.3	33.0

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.10	78.1	95.5
2	0.10	78.1	95.4
3	0.10	79.2	96.4

STRESS PATH			MOHR CIRCLES		
*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	16.9 °	ϕ	=	17.7 °
a	=	134.4 psf	c	=	141.1 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	27.7 °	ϕ '	=	31.6 °
a '	=	0.0 psf	c '	=	0.0 psf



Soil Description

FLY ASH - Dark Gray, CLAYEY SILT, little fine sand.

USCS (ML)

LL	PL	PI
-	-	-

Comments

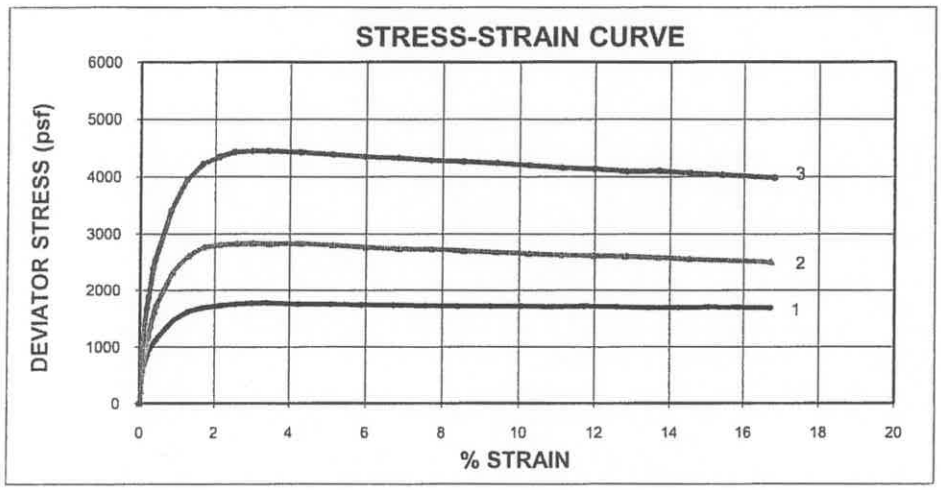
Sample was remolded to approx. 95% of the Max. Dry Density, @ Opt. Moisture Content+3.5%.

*** Failure based on effective stress ratio or 15% strain.**

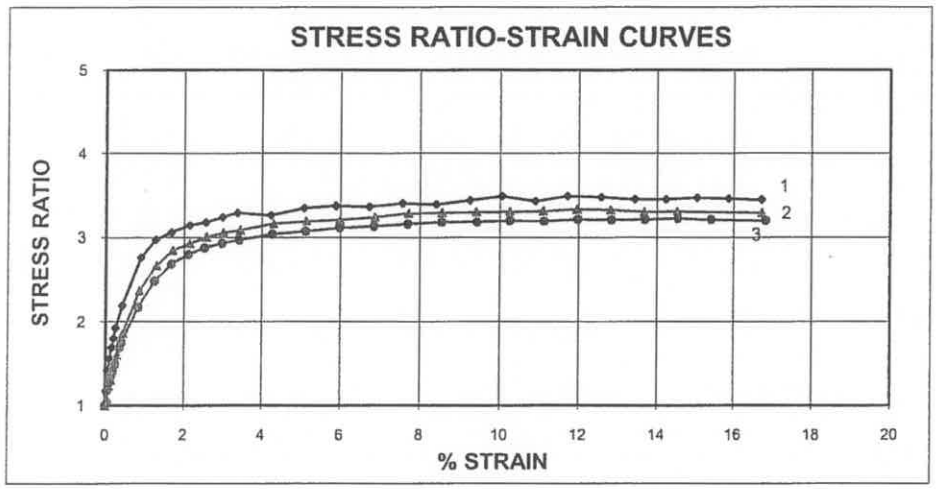
CHECK AJL
REVIEW

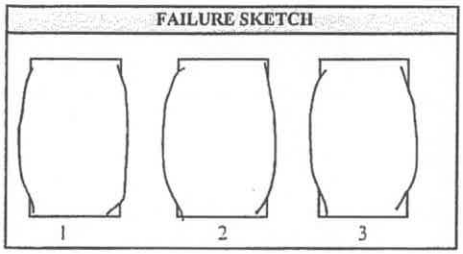
TRIAXIAL COMPRESSION TEST - CONSOLIDATED UNDRAINED WITH PORE PRESSURE
ASTM D 4767

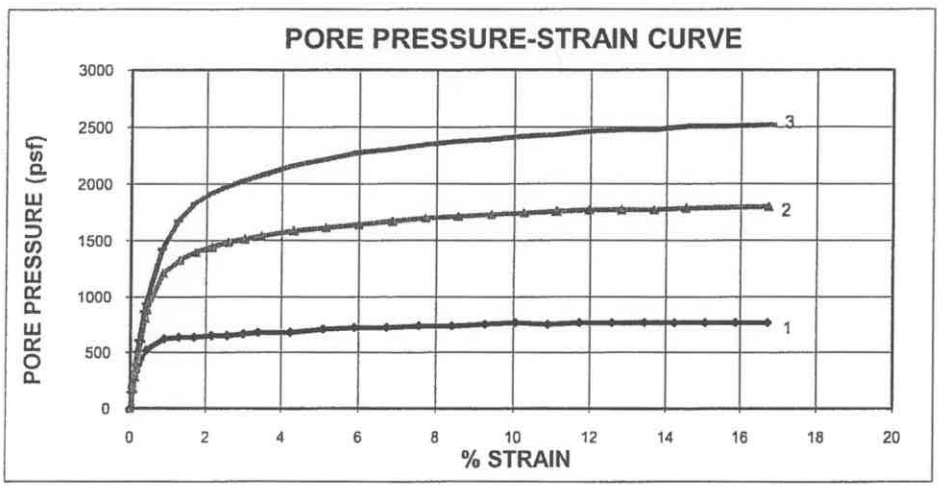
PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
PROJECT NUMBER: **083-82671**
SAMPLE ID: **Fly Ash** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1454	71.2	32.6
2	2894	71.2	32.6
3	4334.4	71.3	33.0
	Average	**71.2**	**32.7**







Soil Description

FLY ASH - Dark Gray, CLAYEY SILT, little fine sand.

USCS (ML)

LL	PL	PI
-	-	-

Comments

Sample was remolded to approx. 95% of the Max. Dry Density, @ Opt. Moisture Content+3.5%.

*** Failure based on effective stress ratio or 15% strain.**

CHECK AU
REVIEW

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Fly Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	70.1
SAMPLE PRESSURE (psi)	60.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	10.1
PRESSURE, σ_3 (psf)	1454.4
FINAL "B" VALUE	0.93
t_{50} (minutes)	0.19
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.237	5.999	5.980
DIAMETER	7.087	2.790	2.784
AREA	39.44	6.11	6.09
VOLUME	601.01	36.68	36.39
WEIGHT (g)	909.32		954.72
% MOISTURE	32.6		39.17
SPECIFIC GRAVITY	2.18		
MOIST DENSITY (pcf)	94.4		
DRY DENSITY, calc (pcf)	71.2		
VOLUME OF SOLIDS	314.98		
VOLUME OF VOIDS	286.03		
VOID RATIO	0.908		
SATURATION	78.1		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	71.8
VOLUME OF SOLIDS	314.98
VOLUME OF VOIDS	281.43
VOID RATIO	0.893

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	954.72
WT SOIL & TARE, DRY (g)	686.02
WT TARE (g)	0.00
WT MOISTURE (g)	268.70
WT DRY SOIL (g)	686.02
% MOISTURE	39.17

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	8	60.3	0.0	0.00	1.00	6.09	5.980	0.0	1454.4	1454.4	1454.4	1.00	1454.4	0.0	0.00
0.5	0.003	31	61.6	187.2	0.05	1.00	6.09	5.977	529.7	1984.1	1796.9	1267.2	1.42	1532.1	264.9	0.35
1.0	0.006	36	62.2	273.6	0.10	1.00	6.09	5.974	661.8	2116.2	1842.6	1180.8	1.56	1511.7	330.9	0.41
1.5	0.009	41	62.6	331.2	0.15	1.00	6.10	5.971	774.9	2229.3	1898.1	1123.2	1.69	1510.6	387.4	0.43
2.0	0.012	45	63.0	388.8	0.20	1.00	6.10	5.968	852.4	2306.8	1918.0	1065.6	1.80	1491.8	426.2	0.46
2.5	0.015	48	63.3	432.0	0.25	1.00	6.10	5.965	941.7	2396.1	1964.1	1022.4	1.92	1493.2	470.8	0.46
4.2	0.025	56	63.9	518.4	0.42	1.00	6.11	5.955	1114.5	2568.9	2050.5	936.0	2.19	1493.2	557.2	0.47
8.8	0.053	71	64.6	619.2	0.89	0.99	6.14	5.927	1468.0	2922.4	2303.2	835.2	2.76	1569.2	734.0	0.42
12.7	0.076	78	64.7	633.6	1.27	0.99	6.16	5.904	1618.8	3073.2	2439.6	820.8	2.97	1630.2	809.4	0.39
16.7	0.100	81	64.7	633.6	1.67	0.98	6.19	5.880	1689.0	3143.4	2509.8	820.8	3.06	1665.3	844.5	0.38
21.3	0.128	83	64.8	648.0	2.14	0.98	6.22	5.852	1725.0	3179.4	2531.4	806.4	3.14	1668.9	862.5	0.38
25.5	0.153	84	64.8	648.0	2.56	0.97	6.25	5.827	1752.2	3206.6	2558.6	806.4	3.17	1682.5	876.1	0.37
29.8	0.179	86	64.9	662.4	2.99	0.97	6.27	5.801	1769.6	3224.0	2561.6	792.0	3.23	1676.8	884.8	0.37
33.7	0.202	86	65.0	676.8	3.38	0.97	6.30	5.778	1778.6	3233.0	2556.2	777.6	3.29	1666.9	889.3	0.38
42.2	0.253	86	65.0	676.8	4.23	0.96	6.35	5.727	1756.1	3210.5	2533.7	777.6	3.26	1655.7	878.1	0.39
50.7	0.304	87	65.2	705.6	5.08	0.95	6.41	5.676	1756.2	3210.6	2505.0	748.8	3.35	1626.9	878.1	0.40
58.7	0.352	87	65.3	720.0	5.89	0.94	6.47	5.628	1741.3	3195.7	2475.7	734.4	3.37	1605.1	870.7	0.41
67.0	0.402	87	65.3	720.0	6.72	0.93	6.52	5.578	1734.7	3189.1	2469.1	734.4	3.36	1601.7	867.3	0.42
75.3	0.452	87	65.4	734.4	7.56	0.92	6.58	5.528	1727.9	3182.3	2447.9	720.0	3.40	1583.9	863.9	0.43
83.8	0.503	88	65.4	734.4	8.41	0.92	6.65	5.477	1718.5	3172.9	2438.5	720.0	3.39	1579.2	859.2	0.43
92.2	0.553	89	65.5	748.8	9.25	0.91	6.71	5.427	1719.9	3174.3	2425.5	705.6	3.44	1565.6	860.0	0.44
100.2	0.601	89	65.6	763.2	10.05	0.90	6.77	5.379	1719.6	3174.0	2410.8	691.2	3.49	1551.0	859.8	0.44
108.7	0.652	90	65.5	748.8	10.90	0.89	6.83	5.328	1711.8	3166.2	2417.4	705.6	3.43	1561.5	855.9	0.44
116.8	0.701	91	65.6	763.2	11.72	0.88	6.89	5.279	1719.0	3173.4	2410.2	691.2	3.49	1550.7	859.5	0.44
125.3	0.752	91	65.6	763.2	12.58	0.87	6.96	5.228	1710.7	3165.1	2401.9	691.2	3.47	1546.5	855.3	0.45
133.8	0.803	91	65.6	763.2	13.43	0.87	7.03	5.177	1694.0	3148.4	2385.2	691.2	3.45	1538.2	847.0	0.45
141.8	0.851	92	65.6	763.2	14.23	0.86	7.10	5.129	1692.5	3146.9	2383.7	691.2	3.45	1537.4	846.2	0.45
150.0	0.900	93	65.6	763.2	15.05	0.85	7.16	5.080	1706.4	3160.8	2397.6	691.2	3.47	1544.4	853.2	0.45
158.2	0.949	94	65.6	763.2	15.87	0.84	7.23	5.031	1698.0	3152.4	2389.2	691.2	3.46	1540.2	849.0	0.45
166.7	1.000	94	65.6	763.2	16.72	0.83	7.31	4.980	1688.6	3143.0	2379.8	691.2	3.44	1535.5	844.3	0.45

DU @ FAILURE	676.8	DEVIATORIC STRESS @ FAILURE	1778.6	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.29

TECH	AK
DATE	8/25/09
CHECKED	AK
REVIEWED	PWA

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Fly Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	80.1
SAMPLE PRESSURE (psi)	60.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	20.1
PRESSURE, σ_3 (psf)	2894.4
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.15
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.248	6.003	5.978
DIAMETER	7.087	2.790	2.778
AREA	39.44	6.11	6.06
VOLUME	601.41	36.70	36.24
WEIGHT (g)	909.99		952.49
% MOISTURE	32.6		38.74
SPECIFIC GRAVITY	2.18		
MOIST DENSITY (pcf)	94.4		
DRY DENSITY, calc (pcf)	71.2		
VOLUME OF SOLIDS	315.21		
VOLUME OF VOIDS	286.20		
VOID RATIO	0.908		
SATURATION	78.1		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	72.1
VOLUME OF SOLIDS	315.21
VOLUME OF VOIDS	278.70
VOID RATIO	0.884

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	952.49
WT SOIL & TARE, DRY (g)	686.53
WT TARE (g)	0.00
WT MOISTURE (g)	265.96
WT DRY SOIL (g)	686.53
% MOISTURE	38.74

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	12	60.2	0.0	0.00	1.00	6.06	5.978	0.0	2894.4	2894.4	2894.4	1.00	2894.4	0.0	0.00
0.3	0.002	21	60.5	43.2	0.03	1.00	6.06	5.976	218.4	3112.8	3069.6	2851.2	1.08	2960.4	109.2	0.20
0.8	0.005	37	61.4	172.8	0.08	1.00	6.07	5.973	598.1	3492.5	3319.7	2721.6	1.22	3020.6	299.0	0.29
1.3	0.008	46	62.1	273.6	0.13	1.00	6.07	5.970	797.0	3691.4	3417.8	2620.8	1.30	3019.3	398.5	0.34
1.8	0.011	56	63.0	403.2	0.18	1.00	6.07	5.967	1031.3	3925.7	3522.5	2491.2	1.41	3006.9	515.7	0.39
2.3	0.014	63	63.8	518.4	0.23	1.00	6.08	5.964	1194.3	4088.7	3570.3	2376.0	1.50	2973.2	597.2	0.43
2.8	0.017	70	64.5	619.2	0.28	1.00	6.08	5.961	1373.7	4268.1	3648.9	2275.2	1.60	2962.1	686.9	0.45
3.8	0.023	81	65.8	806.4	0.38	1.00	6.09	5.955	1625.5	4519.9	3713.5	2088.0	1.78	2900.7	812.7	0.50
4.3	0.026	86	66.3	878.4	0.43	1.00	6.09	5.952	1733.5	4627.9	3749.5	2016.0	1.86	2882.7	866.7	0.51
8.5	0.051	110	68.6	1209.6	0.85	0.99	6.11	5.927	2300.8	5195.2	3985.6	1684.8	2.37	2835.2	1150.4	0.53
12.8	0.077	124	69.4	1324.8	1.29	0.99	6.14	5.901	2611.9	5506.3	4181.5	1569.6	2.66	2875.6	1306.0	0.51
17.0	0.102	131	69.9	1396.8	1.71	0.98	6.17	5.876	2761.9	5656.3	4259.5	1497.6	2.84	2878.6	1381.0	0.51
21.3	0.128	133	70.2	1440.0	2.14	0.98	6.20	5.850	2803.2	5697.6	4257.6	1454.4	2.93	2856.0	1401.6	0.51
25.7	0.154	134	70.5	1483.2	2.58	0.97	6.22	5.824	2825.4	5719.8	4236.6	1411.2	3.00	2823.9	1412.7	0.52
30.0	0.180	135	70.7	1512.0	3.01	0.97	6.25	5.798	2831.2	5725.6	4213.6	1382.4	3.05	2798.0	1415.6	0.53
34.3	0.206	135	70.9	1540.8	3.45	0.97	6.28	5.772	2818.5	5712.9	4172.1	1353.6	3.08	2762.9	1409.3	0.55
42.8	0.257	137	71.2	1584.0	4.30	0.96	6.33	5.721	2827.7	5722.1	4138.1	1310.4	3.16	2724.3	1413.9	0.56
51.2	0.307	137	71.4	1612.8	5.14	0.95	6.39	5.671	2803.0	5697.4	4084.6	1281.6	3.19	2683.1	1401.5	0.58
59.7	0.358	136	71.6	1641.6	5.99	0.94	6.45	5.620	2759.9	5654.3	4012.7	1252.8	3.20	2632.8	1380.0	0.59
68.3	0.410	136	71.8	1670.4	6.86	0.93	6.51	5.568	2734.4	5628.8	3958.4	1224.0	3.23	2591.2	1367.2	0.61
76.8	0.461	137	72.0	1699.2	7.71	0.92	6.57	5.517	2726.9	5621.3	3922.1	1195.2	3.28	2558.7	1363.5	0.62
85.2	0.511	137	72.1	1713.6	8.55	0.91	6.63	5.467	2702.2	5596.6	3883.0	1180.8	3.29	2531.9	1351.1	0.63
93.7	0.562	137	72.2	1728.0	9.40	0.91	6.69	5.416	2677.0	5571.4	3843.4	1166.4	3.30	2504.9	1338.5	0.65
102.2	0.613	137	72.3	1742.4	10.25	0.90	6.76	5.365	2651.8	5546.2	3803.8	1152.0	3.30	2477.9	1325.9	0.66
110.7	0.664	137	72.4	1756.8	11.11	0.89	6.82	5.314	2626.6	5521.0	3764.2	1137.6	3.31	2450.9	1313.3	0.67
119.2	0.715	137	72.5	1771.2	11.96	0.88	6.89	5.263	2618.1	5512.5	3741.3	1123.2	3.33	2432.2	1309.0	0.68
127.7	0.766	138	72.5	1771.2	12.81	0.87	6.95	5.212	2607.2	5501.6	3730.4	1123.2	3.32	2426.8	1303.6	0.68
136.2	0.817	138	72.5	1771.2	13.67	0.86	7.02	5.161	2581.7	5476.1	3704.9	1123.2	3.30	2414.0	1290.8	0.69
144.7	0.868	138	72.6	1785.6	14.52	0.85	7.09	5.110	2556.2	5450.6	3665.0	1108.8	3.31	2386.9	1278.1	0.70
166.7	1.000	139	72.7	1800.0	16.73	0.83	7.28	4.978	2506.0	5400.4	3600.4	1094.4	3.29	2347.4	1253.0	0.72

DU @ FAILURE	1713.6	DEVIATORIC STRESS @ FAILURE	2702.2	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.29

TECH	AK
DATE	8/25/09
CHECKED	AK
REVIEWED	MM

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	Fly Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	90.1
SAMPLE PRESSURE (psi)	60.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	30.1
PRESSURE, σ_3 (psi)	4334.4
FINAL "B" VALUE	0.96
t_{50} (minutes)	0.48

Mounting Method: Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.243	6.001	5.968
DIAMETER	7.087	2.790	2.756
AREA	39.44	6.11	5.96
VOLUME	601.21	36.69	35.60
WEIGHT (g)	913.14		945.24
% MOISTURE	33.0		37.64
SPECIFIC GRAVITY	2.18		
MOIST DENSITY (pcf)	94.8		
DRY DENSITY, calc (pcf)	71.3		
VOLUME OF SOLIDS	315.32		
VOLUME OF VOIDS	285.88		
VOID RATIO	0.907		
SATURATION	79.2		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	73.5
VOLUME OF SOLIDS	315.32
VOLUME OF VOIDS	267.98
VOID RATIO	0.850

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	945.24
WT SOIL & TARE, DRY (g)	686.77
WT TARE (g)	0.00
WT MOISTURE (g)	258.47
WT DRY SOIL (g)	686.77
% MOISTURE	37.64

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	15	60.3	0.0	0.00	1.00	5.96	5.968	0.0	4334.4	4334.4	4334.4	1.00	4334.4	0.0	0
0.3	0.002	45	61.3	144.0	0.03	1.00	5.97	5.966	716.8	5051.2	4907.2	4190.4	1.17	4548.8	358.4	0.20
0.8	0.005	61	62.1	259.2	0.08	1.00	5.97	5.963	1102.4	5436.8	5177.6	4075.2	1.27	4626.4	551.2	0.24
1.3	0.008	74	63.0	388.8	0.13	1.00	5.97	5.960	1415.3	5749.7	5360.9	3945.6	1.36	4653.3	707.7	0.27
1.8	0.011	85	63.8	504.0	0.18	1.00	5.98	5.957	1672.5	6006.9	5502.9	3830.4	1.44	4666.6	836.2	0.30
2.3	0.014	93	64.5	604.8	0.23	1.00	5.98	5.954	1873.9	6208.3	5603.5	3729.6	1.50	4666.6	937.0	0.32
3.5	0.021	114	66.3	864.0	0.35	1.00	5.99	5.947	2384.2	6718.6	5854.6	3470.4	1.69	4662.5	1192.1	0.36
4.0	0.024	121	66.8	936.0	0.40	1.00	5.99	5.944	2529.7	6864.1	5928.1	3398.4	1.74	4663.2	1264.8	0.37
8.2	0.049	158	70.2	1425.6	0.82	0.99	6.01	5.919	3414.6	7749.0	6323.4	2908.8	2.17	4616.1	1707.3	0.42
12.3	0.074	181	71.9	1670.4	1.24	0.99	6.04	5.894	3946.2	8280.6	6610.2	2664.0	2.48	4637.1	1973.1	0.42
16.7	0.100	193	73.0	1828.8	1.68	0.98	6.07	5.868	4218.4	8552.8	6724.0	2505.6	2.68	4614.8	2109.2	0.43
21.0	0.126	199	73.6	1915.2	2.11	0.98	6.09	5.842	4343.8	8678.2	6763.0	2419.2	2.80	4591.1	2171.9	0.44
25.2	0.151	204	74.0	1972.8	2.53	0.97	6.12	5.817	4433.5	8767.9	6795.1	2361.6	2.88	4578.4	2216.8	0.44
29.7	0.178	205	74.4	2030.4	2.98	0.97	6.15	5.790	4448.1	8782.5	6752.1	2304.0	2.93	4528.0	2224.0	0.46
34.0	0.204	206	74.7	2073.6	3.42	0.97	6.18	5.764	4446.7	8781.1	6707.5	2260.8	2.97	4484.2	2223.4	0.47
42.5	0.255	207	75.3	2160.0	4.27	0.96	6.23	5.713	4425.9	8760.3	6600.3	2174.4	3.04	4387.3	2212.9	0.49
51.0	0.306	207	75.7	2217.6	5.13	0.95	6.29	5.662	4386.4	8720.8	6503.2	2116.8	3.07	4310.0	2193.2	0.51
59.5	0.357	207	76.1	2275.2	5.98	0.94	6.34	5.611	4346.9	8681.3	6406.1	2059.2	3.11	4232.6	2173.4	0.52
68.0	0.408	208	76.3	2304.0	6.84	0.93	6.40	5.560	4323.1	8657.5	6353.5	2030.4	3.13	4192.0	2161.6	0.53
76.5	0.459	208	76.6	2347.2	7.69	0.92	6.46	5.509	4283.4	8617.8	6270.6	1987.2	3.16	4128.9	2141.7	0.55
85.0	0.510	208	76.8	2376.0	8.55	0.91	6.52	5.458	4261.5	8595.9	6219.9	1958.4	3.18	4089.1	2130.7	0.56
93.7	0.562	209	76.9	2390.4	9.42	0.91	6.58	5.406	4238.4	8572.8	6182.4	1944.0	3.18	4063.2	2119.2	0.56
102.0	0.612	209	77.1	2419.2	10.25	0.90	6.65	5.356	4199.2	8533.6	6114.4	1915.2	3.19	4014.8	2099.6	0.58
110.7	0.664	209	77.2	2433.6	11.13	0.89	6.71	5.304	4158.4	8492.8	6059.2	1900.8	3.19	3980.0	2079.2	0.59
119.2	0.715	210	77.4	2462.4	11.98	0.88	6.78	5.253	4133.3	8467.7	6005.3	1872.0	3.21	3938.6	2066.6	0.60
127.7	0.766	210	77.5	2476.8	12.84	0.87	6.84	5.202	4093.1	8427.5	5950.7	1857.6	3.20	3904.2	2046.6	0.61
136.2	0.817	212	77.5	2476.8	13.69	0.86	6.91	5.151	4100.9	8435.3	5958.5	1857.6	3.21	3908.1	2050.5	0.60
144.7	0.868	212	77.7	2505.6	14.54	0.85	6.98	5.100	4060.3	8394.7	5889.1	1828.8	3.22	3859.0	2030.2	0.62
153.3	0.920	213	77.7	2505.6	15.42	0.85	7.05	5.048	4035.3	8369.7	5864.1	1828.8	3.21	3846.4	2017.6	0.62
167.3	1.004	214	77.8	2520.0	16.82	0.83	7.17	4.964	3982.2	8316.6	5796.6	1814.4	3.19	3805.5	1991.1	0.63

DU @ FAILURE	2347.2	DEVIATORIC STRESS @ FAILURE	4283.4	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.16

TECH	AK
DATE	8/30/09
CHECKED	AJC
REVIEWED	MJM

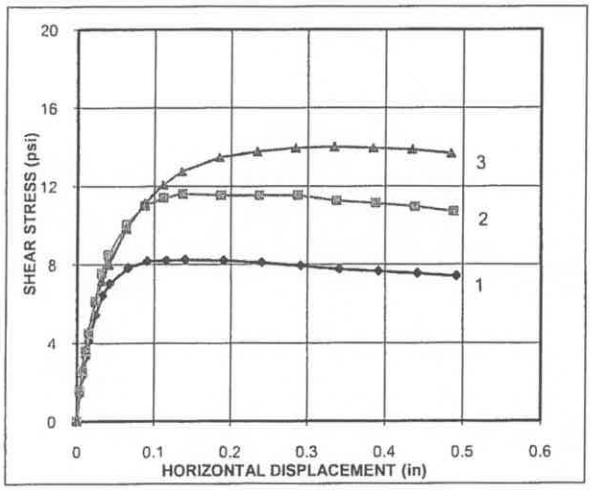
Golder Associates Inc.

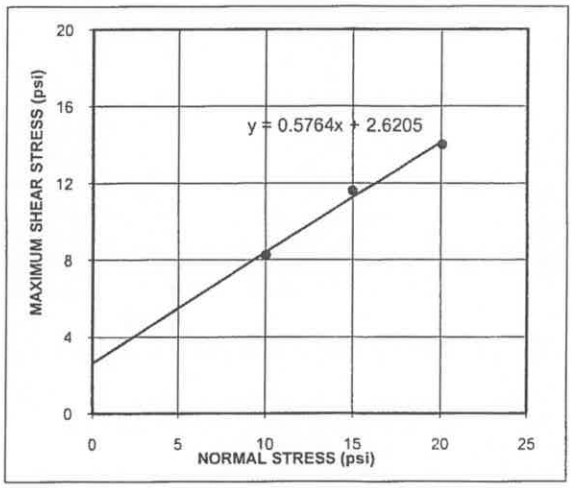
DECEMBER 2009 083-82671

DIRECT SHEAR

ASTM D 3080

PROJECT NAME: PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER: 083-82671
SAMPLE ID: Fly Ash **DEPTH:** -





ϕ = 30.0 °
C = 2.62 psi

SPECIMEN 1	
Normal Stress (psi)	10.0
t50 (minutes)	0.14
SPEED mm/min	0.400
Sample Diameter (in)	4.00
Moisture Content (%)	26.3
Wet Density (pcf)	84.6
Dry Density (pcf)	67.0
Void Ratio	1.029
Saturation (%)	55.7

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.00
0.004	1.35
0.007	2.34
0.011	3.29
0.015	4.11
0.024	5.44
0.033	6.43
0.042	7.04
0.066	7.82
0.091	8.16
0.116	8.20
0.141	8.23
0.191	8.20
0.241	8.09
0.291	7.92
0.341	7.75
0.391	7.65
0.441	7.55
0.492	7.41

8.2 Max Shear Stress

SPECIMEN 2	
Normal Stress (psi)	15.0
t50 (minutes)	0.27
SPEED mm/min	0.300
Sample Diameter (in)	4.00
Moisture Content (%)	26.3
Wet Density (pcf)	84.6
Dry Density (pcf)	67.0
Void Ratio	1.029
Saturation (%)	55.7

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.00
0.003	1.52
0.007	2.58
0.011	3.60
0.015	4.52
0.023	6.15
0.031	7.55
0.040	8.50
0.064	10.07
0.087	10.99
0.112	11.40
0.137	11.60
0.187	11.53
0.237	11.53
0.287	11.53
0.337	11.26
0.387	11.13
0.438	10.96
0.488	10.72

11.6 Max Shear Stress

SPECIMEN 3	
Normal Stress (psi)	20.1
t50 (minutes)	0.22
SPEED mm/min	0.400
Sample Diameter (in)	4.00
Moisture Content (%)	26.3
Wet Density (pcf)	84.6
Dry Density (pcf)	67.0
Void Ratio	1.029
Saturation (%)	55.7

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.00
0.003	1.52
0.007	2.71
0.011	3.67
0.015	4.62
0.023	6.12
0.032	7.18
0.041	7.99
0.064	9.80
0.087	11.13
0.111	12.08
0.135	12.76
0.185	13.48
0.234	13.78
0.284	13.95
0.334	14.02
0.384	13.95
0.434	13.88
0.484	13.68

14.0 Max Shear Stress

REMARKS The sample was remolded to 89.4% of the Maximum Dry Density @ -2.6% of Opt. Moisture Content. Specimens were run dry (not inundated).

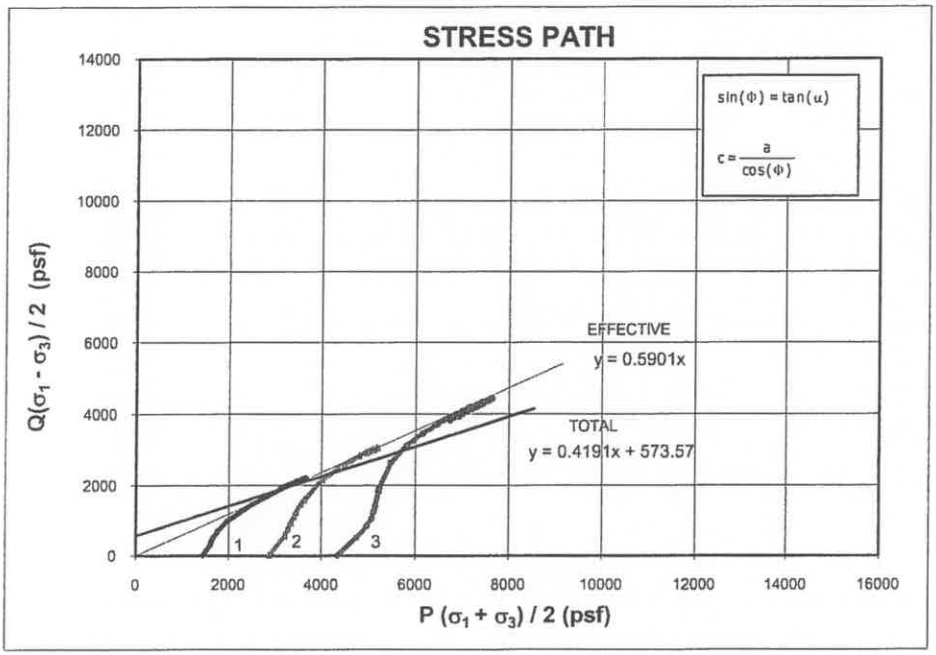
DESCRIPTION FLY ASH - Dark Gray, Clayey Silt, little fine sand.

USCS (ML)

TECH	SW
DATE	12/1/09
CHECK	AK
REVIEW	DA

TRIAXIAL COMPRESSION TEST - CONSOLIDATED UNDRAINED WITH PORE PRESSURE
ASTM D 4767

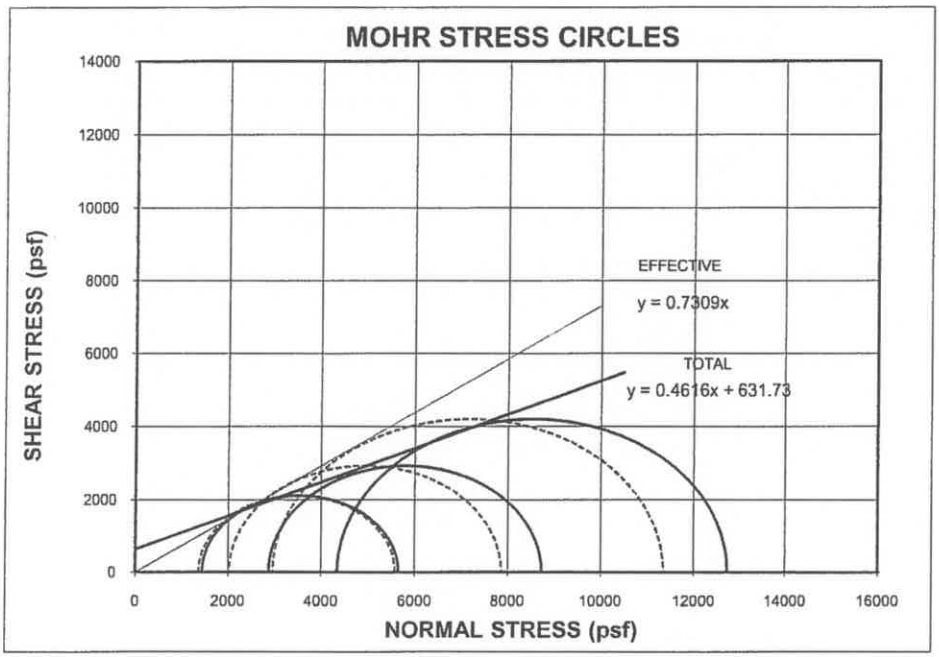
PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
PROJECT NUMBER: **083-82671**
SAMPLE ID: **High Chloride Ash** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1440	76.3	29.4
2	2880	76.4	29.2
3	4348.8	76.2	29.6

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.10	74.9	95.6
2	0.10	74.6	95.3
3	0.10	75.2	95.0

STRESS PATH			MOHR CIRCLES		
*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	22.7 °	ϕ	=	24.8 °
a	=	573.6 psf	c	=	631.7 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	30.5 °	ϕ '	=	36.2 °
a '	=	0.0 psf	c '	=	0.0 psf



Soil Description

Dark Gray and Yellowish Brown, CLAYEY SILT, and medium to fine sand, trace fine gravel.

USCS (ML)

LL	PL	PI
-	-	-

Comments

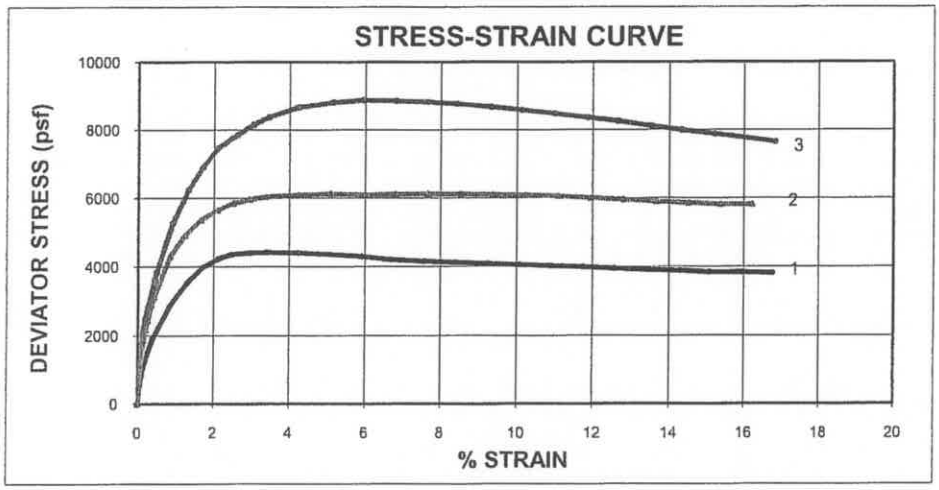
Sample was remolded to approx. 95% of the Max. Dry Density, @ Opt. Moisture Content+3.3%.

*** Failure based on effective stress ratio or 15% strain.**

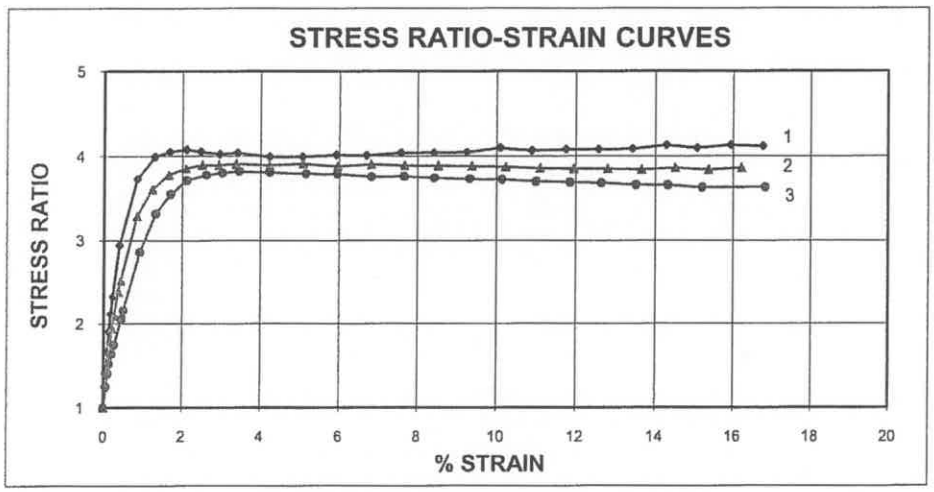
CHECK AJL
REVIEW

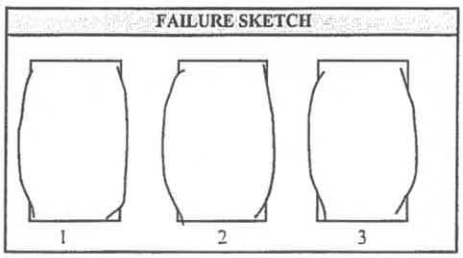
TRIAXIAL COMPRESSION TEST - CONSOLIDATED UNDRAINED WITH PORE PRESSURE
ASTM D 4767

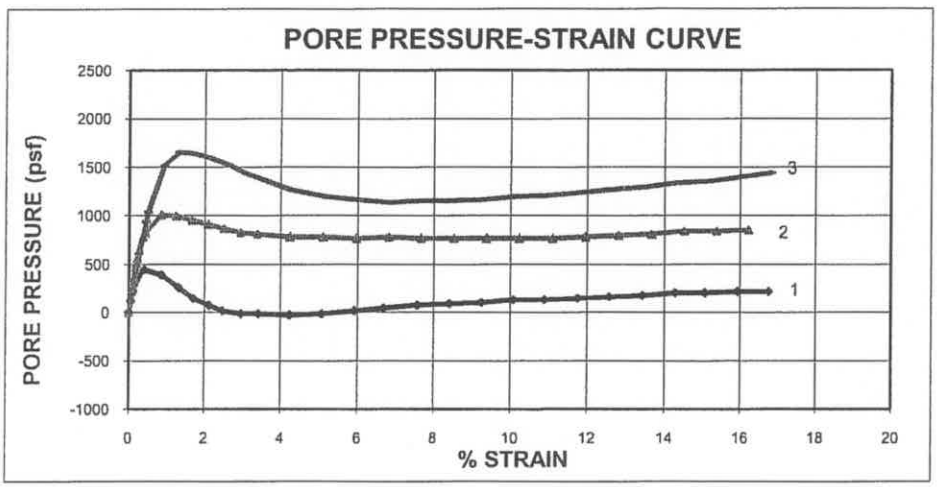
PROJECT NAME: **PEF/CREC CCP MGMT PLAN/FL**
PROJECT NUMBER: **083-82671**
SAMPLE ID: **High Chloride Ash** DEPTH: - Sample Type: **Bulk**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1440	76.3	29.4
2	2880	76.4	29.2
3	4348.8	76.2	29.6
	Average	**76.3**	**29.4**







Soil Description

Dark Gray and Yellowish Brown, CLAYEY SILT, and medium to fine sand, trace fine gravel.

USCS (ML)

LL	PL	PI
-	-	-

Comments

Sample was remolded to approx. 95% of the Max. Dry Density, @ Opt. Moisture Content+3.3%.

*** Failure based on effective stress ratio or 15% strain.**

CHECK AJL
REVIEW

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	High Chloride Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	90.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	10.0
PRESSURE, σ_3 (psf)	1440.0
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.38
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.235	5.998	5.982
DIAMETER	7.087	2.790	2.786
AREA	39.44	6.11	6.10
VOLUME	600.91	36.67	36.46
WEIGHT (g)	950.54		1007.14
% MOISTURE	29.4		37.14
SPECIFIC GRAVITY	2.35		
MOIST DENSITY (pcf)	98.7		
DRY DENSITY, calc (pcf)	76.3		
VOLUME OF SOLIDS	312.23		
VOLUME OF VOIDS	288.67		
VOID RATIO	0.925		
SATURATION	74.9		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	76.7
VOLUME OF SOLIDS	312.23
VOLUME OF VOIDS	285.27
VOID RATIO	0.914

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1007.14
WT SOIL & TARE, DRY (g)	734.37
WT TARE (g)	0.00
WT MOISTURE (g)	272.77
WT DRY SOIL (g)	734.37
% MOISTURE	37.14

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	13	80.3	0.0	0.00	1.00	6.10	5.982	0.0	1440.0	1440.0	1440.0	1.00	1440.0	0.0	0.00
0.5	0.003	36	81.1	115.2	0.05	1.00	6.10	5.979	545.5	1985.5	1870.3	1324.8	1.41	1597.5	272.7	0.21
1.0	0.006	48	81.8	216.0	0.10	1.00	6.10	5.976	816.6	2256.6	2040.6	1224.0	1.67	1632.3	408.3	0.26
1.3	0.008	57	82.3	288.0	0.13	1.00	6.10	5.974	1045.2	2485.2	2197.2	1152.0	1.91	1674.6	522.6	0.28
1.8	0.011	65	82.6	331.2	0.18	1.00	6.11	5.971	1238.0	2678.0	2346.8	1108.8	2.12	1727.8	619.0	0.27
2.3	0.014	73	82.9	374.4	0.23	1.00	6.11	5.968	1411.8	2851.8	2477.4	1065.6	2.32	1771.5	705.9	0.27
4.0	0.024	95	83.4	446.4	0.40	1.00	6.12	5.958	1927.1	3367.1	2920.7	993.6	2.94	1957.2	963.6	0.23
8.5	0.051	135	83.0	388.8	0.85	0.99	6.15	5.931	2869.4	4309.4	3920.6	1051.2	3.73	2485.9	1434.7	0.14
13.0	0.078	164	82.1	259.2	1.30	0.99	6.18	5.904	3532.5	4972.5	4713.3	1180.8	3.99	2947.0	1766.2	0.07
16.8	0.101	183	81.3	144.0	1.69	0.98	6.20	5.881	3950.7	5390.7	5246.7	1296.0	4.05	3271.4	1975.4	0.04
21.0	0.126	195	80.8	72.0	2.11	0.98	6.23	5.856	4209.2	5649.2	5577.2	1368.0	4.08	3472.6	2104.6	0.02
24.7	0.148	202	80.4	14.4	2.47	0.98	6.25	5.834	4347.7	5787.7	5773.3	1425.6	4.05	3599.5	2173.9	0.00
29.5	0.177	205	80.2	-14.4	2.96	0.97	6.28	5.805	4394.9	5834.9	5849.3	1454.4	4.02	3651.8	2197.4	0.00
34.0	0.204	207	80.2	-14.4	3.41	0.97	6.31	5.778	4417.8	5857.8	5872.2	1454.4	4.04	3663.3	2208.9	0.00
42.2	0.253	207	80.1	-28.8	4.23	0.96	6.36	5.729	4396.2	5836.2	5865.0	1468.8	3.99	3666.9	2198.1	-0.01
50.5	0.303	207	80.2	-14.4	5.07	0.95	6.42	5.679	4348.8	5788.8	5803.2	1454.4	3.99	3628.8	2174.4	0.00
59.0	0.354	206	80.4	14.4	5.92	0.94	6.48	5.628	4294.2	5734.2	5719.8	1425.6	4.01	3572.7	2147.1	0.00
66.7	0.400	204	80.6	43.2	6.69	0.93	6.53	5.582	4201.8	5641.8	5598.6	1396.8	4.01	3497.7	2100.9	0.01
75.5	0.453	203	80.8	72.0	7.57	0.92	6.59	5.529	4153.2	5593.2	5521.2	1368.0	4.04	3444.6	2076.6	0.02
83.8	0.503	203	80.9	86.4	8.41	0.92	6.65	5.479	4115.6	5555.6	5469.2	1353.6	4.04	3411.4	2057.8	0.02
92.2	0.553	203	81.0	100.8	9.24	0.91	6.72	5.429	4078.0	5518.0	5417.2	1339.2	4.05	3378.2	2039.0	0.02
100.5	0.603	204	81.2	129.6	10.08	0.90	6.78	5.379	4057.5	5497.5	5367.9	1310.4	4.10	3339.1	2028.7	0.03
108.5	0.651	204	81.2	129.6	10.88	0.89	6.84	5.331	4012.9	5452.9	5323.3	1310.4	4.06	3316.8	2006.4	0.03
117.2	0.703	204	81.3	144.0	11.75	0.88	6.91	5.279	3988.3	5428.3	5284.3	1296.0	4.08	3290.2	1994.2	0.04
125.3	0.752	204	81.4	158.4	12.57	0.87	6.97	5.230	3945.1	5385.1	5226.7	1281.6	4.08	3254.1	1972.5	0.04
133.8	0.803	204	81.5	172.8	13.42	0.87	7.04	5.179	3906.6	5346.6	5173.8	1267.2	4.08	3220.5	1953.3	0.04
142.3	0.854	204	81.7	201.6	14.28	0.86	7.11	5.128	3874.2	5314.2	5112.6	1238.4	4.13	3175.5	1937.1	0.05
150.2	0.901	204	81.7	201.6	15.06	0.85	7.18	5.081	3832.7	5272.7	5071.1	1238.4	4.09	3154.7	1916.3	0.05
158.8	0.953	206	81.8	216.0	15.93	0.84	7.25	5.029	3829.2	5269.2	5053.2	1224.0	4.13	3138.6	1914.6	0.06
167.2	1.003	207	81.8	216.0	16.77	0.83	7.32	4.979	3812.8	5252.8	5036.8	1224.0	4.12	3130.4	1906.4	0.06

DU @ FAILURE	72.0	DEVIATORIC STRESS @ FAILURE	4209.2	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	4.08

TECH	AK
DATE	8/27/09
CHECKED	AK
REVIEWED	MWM

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	High Chloride Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	100.0
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	20.0
PRESSURE, σ_3 (psf)	2880.0
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.42
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.232	5.997	5.975
DIAMETER	7.087	2.790	2.771
AREA	39.44	6.11	6.03
VOLUME	600.80	36.66	36.03
WEIGHT (g)	950.63		1000.23
% MOISTURE	29.2		35.93
SPECIFIC GRAVITY	2.35		
MOIST DENSITY (pcf)	98.7		
DRY DENSITY, calc (pcf)	76.4		
VOLUME OF SOLIDS	312.85		
VOLUME OF VOIDS	287.96		
VOID RATIO	0.920		
SATURATION	74.6		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	77.8
VOLUME OF SOLIDS	312.85
VOLUME OF VOIDS	277.56
VOID RATIO	0.887

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1000.23
WT SOIL & TARE, DRY (g)	735.82
WT TARE (g)	0.00
WT MOISTURE (g)	264.41
WT DRY SOIL (g)	735.82
% MOISTURE	35.93

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	15	80.5	0.0	0.00	1.00	6.03	5.975	0.0	2880.0	2880.0	2880.0	1.00	2880.0	0.0	0.00
0.7	0.004	61	82.0	216.0	0.07	1.00	6.03	5.971	1093.0	3973.0	3757.0	2664.0	1.41	3210.5	546.5	0.20
1.2	0.007	78	82.9	345.6	0.12	1.00	6.04	5.968	1493.2	4373.2	4027.6	2534.4	1.59	3281.0	746.6	0.23
1.7	0.010	93	83.7	460.8	0.17	1.00	6.04	5.965	1854.8	4734.8	4274.0	2419.2	1.77	3346.6	927.4	0.25
2.2	0.013	107	84.4	561.6	0.22	1.00	6.04	5.962	2182.7	5062.7	4501.1	2318.4	1.94	3409.8	1091.4	0.26
2.7	0.016	118	85.0	648.0	0.27	1.00	6.05	5.959	2436.5	5316.5	4668.5	2232.0	2.09	3450.2	1218.2	0.27
3.7	0.022	137	85.9	777.6	0.37	1.00	6.05	5.953	2905.1	5785.1	5007.5	2102.4	2.38	3555.0	1452.6	0.27
4.3	0.026	147	86.2	820.8	0.44	1.00	6.06	5.949	3121.9	6001.9	5181.1	2059.2	2.52	3620.2	1561.0	0.26
8.5	0.051	196	87.5	1008.0	0.85	0.99	6.08	5.924	4283.2	7163.2	6155.2	1872.0	3.29	4013.6	2141.6	0.24
12.3	0.074	224	87.4	993.6	1.24	0.99	6.11	5.901	4912.8	7792.8	6799.2	1886.4	3.60	4342.8	2456.4	0.20
16.5	0.099	244	87.1	950.4	1.66	0.98	6.13	5.876	5359.3	8239.3	7288.9	1929.6	3.78	4609.3	2679.7	0.18
20.8	0.125	256	86.8	907.2	2.09	0.98	6.16	5.850	5637.2	8517.2	7610.0	1972.8	3.86	4791.4	2818.6	0.16
25.0	0.150	266	86.5	864.0	2.51	0.97	6.19	5.825	5846.0	8726.0	7862.0	2016.0	3.90	4939.0	2923.0	0.15
29.3	0.176	273	86.2	820.8	2.95	0.97	6.21	5.799	5961.3	8841.3	8020.5	2059.2	3.89	5039.8	2980.6	0.14
33.7	0.202	277	86.1	806.4	3.38	0.97	6.24	5.773	6038.4	8918.4	8112.0	2073.6	3.91	5092.8	3019.2	0.13
42.2	0.253	282	85.9	777.6	4.23	0.96	6.30	5.722	6090.2	8970.2	8192.6	2102.4	3.90	5147.5	3045.1	0.13
50.7	0.304	285	85.9	777.6	5.09	0.95	6.35	5.671	6122.1	9002.1	8224.5	2102.4	3.91	5163.4	3061.0	0.13
59.3	0.356	287	85.8	763.2	5.96	0.94	6.41	5.619	6101.9	8981.9	8218.7	2116.8	3.88	5167.7	3050.9	0.13
67.8	0.407	290	85.9	777.6	6.81	0.93	6.47	5.568	6113.2	8993.2	8215.6	2102.4	3.91	5159.0	3056.6	0.13
76.3	0.458	293	85.8	763.2	7.67	0.92	6.53	5.517	6125.6	9005.6	8242.4	2116.8	3.89	5179.6	3062.8	0.12
84.8	0.509	295	85.8	763.2	8.52	0.91	6.59	5.466	6117.0	8997.0	8233.8	2116.8	3.89	5175.3	3058.5	0.12
93.3	0.560	298	85.8	763.2	9.37	0.91	6.65	5.415	6109.7	8989.7	8226.5	2116.8	3.89	5171.7	3054.9	0.12
101.8	0.611	299	85.8	763.2	10.23	0.90	6.72	5.364	6086.5	8966.5	8203.3	2116.8	3.88	5160.1	3043.3	0.13
110.5	0.663	301	85.8	763.2	11.10	0.89	6.78	5.312	6059.3	8939.3	8176.1	2116.8	3.86	5146.5	3029.7	0.13
119.0	0.714	301	85.9	777.6	11.95	0.88	6.85	5.261	6001.2	8881.2	8103.6	2102.4	3.85	5103.0	3000.6	0.13
127.5	0.765	302	86.0	792.0	12.80	0.87	6.92	5.210	5959.7	8839.7	8047.7	2088.0	3.85	5067.8	2979.8	0.13
136.0	0.816	302	86.1	806.4	13.66	0.86	6.98	5.159	5901.3	8781.3	7974.9	2073.6	3.85	5024.3	2950.7	0.14
144.5	0.867	302	86.3	835.2	14.51	0.85	7.05	5.108	5857.3	8737.3	7902.1	2044.8	3.86	4973.4	2928.6	0.14
153.0	0.918	303	86.3	835.2	15.36	0.85	7.12	5.057	5815.0	8695.0	7859.8	2044.8	3.84	4952.3	2907.5	0.14
161.5	0.969	306	86.4	849.6	16.22	0.84	7.20	5.006	5816.3	8696.3	7846.7	2030.4	3.86	4938.6	2908.2	0.15

DU @ FAILURE	864.0	DEVIATORIC STRESS @ FAILURE	5846.0	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.90

TECH	AK
DATE	8/27/09
CHECKED	AK
REVIEWED	

Golder Associates Inc.

TRIAXIAL COMPRESSION TEST (ASTM D 4767) CONSOLIDATED UNDRAINED WITH PORE PRESSURE

PROJECT TITLE	PEF/CREC CCP MGMT PLAN/FL
PROJECT NUMBER	083-82671
SAMPLE ID	High Chloride Ash
SAMPLE TYPE	Bulk
DEPTH INTERVAL	-
MACHINE SPEED (in/min)	0.006
STRAIN RATE (%/min)	0.10
CELL PRESSURE (psi)	110.2
SAMPLE PRESSURE (psi)	80.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	30.2
PRESSURE, σ_3 (psf)	4348.8
FINAL "B" VALUE	0.95
t_{50} (minutes)	0.77
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.230	5.996	5.956
DIAMETER	7.087	2.790	2.783
AREA	39.44	6.11	6.08
VOLUME	600.70	36.66	36.22
WEIGHT (g)	950.52		1001.02
% MOISTURE	29.6		36.49
SPECIFIC GRAVITY	2.35		
MOIST DENSITY (pcf)	98.7		
DRY DENSITY, calc (pcf)	76.2		
VOLUME OF SOLIDS	311.82		
VOLUME OF VOIDS	288.89		
VOID RATIO	0.926		
SATURATION	75.2		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	77.1
VOLUME OF SOLIDS	311.82
VOLUME OF VOIDS	281.79
VOID RATIO	0.904

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1001.02
WT SOIL & TARE, DRY (g)	733.40
WT TARE (g)	0.00
WT MOISTURE (g)	267.62
WT DRY SOIL (g)	733.40
% MOISTURE	36.49

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	19	80.3	0.0	0.00	1.00	6.08	5.956	0.0	4348.8	4348.8	4348.8	1.00	4348.8	0.0	0
0.5	0.003	62	81.1	115.2	0.05	1.00	6.08	5.953	1029.4	5378.2	5263.0	4233.6	1.24	4748.3	514.7	0.11
1.0	0.006	90	81.9	230.4	0.10	1.00	6.09	5.950	1688.8	6037.6	5807.2	4118.4	1.41	4962.8	844.4	0.14
1.3	0.008	108	82.6	331.2	0.13	1.00	6.09	5.948	2094.9	6443.7	6112.5	4017.6	1.52	5065.1	1047.5	0.16
2.0	0.012	124	83.6	475.2	0.20	1.00	6.09	5.944	2471.6	6820.4	6345.2	3873.6	1.64	5109.4	1235.8	0.19
2.7	0.016	137	84.5	604.8	0.27	1.00	6.10	5.940	2793.4	7142.2	6537.4	3744.0	1.75	5140.7	1396.7	0.22
4.5	0.027	172	86.8	936.0	0.45	1.00	6.11	5.929	3606.1	7954.9	7018.9	3412.8	2.06	5215.9	1803.1	0.26
5.0	0.030	182	87.5	1036.8	0.50	0.99	6.11	5.926	3830.4	8179.2	7142.4	3312.0	2.16	5227.2	1915.2	0.27
9.2	0.055	244	90.8	1512.0	0.92	0.99	6.14	5.901	5273.4	9622.2	8110.2	2836.8	2.86	5473.5	2636.7	0.29
13.2	0.079	286	91.8	1656.0	1.33	0.99	6.16	5.877	6242.5	10591.3	8935.3	2692.8	3.32	5814.0	3121.2	0.27
17.0	0.102	316	91.7	1641.6	1.71	0.98	6.19	5.854	6911.5	11260.3	9618.7	2707.2	3.55	6163.0	3455.8	0.24
21.0	0.126	341	91.4	1598.4	2.12	0.98	6.21	5.830	7462.6	11811.4	10213.0	2750.4	3.71	6481.7	3731.3	0.21
26.0	0.156	359	90.9	1526.4	2.62	0.97	6.25	5.800	7843.8	12192.6	10666.2	2822.4	3.78	6744.3	3921.9	0.19
30.2	0.181	374	90.3	1440.0	3.04	0.97	6.27	5.775	8152.1	12500.9	11060.9	2908.8	3.80	6984.8	4076.0	0.18
34.3	0.206	386	89.9	1382.4	3.46	0.97	6.30	5.750	8379.7	12728.5	11346.1	2966.4	3.82	7156.2	4189.8	0.16
42.0	0.252	401	89.1	1267.2	4.23	0.96	6.35	5.704	8668.6	13017.4	11750.2	3081.6	3.81	7415.9	4334.3	0.15
51.2	0.307	411	88.6	1195.2	5.15	0.95	6.41	5.649	8809.6	13158.4	11963.2	3153.6	3.79	7558.4	4404.8	0.14
59.0	0.354	418	88.4	1166.4	5.94	0.94	6.47	5.602	8876.6	13225.4	12059.0	3182.4	3.79	7620.7	4438.3	0.13
67.7	0.406	421	88.2	1137.6	6.82	0.93	6.53	5.550	8860.4	13209.2	12071.6	3211.2	3.76	7641.4	4430.2	0.13
76.0	0.456	423	88.3	1152.0	7.66	0.92	6.59	5.500	8828.7	13177.5	12025.5	3196.8	3.76	7611.1	4414.3	0.13
83.7	0.502	424	88.3	1152.0	8.43	0.92	6.64	5.454	8772.2	13121.0	11969.0	3196.8	3.74	7582.9	4386.1	0.13
92.5	0.555	424	88.4	1166.4	9.32	0.91	6.71	5.401	8686.9	13035.7	11869.3	3182.4	3.73	7525.9	4343.5	0.13
100.5	0.603	422	88.6	1195.2	10.12	0.90	6.77	5.353	8586.3	12935.1	11739.9	3153.6	3.72	7446.8	4293.2	0.14
109.2	0.655	421	88.7	1209.6	11.00	0.89	6.83	5.301	8479.7	12828.5	11618.9	3139.2	3.70	7379.1	4239.9	0.14
117.7	0.706	420	88.9	1238.4	11.85	0.88	6.90	5.250	8366.8	12715.6	11477.2	3110.4	3.69	7293.8	4183.4	0.15
125.5	0.753	418	89.1	1267.2	12.64	0.87	6.96	5.203	8260.9	12609.7	11342.5	3081.6	3.68	7212.1	4130.5	0.15
134.2	0.805	415	89.3	1296.0	13.52	0.86	7.03	5.151	8116.9	12465.7	11169.7	3052.8	3.66	7111.3	4058.5	0.16
142.2	0.853	413	89.6	1339.2	14.32	0.86	7.10	5.103	7996.7	12345.5	11006.3	3009.6	3.66	7007.9	3998.3	0.17
150.8	0.905	411	89.7	1353.6	15.19	0.85	7.17	5.051	7877.0	12225.8	10872.2	2995.2	3.63	6933.7	3938.5	0.17
167.0	1.002	408	90.3	1440.0	16.82	0.83	7.31	4.954	7652.9	12001.7	10561.7	2908.8	3.63	6735.2	3826.4	0.19

DU @ FAILURE	1382.4	DEVIATORIC STRESS @ FAILURE	8379.7	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.82

TECH	AK
DATE	8/27/09
CHECKED	AK
REVIEWED	

Golder Associates Inc.

APPENDIX E
HORIZONTAL GRADIENT AND FLOW VELOCITY CALCULATIONS

GOLDER ASSOCIATES	GROUNDWATER FLOW VELOCITY ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION							
	Job No.	043-2650.1	Made by	SFS	Date	11/25/2009		
	Ref.		Checked	KLH	Sheet	1	of	1
			Reviewed	KBK				

PURPOSE

To estimate the average linear velocity of groundwater flow in the Ash Disposal Area at the Crystal River Energy Complex, Crystal River, Florida.

METHOD

Using a variation of Darcy's Law (Q = KiA) with hydraulic conductivity values from slug testing, hydraulic gradients from water level measurements, and effective porosity values from literature sources yields the following equation:

$$V_h = \frac{K \bullet i_h}{n_e}$$

Where: V_h = Average linear groundwater velocity (feet/day)
K = Average hydraulic conductivity (feet/day)
i_h = Average horizontal hydraulic gradient (feet/feet)
n_e = Effective porosity (percent)

INPUT VALUES

K = 4.5 feet/day $\Rightarrow$ 22.5 feet/day
i_h = 0.00008 feet/foot (composite)
n_e = 25% (assumed)

Notes:

1. As shown above, for the groundwater velocity calculations, the calculated mean hydraulic conductivity values for each aquifer were increased by one-half order of magnitude. This adjustment is based on experience comparing slug test K-values to pump test K-values and provides a more conservative (higher) hydraulic conductivity value for the calculations of groundwater flow velocity.

2. The assumed effective porosity value of 25 percent is based on literature values reported for karst limestone aquifers (Freeze and Cherry, 1979).

ANALYSIS

$$V_h = \frac{(22.5 \text{ feet/day}) \times (0.00008 \text{ feet/foot})}{0.25} = 0.007 \text{ feet/day} \approx 2.6 \text{ feet/year}$$

REFERENCES

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Inc.

FN: G:\Projects\083\083-82\083-82671\083-82671.1 (Vertical Expansion)\Calculations\Hydraulic Gradients\GW FLOW VELOCITY.Doc

Summary of Horizontal Hydraulic Gradients and Angles

Area	10/23/2009		10/29/2009		Composite Gradient	Average Angle
	Gradient	Angle	Gradient	Angle		
Northern Portion	0.00067	263	0.00021	74	0.00023	217.9
North Central Portion	0.00033	178	0.00014	354	0.00009	230.6
South Central Portion	0.00015	179	0.00023	355	-0.00004	287.4
Southern Portion	0.00032	217	0.00023	303	0.00005	252.8
				OVERALL	**0.00008**	**240**

(If angle between 270° and 90°, the gradient was treated as a negative value)

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 1 OF 8

PURPOSE

To estimate the average horizontal hydraulic gradient in in the Ash Disposal Area at the Crystal River Energy Complex, Crystal River, Florida.

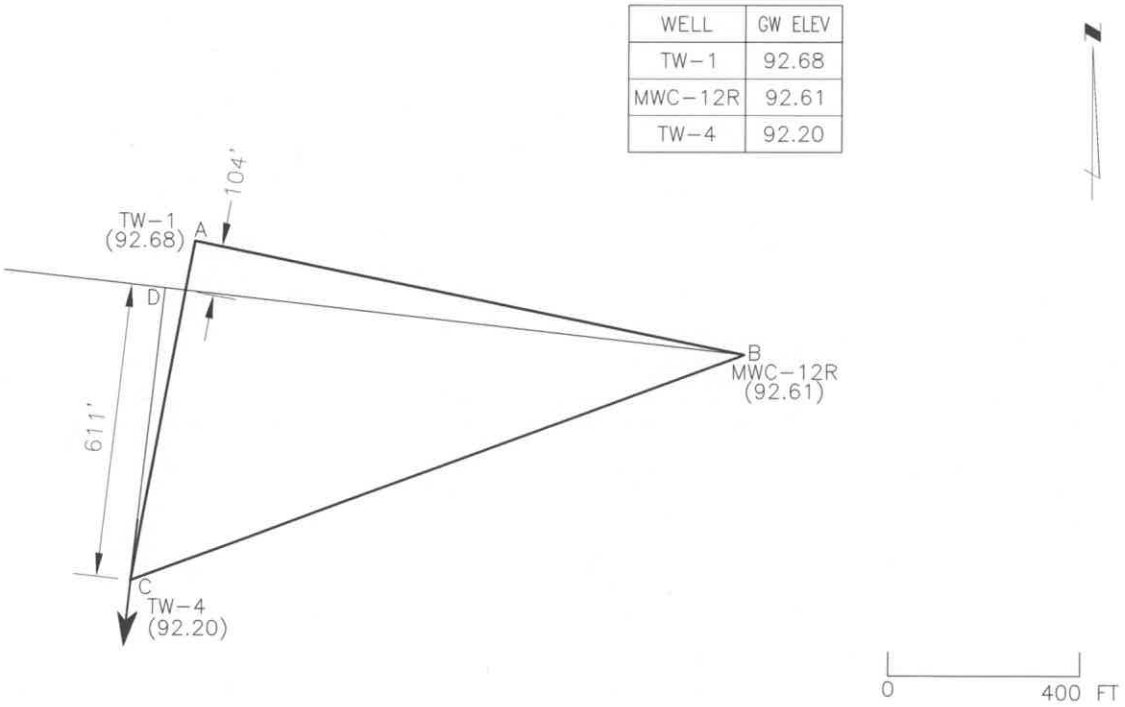
METHOD

Using groundwater elevations measured at the site on October 23, 2009 and October 29,2009 and surveyed locations of the wells, a 3-point analysis was performed using wells at the northern portion, central portion, and southern portion of the site to estimate an average horizontal hydraulic gradient.

ANALYSIS

NORTHERN PORTION - OCTOBER 23, 2009

WELL	GW ELEV
TW-1	92.68
MWC-12R	92.61
TW-4	92.20



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 716 \text{ ft} \times \frac{(92.68-92.61)}{(92.68-92.20)} = 104 \text{ FEET}$$

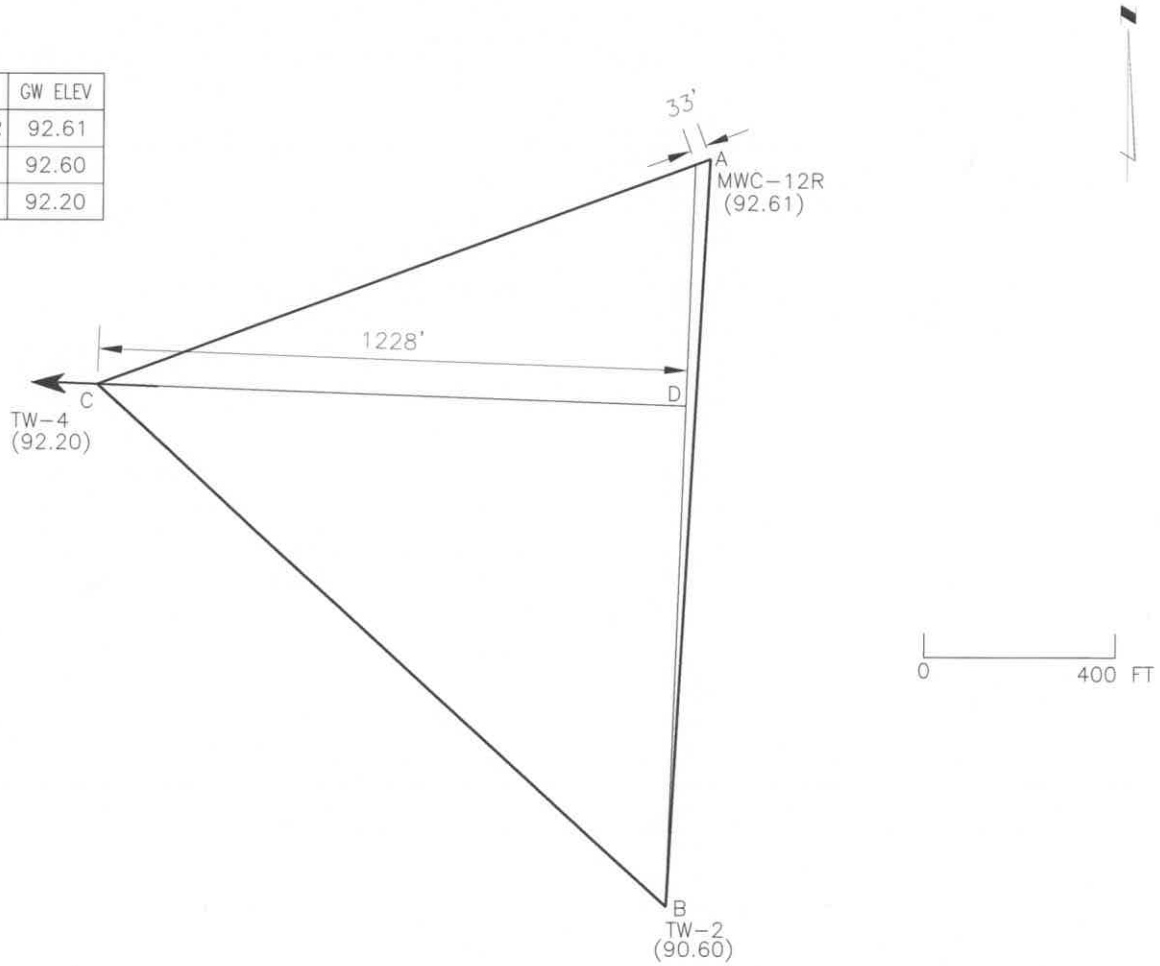
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.61-92.20)}{611} = 0.00067 \text{ FEET/FOOT}$$

ANGLE = 263°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 2 OF 8

NORTH CENTRAL PORTION - OCTOBER 23, 2009

WELL	GW ELEV
MWC-12R	92.61
TW-2	92.60
TW-4	92.20



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}359 \text{ ft} \times \frac{(92.61-92.60)}{(92.61-92.20)} = 33 \text{ FEET}$$

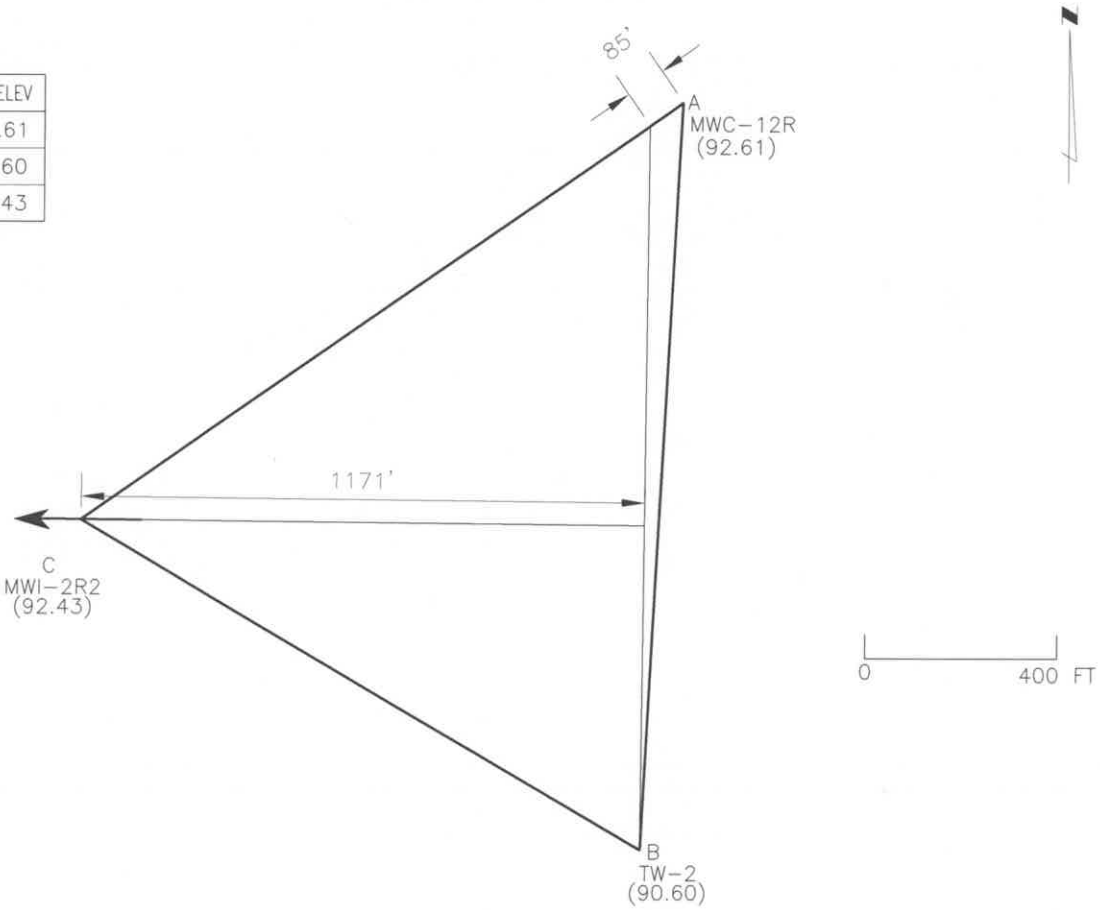
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.60-92.20)}{1228} = 0.00033 \text{ FEET/FOOT}$$

ANGLE = 178°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 3 OF 8

SOUTH CENTRAL PORTION - OCTOBER 23, 2009

WELL	GW ELEV
MWC-12R	92.61
TW-2	92.60
MWI-2R2	92.43



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}521 \text{ ft} \times \frac{(92.61-92.60)}{(92.61-92.43)} = 85 \text{ FEET}$$

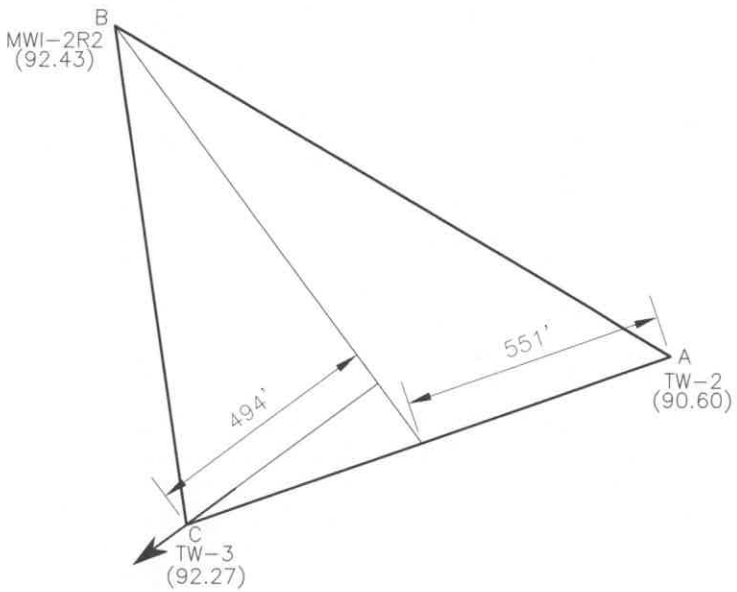
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.60-92.43)}{1171} = 0.00015 \text{ FEET/FOOT}$$

ANGLE = 179°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 4 OF 8

SOUTHERN PORTION - OCTOBER 23, 2009

WELL	GW ELEV
TW-2	92.60
MWI-2R2	92.43
TW-3	92.27



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}069 \text{ ft} \times \frac{(92.60-92.43)}{(92.60-92.27)} = 551 \text{ FEET}$$

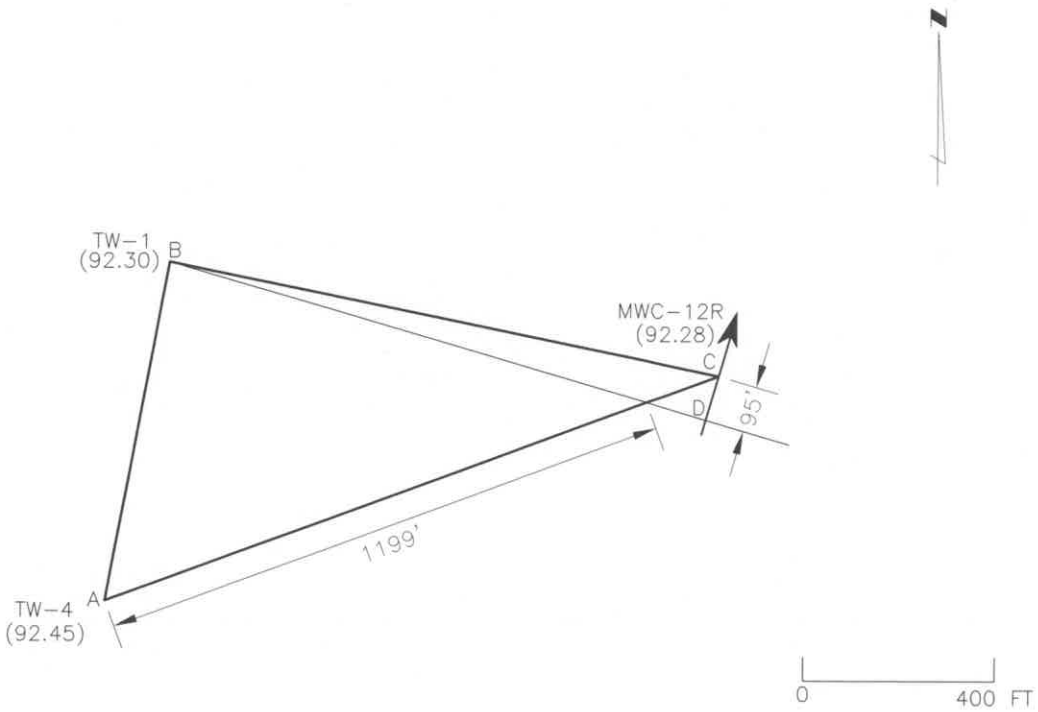
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.43-92.27)}{494} = 0.00032 \text{ FEET/FOOT}$$

ANGLE = 217°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 5 OF 8

NORTHERN PORTION - OCTOBER 29, 2009

WELL	GW ELEV
TW-4	92.45
TW-1	92.30
MWC-12R	92.28



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}359 \text{ ft} \times \frac{(92.45-92.30)}{(92.45-92.28)} = 1{,}199 \text{ FEET}$$

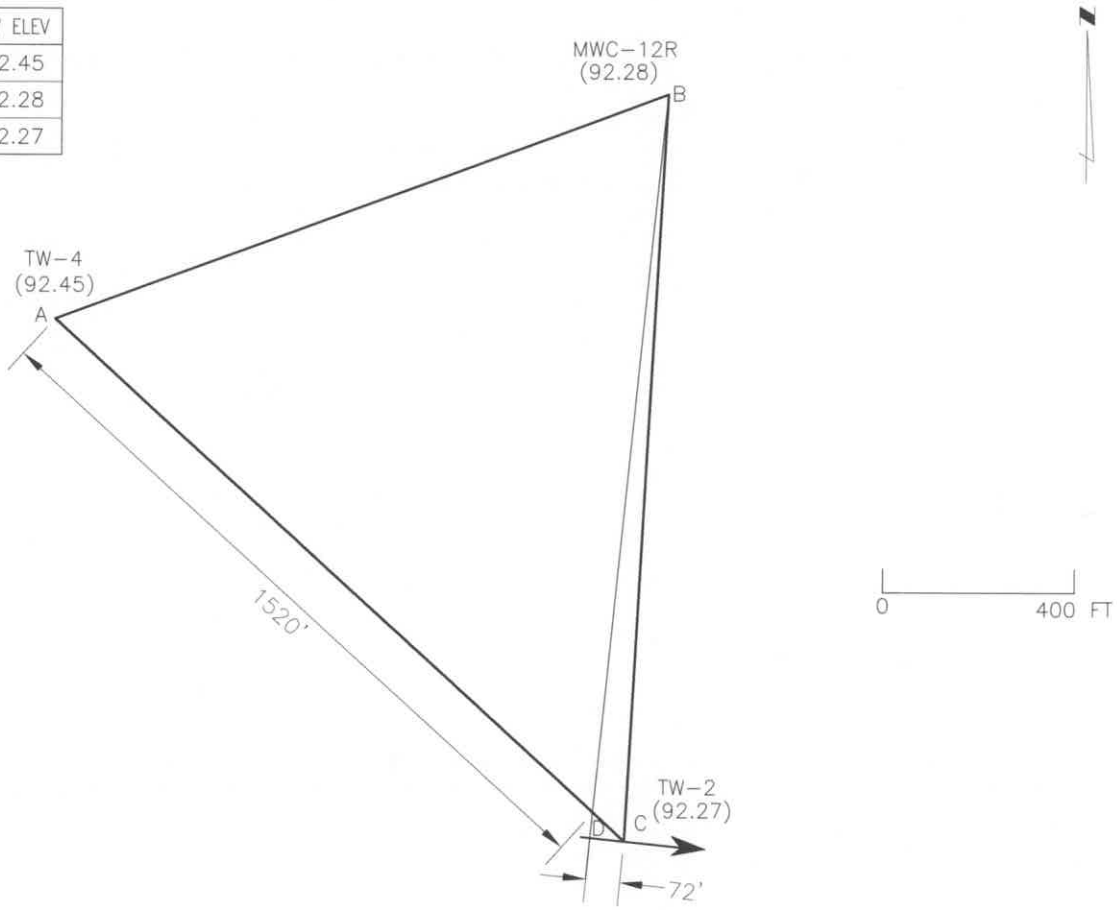
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.30-92.28)}{95} = 0.00021 \text{ FEET/FOOT}$$

ANGLE = 74°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 6 OF 8

NORTH CENTRAL PORTION - OCTOBER 29, 2009

WELL	GW ELEV
TW-4	92.45
MWC-12R	92.28
TW-2	92.27



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}609 \text{ ft} \times \frac{(92.45-92.28)}{(92.45-92.27)} = 1{,}520 \text{ FEET}$$

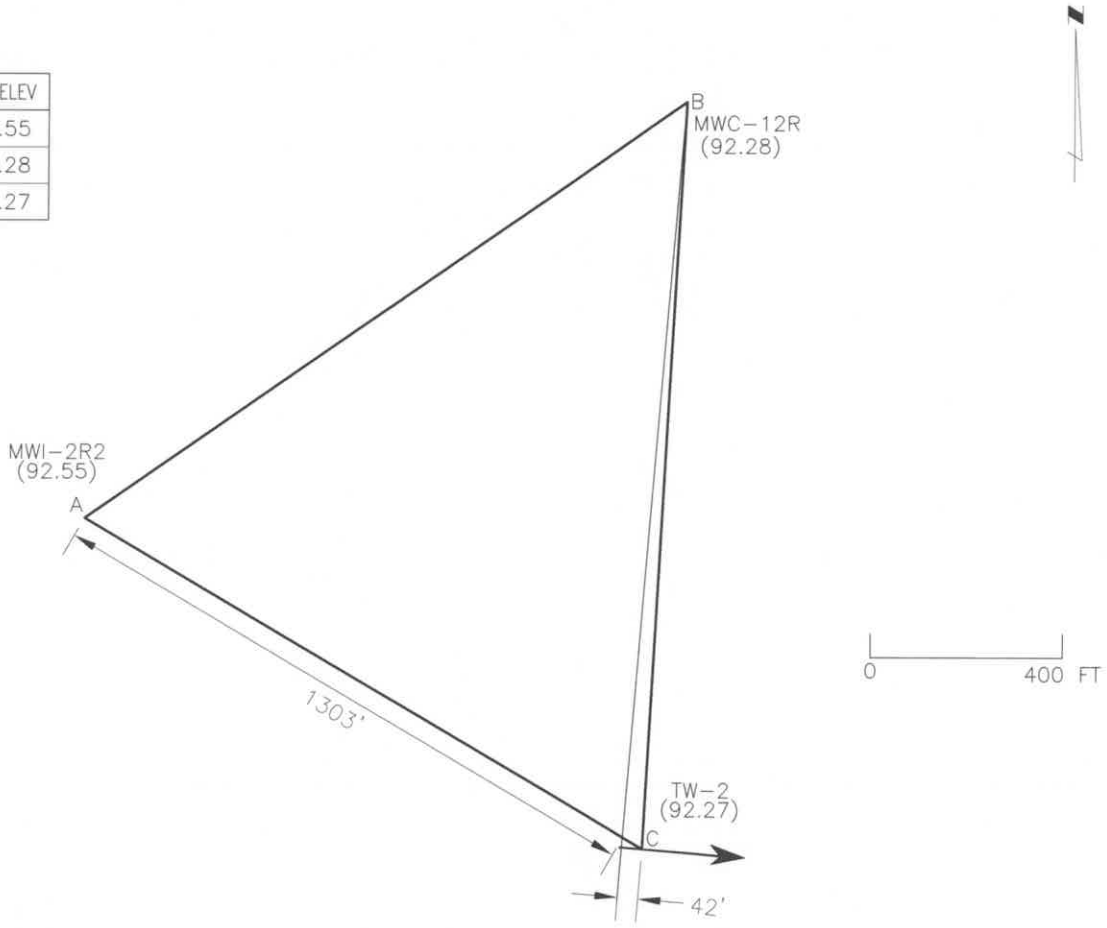
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.28-92.27)}{72} = 0.00014 \text{ FEET/FOOT}$$

ANGLE = 354°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 7 OF 8

SOUTH CENTRAL PORTION - OCTOBER 29, 2009

WELL	GW ELEV
MWI-2R2	92.55
MWC-12R	92.28
TW-2	92.27



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}351 \text{ ft} \times \frac{(92.55-92.28)}{(92.55-92.27)} = 1{,}303 \text{ FEET}$$

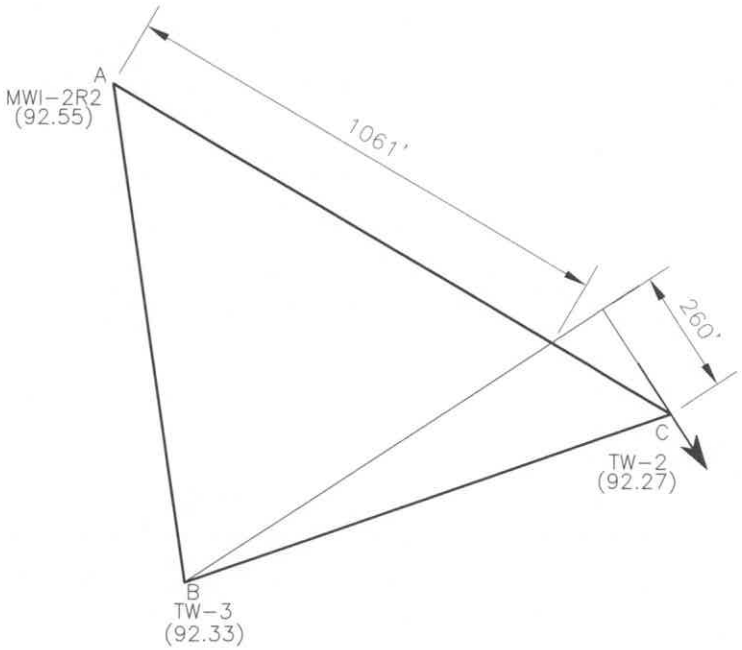
$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.28-92.27)}{43} = 0.00023 \text{ FEET/FOOT}$$

ANGLE = 355°

GOLDER ASSOCIATES	HORIZONTAL HYDRAULIC GRADIENT ESTIMATES PEF CREC ASH DISPOSAL AREA RECONFIGURATION		
	JOB NO. 083-82671.1 REF.	MADE BY SFS CHECKED KLH REVIEWED KBK	DATE 11/25/2009 SHEET 8 OF 8

SOUTHERN PORTION - OCTOBER 23, 2009

WELL	GW ELEV
MWI-2R2	92.55
TW-3	92.33
TW-2	92.27



$$AD = AC \times \frac{(\delta \text{Water Level A-B})}{(\delta \text{Water Level A-C})} = 1{,}351 \text{ ft} \times \frac{(92.55-92.33)}{(92.55-92.27)} = 1{,}061 \text{ FEET}$$

$$i = \frac{(\delta \text{Water Level B-C})}{(\text{DIST DC})} = \frac{(92.33-92.27)}{260} = 0.00032 \text{ FEET/FOOT}$$

ANGLE = 303°

APPENDIX F

GROUNDWATER SAMPLING FIELD FORMS AND EQUIPMENT CALIBRATION RECORDS

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME:	PER / CREC CCP MGMT PLAN / FL 083-82671.1	SITE LOCATION:	CRYSTAL RIVER, FL
WELL NO:	TW-1	SAMPLE ID:	TW-1
DATE:	10/22/2009		

PURGING DATA

WELL DIAMETER (inches):	2	TUBING DIAMETER (inches):	1/4	WELL SCREEN INTERVAL DEPTH:	12.5 feet to 22.5 feet	STATIC DEPTH TO WATER (feet):	6.63	PURGE PUMP TYPE OR BAILER:	PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)

= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME 1.5 = 1.062
(only fill out if applicable)

= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.25 gallons = 0.354 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	17.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	17.5	PURGING INITIATED AT:	1330	PURGING ENDED AT:	1351	TOTAL VOLUME PURGED (gallons):	2.10

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP	COLOR/ODOR (describe)
1345	1.50	1.50	0.10	6.73	7.07 J	25.02	1674	0.99/12.4%	9.79	134.6	clear mod. bdor
1348	0.30	1.80	0.10	6.73	7.07 J	25.04	1675	0.98/12.8%	11.2	132.5	" "
1351	0.30	2.10	0.10	6.73	7.08 J	29.00	1673	0.97/12.6%	9.41	131.6	" "

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	Matthew Hampton / Golder Associates Inc. Sam Stafford / Golder Associates Inc.	SAMPLER(S) SIGNATURE(S):		SAMPLING INITIATED AT:	1352	SAMPLING ENDED AT:	1405
PUMP OR TUBING DEPTH IN WELL (feet):	17.5	TUBING MATERIAL CODE:	PE	FIELD-FILTERED: Y (N) Filtration Equipment Type:		FILTER SIZE: — µm	
FIELD DECONTAMINATION:	PUMP Y (N)	TUBING Y N (replaced)		DUPLICATE: Y (N)			

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
TW-1	1	PE	500 ml	HNO_3	—	<2.0	Total Metals	APP	<100
	~~1~~	~~PE~~	~~500 ml~~	~~HNO_3~~		~~<2.0~~	~~Dissolved Metals~~	~~APP~~	~~<100~~ (#)
	1	PE	500 ml	H_2SO_4	—	<2.0	TN/NH_3	APP	<100
	1	PE	500 ml	—	—	—	Chloride, Nitrate, Sulfate, TDS	APP	<100
	1	PE	125 ml	—	—	—	Fluoride	APP	<100
	1	AG	250 ml	NaOH	—	<2.0	Cyanide	APP	<100
REMARKS	1	~~PE~~ PE	1L	HNO_3	—	<2.0	RAD 226/RAD 228 Gross alpha	APP	<100

C02 (mg/l): — Fe+2 (mg/l): — H2S (mg/l): —

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)
"J" = indicates that the calibration result for the parameter of concern was outside of the acceptable criteria for standard range.

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME:	PER / CREC CCP MGMT PLAN / FL 083-82671.1	SITE LOCATION:	CRYSTAL RIVER, FL
WELL NO:	TW-2	SAMPLE ID:	TW-2
DATE:	10/ 22 /2009		

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches):	WELL SCREEN INTERVAL DEPTH:	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER:
2	1/4	12.5 feet to 22.5 feet	6.92	PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME = 1.19
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 50 feet) + 0.25 gallons = 0.38 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):
17.5	17.5	1641	1706	1.79

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP	COLOR/ODOR (describe)
1654	1.25	1.25	0.09	6.98	6.91 J	26.39	1374	0.37/4.6%	5.36	-28.7	clear, no odor
1857	0.27	1.52	0.09	6.98	6.92 J	26.32	1383	0.38/4.7%	5.19	-30.3	" "
1700	0.27	1.79	0.09	6.98	6.91 J	26.29	1383	0.39/4.8%	4.84	-30.5	" "

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
Matthew Hampton / Golder Associates Inc. Sam Stafford / Golder Associates Inc.	M. Hp=	1701	1715

PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type:	FILTER SIZE: — µm
17.5			

FIELD DECONTAMINATION: PUMP Y (N) TUBING Y (N) replaced) DUPLICATE: Y (N)

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
TW-2	1	PE	500 ml	H_2SO_4	–	<2.0	TN/NH3	APP	<100
	1	PE	500ml	–	–	–	chloride, Nitrate, SO4, TDS	APP	<100
	1	PE	125ml	–	–	–	Fluoride	APP	<100
	1	AG	250ml	NaOH	–	<2.0	Cyanide	APP	<100
	1	PE	1L	HNO_3	–	<2.0	RAD 226/228 GROSS ALPHA	APP	<100
	1	PE	500ml	HNO_3	–	<2.0	Total Metals	APP	<100

REMARKS:

C02 (mg/l): — Fe+2 (mg/l): — H2S (mg/l): —

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)
"J" = indicates that the calibration result for the parameter of concern was outside of the acceptable criteria for standard range.

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME:	PER / CREC CCP MGMT PLAN / FL 083-82671.1	SITE LOCATION:	CRYSTAL RIVER, FL
WELL NO: TW-3	SAMPLE ID: TW-3	DATE:	10/ 27 /2009

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 12.5 feet to 22.5 feet	STATIC DEPTH TO WATER (feet): 9.33	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME x3 = 0.984
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.25 gallons = 0.328 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 17.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 17.5	PURGING INITIATED AT: 1540	PURGING ENDED AT: 1601	TOTAL VOLUME PURGED (gallons): 2.10

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP	COLOR/ODOR (describe)
1555	1.50	1.50	0.10	9.37	7.11 J	24.84	946	0.37/4.4%	6.27	72.6	clear, no odor
1558	0.30	1.80	0.10	9.37	7.12 J	24.82	946	0.35/4.3%	6.20	66.5	" "
1601	0.30	2.10	0.10	9.37	7.12 J	24.81	947	0.35/4.2%	5.72	63.1	" "

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Matthew Hampton / Golder Associates Inc. Sam Stafford / Golder Associates Inc.	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1602	SAMPLING ENDED AT: 1617
PUMP OR TUBING DEPTH IN WELL (feet): 17.5	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type:	FILTER SIZE: — µm
FIELD DECONTAMINATION: PUMP Y (N)	TUBING Y (N) (replaced)	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
TW-3	1	PE	500ml	H_2SO_4	-	<2.0	TN/NH_3	APP	<100
	1	PE	500ml	-	-	-	Chloride, Nitrate, SO_4, TDS	APP	<100
	1	PE	125ml	-	-	-	Fluoride	APP	<100
	1	AG	250ml	NaOH	-	<2.0	Cyanide	APP	<100
	1	PE	1L	HNO_3	-	<2.0	RAD 226/228 GROSS ALPHA	APP	<100
▽	1	PE	500 mL	HNO_3	-	<2.0	Total Metals	APP	<100

REMARKS: —

C02 (mg/l): — Fe+2 (mg/l): — H2S (mg/l): —

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)
"J" = indicates that the calibration result for the parameter of concern was outside of the acceptable criteria for standard range.

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME:	PER / CREC CCP MGMT PLAN / FL 083-82671.1	SITE LOCATION:	CRYSTAL RIVER, FL
WELL NO:	TW-4	SAMPLE ID:	TW-4
DATE:	10/22/2009		

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches):	WELL SCREEN INTERVAL DEPTH:	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER:
2	1/4	13.5 feet to 23.5 feet	6.92	PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)

= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) NOT USED

= 0 gallons + (0.0026 gallons/foot X 40 feet) + 0.25 gallons = 0.354 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):
18.5	18.5	1421	1507	4.74

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP	COLOR/ODOR (describe)
1434	1.25	1.25	0.09	10.24	6.76 J	25.66	1410	0.81/11.0 %	51.2	142.5	clear odor
1437	0.27	1.52	0.09	10.24	6.75 J	25.65	1417	0.87/11.7 %	40.6	141.5	" "
1440	0.27	1.79	0.09	10.24	6.74 J	25.74	1419	0.95/12.4 %	31.4	140.2	" "
1501	2.43	4.22	0.09	10.24	6.77 J	26.21	1426	0.88/10.9 %	15.2	126.1	" "
1504	0.27	4.49	0.09	10.24	6.75 J	26.15	1426	0.86/10.7 %	14.7	125.7	" "
1507	0.27	4.76	0.09	10.24	6.75 J	26.16	1426	0.85/10.6 %	13.3	125.4	" "
* DUSTY AREA *											

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
Matthew Hampton / Golder Associates Inc. Sam Stafford / Golder Associates Inc.	M. Hampton	1508	1525

PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y (N) Filtration Equipment Type:	FILTER SIZE: — µm
18.5	PE		

FIELD DECONTAMINATION: PUMP Y (N) TUBING Y (N) (replaced) DUPLICATE: Y (N)

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
TW-4	1	PE	500ml	H_2SO_4	—	<2.0	TN / NH_3	APP	<100
	1	PE	500ml	—	—	—	Chloride, Nitrate, SO_4, TDS	APP	<100
	1	PE	125ml	—	—	—	Fluoride	APP	<100
	1	AG	250ml	NaOH	—	<2.0	Cyanide	APP	<100
	1	PE	1 L	HNO_3	—	<2.0	RAD226/RAD228 GROSS ALPHA	APP	<100
	1	PE	500ml	HNO_3	—	<2.0	Total Metals	APP	<100

REMARKS:

C02 (mg/l): — Fe+2 (mg/l): — H2S (mg/l): —

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)
"J" = indicates that the calibration result for the parameter of concern was outside of the acceptable criteria for standard range.

Golder Associates

Field Instrument Dissolved Oxygen & Oxidation-Reduction Potential Calibration Records

INSTRUMENT (MAKE/MODEL NO.) **YSI 556 MPS** **INSTRUMENT NO.** 02603 / YSI #5

STANDARD INFORMATION

Project Number: 083-82671.1 **Project Name:** PEF / CREC CCP MGMT PLAN / FL

Standard Vendor: GEOTECH

Prepared Date: AUG-09 **Where Prepared:** Golder Associates Inc.

Grade: NA **DO Units:** mg/L **ORP Units:** mV

ORP Standard **Lot # 9AG004 Exp Date: APR-10 Pur Date: AUG-09**

DO Standard Air Calibration Chamber in Air (Table FS 2200-2)

Standard

Standard

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C	CHART 100% VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
10/22/09	1100	24.72	8.309	75.5 8.317 4.28	<0.3	P	No	INIT	MH / SS
10/22/09	1730	20.65	8.985	85.0 8.97 7.49	< 0.3	P	No	FINAL	MH / SS
ORP									
10/22/09	1102	23.47	~222	207.5	>10 mV	F	Yes	INIT	MH / SS
10/22/09	1103	23.58	~222	2220	<10 mV	P	No	~~FINAL~~	MH / SS
10/22/09	1732	24.29	~220.5	225.9	<10mV	P	No	Final	MH/SS

Acceptable calibration check is if the meter reads within +/- 0.3 mg/L of the value of appropriate calibration standard. Need to record DO readings in mg/L and use Table FS 2200-2 "Dissolved Oxygen Saturation". ORP calibration reading must be within +/- 10 mV from the theoretical redox standard value at that temperature.

Golder Associates

Field Instrument Conductivity Calibration Records

INSTRUMENT (MAKE/MODEL NO.) **YSI 556 MPS** **INSTRUMENT NO.** 02003/YSI #5

STANDARD INFORMATION

Project Number: 083-82671.1 **Project Name:** PEF / CREC CCP MGMT PLAN / FL

Standard Vendor: GEOTECH

Prepared Date: UKN **Where Prepared:** Golder Associates Inc.

Grade: NA **Units:** umhos/uS-cm

Standard 84 uS / cm @ 25°C *Lot# 9AH041 Purchase date: AUG-09 Expiration date: AUG-10*

Standard 500 uS / cm @ 25°C *Lot# 9AH037 Purchase date: AUG-09 Expiration date: AUG-10*

Standard 2000 uS / cm @ 25°C *Lot# 9AF367 Purchase date: AUG-09 Expiration date: JUN-10*

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C°	STD VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
10/22/09	1106	22.72	2000	1998	< 5%	P	No	INIT	MH / SS
10/22/09	1108	22.78	500	510	< 5%	P	No	INIT	MH / SS
10/22/09	1110	23.10	84	85	< 5%	P	No	INIT	MH / SS
10/22/09	1737	24.44	2000	2011	< 5%	P	No	FINAL	MH / SS
10/22/09	1739	24.59	500	511	< 5%	P	No	FINAL	MH / SS
10/22/09	1741	24.66	84	85	< 5%	P	No	FINAL	MH / SS

Acceptable calibration check is if the meter reads within +/- 5% of the appropriate calibration standard.

Golder Associates

Field Instrument pH Calibration Records

INSTRUMENT (MAKE/MODEL NO.) **YSI 556 MPS** **INSTRUMENT NO.** 02603 / YSI #5

STANDARD INFORMATION

Project Number: 083-82671.1 **Project Name:** PEF / CREC CCP MGMT PLAN / FL

Standard Vendor: LSS

Prepared Date: AUG-09 **Where Prepared:** Golder Associates Inc.

Grade: UKN **Units:** Standard Units

Standard 4.01 @ 25 Deg C **Lot #** 9169-09 **Exp Date:** JUN-10 **Purch Date** AUG-09

Standard 7.00 @ 25 Deg C **Lot #** 9079-05 **Exp Date** MAR-11 **Purch Date** AUG-09

Standard 10.0 @ 25 Deg C **Lot #** 9147-17 **Exp Date** JUN-10 **Purch Date** AUG -09

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C	STD VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
10/22/09	1112	22.78	7.00	7.10	< 0.2	P	No	INIT	MH / SS
10/22/09	1114	23.29	4.01	3.97	< 0.2	P	No	INIT	MH / SS
10/22/09	1116	22.91	10.0	9.92	< 0.2	P	No	INIT	MH / SS
10/22/09	1740	24.82	7.00	7.25	> 0.2	F	No	FINAL	MH / SS
10/22/09	1742	24.61	4.01	4.08	< 0.2	P	No	FINAL	MH / SS
10/22/09	1744	24.70	10.0	10.14	< 0.2	P	No	FINAL	MH / SS

Acceptable calibration check is if the meter reads within +/- 0.2 pH units of the value of appropriate calibration standard.

Equipment Services Program
Jacksonville, FL

Calibration Standards Data

Used during:
8/27/2009 to Current

Parameter	Temperature	pH			Conductivity			ORP	Turbidity			
Value	ERTCO Thermometer	4.01	7	10	84	500	2000	220	0.1-10	11.0-40	41.0-100	>100
Measurement	Celcius	pH	pH	pH	mS/cm	mS/cm	mS/cm	mV	NTU	NTU	NTU	NTU
Volume	-1 to 101 C	250	250	250	250	250	250	250	15	15	15	15
Unit of Measure	Degrees C	m/L	m/L	m/L	m/L	m/L	m/L	m/L	m/L	m/L	m/L	m/L
Lot #	2401	9169-05	9079-05	9147-17	9AH041	9AH037	9AF367	9AG004	A9212	A9211	A9216	A9215
Purchase Date	May '04	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09
Preparation Date	May-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09	Aug-09
Expiration Date	Oct-10	Jun-11	Mar-11	Jun-10	Aug-10	Aug-10	Jun-10	Apr-10	Aug-11	Aug-11	Aug-11	Aug-11
Vendor Name	hf scientific	LSS	LSS	LSS	GEOTECH	GEOTECH	GEOTECH	GEOTECH	HACH	HACH	HACH	HACH
Loc. of Preparation	hf scientific	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER	GOLDER
Acceptance Criteria	+/- 0.2°C	+/- 0.2 pH units			+/- 5%			+/- 20mV	+/- 10%	+/- 8.0%	+/- 6.5%	+/- 5%

"Loc. of Preparation" indicates the transfer of solutions from manufacturers' containers to GAI containers for field use, except where otherwise noted.
No solutions are mixed or created at Golder.
"Preparation Date" is typically 1 - 3 days prior to scheduled activity, except in the case of thermometer calibration check.
ORP solution will yield more calibrations if kept clean and it requires less than 50 mL to perform a calibration check.
NIST Thermometer: Serial # 2401, Product # 1005, Inscription: ERTCO, Scale range: -1 to 101 C, Total Immersion, Scale division: 0.1

Advanced Environmental Laboratories, Inc.

Page 1 of 1 LAB NUMBER:

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CLIENT NAME: Golder Associates Inc
ADDRESS: 9428 Baymeadows Rd, Suite 400
Jacksonville FL 32256
PHONE: (904) 363-3130
FAX: (904) 363-3115
CONTACT: Ken Kerasky
SAMPLED BY: Matthew Hampton
TURN AROUND TIME: ☑ STANDARD _____ ☒ RUSH _____

PROJECT NAME: CREC Ash Expansion
P.O. NUMBER/PROJECT NUMBER: 083-82671
PROJECT LOCATION: Crystal River, FL
REMARKS/SPECIAL INSTRUCTIONS:

SAMPLE ID	SAMPLE DESCRIPTION	Grab Comp	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. COUNT	PRESERVATION
TW-1		G	10/22/09	1352	GW	7	
TW-2		G	10/22/09	1701	GW	7	
TW-3		G	10/22/09	1602	GW	7	
TW-4		G	10/22/09	1508	GW	7	

ANALYSIS REQUIRED

BOTTLE SIZE & TYPE	500ml PE	250ml AG	500ml PE	125ml PE	1 L PE	1 L PE	500ml PE				LABORATORY I.D. NUMBER
	Chloride, Nitrate, Sulf, TDS	Cyanide	TN/NH3	Fluoride	RAD 226/RAD228	GROSS ALPHA	Total Metals				
	I	T/I	S/I	I	N/I	N/I	N/I				
	1	1	1	1	1	1	1				
	1	1	1	1	1	1	1				
	1	1	1	1	1	1	1				
	1	1	1	1	1	1	1				

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge

Preservation Code: I = ice H=(HCl) S = (H2SO4) N = (HNO3) T = (Sodium Thiosulfate)

Received on Ice ☐ Yes ☐ No ☐ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked Temperature when received _____(in degrees celcius)

Form revised 2/8/08

Device used for measuring Temp by unique identifier (circle IR temp gun used) J : 9A G: LT-1 LT-2 T: 10A A: 3A

	Relinquished by:	Date	Time	Received by:	Date	Time
1		10/23/09	0907		10/23/09	09:07
2						
3						
4						

FOR DRINKING WATER USE:
(When PWS Information not otherwise supplied) PWS ID:_____
Contact Person:_____ Phone :_____
Supplier of Water:_____
Site-Address:_____

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Progress Energy Florida - CREC (083-82671.1)	SITE LOCATION: Crystal River, Florida	
WELL NO: TW-5	SAMPLE ID: TW-5	DATE: 1/14/2010

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): 0.25	WELL SCREEN INTERVAL DEPTH: 9.5 feet to 19.5 feet	STATIC DEPTH TO WATER (feet): 7.84	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)

= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)

= Ø gallons + (0.0026 gallons/foot X 40 feet) + 0.25 gallons = 0.35 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15	PURGING INITIATED AT: 1415	PURGING ENDED AT: 1440	TOTAL VOLUME PURGED (gallons): 2.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP	COLOR/ODOR (describe)
1430	1.2	1.2	0.08	7.85	6.59	21.83	1736	0.29 @ 3.3%	3.43	10.0	CLEAR / NONE
1433	0.25	1.45	0.08	7.86	6.60	21.97	1735	0.27 @ 3.0%	5.53	8.1	" "
1436	0.25	1.7	0.08	7.86	6.61	21.96	1739	0.22 @ 2.5%	3.44	4.3	" "
1439	0.25	1.95	0.08	7.86	6.62	22.16	1741	0.21 @ 2.4%	2.71	1.4	" "

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Sam Stafford / Golder Associates Inc.	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1440	SAMPLING ENDED AT: 1455
PUMP OR TUBING DEPTH IN WELL (feet): 15	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type:	FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y (N)	TUBING Y (N) (replaced)	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
TW-5	1	PE	1 L	HNO3	—	<2	Gross Alpha	APP	300
	1	PE	1 L	HNO3	—	<2	Radium 226/228	APP	300
	1	PE	500 mL	H2SO4	—	<2	NH3, TN	APP	300
	1	PE	500 mL	HNO3	—	<2	Metals	APP	300
	1	AG	250 mL	NaOH	—	-	Cyanide	APP	300
	1	PE	120 mL	None	—	-	Flouride	APP	300
	1	PE	1 L	none	—	-	Cl,NO3,SO4,TDS	APP	300

REMARKS:

C02 (mg/l): N/A Fe+2 (mg/l): N/A H2S (mg/l): N/A

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)
"J" = indicates that the calibration result for the parameter of concern was outside of the acceptable criteria for standard range.

Revision Date: February 12, 2009

Golder Associates

Field Instrument Turbidity Calibration Records

INSTRUMENT (MAKE/MODEL NO.) *HACH 2100 P* **INSTRUMENT NO.** *HT-4*

Project Number: 093-82538 083-82671.1 **Project Name:** PEF CREC / FLD PONDS WELLS / FL PEF CREC / ASH DISPOSAL AREA WELL / FL

Standard Vendor: *HACH*

Prepared Date: *AUG 2009* **Where Prepared:** *GOLDER ASSOCIATES*

Purchase Date: *AUG 2009* **Expiration Date:** *AUG 2011* **Lot Number:** *SEE BELOW*

Units:Nephelometric Turbidity Unit

Standard ~~<0.1 SFS~~ *Nephelometric Turbidity Unit* 5.10 *LOT # A9212*

Standard ~~20 SFS~~ *Nephelometric Turbidity Unit* 53.9 *LOT#* ~~*A9211* SFS~~ A9216

Standard ~~100 SFS~~ *Nephelometric Turbidity Unit* 510 *LOT#* ~~*A9216* SFS~~ A9215

Standard ~~800 SFS~~ ~~*Nephelometric Turbidity Unit* SFS~~ ~~*LOT# A9215* SFS~~

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C	STD VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
01/19/10	0855	10°C	5.10	5.07	0.6%	P	N	INIT	SFS
↓	0856	10°C	53.9	53.7	0.4%	P	N	INIT	SFS
↓	0857	10°C	510	511	0.2%	P	N	INIT	SFS
1/14/10	1831	~10°C	5.10	5.14	0.8%	P	N	CONT	~~SFS~~
↓	1832	~10°C	53.9	53.7	0.4%	P	N	CONT	SFS
	1833	~10°C	510	512	0.4%	P	N	CONT	SFS

Calibration values for turbidity needs to be within 10% of the standard for values between 0.1-10 NTU; 8% for values between 11-40 NTU; 6.5% for values between 41-100 NTU and 5% for values >100 NTU.

Golder Associates

Field Instrument Conductivity Calibration Records

INSTRUMENT (MAKE/MODEL NO.) *YSI 556 MPS* **INSTRUMENT NO.** *YSI - 2*

STANDARD INFORMATION

Project Number: ~~043-82538~~ *083-82671.1* **Project Name:** ~~PEF CREC/ FGD POND WELLS / FL~~ *PEF CREC/ ASH DISPOSAL AREA WELL / FL*

Standard Vendor: *GEOTECH*

Prepared Date: *AUGUST 2009* **Where Prepared:** *GOLDER ASSOCIATES*

Grade: *N/A* **Units:** *umhos/uS-cm*

Standard *84@25 °C* **Lot #***9AH041* **Exp Date** *AUG 2009* **Pur Date** *AUG 2009*

Standard *500@25 °C* **Lot #***9AH037* **Exp Date** *AUG 2009* **Pur Date** *AUG 2009*

Standard *2000@25 °C* **Lot #***9AF367* **Exp Date** *AUG 2009* **Pur Date** *AUG 2009*

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C°	STD VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
01/14/10	0918	11.40	84	84	0 %	P	N	INIT	SFS
↓	0920	11.61	500 (SFS)	509	1.8 %	P	N	INIT	SFS
↓	0922	11.20	2000	2016	0.8 %	P	N	INIT	SFS
1/19/10	1835	12.14	84	85	1 %	P	N	CONT	SFS
↓	1837	11.97	500	511	2.2 %	P	N	CONT	SFS
↓	1839	12.04	2000	2018	0.9	P	N	CONT	SFS

Acceptable calibration check is if the meter reads within +/- 5% of the appropriate calibration standard.

Note: Standards and instrument response readings are corrected to 25°C.

Golder Associates

Field Instrument pH Calibration Records

INSTRUMENT (MAKE/MODEL NO.) *YSI 556 MPS* **INSTRUMENT NO.** YSI-2 (02171)

STANDARD INFORMATION

Project Number: 083-82671.1 093-82538 **Project Name:** PEF CRE / FLD POND WELL/FL PEF CREEK/ASH DISPOSAL WELL/FL

Standard Vendor: *LSS*

Prepared Date: *AUG 2009* **Where Prepared:** *GOLDER ASSOCIATES*

Purchase Date: *AUG 2009* **Expiration Date:** *Varies* **Grade:** *N/A* **Units:** *Standard Units*

Standard *4.01 @25 °C* **Lot #** *9169-05* **Exp Date** *JUN 2011* **Purch Date** *AUG 2009*

Standard *7.00 @25 °C* **Lot #** *9079-05* **Exp Date** *MAR 2011* **Purch Date** *AUG 2009*

Standard *10.0 @25 °C* **Lot #** *9147-17* **Exp Date** *JUN 2011* **Purch Date** *AUG 2009*

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C	STD VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
1/19/2010	0910	12.42	7.05	7.05	0 %	P	Y	INIT	SFS
1/19/2010	0912	12.27	4.00	4.00	0%	P	Y	INIT	SFS
1/19/2010	0914	12.26	10.12	10.07	0.5%	P	Y	INIT	SFS
1/19/2010	1842	11.86	7.05	7.08	0.4%	P	N	CONT	SFS
↓	1844	12.16	4.00	4.04	1%	P	N	CONT	SFS
↓	1846	11.93	10.12	10.03	0.9%	P	N	CONT	SFS

Acceptable calibration check is if the meter reads within +/- 0.2 pH units of the value of appropriate calibration standard.

Golder Associates

Field Instrument Dissolved Oxygen & Oxidation-Reduction Potential Calibration Records

INSTRUMENT (MAKE/MODEL NO.) *YSI 556 MPS* **INSTRUMENT NO.** YSI-2

STANDARD INFORMATION

Project Number: 093-82538 (093-82671.1) **Project Name:** PEF CREC/ASH DISPOSAL AREA WELLS/FL PEF CREC/FGD POND WELLS/FL

Standard Vendor: *GEOTECH*

Prepared Date: *AUG 2009* **Where Prepared:** *GOLDER ASSOCIATES*

Grade: *N/A* **DO Units:** *mg/L* **ORP Units:** *mV*

ORP Standard *220@25 °C* **Lot #** *9AG004* **Exp Date** *APR 2010* **P ur Date** *AUG 2009*

DO Standard *Air Calibration Chamber in Air (Table FS 2200-2)*

Standard _____

Standard _____

DATE (mm/dd/yy)	TIME (hr:min)	TEMP DEG C	CHART 100% VALUE	INSTRUMENT RESPONSE	% DEV	PASS/ FAIL	CALIBRATED (YES, NO)	TYPE (INIT, CONT)	SAMPLER INITIALS
1/19/2010	0904	10.98	11.027	11.02	0.06%	P	N	INIT	SFS
1/19/2010	1856	11.44	10.777	10.68	0.9%	P	N	CONT	SFS
2P				ORP					
01/19/10	0928	12.42	~240.5	247.1	2.7%	P	N	INIT	SFS
1/19/10	1900	11.36	~242.8	248.6	2.4%	P	N	CONT	SFS

Acceptable calibration check is if the meter reads within +/- 0.3 mg/L of the value of appropriate calibration standard. Need to record DO readings in mg/L and use Table FS 2200-2 "Dissolved Oxygen Saturation". ORP calibration reading must be within +/- 10 mV from the theoretical redox standard value at that temperature.

Advanced Environmental Laboratories, Inc.

Page_____ of _____ LAB NUMBER:

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- [ ] 528 S. North Lake Blvd., Ste. 1016 • Altamonte Springs, FL 32701 • 407.937.1594 • Fax 407.937.1597• E53076

CLIENT NAME: ~~PROGRESS ENERGY FL CREC~~ GOLDER ASSOCIATES	PROJECT NAME: PROGRESS ENERGY CREC
ADDRESS: 9428 RAMEADOWS RD	P.O. NUMBER/PROJECT NUMBER: 083-82071.1
SUITE 400 JAX. FL. 32256	PROJECT LOCATION: CRYSTAL RIVER, FL
PHONE: 904.363.3430	REMARKS/SPECIAL INSTRUCTIONS:
FAX:	
CONTACT: K. KARABLY	
SAMPLED BY: S. STAFFORD	
TURN AROUND TIME: ☐ STANDARD _____ ☐ RUSH _____	

SAMPLE ID	SAMPLE DESCRIPTION	Grab Comp	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. COUNT	PRESERVATION	ANALYSIS REQUIRED: Gross Alpha	Rad 226/Rad 228	NH_3, TN	METALS	CYANIDE	FLOURIDE	Cl, NO_3, SO_4, TDS				LABORATORY I.D. NUMBER
BOTTLE SIZE & TYPE								1L PE	1L PE	500mL PE	500mL PE	250mL AG	120mL PE	1L PE				
TW-5	TW-5	G	1/19/10	1440	GW	7	N	1	1	1	1	1	1	1				001

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge

Preservation Code: I = ice H=(HCl) S = (H_2SO_4) N = (HNO_3) T = (Sodium Thiosulfate)

Received on Ice ☒ Yes ☐ No ☒ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked Temperature when received 1 (in degrees celcius)

Form revised 2/8/08

Device used for measuring Temp by unique identifier (circle IR temp gun used) J : 9A G: LT-1 LT-2 T: 10A A: 3A

	Relinquished by:	Date	Time	Received by:	Date	Time
1		1/20/10	09:30		1-20-10	09:30
2						
3						
4						

FOR DRINKING WATER USE:

(When PWS Information not otherwise supplied) PWS ID:_____

Contact Person:_____ Phone :_____

Supplier of Water:_____

Site-Address:_____

APPENDIX G
GROUNDWATER LABORATORY ANALYTICAL REPORTS

Advanced Environmental Laboratories, Inc.

Advanced Environmental Laboratories, Inc
6601 Southpoint Parkway
Jacksonville, FL 32216
Phone: (904)363-9350
Fax: (904)363-9354

November 3, 2009

Ken Karably
Golder Associates
9428 Baymeadows Rd
Suite 400
Jacksonville, FL 32256

RE: Workorder: J0908639 CREC Ash Expansion

Dear Ken Karably:

Enclosed are the analytical results for sample(s) received by the laboratory on Tuesday, October 27, 2009. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report. The analytical results for the samples contained in this report were submitted for analysis as outlined by the Chain of Custody and results pertain only to these samples.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Paul Gunsaulies for
Bob Dempsey
bdempsey@aellab.com

Enclosures

CERTIFICATE OF ANALYSIS

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Advanced Environmental Laboratories, Inc.

Advanced Environmental Laboratories, Inc
6601 Southpoint Parkway
Jacksonville, FL 32216
Phone: (904)363-9350
Fax: (904)363-9354

SAMPLE SUMMARY

Workorder: J0908639 CREC Ash Expansion

Lab ID	Sample ID	Matrix	Date Collected	Date Received
J0908639001	TW-1	Water	10/22/2009 13:52	10/27/2009 08:30
J0908639002	TW-2	Water	10/22/2009 17:01	10/27/2009 08:30
J0908639003	TW-3	Water	10/22/2009 16:02	10/27/2009 08:30
J0908639004	TW-4	Water	10/22/2009 15:08	10/27/2009 08:30

CERTIFICATE OF ANALYSIS

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Advanced Environmental Laboratories, Inc.

Advanced Environmental Laboratories, Inc
6601 Southpoint Parkway
Jacksonville, FL 32216
Phone: (904)363-9350
Fax: (904)363-9354

ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639001** Date Received: 10/27/2009 08:30 Matrix: Water

Sample ID: **TW-1** Date Collected: 10/22/2009 13:52

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
METALS								
Analysis Desc: SW846 6010B Analysis,Water	Preparation Method: SW-846 3010A Analytical Method: SW-846 6010							
Aluminum	**0.061**	**mg/L**	**U**	**1**	0.20	0.061	10/28/2009 17:11	J
Arsenic	**0.0085**	**mg/L**	**U**	**1**	0.010	0.0085	10/28/2009 17:11	J
Barium	**0.014**	**mg/L**		**1**	0.0020	0.00028	10/28/2009 17:11	J
Beryllium	**0.00013**	**mg/L**	**U**	**1**	0.00030	0.00013	10/28/2009 17:11	J
Boron	**0.99**	**mg/L**	**V**	**1**	0.015	0.0043	10/28/2009 17:11	J
Cadmium	**0.00032**	**mg/L**	**U**	**1**	0.00060	0.00032	10/28/2009 17:11	J
Chromium	**0.00050**	**mg/L**	**U**	**1**	0.0040	0.00050	10/28/2009 17:11	J
Cobalt	**0.00060**	**mg/L**	**U**	**1**	0.0040	0.00060	10/28/2009 17:11	J
Copper	**0.0025**	**mg/L**	**U**	**1**	0.0040	0.0025	10/28/2009 17:11	J
Iron	**0.038**	**mg/L**	**U**	**1**	0.20	0.038	10/28/2009 17:11	J
Lead	**0.0013**	**mg/L**	**U**	**1**	0.0070	0.0013	10/28/2009 17:11	J
Molybdenum	**0.0041**	**mg/L**	**U**	**1**	0.010	0.0041	10/28/2009 17:11	J
Nickel	**0.0011**	**mg/L**	**U**	**1**	0.0065	0.0011	10/28/2009 17:11	J
Selenium	**0.0068**	**mg/L**	**U**	**1**	0.020	0.0068	10/28/2009 17:11	J
Sodium	**170**	**mg/L**		**1**	0.20	0.026	10/28/2009 17:11	J
Vanadium	**0.0023**	**mg/L**		**1**	0.0015	0.00018	10/28/2009 17:11	J
Zinc	**0.016**	**mg/L**		**1**	0.010	0.0020	10/28/2009 17:11	J
Analysis Desc: SW846 6020B Analysis,Total	Preparation Method: SW-846 3010A Analytical Method: SW-846 6020							
Antimony	**1.0**	**ug/L**		**1**	0.60	0.073	10/28/2009 16:24	J
Thallium	**0.26**	**ug/L**		**1**	0.20	0.067	10/28/2009 16:24	J
Analysis Desc: Total Dissolved Solids,E160.1,Water	Analytical Method: EPA 160.1							
Total Dissolved Solids	**810**	**mg/L**		**1**	10	10	10/27/2009 10:06	J
Analysis Desc: Chlorides,SM4500-Cl-E,Water	Analytical Method: SM 4500-Cl-E							
Chloride	**350**	**mg/L**		**5**	10	7.3	10/30/2009 16:06	J
Analysis Desc: Sulfate,E375.4,Water	Analytical Method: EPA 375.4							
Sulfate	**150**	**mg/L**		**5**	50	25	11/2/2009 11:06	J
Analysis Desc: Total Nitrogen,Calculated,Water	Analytical Method: Calculation							

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639001** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-1** Date Collected: 10/22/2009 13:52

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Total Nitrogen	**0.47**	**mg/L**		**1**	0.052	0.052	11/3/2009 13:09	J
WET CHEMISTRY								
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Fluoride	**0.063**	**mg/L**	**I**	**1**	0.20	0.055	10/29/2009 14:28	T
Analysis Desc: Ammonia,E350.1,Water	Analytical Method: EPA 350.1							
Ammonia	**0.010**	**mg/L**	**U**	**1**	0.040	0.010	11/2/2009 14:00	T
Analysis Desc: TKN,E351.2,Water	Preparation Method: EPA 351.2 Analytical Method: EPA 351.2							
Total Kjeldahl Nitrogen	**0.47**	**mg/L**		**1**	0.080	0.052	10/29/2009 21:52	T
Analysis Desc: Nitrate+Nitrite,SM4500NO3F,W	Analytical Method: SM 4500NO3-F							
Nitrate + Nitrite	**0.048**	**mg/L**	**U**	**1**	0.20	0.048	10/30/2009 10:53	T
Analysis Desc: Cyanide, SM4500-E, Water	Analytical Method: SM 4500-CN-E							
Cyanide	**0.00097**	**mg/L**	**U**	**1**	0.0020	0.00097	11/2/2009 16:28	T

Lab ID: **J0908639002** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-2** Date Collected: 10/22/2009 17:01

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
METALS								
Analysis Desc: SW846 6010B Analysis,Water	Preparation Method: SW-846 3010A Analytical Method: SW-846 6010							
Aluminum	**0.061**	**mg/L**	**U**	**1**	0.20	0.061	10/28/2009 17:36	J
Arsenic	**0.0085**	**mg/L**	**U**	**1**	0.010	0.0085	10/28/2009 17:36	J
Barium	**0.15**	**mg/L**		**1**	0.0020	0.00028	10/28/2009 17:36	J
Beryllium	**0.00013**	**mg/L**	**U**	**1**	0.00030	0.00013	10/28/2009 17:36	J
Boron	**1.1**	**mg/L**	**V**	**1**	0.015	0.0043	10/28/2009 17:36	J

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639002** Date Received: 10/27/2009 08:30 Matrix: Water

Sample ID: **TW-2** Date Collected: 10/22/2009 17:01

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Cadmium	**0.00032**	**mg/L**	**U**	**1**	0.00060	0.00032	10/28/2009 17:36	J
Chromium	**0.00050**	**mg/L**	**U**	**1**	0.0040	0.00050	10/28/2009 17:36	J
Cobalt	**0.00060**	**mg/L**	**U**	**1**	0.0040	0.00060	10/28/2009 17:36	J
Copper	**0.0025**	**mg/L**	**U**	**1**	0.0040	0.0025	10/28/2009 17:36	J
Iron	**2.9**	**mg/L**		**1**	0.20	0.038	10/28/2009 17:36	J
Lead	**0.0013**	**mg/L**	**U**	**1**	0.0070	0.0013	10/28/2009 17:36	J
Molybdenum	**0.0041**	**mg/L**	**U**	**1**	0.010	0.0041	10/28/2009 17:36	J
Nickel	**0.0011**	**mg/L**	**U**	**1**	0.0065	0.0011	10/28/2009 17:36	J
Selenium	**0.0068**	**mg/L**	**U**	**1**	0.020	0.0068	10/28/2009 17:36	J
Sodium	**120**	**mg/L**		**1**	0.20	0.026	10/28/2009 17:36	J
Vanadium	**0.00081**	**mg/L**	**I**	**1**	0.0015	0.00018	10/28/2009 17:36	J
Zinc	**0.015**	**mg/L**		**1**	0.010	0.0020	10/28/2009 17:36	J
Analysis Desc: SW846 6020B Analysis,Total	Preparation Method: SW-846 3010A Analytical Method: SW-846 6020							
Antimony	**0.30**	**ug/L**	**I**	**1**	0.60	0.073	10/28/2009 17:02	J
Thallium	**0.076**	**ug/L**	**I**	**1**	0.20	0.067	10/28/2009 17:02	J
Analysis Desc: Total Dissolved Solids,E160.1,Water	Analytical Method: EPA 160.1							
Total Dissolved Solids	**880**	**mg/L**		**1**	10	10	10/27/2009 10:06	J
Analysis Desc: Chlorides,SM4500-Cl-E,Water	Analytical Method: SM 4500-Cl-E							
Chloride	**240**	**mg/L**		**5**	10	7.3	10/30/2009 16:06	J
Analysis Desc: Sulfate,E375.4,Water	Analytical Method: EPA 375.4							
Sulfate	**81**	**mg/L**		**5**	50	25	11/2/2009 11:06	J
Analysis Desc: Total Nitrogen,Calculated,Water	Analytical Method: Calculation							
Total Nitrogen	**2.7**	**mg/L**		**1**	0.052	0.052	11/3/2009 13:16	J
WET CHEMISTRY								
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Fluoride	**0.13**	**mg/L**	**I**	**1**	0.20	0.055	10/29/2009 14:28	T
Analysis Desc: Ammonia,E350.1,Water	Analytical Method: EPA 350.1							
Ammonia	**0.58**	**mg/L**		**1**	0.040	0.010	11/2/2009 14:00	T

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639002** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-2** Date Collected: 10/22/2009 17:01

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Analysis Desc: TKN,E351.2,Water	Preparation Method: EPA 351.2 Analytical Method: EPA 351.2							
Total Kjeldahl Nitrogen	**2.7**	**mg/L**		1	0.080	0.052	10/29/2009 21:54	T
Analysis Desc: Nitrate+Nitrite,SM4500NO3F,W	Analytical Method: SM 4500NO3-F							
Nitrate + Nitrite	**0.048**	**mg/L**	U	1	0.20	0.048	10/30/2009 10:53	T
Analysis Desc: Cyanide, SM4500-E, Water	Analytical Method: SM 4500-CN-E							
Cyanide	**0.00097**	**mg/L**	U	1	0.0020	0.00097	11/2/2009 16:28	T

Lab ID: **J0908639003** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-3** Date Collected: 10/22/2009 16:02

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
METALS								
Analysis Desc: SW846 6010B Analysis,Water	Preparation Method: SW-846 3010A Analytical Method: SW-846 6010							
Aluminum	**0.061**	**mg/L**	U	1	0.20	0.061	10/28/2009 18:05	J
Arsenic	**0.0085**	**mg/L**	U	1	0.010	0.0085	10/28/2009 18:05	J
Barium	**0.019**	**mg/L**		1	0.0020	0.00028	10/28/2009 18:05	J
Beryllium	**0.00013**	**mg/L**	U	1	0.00030	0.00013	10/28/2009 18:05	J
Boron	**0.90**	**mg/L**	V	1	0.015	0.0043	10/28/2009 18:05	J
Cadmium	**0.00032**	**mg/L**	U	1	0.00060	0.00032	10/28/2009 18:05	J
Chromium	**0.00050**	**mg/L**	U	1	0.0040	0.00050	10/28/2009 18:05	J
Cobalt	**0.00060**	**mg/L**	U	1	0.0040	0.00060	10/28/2009 18:05	J
Copper	**0.0025**	**mg/L**	U	1	0.0040	0.0025	10/28/2009 18:05	J
Iron	**0.19**	**mg/L**	I	1	0.20	0.038	10/28/2009 18:05	J
Lead	**0.0013**	**mg/L**	U	1	0.0070	0.0013	10/28/2009 18:05	J
Molybdenum	**0.027**	**mg/L**		1	0.010	0.0041	10/28/2009 18:05	J
Nickel	**0.0011**	**mg/L**	U	1	0.0065	0.0011	10/28/2009 18:05	J
Selenium	**0.0068**	**mg/L**	U	1	0.020	0.0068	10/28/2009 18:05	J

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639003** Date Received: 10/27/2009 08:30 Matrix: Water

Sample ID: **TW-3** Date Collected: 10/22/2009 16:02

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Sodium	**53**	**mg/L**		**1**	0.20	0.026	10/28/2009 18:05	J
Vanadium	**0.0059**	**mg/L**		**1**	0.0015	0.00018	10/28/2009 18:05	J
Zinc	**0.015**	**mg/L**		**1**	0.010	0.0020	10/28/2009 18:05	J
Analysis Desc: SW846 6020B Analysis,Total	Preparation Method: SW-846 3010A Analytical Method: SW-846 6020							
Antimony	**3.0**	**ug/L**		**1**	0.60	0.073	10/28/2009 17:09	J
Thallium	**0.085**	**ug/L**	I	**1**	0.20	0.067	10/28/2009 17:09	J
Analysis Desc: Total Dissolved Solids,E160.1,Water	Analytical Method: EPA 160.1							
Total Dissolved Solids	**630**	**mg/L**		**1**	10	10	10/27/2009 10:06	J
Analysis Desc: Chlorides,SM4500-Cl-E,Water	Analytical Method: SM 4500-Cl-E							
Chloride	**95**	**mg/L**		**1**	2.0	1.5	10/30/2009 16:06	J
Analysis Desc: Sulfate,E375.4,Water	Analytical Method: EPA 375.4							
Sulfate	**130**	**mg/L**		**5**	50	25	11/2/2009 11:06	J
Analysis Desc: Total Nitrogen,Calculated,Water	Analytical Method: Calculation							
Total Nitrogen	**0.46**	**mg/L**		**1**	0.052	0.052	11/3/2009 13:17	J
WET CHEMISTRY								
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Fluoride	**0.092**	**mg/L**	I	**1**	0.20	0.055	10/29/2009 14:28	T
Analysis Desc: Ammonia,E350.1,Water	Analytical Method: EPA 350.1							
Ammonia	**0.010**	**mg/L**	U	**1**	0.040	0.010	11/2/2009 14:00	T
Analysis Desc: TKN,E351.2,Water	Preparation Method: EPA 351.2 Analytical Method: EPA 351.2							
Total Kjeldahl Nitrogen	**0.46**	**mg/L**		**1**	0.080	0.052	10/29/2009 21:55	T
Analysis Desc: Nitrate+Nitrite,SM4500NO3F,W	Analytical Method: SM 4500NO3-F							
Nitrate + Nitrite	**0.048**	**mg/L**	U	**1**	0.20	0.048	10/30/2009 10:53	T

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639003** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-3** Date Collected: 10/22/2009 16:02

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Analysis Desc: Cyanide, SM4500-E, Water	Analytical Method: SM 4500-CN-E							
Cyanide	**0.00097**	**mg/L**	**U**	**1**	0.0020	0.00097	11/2/2009 16:28	T

Lab ID: **J0908639004** Date Received: 10/27/2009 08:30 Matrix: Water
Sample ID: **TW-4** Date Collected: 10/22/2009 15:08

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
METALS								
Analysis Desc: SW846 6010B Analysis,Water	Preparation Method: SW-846 3010A Analytical Method: SW-846 6010							
Aluminum	**0.061**	**mg/L**	**U**	**1**	0.20	0.061	10/28/2009 18:10	J
Arsenic	**0.0085**	**mg/L**	**U**	**1**	0.010	0.0085	10/28/2009 18:10	J
Barium	**0.024**	**mg/L**		**1**	0.0020	0.00028	10/28/2009 18:10	J
Beryllium	**0.00013**	**mg/L**	**U**	**1**	0.00030	0.00013	10/28/2009 18:10	J
Boron	**0.31**	**mg/L**	**V**	**1**	0.015	0.0043	10/28/2009 18:10	J
Cadmium	**0.00032**	**mg/L**	**U**	**1**	0.00060	0.00032	10/28/2009 18:10	J
Chromium	**0.00050**	**mg/L**	**U**	**1**	0.0040	0.00050	10/28/2009 18:10	J
Cobalt	**0.00060**	**mg/L**	**U**	**1**	0.0040	0.00060	10/28/2009 18:10	J
Copper	**0.0025**	**mg/L**	**U**	**1**	0.0040	0.0025	10/28/2009 18:10	J
Iron	**0.045**	**mg/L**	**I**	**1**	0.20	0.038	10/28/2009 18:10	J
Lead	**0.0013**	**mg/L**	**U**	**1**	0.0070	0.0013	10/28/2009 18:10	J
Molybdenum	**0.0041**	**mg/L**	**U**	**1**	0.010	0.0041	10/28/2009 18:10	J
Nickel	**0.0011**	**mg/L**	**U**	**1**	0.0065	0.0011	10/28/2009 18:10	J
Selenium	**0.0068**	**mg/L**	**U**	**1**	0.020	0.0068	10/28/2009 18:10	J
Sodium	**100**	**mg/L**		**1**	0.20	0.026	10/28/2009 18:10	J
Vanadium	**0.0025**	**mg/L**		**1**	0.0015	0.00018	10/28/2009 18:10	J
Zinc	**0.016**	**mg/L**		**1**	0.010	0.0020	10/28/2009 18:10	J
Analysis Desc: SW846 6020B Analysis,Total	Preparation Method: SW-846 3010A Analytical Method: SW-846 6020							
Antimony	**0.57**	**ug/L**	**I**	**1**	0.60	0.073	10/28/2009 17:31	J
Thallium	**2.0**	**ug/L**		**1**	0.20	0.067	10/28/2009 17:31	J

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ANALYTICAL RESULTS

Workorder: J0908639 CREC Ash Expansion

Lab ID: **J0908639004** Date Received: 10/27/2009 08:30 Matrix: Water

Sample ID: **TW-4** Date Collected: 10/22/2009 15:08

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Nitrate	**0**	**mg/L**	**U**	**1**			10/23/2009 12:24	SUB G^
WET CHEMISTRY								
Analysis Desc: Total Dissolved Solids,E160.1,Water	Analytical Method: EPA 160.1							
Total Dissolved Solids	**850**	**mg/L**		**1**	10	10	10/27/2009 10:06	J
Analysis Desc: Chlorides,SM4500-Cl-E,Water	Analytical Method: SM 4500-Cl-E							
Chloride	**220**	**mg/L**		**5**	10	7.3	10/30/2009 16:06	J
Analysis Desc: Sulfate,E375.4,Water	Analytical Method: EPA 375.4							
Sulfate	**51**	**mg/L**		**5**	50	25	11/2/2009 11:06	J
Analysis Desc: Total Nitrogen,Calculated,Water	Analytical Method: Calculation							
Total Nitrogen	**7.3**	**mg/L**		**1**	0.052	0.052	11/3/2009 13:18	J
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Fluoride	**0.064**	**mg/L**	**I**	**1**	0.20	0.055	10/29/2009 14:28	T
Analysis Desc: Ammonia,E350.1,Water	Analytical Method: EPA 350.1							
Ammonia	**1.0**	**mg/L**		**1**	0.040	0.010	11/2/2009 14:00	T
Analysis Desc: TKN,E351.2,Water	Preparation Method: EPA 351.2 Analytical Method: EPA 351.2							
Total Kjeldahl Nitrogen	**7.3**	**mg/L**		**5**	0.40	0.26	10/30/2009 08:58	T
Analysis Desc: Nitrate+Nitrite,SM4500NO3F,W	Analytical Method: SM 4500NO3-F							
Nitrate + Nitrite	**0.048**	**mg/L**	**U**	**1**	0.20	0.048	10/30/2009 11:12	T
Analysis Desc: Cyanide, SM4500-E, Water	Analytical Method: SM 4500-CN-E							
Cyanide	**0.0012**	**mg/L**	**I**	**1**	0.0020	0.00097	11/2/2009 16:28	T

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ANALYTICAL RESULTS QUALIFIERS

Workorder: J0908639 CREC Ash Expansion

PARAMETER QUALIFIERS

U	The compound was analyzed for but not detected.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
V	Method Blank Contamination

LAB QUALIFIERS

J	DOH Certification #E82574(AEL-JAX)(FL NELAC Certification)
T	DOH Certification #E84589(AEL-T)(FL NELAC Certification)

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QUALITY CONTROL DATA

Workorder: J0908639 CREC Ash Expansion

QC Batch:	WCAj/21700		Analysis Method:	EPA 160.1
QC Batch Method:	EPA 160.1		Prepared:	
Associated Lab Samples:	J0908639001	J0908639002	J0908639003	J0908639004

METHOD BLANK: 437301

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Total Dissolved Solids	mg/L	10U	10	

QC Batch:	DGMj/20252		Analysis Method:	SW-846 6010
QC Batch Method:	SW-846 3010A		Prepared:	10/28/2009 08:00
Associated Lab Samples:	J0908639001	J0908639002	J0908639003	J0908639004

METHOD BLANK: 437707

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Aluminum	mg/L	0.061U	0.061	
Arsenic	mg/L	0.0085U	0.0085	
Boron	mg/L	0.0052I	0.0043	V
Barium	mg/L	0.00028U	0.00028	
Beryllium	mg/L	0.00013U	0.00013	
Cadmium	mg/L	0.00032U	0.00032	
Cobalt	mg/L	0.00060U	0.00060	
Chromium	mg/L	0.00050U	0.00050	
Copper	mg/L	0.0025U	0.0025	
Iron	mg/L	0.038U	0.038	
Molybdenum	mg/L	0.0041U	0.0041	
Sodium	mg/L	0.026U	0.026	
Nickel	mg/L	0.0011U	0.0011	
Lead	mg/L	0.0017I	0.0013	V
Selenium	mg/L	0.0068U	0.0068	
Vanadium	mg/L	0.00018U	0.00018	
Zinc	mg/L	0.0020U	0.0020	

QC Batch:	DGMj/20256		Analysis Method:	SW-846 6020
QC Batch Method:	SW-846 3010A		Prepared:	10/28/2009 11:00
Associated Lab Samples:	J0908639001	J0908639002	J0908639003	J0908639004

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Advanced Environmental Laboratories, Inc
6601 Southpoint Parkway
Jacksonville, FL 32216
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Fax: (904)363-9354

QUALITY CONTROL DATA

Workorder: J0908639 CREC Ash Expansion

METHOD BLANK: 437976

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Antimony	ug/L	0.073U	0.073	
Thallium	ug/L	0.067U	0.067	

QC Batch: WCAt/27253 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Prepared:
Associated Lab Samples: J0908639001 J0908639002 J0908639003 J0908639004 T0916551001

METHOD BLANK: 439043

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Fluoride	mg/L	0.055U	0.055	

QC Batch: WCAt/27274 Analysis Method: EPA 351.2
QC Batch Method: EPA 351.2 Prepared: 10/29/2009 10:30
Associated Lab Samples: J0908639001 J0908639002 J0908639003 J0908639004

METHOD BLANK: 439370

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Total Kjeldahl Nitrogen	mg/L	0.052U	0.052	

QC Batch: WCAt/27279 Analysis Method: SM 4500NO3-F
QC Batch Method: SM 4500NO3-F Prepared:
Associated Lab Samples: J0908639001 J0908639002 J0908639003

METHOD BLANK: 439411

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Nitrate + Nitrite	mg/L	0.048U	0.048	

QC Batch: WCAt/27280 Analysis Method: SM 4500NO3-F
QC Batch Method: SM 4500NO3-F Prepared:
Associated Lab Samples: J0908639004 T0916467004

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QUALITY CONTROL DATA

Workorder: J0908639 CREC Ash Expansion

METHOD BLANK: 439415

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Nitrate + Nitrite	mg/L	0.048U	0.048	

QC Batch: WCAj/21764 Analysis Method: SM 4500-Cl-E
QC Batch Method: SM 4500-Cl-E Prepared:
Associated Lab Samples: J0908394001 J0908395001 J0908492001 J0908492002 J0908492003 J0908492004 J0908639001 J0908639002 J0908639003 J0908639004

METHOD BLANK: 439676

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Chloride	mg/L	1.5U	1.5	

QC Batch: WCAj/21771 Analysis Method: EPA 375.4
QC Batch Method: EPA 375.4 Prepared:
Associated Lab Samples: J0908492001 J0908492002 J0908492003 J0908492004 J0908639001 J0908639002 J0908639003 J0908639004 M0901063001

METHOD BLANK: 439885

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Sulfate	mg/L	5.0U	5.0	

QC Batch: WCAt/27297 Analysis Method: EPA 350.1
QC Batch Method: EPA 350.1 Prepared:
Associated Lab Samples: J0908639001 J0908639002 J0908639003 J0908639004

METHOD BLANK: 439953

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Ammonia	mg/L	0.010U	0.010	

QC Batch: WCAt/27304 Analysis Method: SM 4500-CN-E
QC Batch Method: SM 4500-CN-E Prepared:
Associated Lab Samples: J0908639001 J0908639002 J0908639003 J0908639004 T0916950001 T0916951001

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QUALITY CONTROL DATA

Workorder: J0908639 CREC Ash Expansion

T0916952001

METHOD BLANK: 440156

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Cyanide	mg/L	0.00097U	0.00097	

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QUALITY CONTROL DATA QUALIFIERS

Workorder: J0908639 CREC Ash Expansion

QUALITY CONTROL PARAMETER QUALIFIERS

V	Method Blank Contamination

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: J0908639 CREC Ash Expansion

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
J0908639001	TW-1	EPA 160.1	WCAj/21700		
J0908639002	TW-2	EPA 160.1	WCAj/21700		
J0908639003	TW-3	EPA 160.1	WCAj/21700		
J0908639004	TW-4	EPA 160.1	WCAj/21700		
J0908639001	TW-1	SW-846 3010A	DGMj/20252	SW-846 6010	ICPj/19771
J0908639002	TW-2	SW-846 3010A	DGMj/20252	SW-846 6010	ICPj/19771
J0908639003	TW-3	SW-846 3010A	DGMj/20252	SW-846 6010	ICPj/19771
J0908639004	TW-4	SW-846 3010A	DGMj/20252	SW-846 6010	ICPj/19771
J0908639001	TW-1	SW-846 3010A	DGMj/20256	SW-846 6020	ICMj/16787
J0908639002	TW-2	SW-846 3010A	DGMj/20256	SW-846 6020	ICMj/16787
J0908639003	TW-3	SW-846 3010A	DGMj/20256	SW-846 6020	ICMj/16787
J0908639004	TW-4	SW-846 3010A	DGMj/20256	SW-846 6020	ICMj/16787
J0908639001	TW-1	EPA 300.0	WCAt/27253		
J0908639002	TW-2	EPA 300.0	WCAt/27253		
J0908639003	TW-3	EPA 300.0	WCAt/27253		
J0908639004	TW-4	EPA 300.0	WCAt/27253		
J0908639001	TW-1	EPA 351.2	WCAt/27274	EPA 351.2	WCAt/27275
J0908639002	TW-2	EPA 351.2	WCAt/27274	EPA 351.2	WCAt/27275
J0908639003	TW-3	EPA 351.2	WCAt/27274	EPA 351.2	WCAt/27275
J0908639004	TW-4	EPA 351.2	WCAt/27274	EPA 351.2	WCAt/27275
J0908639001	TW-1	SM 4500NO3-F	WCAt/27279		
J0908639002	TW-2	SM 4500NO3-F	WCAt/27279		
J0908639003	TW-3	SM 4500NO3-F	WCAt/27279		
J0908639004	TW-4	SM 4500NO3-F	WCAt/27280		
J0908639001	TW-1	SM 4500-Cl-E	WCAj/21764		
J0908639002	TW-2	SM 4500-Cl-E	WCAj/21764		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: J0908639 CREC Ash Expansion

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
J0908639003	TW-3	SM 4500-Cl-E	WCAj/21764		
J0908639004	TW-4	SM 4500-Cl-E	WCAj/21764		
J0908639001	TW-1	EPA 375.4	WCAj/21771		
J0908639002	TW-2	EPA 375.4	WCAj/21771		
J0908639003	TW-3	EPA 375.4	WCAj/21771		
J0908639004	TW-4	EPA 375.4	WCAj/21771		
J0908639001	TW-1	EPA 350.1	WCAt/27297		
J0908639002	TW-2	EPA 350.1	WCAt/27297		
J0908639003	TW-3	EPA 350.1	WCAt/27297		
J0908639004	TW-4	EPA 350.1	WCAt/27297		
J0908639001	TW-1	SM 4500-CN-E	WCAt/27304		
J0908639002	TW-2	SM 4500-CN-E	WCAt/27304		
J0908639003	TW-3	SM 4500-CN-E	WCAt/27304		
J0908639004	TW-4	SM 4500-CN-E	WCAt/27304		
J0908639001	TW-1	Calculation	PM/	Calculation	PM/
J0908639002	TW-2	Calculation	PM/	Calculation	PM/
J0908639003	TW-3	Calculation	PM/	Calculation	PM/
J0908639004	TW-4	Calculation	PM/	Calculation	PM/
J0908639004	TW-4	EPA 300.0	SUBg/	EPA 300.0	SUBg/

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LAB NUMBER: **J0908639**

Advanced Environmental Laboratories, Inc.

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☐ 9610 Princess Palm Ave. • Tampa, FL 33619 • 813.630.9616 • Fax 813.630.4327 • E84589
☐ 6815 SW Archer Road • Gainesville, FL 32608 • 352.377.2349 • Fax 352.395.6639 • E82001
☐ 528 S. North Lake Blvd., Ste. 1016 • Altamonte Springs, FL 32701 • 407.937.1694 • Fax 407.937.1597 • E83076

CLIENT NAME: Golder Associates Inc.	PROJECT NAME: CREC Ash Expansion
ADDRESS: 9428 Baymeadows Rd.; Suite 400	P.O. NUMBER/PROJECT NUMBER: 083-82671
Jacksonville FL 32256	PROJECT LOCATION: Crystal River, FL
PHONE: (904) 363-3430	REMARKS/SPECIAL INSTRUCTIONS:
FAX: (904) 363-3445	
CONTACT: Ken Karably	
SAMPLED BY: Matthew Hampton	
TURN AROUND TIME: ☑ STANDARD ____ ☒ RUSH ____	

SAMPLE ID	SAMPLE DESCRIPTION	Grab Comp	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. COUNT	PRESERVATION	BOTTLE SIZE & TYPE	500ml PE	250ml AG	500ml PE	125ml PE	1 L PE	1L PE	500ml PE				LABORATORY I.D. NUMBER
								ANALYSIS REQUIRED	Chloride, Nitrate, SO4, TDS	Cyanide	TN/NH3	Fluoride	RAD 226/RAD 228	GROSS Alpha	Total Metals				
TW-1		G	10/22/09	1352	GW	7	I		1	1	1	1	1	1	1				001
TW-2		G	10/22/09	1701	GW	7	I		1	1	1	1	1	1	1				002
TW-3		G	10/22/09	1602	GW	7	I		1	1	1	1	1	1	1				003
TW-4		G	10/22/09	1508	GW	7	I		1	1	1	1	1	1	1				004

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge

Preservation Code: I = ice H=(HCl) S = (H2SO4) N = (HNO3) T = (Sodium Thiosulfate)

Received on Ice ☒ Yes ☐ No ☒ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked Temperature when received 3 (in degrees celcius)

Form revised 2/8/08

Device used for measuring Temp by unique identifier (circle IR temp gun used) J: 9A G: LT-1 LT-2 T: 10A A: 3A

	Relinquished by:	Date	Time	Received by:	Date	Time
1	[signature]	10/23/09	0907	[signature]	10-23-09	09:07
2	[signature]	10-23-09	1100	Patti Hantin	102309	1100
3	Patti Hantin	10-26-09	1100	[signature]	10-27-09	08:15
4						

FOR DRINKING WATER USE:
(When PWS information not otherwise supplied) PWS ID: ____
Contact Person: ____ Phone: ____
Supplier of Water: ____
Site-Address: ____

Tuesday, November 03, 2009 1:28:24 PM

Advanced
Environmental Laboratories, Inc.

6815 SW Archer Road
Gainesville, Florida 32608
(352) 377-2349
FAX (352) 395-6639

October 28, 2009

Serial: LAB-091028 92758

Bob Dempsey
Advanced Environmental Laboratories, Inc.
6601 Southpoint Parkway
Jacksonville, FL 32216
RE: Jacksonville
Work Order: 0910404

Enclosed are the results of analyses for samples received by the laboratory on October 23, 2009.

All data were determined in accordance with published procedures (EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Rev March 1983; and Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992). Our laboratory is certified by Florida Department of Health (FDH No. E82001).

All results were determined in accordance with NELAP requirements and in accordance with the chain of custody document unless noted in the report case narrative or data report. The results relate only to the samples listed on the chain of custody. All data is subject to a degree of uncertainty. For a discussion of laboratory uncertainty, please contact your project manager. This analytical report must be reproduced in its entirety. The report pages are numbered separately from the chain of custody and any sample receipt documentation, which, if appropriate, are included in an unnumbered appendix.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Beth Elton

Beth Elton
Project Manager
belton@aellab.com

Advanced Environmental Laboratories, Inc.

6815 SW Archer Rd
Gainesville, FL 32608
352.377.2349 Phone
352.395.6639 Fax
NELAP Certified - FDH #E82001

Advanced Environmental Laboratories, Inc.
6601 Southpoint Parkway
Jacksonville, FL 32216

Project: Jacksonville
Project Manager: Bob Dempsey

Reported:
10/28/09 09:25

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
J0908639001	0910404-01	Water	10/22/09 13:52	10/23/09 11:00
J0908639002	0910404-02	Water	10/22/09 17:01	10/23/09 11:00
J0908639003	0910404-03	Water	10/22/09 16:02	10/23/09 11:00
J0908639004	0910404-04	Water	10/22/09 15:08	10/23/09 11:00

REPORT OF RESULTS

J0908639001

0910404-01 (Water)

Analysis	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Nitrate by EPA 300.0	0.1 U	0.1	mg/L	1	9102602	10/23/09	10/23/09 11:41	

J0908639002

0910404-02 (Water)

Analysis	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Nitrate by EPA 300.0	0.1 U	0.1	mg/L	1	9102602	10/23/09	10/23/09 11:55	

J0908639003

0910404-03 (Water)

Analysis	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Nitrate by EPA 300.0	0.1 U	0.1	mg/L	1	9102602	10/23/09	10/23/09 12:09	

J0908639004

0910404-04 (Water)

Analysis	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Nitrate by EPA 300.0	0.1 U	0.1	mg/L	1	9102602	10/23/09	10/23/09 12:24	

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Gainesville, FL 32608
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Advanced Environmental Laboratories, Inc. 6601 Southpoint Parkway Jacksonville, FL 32216	Project: Jacksonville Project Manager: Bob Dempsey	**Reported:** 10/28/09 09:25

QUALITY CONTROL FOR SAMPLES

Nutrients - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 9102602 = Nitrate by EPA 300.0										
Blank (9102602-BLK1)										
Nitrate by EPA 300.0	0.1 U	0.1	mg/L							
LCS (9102602-BS1)										
Nitrate by EPA 300.0	0.90		mg/L	1.00		90	90-110			
Reference (9102602-SRM1)										
Nitrate by EPA 300.0	0.21		mg/L	0.200		105	90-110			

Advanced Environmental Laboratories, Inc.

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Gainesville, FL 32608
352.377.2349 Phone
352.395.6639 Fax
NELAP Certified - FDH #E82001

Advanced Environmental Laboratories, Inc. 6601 Southpoint Parkway Jacksonville, FL 32216	Project: Jacksonville Project Manager: Bob Dempsey	**Reported:** 10/28/09 09:25

NOTES AND DEFINITIONS

U	Indicates that the compound was analyzed for but not detected. The value associated with the qualifier is the laboratory method detection limit.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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528 S. North Lake Blvd., Ste. 1016 • Altamonte Springs, FL 32701 • 407.937.1594 • Fax 407.937.1597 • E53076

 LAB NUMBER: 0910404

CLIENT NAME: Golder Associates Inc.
ADDRESS: 9428 Baymeadows Rd, Suite 400
Jacksonville FL 32256
PHONE: (904) 363-3430
FAX: (904) 363-3445
CONTACT: Ken Karably
SAMPLED BY: Matthew Hampton
TURN AROUND TIME: ☑ STANDARD ☐ RUSH

PROJECT NAME: CREC Ash Expansion
P.O. NUMBER/PROJECT NUMBER: 053-82671
PROJECT LOCATION: Crystal River, FL
REMARKS/SPECIAL INSTRUCTIONS: Nitrate analyzed at AEL-Gainesville PL 10-27-09

SAMPLE ID	SAMPLE DESCRIPTION	Grab / Comp	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. COUNT	LABORATORY I.D. NUMBER
TW-1		G	10/22/09	1352	GW	7	-01
TW-2		G	10/22/09	1701	GW	7	-02
TW-3		G	10/22/09	1602	GW	7	-03
TW-4		G	10/22/09	1508	GW	7	-04

ANALYSIS REQUIRED

BOTTLE SIZE & TYPE	PRESERVATION	Chloride, Nitrate, SO4, TDS	Cyanide	TN/NH3	Fluoride	RAD 226/RAD 228	GROSS Alpha	Total Metals
500ml PE	I	1	T/I 1	S/I 1	I 1	N/I 1	N/I 1	N/I 1
250ml AG	T/I	1	1					
500ml PE	S/I	1	1					
125ml PE	I	1	1					
1 L PE	N/I	1	1					
1 L PE	N/I	1	1					
500ml PE	N/I	1	1					

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge
Preservation Code: I = ice H=(HCl) S = (H2SO4) N = (HNO3) T = (Sodium Thiosulfate)

Received on ice ☐ Yes ☐ No ☐ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked Temperature when received _____ (in degrees celcius)

Form revised 2/8/08

Device used for measuring Temp by unique identifier (circle IR temp gun used) J: 8A G: LT-1 LT-2 T: 10A A: 3A

	Relinquished by:	Date	Time	Received by:	Date	Time
1	[signature]	10/23/09	0907	[signature]	10/23/09	09:07
2	[signature]	10-23-09	1100	Paul T Hanlin	10/23/09	1100
3	Paul T Hanlin	10-26-09	000			
4						

FOR DRINKING WATER USE:
(When PWS information not otherwise supplied) PWS ID: _____
Contact Person: _____ Phone: _____
Supplier of Water: _____
Site-Address: _____

Florida Radiochemistry Services, Inc.

Contact: Michael J. Naumann
5456 Hoffner Ave., Suite 201 Orlando, FL 32812
Phone: (407) 382-7733 Fax: (407)382-7744
Certification I. D. # E83033

Work Order #: 0910314
Report Date: 11/06/09

Report to:

Advanced Environmental Laboratories, Inc.
6601 Southpoint Parkway
Jacksonville, FL 32216
Attn: Bob Dempsey

I do hereby affirm that this record contains no willful misrepresentations and that this information given by me is true to the best of my knowledge and belief. I further certify that the methods and quality control measures used to produce these laboratory results were implemented in accordance with the requirements of this laboratory's certification and NELAC Standards. The test results in this report relate only to the samples received.

Signed Michael J. Naumann Date 11-6-09
Michael J. Naumann - President

Florida Radiochemistry Services, Inc.

Sample Login

Client:	**Advanced Environmental Laboratories, Inc.**	**Date / Time Received**	**Work order #**
		10/29/09 13:19	**0910314**
Client Contact:	**Bob Dempsey**		
Client P.O.			
Project I.D.	**J0908639**		

Lab Sample I.D.	Client Sample I.D.	Sample Date/Time	Analysis Requested
0910314-01	J0908639-001	10/22/09 13:52	Ga, Ra226, Ra228
0910314-02	J0908639-002	10/22/09 17:01	Ga, Ra226, Ra228
0910314-03	J0908639-003	10/22/09 16:02	Ga, Ra226, Ra228
0910314-04	J0908639-004	10/22/09 15:08	Ga, Ra226, Ra228

Florida Radiochemistry Services, Inc.

Analysis Report

Lab Sample I.D.	0910314-01	0910314-02	0910314-03	0910314-04
Client I.D.	J0908639-001	J0908639-002	J0908639-003	J0908639-004
Gross Alpha	3.5U	5.1	4.6	3.4U
Error +/-	2.2	2.7	2.1	2.1
MDL	3.5	4.2	2.8	3.4
EPA Method	900.0	900.0	900.0	900.0
Prep Date	11/02/09	11/02/09	11/02/09	11/02/09
Prep Time	06:33	06:33	06:33	06:33
Analysis Date	11/03/09	11/03/09	11/03/09	11/03/09
Analysis Time	07:33	15:57	15:58	14:13
Analyst	MJN	MJN	MJN	MJN
Radium 226	2.3	4.2	3.0	2.3
Error +/-	0.3	0.5	0.4	0.3
MDL	0.1	0.1	0.1	0.1
EPA Method	903.1	903.1	903.1	903.1
Prep Date	10/31/09	10/31/09	10/31/09	10/31/09
Prep Time	10:15	10:15	10:15	10:15
Analysis Date	11/05/09	11/05/09	11/05/09	11/05/09
Analysis Time	13:58	13:58	13:58	13:58
Analyst	MJN	MJN	MJN	MJN
Radium 228	0.9U	0.9	0.9U	0.8U
Error +/-	0.6	0.5	0.6	0.5
MDL	0.9	0.7	0.9	0.8
EPA Method	Ra-05	Ra-05	Ra-05	Ra-05
Prep Date	10/31/09	10/31/09	10/31/09	10/31/09
Prep Time	10:15	10:15	10:15	10:15
Analysis Date	11/02/09	11/02/09	11/02/09	11/02/09
Analysis Time	13:17	13:17	13:17	14:25
Analyst	PJ	PJ	PJ	PJ
Units	pCi/l	pCi/l	pCi/l	pCi/l

Florida Radiochemistry Services, Inc.

QA Page

Analyte	Sample #	Date Analyzed	Sample Result	Amount Spiked	Spike Result	Spike /Dup Result	Spike % Rec.	Spike Dup % Rpd
Gross Alpha	0910276-01	11/03/09	<1.1	10.2	9.6	9.0	94	6.5
Radium 226	0910276-01	11/05/09	0.4	25.2	27.2	29.9	106	9.5
Radium 228	0910276-01	11/05/09	<0.8	5.6	5.4	6.5	96	18.5

	Quality Control Limits	
	% RPD	% Rec.
Gross Alpha	25.0	60-125
Radium 226	23.4	78-125
Radium 228	23.9	67-125

Chain of Custody

Advanced Environmental Laboratories, Inc.

Circle if Applicable: **RUSH** **SHORT HOLD**

Document 118590 - HBN 66578 **Project Reference Number : J0908639** Results Requested By ~~11/4/2009~~ ~~11-3-09~~ 11-6-09

Bob Dempsey Advanced Environmental Laboratories, Inc 6601 Southpoint Parkway Jacksonville, FL 32216 Phone (904)363-9350 Fax (904)363-9354	FLRAD-Orlando-FL Florida Radiochemistry 5456 Hoffner Rd. Suite 201 Orlando, FL 32812-2517 Phone Fax

	Sample ID	Collect Date/Time	PM	Matrix	Container(s)	Preservative(s)						Requested Analysis																		LAB USE ONLY
						HNO3						EPA 900 Gross Alpha	EPA 903.1 R226	EPA Ra-05 R228																
1	J0908639001	10/22/2009 14:52	BD	Water	2							X	X	X																
2	J0908639002	10/22/2009 17:01	BD	Water	2							X	X	X																
3	J0908639003	10/22/2009 16:02	BD	Water	2							X	X	X																
4	J0908639004	10/22/2009 15:08	BD	Water	2							X	X	X																
5																														
6																														
7																														
8																														

Comments:

Preservative Codes
HNO3 = HNO3

Transfers	Released By	Date/Time	Received By	Date/Time
1	D. Schultz	10-28-09 16:00	~~UPS~~ BS	
2			K Edwards	10/29/09 13:19
3				
4				
5				

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6601 Southpoint Parkway
Jacksonville, FL 32216
Phone: (904)363-9350
Fax: (904)363-9354

January 28, 2010

Ken Karably
Golder Associates
9428 Baymeadows Rd.
Suite 400
Jacksonville, FL 32256

RE: Workorder: J1000509 Progress Energy CREC

Dear Ken Karably:

Enclosed are the analytical results for sample(s) received by the laboratory on Wednesday, January 20, 2010. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report. The analytical results for the samples contained in this report were submitted for analysis as outlined by the Chain of Custody and results pertain only to these samples.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Andres Alvarez

Digitally signed by Andres Alvarez
DN: cn=Andres Alvarez, o=Advanced Environmental Laboratories, Inc., ou, email=aalvarez@aellab.com, c=US
Date: 2010.01.28 09:57:28 -05'00'

Andy Alvarez for
Bob Dempsey
bdempsey@aellab.com

Enclosures

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Fax: (904)363-9354

SAMPLE SUMMARY

Workorder: J1000509 Progress Energy CREC

Lab ID	Sample ID	Matrix	Date Collected	Date Received
J1000509001	TW-5	Water	1/19/2010 14:40	1/20/2010 09:30

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ANALYTICAL RESULTS

Workorder: J1000509 Progress Energy CREC

Lab ID: **J1000509001** Date Received: 1/20/2010 09:30 Matrix: Water

Sample ID: **TW-5** Date Collected: 1/19/2010 14:40

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
METALS								
Analysis Desc: SW846 6010B Analysis,Water	Preparation Method: SW-846 3010A Analytical Method: SW-846 6010							
Aluminum	**0.061**	mg/L	U	1	0.20	0.061	1/22/2010 13:06	J
Arsenic	**0.0085**	mg/L	U	1	0.010	0.0085	1/22/2010 13:06	J
Barium	**0.062**	mg/L		1	0.0020	0.00028	1/22/2010 13:06	J
Beryllium	**0.00013**	mg/L	U	1	0.00030	0.00013	1/22/2010 13:06	J
Boron	**7.5**	mg/L		1	0.015	0.0043	1/22/2010 13:06	J
Cadmium	**0.00062**	mg/L		1	0.00060	0.00032	1/22/2010 13:06	J
Chromium	**0.00077**	mg/L	I	1	0.0040	0.00050	1/22/2010 13:06	J
Cobalt	**0.00060**	mg/L	U	1	0.0040	0.00060	1/22/2010 13:06	J
Copper	**0.0025**	mg/L	U	1	0.0040	0.0025	1/22/2010 13:06	J
Iron	**11**	mg/L		1	0.20	0.038	1/22/2010 13:06	J
Lead	**0.0013**	mg/L	U	1	0.0070	0.0013	1/22/2010 13:06	J
Molybdenum	**0.0041**	mg/L	U	1	0.010	0.0041	1/22/2010 13:06	J
Nickel	**0.0011**	mg/L	U	1	0.0065	0.0011	1/22/2010 13:06	J
Selenium	**0.0068**	mg/L	U	1	0.020	0.0068	1/22/2010 13:06	J
Sodium	**130**	mg/L	V	1	0.20	0.026	1/22/2010 13:06	J
Vanadium	**0.0011**	mg/L	I	1	0.0015	0.00018	1/22/2010 13:06	J
Zinc	**0.014**	mg/L		1	0.010	0.0020	1/22/2010 13:06	J
Analysis Desc: SW846 7470A Analysis,Water	Preparation Method: SW-846 7470A Analytical Method: SW-846 7470A							
Mercury	**0.000014**	mg/L	U	1	0.00010	0.000014	1/25/2010 13:48	J
Analysis Desc: SW846 6020B Analysis,Total	Preparation Method: SW-846 3010A Analytical Method: SW-846 6020							
Antimony	**0.10**	ug/L	I	1	0.60	0.073	1/25/2010 16:09	J
Thallium	**0.067**	ug/L	U	1	0.20	0.067	1/23/2010 00:44	J
Analysis Desc: Nitrate,SM4500NO3F,Water	Analytical Method: SM 4500NO3-F							
Nitrate	**0.055**	mg/L	U	1	0.10	0.055	1/21/2010 12:08	J
Analysis Desc: Chlorides,SM4500-Cl-E,Water	Analytical Method: SM 4500-Cl-E							
Chloride	**160**	mg/L		5	10	7.3	1/25/2010 08:53	J

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ANALYTICAL RESULTS

Workorder: J1000509 Progress Energy CREC

Lab ID: **J1000509001** Date Received: 1/20/2010 09:30 Matrix: Water

Sample ID: **TW-5** Date Collected: 1/19/2010 14:40

Sample Description Location

Parameters	Results	Units	Qual	DF	Adjusted PQL	Adjusted MDL	Analyzed	Lab
Analysis Desc: Sulfate,E375.4,Water	Analytical Method: EPA 375.4							
Sulfate	**210**	**mg/L**		**10**	100	50	1/21/2010 12:38	J
Analysis Desc: Tot Dissolved Solids,SM2540C	Analytical Method: SM 2540C							
Total Dissolved Solids	**1100**	**mg/L**		**1**	10	10	1/21/2010 10:20	J
Analysis Desc: Total Nitrogen,Calculated,Water	Analytical Method: Calculation							
Total Nitrogen	**12**	**mg/L**		**1**	0.052	0.052	1/28/2010 08:34	J
WET CHEMISTRY								
Analysis Desc: IC,E300.0,Water	Analytical Method: EPA 300.0							
Fluoride	**2.2**	**mg/L**		**5**	1.0	0.28	1/27/2010 10:49	T
Analysis Desc: Ammonia,E350.1,Water	Analytical Method: EPA 350.1							
Ammonia	**8.6**	**mg/L**		**10**	0.40	0.10	1/25/2010 17:37	T
Analysis Desc: TKN,E351.2,Water	Preparation Method: EPA 351.2 Analytical Method: EPA 351.2							
Total Kjeldahl Nitrogen	**12**	**mg/L**		**5**	0.40	0.26	1/27/2010 12:36	T
Analysis Desc: Nitrate+Nitrite,SM4500NO3F,W	Analytical Method: SM 4500NO3-F							
Nitrate + Nitrite	**0.048**	**mg/L**	**U**	**1**	0.20	0.048	1/26/2010 16:55	T
Analysis Desc: Cyanide, SM4500-E, Water	Analytical Method: SM 4500-CN-E							
Cyanide	**0.00097**	**mg/L**	**U**	**1**	0.0020	0.00097	1/26/2010 13:10	T

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ANALYTICAL RESULTS QUALIFIERS

Workorder: J1000509 Progress Energy CREC

PARAMETER QUALIFIERS

U	The compound was analyzed for but not detected.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
V	Method Blank Contamination

LAB QUALIFIERS

J	DOH Certification #E82574(AEL-JAX)(FL NELAC Certification)
T	DOH Certification #E84589(AEL-T)(FL NELAC Certification)

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QUALITY CONTROL DATA

Workorder: J1000509 Progress Energy CREC

QC Batch:	WCAj/22363		Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C		Prepared:	
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001

METHOD BLANK: 478982

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Total Dissolved Solids	mg/L	10U	10	

QC Batch:	WCAj/22369		Analysis Method:	SM 4500NO3-F
QC Batch Method:	SM 4500NO3-F		Prepared:	
Associated Lab Samples:	J1000509001	J1000526002		

METHOD BLANK: 479344

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Nitrate	mg/L	0.055U	0.055	

QC Batch:	DGMj/20639		Analysis Method:	SW-846 6020
QC Batch Method:	SW-846 3010A		Prepared:	1/22/2010 05:00
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001

METHOD BLANK: 479649

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Thallium	ug/L	0.067U	0.067	

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Antimony	ug/L	0.073U	0.073	

QC Batch:	DGMj/20640		Analysis Method:	SW-846 6010		
QC Batch Method:	SW-846 3010A		Prepared:	1/21/2010 05:00		
Associated Lab Samples:	J1000508001 M1000071002	J1000508002	J1000508003	J1000509001	M1000070002	M1000071001

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QUALITY CONTROL DATA

Workorder: J1000509 Progress Energy CREC

METHOD BLANK: 479654

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Aluminum	mg/L	0.061U	0.061	
Arsenic	mg/L	0.0085U	0.0085	
Boron	mg/L	0.0043U	0.0043	
Barium	mg/L	0.00028U	0.00028	
Beryllium	mg/L	0.00013U	0.00013	
Cadmium	mg/L	0.00032U	0.00032	
Cobalt	mg/L	0.00060U	0.00060	
Chromium	mg/L	0.00050U	0.00050	
Copper	mg/L	0.0025U	0.0025	
Iron	mg/L	0.038U	0.038	
Molybdenum	mg/L	0.0041U	0.0041	
Sodium	mg/L	0.031I	0.026	V
Nickel	mg/L	0.0011U	0.0011	
Lead	mg/L	0.0013U	0.0013	
Selenium	mg/L	0.0068U	0.0068	
Vanadium	mg/L	0.00018U	0.00018	
Zinc	mg/L	0.0020U	0.0020	

QC Batch: WCAj/22386 Analysis Method: EPA 375.4

QC Batch Method: EPA 375.4 Prepared:

Associated Lab Samples: J1000508001 J1000508002 J1000508003 J1000509001

METHOD BLANK: 479771

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Sulfate	mg/L	5.0U	5.0	

QC Batch: WCAj/22398 Analysis Method: SM 4500-Cl-E

QC Batch Method: SM 4500-Cl-E Prepared:

Associated Lab Samples: J1000508001 J1000508002 J1000508003 J1000509001

METHOD BLANK: 480177

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Chloride	mg/L	1.5U	1.5	

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QUALITY CONTROL DATA

Workorder: J1000509 Progress Energy CREC

QC Batch:	DGMj/20649		Analysis Method:	SW-846 7470A		
QC Batch Method:	SW-846 7470A		Prepared:	1/25/2010 09:45		
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001	J1000618001	J1000618002
	J1000618003					

METHOD BLANK: 480215

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Mercury	mg/L	0.000014U	0.000014	

QC Batch:	WCAt/28537		Analysis Method:	SM 4500-CN-E		
QC Batch Method:	SM 4500-CN-E		Prepared:			
Associated Lab Samples:	A1000448001	J1000508001	J1000508002	J1000508003	J1000509001	T1001130001

METHOD BLANK: 481288

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Cyanide	mg/L	0.00097U	0.00097	

QC Batch:	WCAt/28567		Analysis Method:	EPA 351.2		
QC Batch Method:	EPA 351.2		Prepared:	1/26/2010 16:00		
Associated Lab Samples:	A1000275007	A1000314008	A1000327007	J1000508001	J1000508002	J1000508003
	J1000509001					

METHOD BLANK: 481946

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Total Kjeldahl Nitrogen	mg/L	0.052U	0.052	

QC Batch:	WCAt/28568		Analysis Method:	EPA 350.1		
QC Batch Method:	EPA 350.1		Prepared:			
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001	M1000051001	M1000051002
	M1000051003					

METHOD BLANK: 481952

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Ammonia	mg/L	0.010U	0.010	

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QUALITY CONTROL DATA

Workorder: J1000509 Progress Energy CREC

QC Batch:	WCAt/28575		Analysis Method:	SM 4500NO3-F
QC Batch Method:	SM 4500NO3-F		Prepared:	
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001

METHOD BLANK: 482032

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Nitrate + Nitrite	mg/L	0.048U	0.048	

QC Batch:	WCAt/28586		Analysis Method:	EPA 300.0
QC Batch Method:	EPA 300.0		Prepared:	
Associated Lab Samples:	J1000508001	J1000508002	J1000508003	J1000509001

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: J1000509 Progress Energy CREC

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
J1000509001	TW-5	SM 2540C	WCAj/22363		
J1000509001	TW-5	SM 4500NO3-F	WCAj/22369		
J1000509001	TW-5	SW-846 3010A	DGMj/20639	SW-846 6020	ICMj/16889
J1000509001	TW-5	SW-846 3010A	DGMj/20639	SW-846 6020	ICMj/16890
J1000509001	TW-5	SW-846 3010A	DGMj/20640	SW-846 6010	ICPj/20090
J1000509001	TW-5	EPA 375.4	WCAj/22386		
J1000509001	TW-5	SM 4500-Cl-E	WCAj/22398		
J1000509001	TW-5	SW-846 7470A	DGMj/20649	SW-846 7470A	CVAj/16614
J1000509001	TW-5	SM 4500-CN-E	WCAt/28537		
J1000509001	TW-5	EPA 351.2	WCAt/28567	EPA 351.2	WCAt/28582
J1000509001	TW-5	EPA 350.1	WCAt/28568		
J1000509001	TW-5	SM 4500NO3-F	WCAt/28575		
J1000509001	TW-5	EPA 300.0	WCAt/28586		
J1000509001	TW-5	Calculation	PM/	Calculation	PM/

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LAB NUMBE **J1000509**

CLIENT NAME: ~~PROGRESS ENERGY FL CREC~~ GOLDER ASSOCIATES	PROJECT NAME: PROGRESS ENERGY CREC
ADDRESS: 9428 BAYMEADOWS RD	P.O. NUMBER/PROJECT NUMBER: 083-82471.1
SUITE 400 JAX, FL. 32256	PROJECT LOCATION: CRYSTAL RIVER, FL
PHONE: 904.363.3430	REMARKS/SPECIAL INSTRUCTIONS:
FAX:	
CONTACT: K. KARABLY	
SAMPLED BY: S. STAFFORD	
TURN AROUND TIME: ☐ STANDARD _____ ☐ RUSH _____	

SAMPLE ID	SAMPLE DESCRIPTION	Grab Comp	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. COUNT	BOTTLE SIZE & TYPE	1L PE	1L PE	500mL PE	500mL PE	250mL AG	120mL PE	1L PE				LABORATORY I.D. NUMBER
							ANALYSIS REQUIRED	Gross Alpha	Rad 226 / Rad 228	NH_3, TN	METALS	CYANIDE	FLOURIDE	Cl, NO_3, SO_4, TDS				
							PRESERVATION	N	N	S	N	NaOH	I	I				
TW-5	TW-5	G	1/19/10	1440	GW	7		1	1	1	1	1	1	1				001

Matrix Code: WW = wastewater SW = surface water GW = ground water DW = drinking water O = oil A = air SO = soil SL = sludge Preservation Code: I = Ice H=(HCl) S = (H_2SO_4) N = (HNO_3) T = (Sodium Thiosulfate)

Received on Ice ☒ Yes ☐ No ☒ Temp taken from sample ☐ Temp from blank ☐ Where required, pH checked Temperature when received 1 (in degrees celcius

Form revised 2/8/08

Device used for measuring Temp by unique identifier (circle IR temp gun used) J : 9A G: LT-1 LT-2 T: 10A A: 3A

	Relinquished by:	Date	Time	Received by:	Date	Time
1		1/20/10	09:30		1-20-10	09:30
2						
3						
4						

FOR DRINKING WATER USE:
(When PWS Information not otherwise supplied) PWS ID:_____
Contact Person:_____ Phone :_____
Supplier of Water:_____
Site-Address:_____

Thursday, January 28, 2010 9:45:31 AM

APPENDIX H
SEASONAL HIGH GROUNDWATER TABLE ESTIMATE

Golder Associates	SUBJECT	ESTIMATE OF SEASONAL HIGH GROUNDWATER LEVEL				
	Job No.	083-82671.1	Made by	SFS	Date	December 2009
	Ref.		Checked	KLH	Sheet	1 of 3
			Reviewed	KBK		

PURPOSE

The purpose of this calculation package is to estimate the seasonal high groundwater level using historical data from 1997 to 2009 for wells MWI-2R, MWI-2R2, and MWC-12R.

METHOD

The Southwest Florida Water Management District (SWFWMD) defines the seasonal high water level (SHWL) as "the elevation to which ground or surface water can be expected to rise due to a normal wet season" (SWFWMD, ERP Application, Part B - Basis of Review, 2002). The average wet season (June to September) rainfall for Citrus County is 30.64 inches according to SWFWMD rainfall data from 1915 to 2009 (http://www.swfwmd.state.fl.us/download/view/site_file_sets/11/cnty.xls).

The SHWL was calculated by averaging recorded water elevations for the five wet seasons(over the past 13 years) with rainfall totals nearest the average wet season rainfall. The 2000, 2001, 2002, 2005, and 2008 wet seasons were selected with an average rainfall total of 31.46 inches, greater than the average wet season rainfall of 30.64 inches as shown in Table 1.

TABLE 1

Year	Citrus County Wet Season Rainfall
1997	23.52
1998	20.75
1999	26.40
2000	29.15
2001	31.36
2002	32.79
2003	36.83
2004	43.34
2005	30.33
2006	26.43
2007	27.84
2008	33.68
2009	27.45
MIN*	17.81
MEAN*	**30.64**
MAX*	48.89

* = MIN, MEAN, and MAX based on SWFWMD data from 1915 to 2009

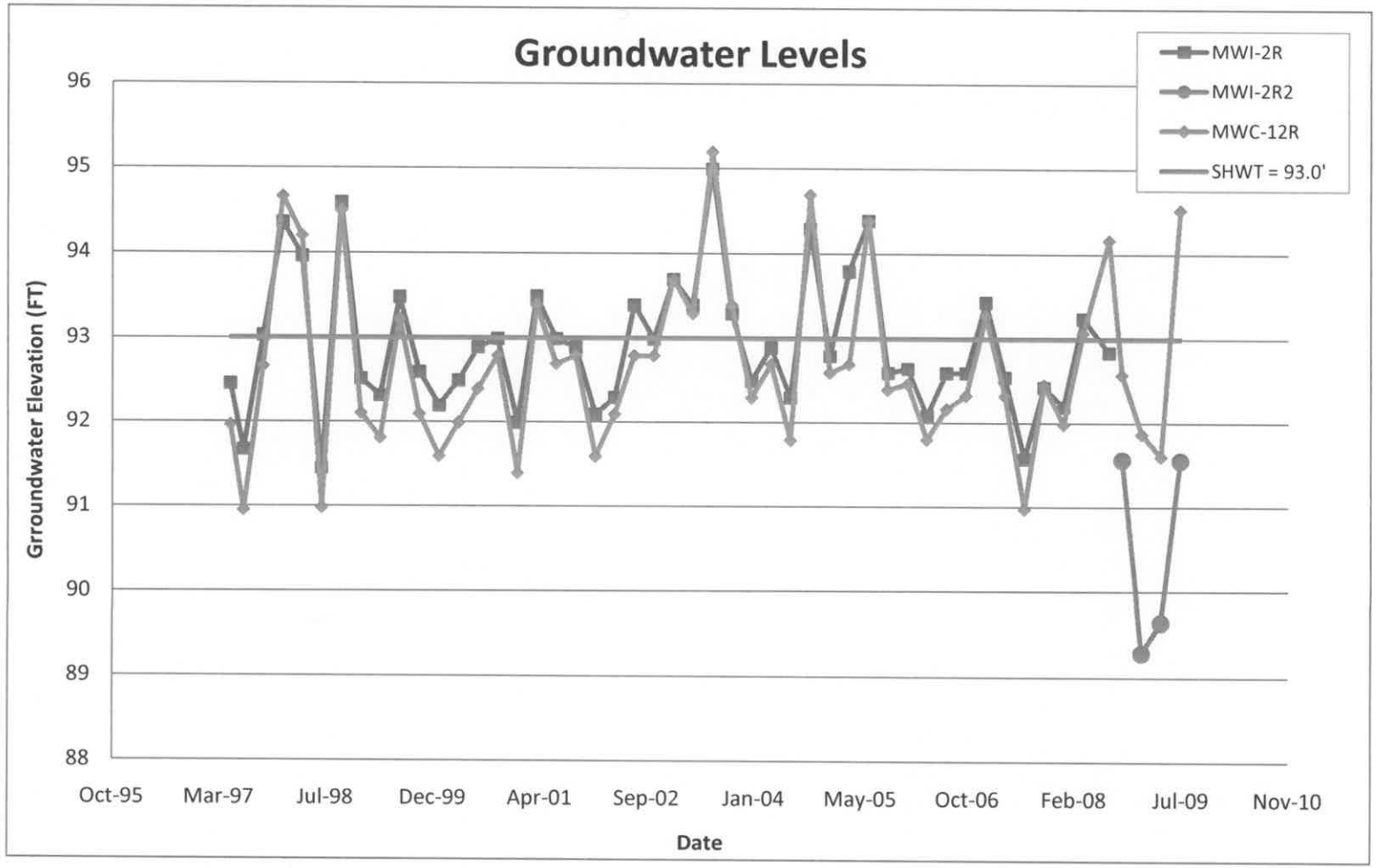
ANALYSIS

The third and fourth quarter groundwater elevations from the quarterly monitoring events were used to estimate the SHWL. The average groundwater elevation for the 2000,2001,2002,2005 and 2008 wet seasons in well MWI-2R/2R2 is 92.95 feet (site vertical datum) and for well MWC-12R is 92.98 feet as shown in Table 2. The SHWL for the ash disposal area is therefore estimated at 92.96 feet or approximately 93 feet. A graph of the historical water elevations is on Figure 1.

TABLE 2

DATE	MW-2R/2R2	MW-12R
Jul-97	91.67	90.95
Oct-97	93.03	92.66
Jul-98	91.45	90.98
Oct-98	94.59	94.5
Jul-99	93.48	93.22
Oct-99	92.59	92.09
Jul-00	92.89	92.39
Oct-00	92.99	92.79
Jul-01	92.99	92.69
Oct-01	92.89	92.79
Jul-02	93.39	92.79
Oct-02	92.99	92.79
Jul-03	94.99	95.19
Oct-03	93.29	93.39
Jul-04	92.29	91.79
Oct-04	94.29	94.69
Jul-05	94.39	94.39
Oct-05	92.59	92.39
Jul-06	92.59	92.16
Oct-06	92.59	92.32
Jul-07	91.57	90.97
Oct-07	92.42	92.45
Aug-08	92.84	94.16
Oct-08	91.56	92.57
Jul-09	91.55	94.52
Average of Selected Years	**92.95**	**92.98**

Figure 1


Groundwater Levels
MWI-2R
MWI-2R2
MWC-12R
SHWT = 93.0'
Grroundwater Elevation (FT)
96
95
94
93
92
91
90
89
88
Oct-95
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Date

APPENDIX I
GEOTECHNICAL CALCULATIONS

TECHNICAL MEMORANDUM

Date: July 22, 2010 **Project No.:** 083-82671.1

To: File

From: Christopher Brown, PhD, PE
Kenneth Karably, PE, PG

RE: SLOPE STABILITY, BEARING CAPACITY, AND SETTLEMENT ANALYSIS
ASH STORAGE/DISPOSAL AREA
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CRYSTAL RIVER, FLORIDA

As requested by Progress Energy Florida, Inc. (PEF), Golder Associates Inc. (Golder) has prepared a slope stability analysis of the existing and proposed configurations of the coal combustion product (CCP) disposal area located at the Crystal River Energy Complex (CREC) in Crystal River, Florida. The assumptions presented in this analysis were based, in part, on the geotechnical investigation of the CCP disposal area that was performed in October 2009

BACKGROUND

The CCP disposal area at the CREC is located near the northeast corner of the main plant area. The original site certification for Units 4 and 5 included an ash storage area of approximately 120 acres with ash placed to a height of 40 feet above existing grade. By 1987, portions of the original footprint were dedicated to other uses (stormwater management, roads, etc.) effectively reducing the footprint to about 80 acres and a revision to the Site Certification Application (SCA) was submitted to increase the height of the CCP disposal area from 40 feet to 80 feet with exterior slopes of 4 horizontal to 1 vertical (4H:1V). In recent years, further reductions to the footprint have occurred with the construction of other projects (in particular Clean Air Act projects) effectively bring the footprint to about 57 acres. These reductions in footprint have resulted in losses of available storage volume. In 2009, PEF requested Golder prepare an evaluation of the technical feasibility of increasing the height and/or slope angle of the ash disposal area in order to regain the lost capacity and the addition of an strip (approximately 100 feet wide) along the eastern edge of the footprint (aka, the east sliver) that had been included in the original SCA then taken out for stormwater management in the 1987 revision.

On August 11, 2009, Golder and PEF personnel collected representative bulk samples of three material types located in the CCP disposal area:

- Fly ash;
- High Chloride Ash; and
- Commingled material

The origins of these materials are described in the CCP/Solid Waste Materials Management Plan (December 2008, revised May 2009 and December 2009) submitted to the Florida Department of Environmental Protection (FDEP). There are other materials (such as bottom ash) located in the CCP disposal area, however, these three materials were selected because they represented the majority of the materials on site and appeared to be the finest grained materials (i.e., likely represent worse case from an internal shear strength standpoint).

In October 2009, geotechnical borings were drilled in the CCP disposal area and additional laboratory testing performed. Geotechnical testing of the bulk samples included grain size and hydrometer, moisture content, maximum dry density (Standard Proctor), pH, and triaxial shear strength (on remolded samples). Geotechnical testing of samples collected from the geotechnical borings included grain size and hydrometer, moisture content, and triaxial shear strength (on Shelby tube). Results of the geotechnical lab testing are presented in Attachment A to this Memorandum.

STABILITY OF 1987 CONFIGURATION

As noted above, in the 1987 revision to the SCA the CCP disposal area was proposed to have a height of 80 feet with 4H:1V sideslopes. Final cover contours and stormwater control details for the final cover were not included in the 1987 revision to the SCA. Observations made by Golder during the site investigation and discussions with PEF personnel familiar with the operation have not indicated any current or historical slope stability problems. In addition, there was no visual indication or reports of sinkholes or subsidence features within the footprint of the CCP disposal area. In summary, the CCP disposal area has been in operation for about 30 years with no reported stability issues indicating that the factor of safety (FOS) must be greater than 1.0.

The slope stability analysis of the monofill and sub-grade is based upon a simplified geologic section. The analysis utilized generalized subsurface conditions based upon existing standard penetration test (SPT) core borings and geotechnical lab data. The results of the geotechnical borings were compiled to evaluate the condition of existing limestone bedrock materials along with a general characterization of the same. The borings reveal that the limestone is relatively soft rock, weathered with some small cavities. The subsurface data also indicates that the limestone is at or very close to the ground surface with minimal soil cover.

Unconfined compressive tests of the limestone indicate strengths of up to 200 pounds per square inch (psi) and unit weights of 130 pounds per cubic feet (pcf). Consolidated undrained (CU) triaxial tests were conducted on remolded ash samples. The ash had an insitu water content of 33% and a dry unit weight of 71.2 pcf. The total stress phi angle was determined to be 21.3 degrees while the effective stress phi angle was determined to be 32.4 degrees. The stress-strain curves also indicate that the material behaves similar to sand. This data is generally consistent with the literature (Kim et al., 2005) which describes the range of effective phi angle to be 28 to 35 degrees for similar fly ash material. In addition, Kim et al. noted that the actual shear strength of moderately compacted fly ash is even higher than compacted sand.

For design purposes, the phi angle for the CCP materials was assumed to be 27 degrees, slightly lower than the literature values, but higher than the total stress phi angle of 21.3 degrees. The design criteria was compared to the minimum factor of safety (FOS) against slope failure of 1.5 as mandated under Chapter 62-701, Florida Administrative Code (Solid Waste Facilities). It is noted that the U.S. Army Corps of Engineers recommends at least a minimum FOS of 1.3 for staged construction slopes using total stress parameters. Therefore, Golder also included a check of the FOS using the total stress phi of 21.3 degrees to ensure that it was at least 1.3. The underlying limestone was assigned a phi angle of 34 degrees although it could be as high as 36 degrees. The stability analysis revealed that the limestone parameters (e.g., phi angle of 34 versus 36 degrees) were not critical in the analysis.

Groundwater elevations shown in the stability analyses are based on a seasonal high groundwater elevation of approximately 93 feet (site datum) and an average CCP disposal area base elevation of 95 feet (site datum).

To further analyze the stability of the embankment, a slope stability computer program (Slope/W by Geoslope) was utilized. As part of the stability evaluation a phi angle of 27 degrees was assumed for the material components of the CCPs. The resulting minimum FOS against slope failure was determined to be 1.89. This critical failure surface is shown on Figure 1. This failure zone is very small and represents the possibility of minor raveling of the slope. Besides this failure surface, a search was completed to find any other critical failure surface in the existing embankment. The critical failure surface in the main part of the existing embankment had a minimum FOS of 2.17. The Geoslope model output is presented below on Figure 2. Model input parameters are presented in Attachment B.

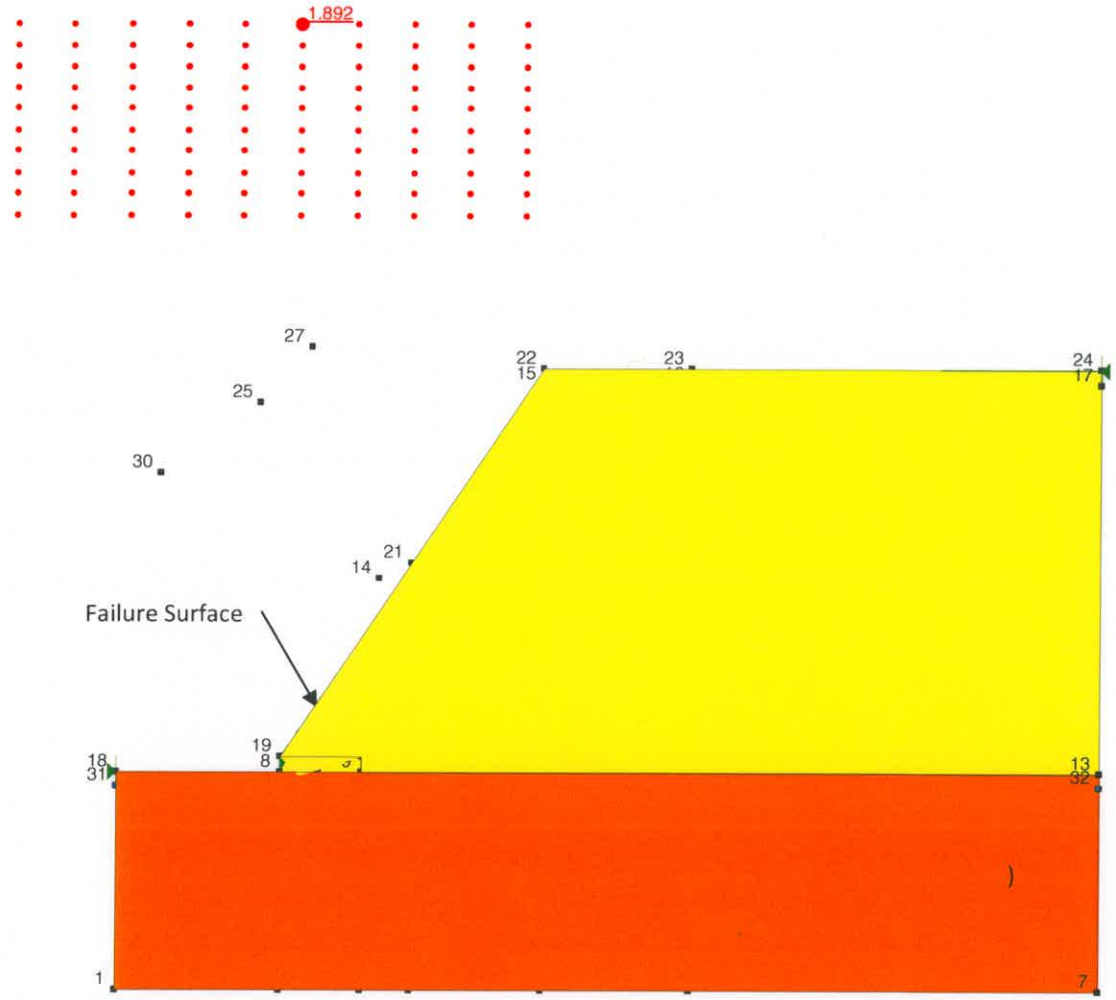


Figure 1 - Section A-A' - 80 Ft Monofill and limestone foundation, shallow FOS_{min} = 1.89

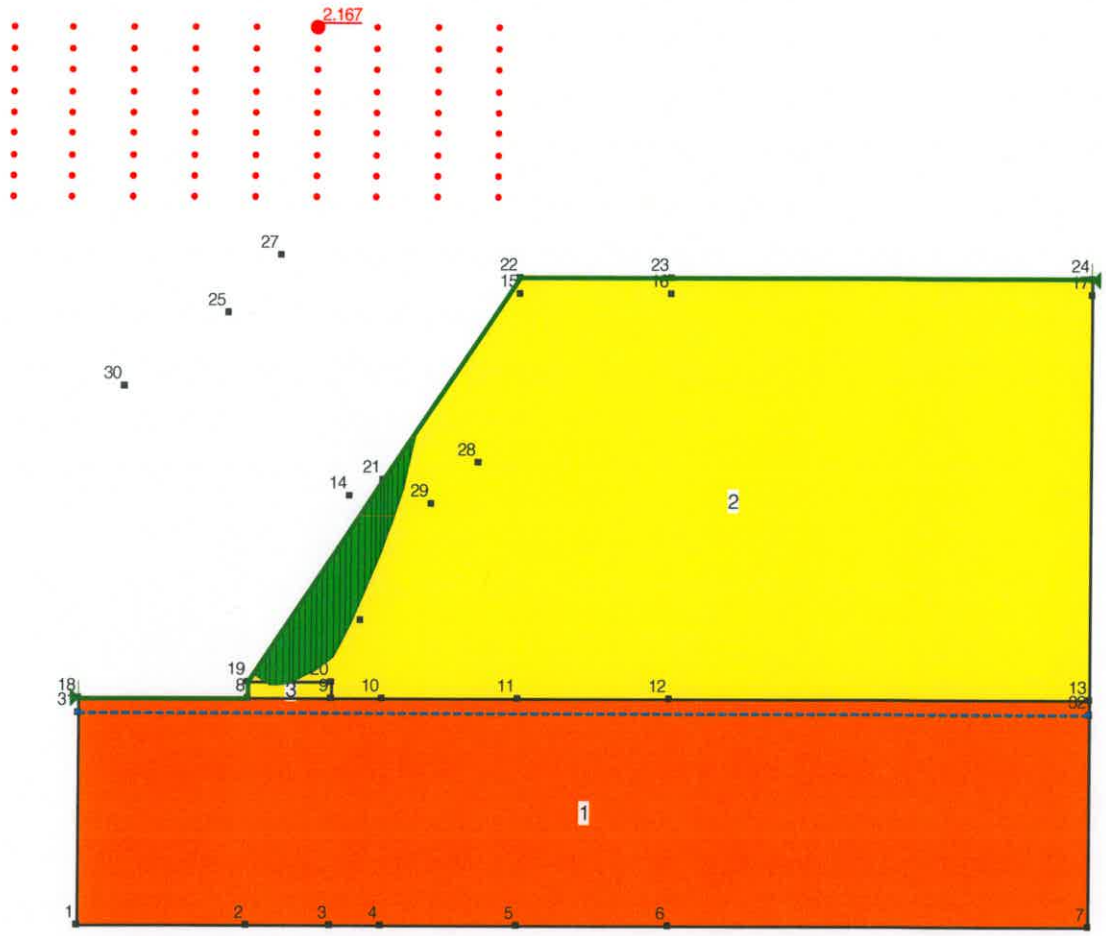


Figure 2 - Section A-A'- 80 Ft Monofill and limestone foundation, wedge FOS_{min} = 2.17

In summary, for the existing embankment configuration our evaluation of potential failure surfaces revealed that all critical slope failure surfaces had a FOS of greater than 1.5.

STABILITY OF "EAST SLIVER" 80 FOOT CONFIGURATION

Golder previously evaluated the stability of a 100-foot wide "sliver" fill on the eastern side of the existing CCP disposal area. The selected configuration included an 80-foot high, 4H:1V side slope underlain at the toe by a 100-foot wide strip of geosynthetic clay liner (GCL) or 3 feet of compacted clay. Although a containment (toe) berm will be included in construction to contain the CCP materials it was excluded from the stability analysis for simplicity of analysis.

The slope stability analysis of the monofill and sub-grade was based upon a simplified geologic section described above (see "Stability of 1987 Configuration"). The analysis utilized generalized subsurface conditions based upon existing standard penetration test (SPT) core borings. The results of the geotechnical borings were compiled to evaluate the condition of existing limestone bedrock materials along with a general characterization of the same. The borings reveal that the limestone is relatively soft and weathered with some small cavities. The cavities identified in the limestone underlying this area are currently being improved with the use of compaction grouting as was done recently for the FGD pond project. The subsurface data indicates that the limestone is at or very close to the ground surface with minimal deposits of other overburden materials. In addition to the explorations performed onsite, geotechnical testing was completed on the limestone and ash samples.

For design purposes, the ash monofill sliver section was subdivided into three primary zones based upon the proposed design. The ash section was assigned a phi angle of 27 degrees with cohesion of 0 pounds per square feet (psf). The GCL section was modeled using 0.20 feet of clay (due to model stability limitations, the actual thickness of 0.03 feet could not be simulated) with a phi angle of 0 degrees and a cohesion of 500 psf. The input values are consistent with manufacturers' specifications for CETCO Bentomat® SDN GCL (see Attachment C). Golder considers these values to be conservative given that interface shear and internal shear testing performed by Golder on similar GCL systems has provided cohesion values as high as several thousand psf. As for the existing configuration analysis, the foundation was selected to be the limestone which was assigned a phi angle of 34 degrees. A general location of the stability section is shown in the figure below.

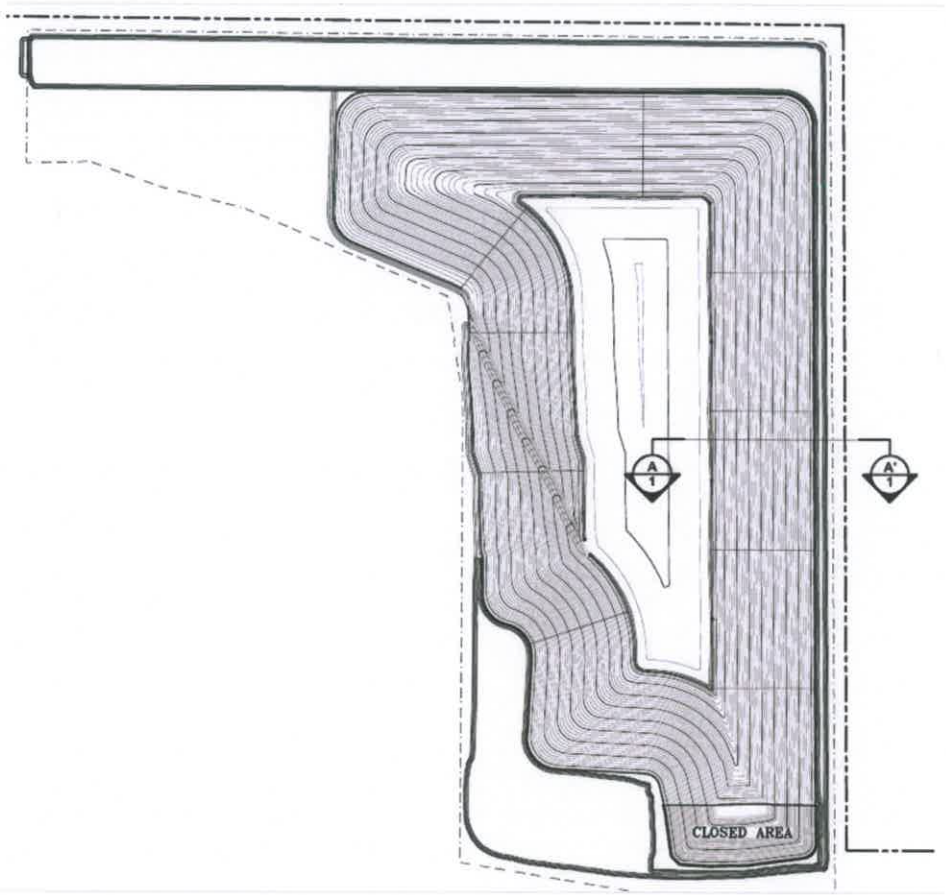


Figure 3 - Location of Stability Section along the eastern "sliver" modification

The results of the slope stability analysis were developed using the Geo-slope software package. The final project 4H:1V, 80-foot high slope alternative resulted in a minimum FOS of 1.72.[1] Sensitivity analysis using even lower strength values were also evaluated to ensure that the factor of safety was at least 1.3 to meet the Corps of Engineers recommendations for staged construction of embankments. Figure 4 shows the critical failure surface which is wedge failure through the GCL on top of the limestone.

[1] It is noted that the FOS presented in the Post Certification Amendment for Ash Storage Area Horizontal Expansion was lower (FOS = 1.5). The reason for the lower FOS in that March 18, 2010 analysis was that a compacted clay liner thickness of 3 feet with an internal shear strength of 500 psf was used. This analysis (using the same internal shear strength but thinnest possible model GCL thickness of 0.20 feet) is more reflective of proposed conditions and closer to actual GCL thickness of 0.03 feet.

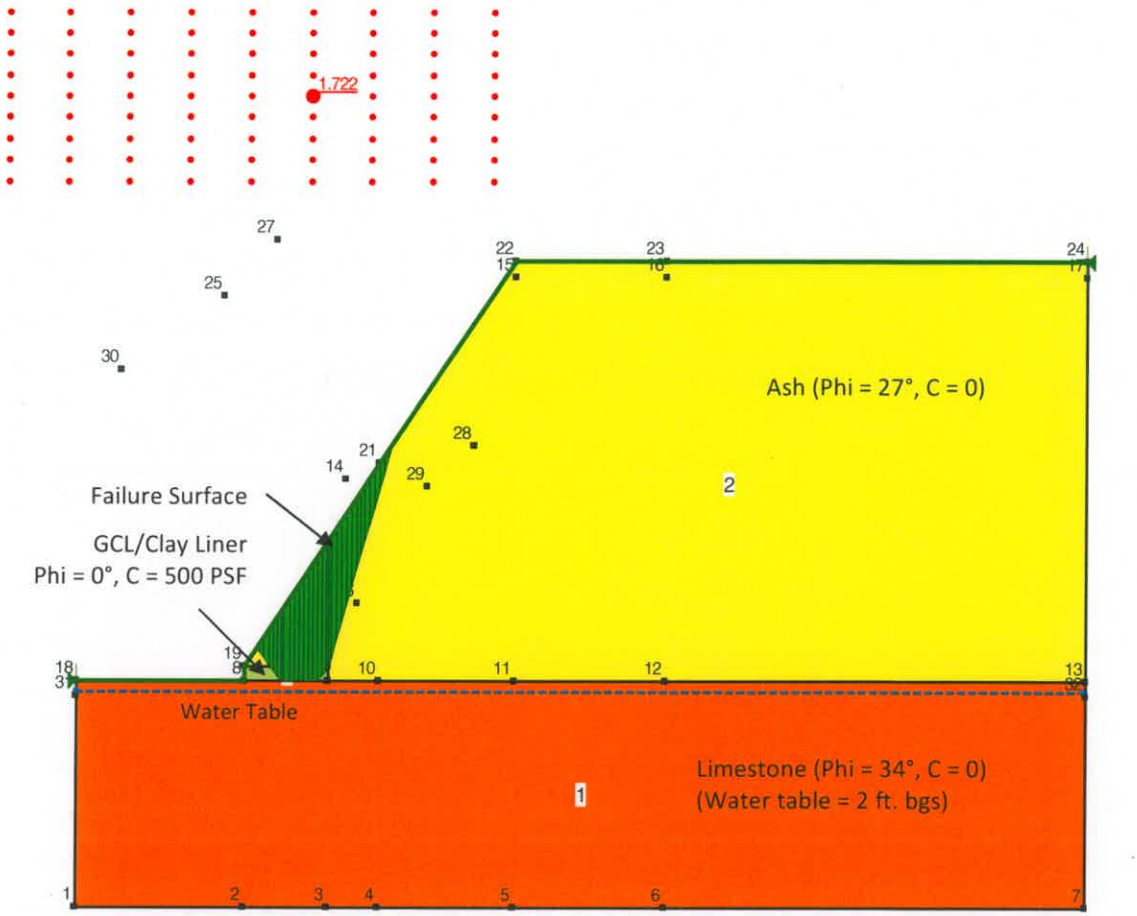


Figure 4 - Section A-A' - 80 Ft Monofill and GCL, Wedge Failure FOS_{min} = 1.72

STABILITY OF PROPOSED 120 FOOT FINAL GRADE CONFIGURATION

In order to maximize airspace within the existing footprint, a raise in height (to approximately 120 feet above original ground surface) and steepening of the sideslopes (from 4H:1V to 3H:1V with 10-foot wide benches every 30 feet) was evaluated. Due to the presence of the GCL liner, the critical slope stability areas at the monofill project are expected again to be on the east side of the project, in the so called "East Sliver Area". Therefore, slope stability modeling was again performed using Slope/W software to ensure that the minimum FOS was greater than 1.5 as required by FDEP regulations.

Stability analysis of this proposed configuration was completed similar to other earlier evaluations. For design purposes, the ash monofill sliver section was subdivided into three primary zones based upon the proposed design. The ash section was assigned a phi angle of 27 degrees with cohesion of 0 pounds per square feet (psf). The GCL section was modeled using 0.20 feet of clay (to simulate the actual liner while permitting stable model runs) with a phi angle of 0 degrees and cohesion of 500 psf. The input strength values are consistent with manufacturers' specifications for CETCO Bentomat® SDN GCL (see Attachment C). Golder considers these values to be conservative given that interface shear and internal shear testing performed by Golder on similar GCL systems has provided cohesion values as high as several thousand psf. As for the existing configuration analysis, the foundation was selected to be the limestone which was assigned a phi angle of 34 degrees. A general location of the East Sliver stability section is shown in the figure below on Figure 5. Figure 5 also shows the location of Section B-B' on the north side of the monofill. This section is essentially the same as the west and south sides of the project also so only one stability section was used for all three areas.

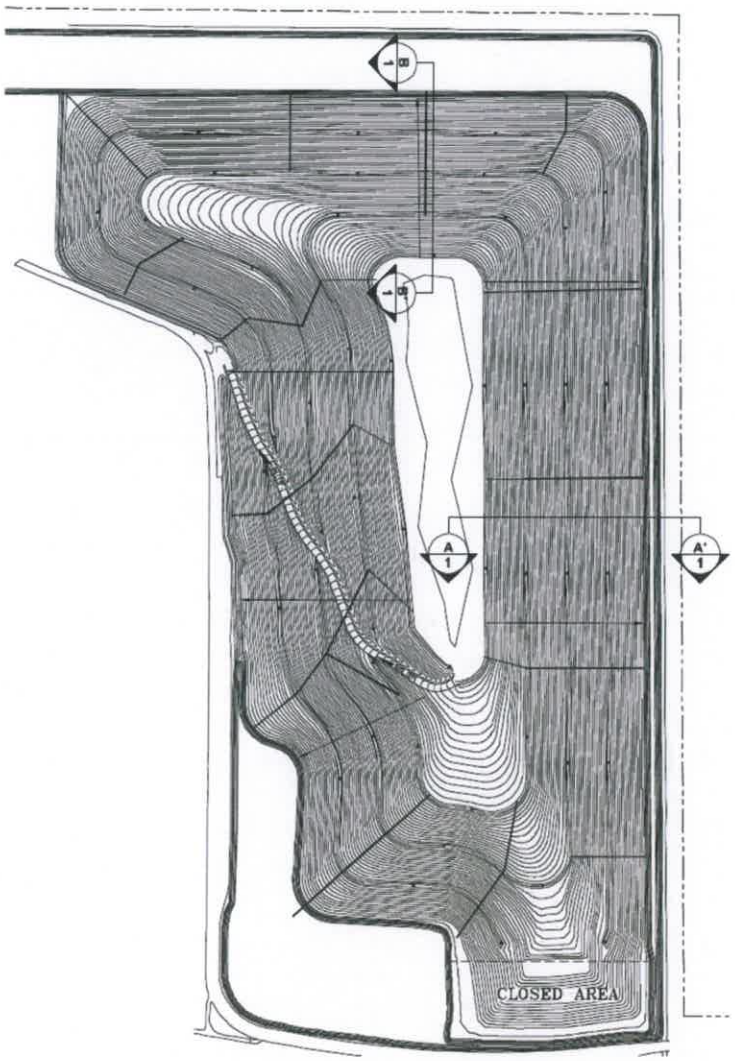


Figure 5 - Location of Stability Section along the Eastern "Sliver"

The slope evaluation was completed using Slope/W and the analysis determined that the proposed 3H:1V side slope with benches is feasible and meets regulatory requirements. The final project 3H:1V with benches, 120-foot high slope alternative resulted in a minimum FOS of 1.67.

Sensitivity analysis using even lower strength values were also evaluated to ensure that the factor of safety was at least 1.3 to meet the Corps of Engineers recommendations for staged construction of embankments. Figure 6 shows the critical failure surface which is wedge failure through the GCL on top of the limestone.

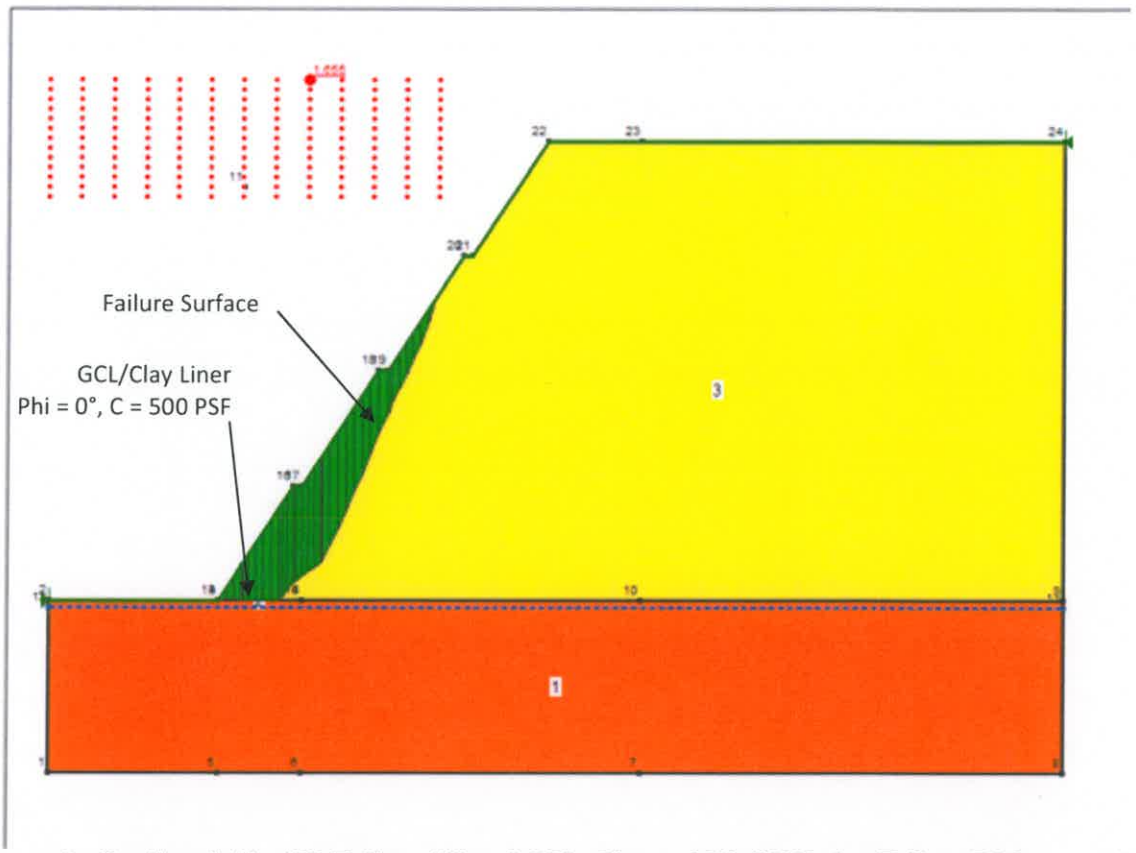


Figure 6 - Section A-A' - 120 Ft Monofill and GCL, Slope of 3H:1V Wedge Failure FOS_{min} = 1.67

For the remaining sides of the ash monofill project with proposed 3H:1V side slopes with 10 foot benches every 30 feet in elevation, the minimum FOS was 1.78. In these project areas, the foundation does not include a new GCL liner resulting in higher FOS values against potential slope failures. Figure 7 shows the Slope/W results for the north, west, and south sides of the project with no liner included in the foundation.

Figure 7 - Section B-B' - 120 Ft Monofill without liner, Wedge Failure FOS_{min} = 1.78

BEARING CAPACITY EVALUATION

The bearing capacity of the underlying soft limestone was evaluated as part of the project geotechnical evaluation. Two calculation approaches were undertaken. First, code-based bearing capacity values for various quality of rocks was used and compared to vertical stress from the 120 foot high embankment. Second, standard bearing capacity equations were used based upon methods used for foundations consisting of soil.

Method 1:

Hunt (1986, page 315) provides recommended values for allowable contact pressures for various rock types and quality. For a limestone with very poor "rock quality designation" or RQD, the recommended contact pressure ranges from 10 to 30 tons per square feet (TSF). Using the lower threshold value of 10 TSF equates to an allowable contact pressure of 20,000 pounds per square feet (psf). Using a typical FOS of 3 for bearing capacity evaluations, the ultimate permitted contact pressure would be 60,000 psf. This value is compared to the actual maximum contact pressure which is expected to be 11,400 psf (120 foot high embankment with unit weight of 95 pounds per cubic feet [pcf]). The calculated FOS is 5.3 which is greater than the minimum FOS of 3. Therefore, the bearing capacity is sufficient.

Method 2:

Salgado (2008) presents standard bearing capacity equations and recommended bearing capacity factors for various soil types. The basic bearing capacity equation is:

Equation (1): $q_{ultimate} = cN_c + qN_q + 0.5\gamma_b BN\gamma$

Where: c = cohesion of soil;
B = foundation width;
q = embedment (assumed to be zero);
γ_b = buoyant unit weight;
Nc, Nq, Nγ = bearing capacity factors.

For this evaluation, the soft limestone was modeled as a soil with a phi angle of 34 degrees and cohesion of 100 pounds per square inch (psi). With a phi angle of 34 degrees and cohesion of 100 psi, the key bearing capacity factors are N_c and Nγ. They were assigned values of 42 and 41, respectively. Using a buoyant unit weight of approximately 68 pcf and a FOS of 3, the allowable bearing capacity is estimated to be almost 250,000 psf. This is more than 20 times higher than the expected contact pressure. Therefore, the bearing capacity is sufficient and meets regulatory requirements.

PUNCHING SHEAR FAILURE EVALUATION

In addition to concerns regarding the slope stability and bearing capacity, the possibility of a limestone shear failure was investigated since some cavities were encountered during the onsite subsurface investigations. A simple evaluation was conducted that simulated possible cavity roof failure assuming different size cavities and limestone roof thickness.

The basic failure mechanism is theorized to be a punching shear failure where the native shear strength of the rock is exceeded by the weight of ash monofill. The failure is assumed to be a collapse of the limestone cavity roof. The resisting shear strength is based upon the circumference of the hypothetical cavity, the thickness of the limestone roof, and the mean shear strength of the rock as determined from unconfined compressive tests (mean unconfined compressive strength = 438 psi) (see Attachment D). The mean limestone shear strength was estimated at one-half the compressive strength (mean limestone shear strength = 219 psi). Figure 8 shows the results for different size cavities with various limestone roof thickness. Assuming a large cavity of 25 feet diameter is present with only 5 feet limestone roof thickness, the FOS is estimated to be 2.2. In fact, most cavities that have been uncovered at the Progress Energy site are on the order of 5 feet or less. With a cavity of 5 foot in diameter and a roof thickness of 5 feet, the FOS against punching failure is estimated to be more than 11. Therefore, punching failure is not expected to be a major issue at the site. In addition, a compaction grouting program is ongoing in the foundation area along the East Sliver area where some voids were identified by

the geotechnical drilling program. The compaction grouting program will be completed in August 2010 to fill those identified possible surface cavities and perform any necessary secondary grouting required adjacent to those areas with high grout takes at low injection pressures are observed, further reducing punching failure potential.

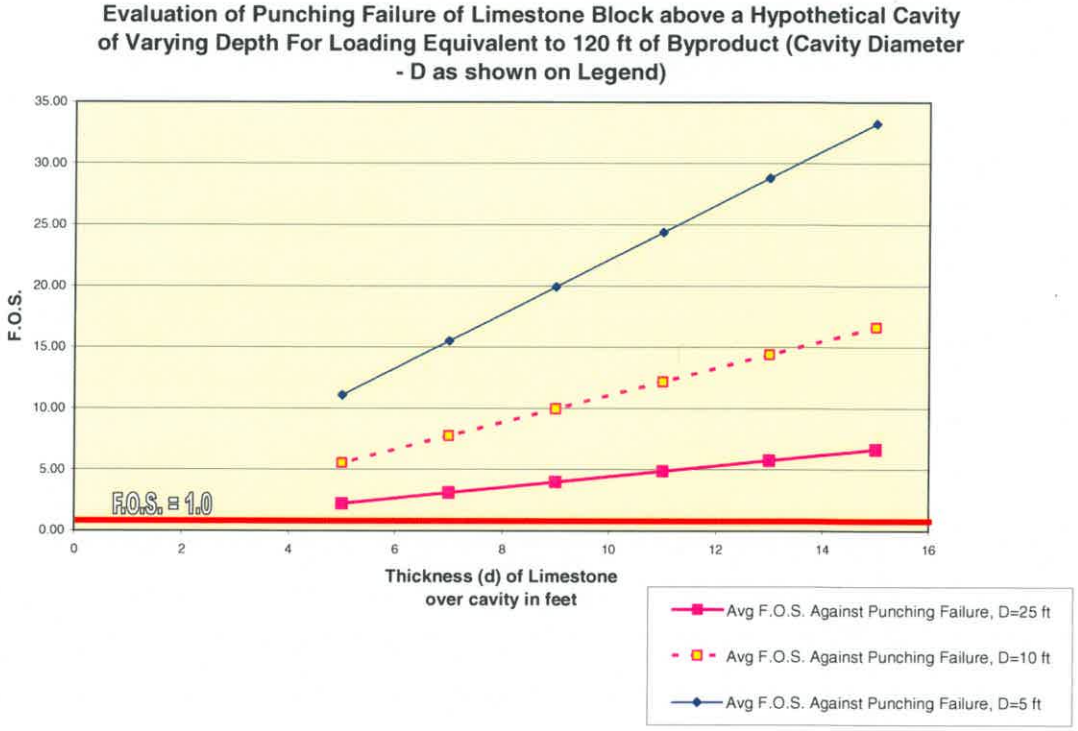


Figure 8 – Hypothetical FOS Against Punching Failure; Minimum is estimated to be 2.2.

SETTLEMENT ANALYSIS

For this report, only the elastic or initial settlement has been estimated since the limestone will not undergo any long-term consolidation. Several analytical methods were used to develop settlement estimates.

Golder used three different methods to estimate the elastic settlement of the 100 feet of limestone bedrock for the projected ash monofill grade. First, Golder used a method based largely upon elastic theory as presented in Lambe and Whitman (1969). The fundamental equation used in the formulation to determine the settlement below a corner of a rectangle is:

$S = \Delta q_s B(1 - \mu^2)I_p/E$, where

Δq_s is the uniform foundation load from the landfill;
B is the width of the rectangle under consideration;
μ is Poisson's ratio taken as 0.4;
I_p is an influence coefficient calculated or taken from a chart; and,
E is the soil layer modulus of elasticity.

Using this method and assuming the following values (Δq_s = 14,905 pounds per square feet; B = 125 feet; I_p = 0.02; E = 10,000,000 pounds per square feet, H is 100 feet of limestone) leads to an estimate of generalized elastic settlement of 0.14 inches.

The second method used to estimate settlement is also based upon elastic theory as presented in Qian et al., (2002). This method uses the elastic constrained modulus to evaluate foundation strain and deformation. The fundamental equation used in the formulation to determine the settlement below the landfill is:

$S = (\Delta P/D)H$, where

ΔP is the added stress increment at mid-depth of H;
D is the constrained modulus which is a function of the modulus of elasticity and Poisson's ratio;
H is the thickness of the soil layer.

Using this method and assuming the following values (ΔP = 14,905 pounds per square feet; D = 21,000,000 pounds per square feet, H = 100 feet) leads to an estimate of generalized elastic settlement of 0.07 inches.

The third method used to estimate settlement is based upon observed settlement of foundations on sandy materials. The Burland and Burbridge method is an empirical method based upon analysis of actual settlement data from hundreds of foundation systems around the world. The full method is presented in Salgado (2008). The fundamental equation used in the formulation to determine the settlement below the landfill is:

$S = [0.10L_r f_s f_L f_t I_c (q_b - 0.67P'_{vp})/Pa](B/L_r)^{0.7}$, where

L_r is a reference length of 3.281 feet;
f_s is a shape factor;
f_L is layer thickness factor;
f_t is a time factor usually assumed to be 1;
I_c is a compressibility index;
P'_{vp} is the vertical effective stress at footing base level;
Pa is a reference stress of 2,000 pounds per square feet; and,
B is the foundation width.

Using this method and assuming the following values (f_s = 0.91; f_L = 0.48; I_c = 0.01; B = 125 feet) leads to an estimate of generalized elastic settlement of 0.20 inches.

Therefore, in summary the range of estimated elastic settlement for the projected ash monofill grade (elevation 215 to 216 feet NGVD) is 0.07 to 0.20 inches. Since the mean high water table is two feet below the base of the CCP disposal area, there should not be any byproducts (or the GCL in the East Sliver area) that settle below the mean high water table.

REFERENCES

Kim, Bumjoo, Prezzi, M., and R. Salgado, 2005. Geotechnical Properties of Fly and Bottom Ash Mixtures for Use in Highway Embankments, *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, pp. 914-924.

Hunt, Roy F., 1986. Geotechnical Engineering. McGraw Hill Higher Education, Boston, MA, 1986.

Lambe T.W. and R.V. Whitman, 1969. Soil Mechanics, John Wiley & Sons, Inc., New York, NY 1969.

Salgado, R., 2008. The Engineering of Foundations. McGraw Hill Higher Education, Boston, MA 2008.

Qian, X., Koerner, R., and D. Gray, 2002. Geotechnical Aspects of Landfill Design and Construction. Prentice Hall, New York, NY 2002.

Attachments:

Attachment A - Geotechnical Borings and Lab Data (see Appendix A and D, respectively)
Attachment B - Geoslope Slope/W Input and Output Parameters
Attachment C - Geosynthetic Clay Liner Certified Properties
Attachment D - Limestone Unconfined Compressive Strength Test Data

CJB/KBK/SFS/ams

FN: G:\Projects\083\083-82\083-82671\083-82671.1 (Vertical Expansion)\Calculations\120feet_alternatives\Final 120 Feet Plan\Vertical Expansion Geotechnical Calculations_Final cb.ss.kk.docx

ATTACHMENT A

GEOTECHNICAL BORINGS AND LAB DATA

(SEE APPENDIX A AND APPENDIX D, RESPECTIVELY)

ATTACHMENT B
GEOSLOPE SLOPE/W INPUT AND OUTPUT PARAMETERS

SLOPE/W

Report generated using GeoStudio 2007, version 7.16. Copyright © 1991-2010 GEO-SLOPE International Ltd.

File Information

Revision Number: 22
Last Edited By: Brown, Chris
Date: 8/5/2010
Time: 3:20:54 PM
File Name: Progress_Ash_120ft_1V_3H_3_bench_phi_native_27_LS34_100Liner_02_ft_thick.gsz
Directory: G:\Projects\083\083-82\083-82671\083-82671.1 (Vertical Expansion)\Calculations\120feet_alternatives\

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W

Kind: SLOPE/W
Method: Spencer
Settings
- **Apply Phreatic Correction:** Yes
- **PWP Conditions Source:** Piezometric Line
- **Use Staged Rapid Drawdown:** No

Slip Surface
- **Direction of movement:** Right to Left
- **Use Passive Mode:** No
- **Slip Surface Option:** Grid and Radius
- **Critical slip surfaces saved:** 1
- **Optimize Critical Slip Surface Location:** Yes
- **Tension Crack**
  - **Tension Crack Option:** (none)

FOS Distribution
- **FOS Calculation Option:** Constant

Advanced
- **Number of Slices:** 30
- **Optimization Tolerance:** 0.01
- **Minimum Slip Surface Depth:** 0.1 ft
- **Optimization Maximum Iterations:** 2000
- **Optimization Convergence Tolerance:** 1e-007
- **Starting Optimization Points:** 8

Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Ash

Model: Mohr-Coulomb
Unit Weight: 95 pcf
Cohesion: 0 psf
Phi: 27 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay Material

Model: Mohr-Coulomb
Unit Weight: 95 pcf
Cohesion: 500 psf
Phi: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Limestone

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Grid

Upper Left: (-200.9901, 231.01648) ft
Lower Left: (-200.9901, 200.47699) ft
Lower Right: (260.7058, 200.47699) ft
Grid Horizontal Increment: 12
Grid Vertical Increment: 12
Left Projection Angle: 0 °
Right Projection Angle: 0 °

Slip Surface Radius

Upper Left Coordinate: (98.7364, 95.14885) ft
Upper Right Coordinate: (98.7364, 95.14885) ft
Lower Left Coordinate: (98.7364, 95.14885) ft
Lower Right Coordinate: (98.7364, 95.14885) ft
Number of Increments: 0

Left Projection: No
Left Projection Angle: 0 °
Right Projection: No
Right Projection Angle: 0 °

Slip Surface Limits

Left Coordinate: (-200, 95) ft
Right Coordinate: (1000, 215.2) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-200	93
	1000	93

Seismic Loads

Horz Seismic Load: 0
Vert Seismic Load: 0

Regions

	Material	Points	Area (ft²)
Region 1	Limestone	1,2,3,4,10,9,8,7,6,5	54000
Region 2	Clay Material	3,14,15,4	20
Region 3	Ash	14,16,17,18,19,20,21,22,23,24,9,10,4,15	96780

Points

	X (ft)	Y (ft)
Point 1	-200	50
Point 2	-200	95
Point 3	0	95
Point 4	100	95
Point 5	0	50
Point 6	100	50
Point 7	500	50
Point 8	1000	50
Point 9	1000	95
Point 10	500	95
Point 11	30.6932	203.06299
Point 12	-200	93
Point 13	1000	93

Point 14	0	95.2
Point 15	100	95.2
Point 16	90	125.2
Point 17	100	125.2
Point 18	190	155.2
Point 19	200	155.2
Point 20	290	185.2
Point 21	300	185.2
Point 22	390	215.2
Point 23	500	215.2
Point 24	1000	215.2

ATTACHMENT C
GEOSYNTHETIC CLAY LINER
CERTIFIED PROPERTIES

CETCO®

LINING TECHNOLOGIES

Certified Properties

BENTOMAT® SDN CERTIFIED PROPERTIES

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY $ft^2(m^2)$	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss[1]	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area[2]	ASTM D 5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2) min
GCL Grab Strength[3]	ASTM D 6768	200,000 ft^2 (20,000 m^2)	25 lbs/in (44 N/cm) MARV
GCL Peel Strength[3]	ASTM D 6496	40,000 ft^2 (4,000 m^2)	3.0 lbs/in (5.2 N/cm) min
GCL Index Flux[4]	ASTM D 5887	Weekly	1×10^{-8} m^3/m^2/sec max
GCL Hydraulic Conductivity[4]	ASTM D 5887	Weekly	5×10^{-9} cm/sec max
GCL Hydrated Internal Shear Strength[5]	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf

Bentomat SDN is a reinforced GCL consisting of a layer of sodium bentonite between two nonwoven geotextiles, which are needlepunched together.

Notes

[1] Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

[2] Bentonite mass/area reported at 0 percent moisture content.

[3] All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

[4] Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5×10^{-9} cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

[5] Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

CETCO has developed an edge enhancement system that eliminates the need to use additional granular sodium bentonite within the overlap area of the seams. We call this edge enhancement, SuperGroove™, and it comes standard on both longitudinal edges of Bentomat® SDN. It should be noted that SuperGroove™ does not appear on the end-of-roll overlaps and recommend the continued use of supplemental bentonite for all end-of-roll seams.

800.527.9948 Fax 847.851.1899

For the most up-to-date product information, please visit our website, www.cetco.com.
A wholly owned subsidiary of AMCOL International Corporation. The information and data contained herein are believed to be accurate and reliable, CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.

ATTACHMENT D

LIMESTONE UNCONFINED COMPRESSIVE STRENGTH TEST DATA

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE

ASTM D 2938

PROJECT TITLE	[illegible]	**SAMPLE ID**	C-2
PROJECT NO.	093-82538	**SAMPLE TYPE**	Core
REMARKS		**SAMPLE DEPTH**	18.0 - 19.0'

SAMPLE DATA

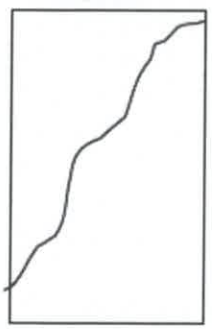
Height (in)	6.953
Diameter (in)	3.695
Height/Diameter Ratio	1.88
Area (in^2)	10.72
Volume (ft^3)	0.0431
Weight (gm)	2381.70
Wet Density (pcf)	121.6
Dry Density (pcf)	114.6
Machine Speed (in/min)	0.07
Strain rate (%/min)	1.00

WATER CONTENT	BEFORE SHEAR (entire)	AFTER SHEAR (partial)
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	2381.70	2606.84
Wt. Dry Soil & Tare (gm)	2242.91	2468.70
Wt. Tare (gm)	0.00	236.25
Wt. Moisture (gm)	138.79	138.14
Wt. Dry Soil (gm)	2242.91	2232.45
Moisture (%)	6.2%	6.2%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	A (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0	0.00	10.72	0	0
0.1	0.009	6	0.13	10.72	81	1
0.2	0.015	11	0.22	10.72	148	1
0.3	0.020	46	0.29	10.72	618	4
0.4	0.030	72	0.43	10.72	967	7
0.6	0.040	175	0.58	10.72	2,350	16
0.7	0.050	267	0.72	10.72	3,586	25
0.9	0.060	454	0.86	10.72	6,097	42
1.0	0.070	639	1.01	10.72	8,581	60
1.2	0.080	1703	1.15	10.72	22,870	159
1.3	0.090	2758	1.29	10.72	37,037	257
1.4	0.100	3970	1.44	10.72	53,313	370
1.7	0.119	6467	1.71	10.72	86,845	603
2.2	0.150	429	2.16	10.72	5,761	40
2.4	0.170	349	2.44	10.72	4,687	33
			UNCONFINED COMPRESSIVE STRENGTH		86,845	603

TIME TO FAILURE (min)	1.7
STRAIN @ FAILURE (%)	1.7

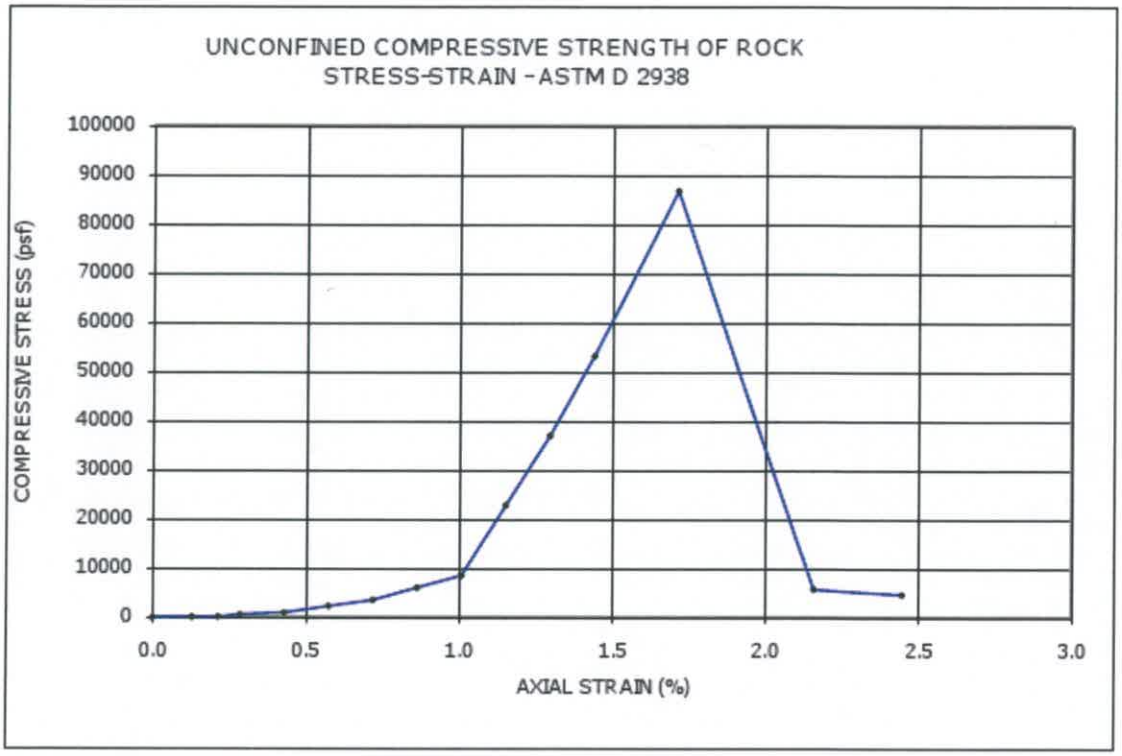
FAILURE SKETCH



SHEAR

Description Rock Core

TECH	AK
DATE	3/18/09
CHECK	
REVIEW	



SAMPLE DATA

Height (in)	6.95
Diameter (in)	3.70
Height/Diameter Ratio	1.88
Wet Density (pcf)	121.6
Dry Density (pcf)	114.6
Moisture Content	6.2%

TIME TO FAILURE (min)	1.7
STRAIN @ FAILURE (%)	1.7
TYPE OF FAILURE	SHEAR

UNCONFINED COMPRESSIVE STRENGTH (psf)	86,845
UNCONFINED COMPRESSIVE STRENGTH (psi)	603

PROJECT TITLE	PEF/FGD POND DESIGN & PERMIT/FL
PROJECT NUMBER	093-82538
SAMPLE ID	G-2
SAMPLE DEPTH	18.0 - 19.0'
SAMPLE TYPE	Core

093-82538
PEF/FGD POND DESIGN & PERMIT/FL

TECH	AK
DATE	3/18/2009
CHECK	
REVIEW	

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE

ASTM D 2938

PROJECT TITLE	[illegible]	**SAMPLE ID**	C-5
PROJECT NO.	093-82538	**SAMPLE TYPE**	Core
REMARKS		**SAMPLE DEPTH**	14.0 - 15.0'

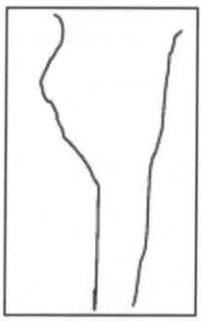
SAMPLE DATA	
Height (in)	9.543
Diameter (in)	3.806
Height/Diameter Ratio	2.51
Area (in^2)	11.38
Volume (ft^3)	0.0628
Weight (gm)	3537.22
Wet Density (pcf)	124.1
Dry Density (pcf)	113.2
Machine Speed (in/min)	0.10
Strain rate (%/min)	1.00

WATER CONTENT	**BEFORE SHEAR (entire)**	**AFTER SHEAR (partial)**
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	3537.22	3758.50
Wt. Dry Soil & Tare (gm)	3228.32	3450.84
Wt. Tare (gm)	0.00	235.44
Wt. Moisture (gm)	308.90	307.66
Wt. Dry Soil (gm)	3228.32	3215.40
Moisture (%)	9.6%	9.6%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	A (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0	0.00	11.38	0	0
0.0	0.003	11	0.03	11.38	139	1
0.1	0.010	91	0.10	11.38	1,152	8
0.2	0.015	218	0.16	11.38	2,759	19
0.3	0.025	404	0.26	11.38	5,113	36
0.4	0.040	1017	0.42	11.38	12,872	89
0.5	0.050	1382	0.52	11.38	17,492	121
0.6	0.060	2042	0.63	11.38	25,846	179
0.7	0.070	2784	0.73	11.38	35,237	245
0.8	0.080	3630	0.84	11.38	45,945	319
0.9	0.090	4710	0.94	11.38	59,615	414
1.0	0.100	5190	1.05	11.38	65,691	456
1.1	0.107	5782	1.12	11.38	73,184	508
1.2	0.110	5340	1.15	11.38	67,589	469
1.3	0.120	4370	1.26	11.38	55,312	384
1.4	0.130	3920	1.36	11.38	49,616	345
1.5	0.140	3760	1.47	11.38	47,591	330
1.6	0.150	2780	1.57	11.38	35,187	244
1.7	0.161	2815	1.69	11.38	35,630	247
		UNCONFINED COMPRESSIVE STRENGTH			73,184	508

TIME TO FAILURE (min)	1.1
STRAIN @ FAILURE (%)	1.1

FAILURE SKETCH



-LONGITUDINAL SPLITTING

Description Rock Core

TECH	AK
DATE	3/18/09
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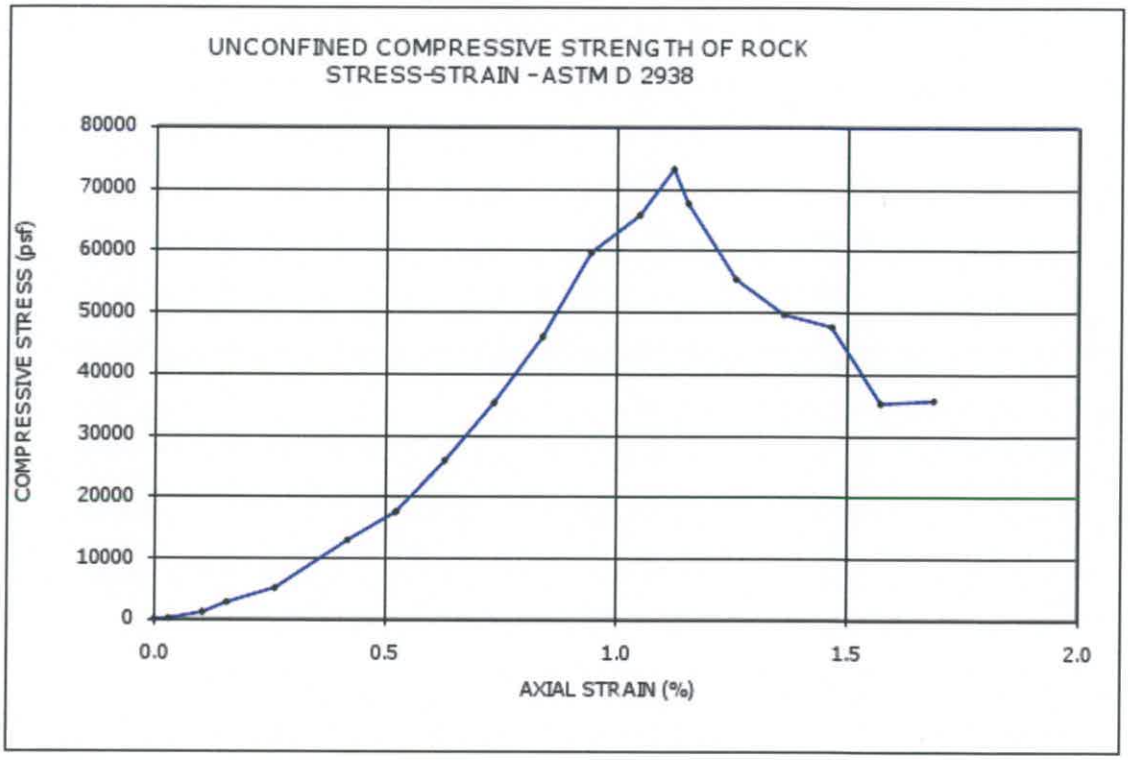
REVIEW	



SAMPLE DATA

Height (in)	9.54
Diameter (in)	3.81
Height/Diameter Ratio	2.51
Wet Density (pcf)	124.1
Dry Density (pcf)	113.2
Moisture Content	9.6%

TIME TO FAILURE (min)	1.1
STRAIN @ FAILURE (%)	1.1
TYPE OF FAILURE	-LONGITUDINAL SPLITTING

UNCONFINED COMPRESSIVE STRENGTH (psf)	73,184
UNCONFINED COMPRESSIVE STRENGTH (psi)	508

PROJECT TITLE	PEF/FGD POND DESIGN & PERMIT/FL
PROJECT NUMBER	093-82538
SAMPLE ID	C-5
SAMPLE DEPTH	14.0 - 15.0'
SAMPLE TYPE	Core

093-82538
PEF/FGD POND DESIGN & PERMIT/FL

TECH	AK
DATE	3/18/2009
CHECK	
REVIEW	

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE

ASTM D 2938

PROJECT TITLE	[illegible]	**SAMPLE ID**	C-8
PROJECT NO.	093-82538	**SAMPLE TYPE**	Core
REMARKS		**SAMPLE DEPTH**	8.0 - 9.0'

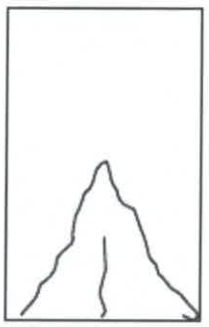
SAMPLE DATA	
Height (in)	8.251
Diameter (in)	4.000
Height/Diameter Ratio	2.06
Area (in^2)	12.57
Volume (ft^3)	0.0600
Weight (gm)	3083.55
Wet Density (pcf)	113.2
Dry Density (pcf)	100.8
Machine Speed (in/min)	0.07
Strain rate (%/min)	0.84

WATER CONTENT	**BEFORE SHEAR (entire)**	**AFTER SHEAR (partial)**
Tare No.	-	-
Wt. Wet Soil & Tare (gm)	3083.55	3310.00
Wt. Dry Soil & Tare (gm)	2745.35	2972.66
Wt. Tare (gm)	0.00	234.33
Wt. Moisture (gm)	338.20	337.34
Wt. Dry Soil (gm)	2745.35	2738.33
Moisture (%)	12.3%	12.3%

TIME (min)	DEFLECT (inch)	FORCE (lbs)	% STRAIN (in/in)	A (in^2)	COMPRESSIVE STRESS (psf)	COMPRESSIVE STRESS (psi)
0.0	0.000	0	0.00	12.57	0	0
0.2	0.015	26	0.18	12.57	298	2
0.4	0.025	271	0.30	12.57	3,105	22
0.7	0.050	1109	0.61	12.57	12,708	88
0.9	0.060	1460	0.73	12.57	16,730	116
1.0	0.070	1652	0.85	12.57	18,931	131
1.2	0.080	1711	0.97	12.57	19,607	136
1.3	0.090	2174	1.09	12.57	24,912	173
1.4	0.100	2434	1.21	12.57	27,892	194
1.5	0.104	2580	1.26	12.57	29,565	205
1.6	0.110	2238	1.33	12.57	25,646	178
1.8	0.125	1955	1.51	12.57	22,403	156
1.9	0.130	1938	1.58	12.57	22,208	154
2.0	0.140	1837	1.70	12.57	21,050	146
2.2	0.150	1816	1.82	12.57	20,810	145
			UNCONFINED COMPRESSIVE STRENGTH		29,565	205

TIME TO FAILURE (min)	1.5
STRAIN @ FAILURE (%)	1.3

FAILURE SKETCH



BRITTLE-DUCTILE TRANSITION

Description Rock Core

TECH	AK
DATE	3/18/09
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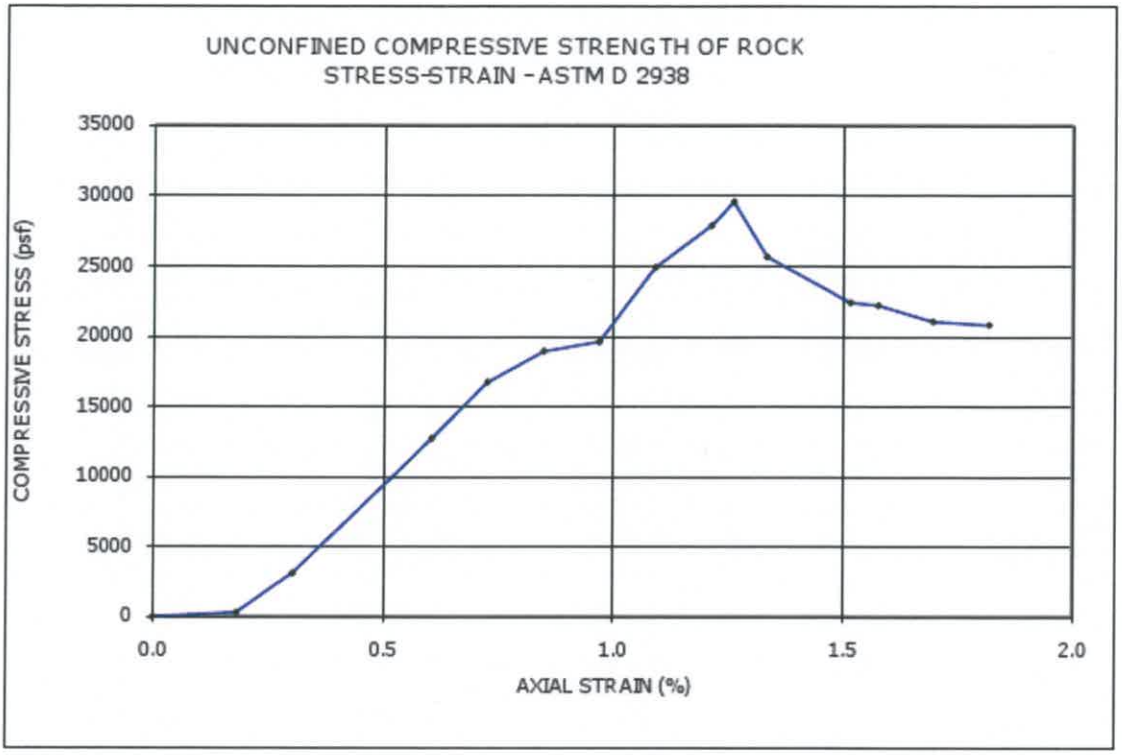

SAMPLE DATA

Height (in)	8.25
Diameter (in)	4.00
Height/Diameter Ratio	2.06
Wet Density (pcf)	113.2
Dry Density (pcf)	100.8
Moisture Content	12.3%

TIME TO FAILURE (min)	1.5
STRAIN @ FAILURE (%)	1.3
TYPE OF FAILURE	BRITTLE-DUCTILE TRANSITION

UNCONFINED COMPRESSIVE STRENGTH (psf)	29,565
UNCONFINED COMPRESSIVE STRENGTH (psi)	205

PROJECT TITLE	PEF/FGD POND DESIGN & PERMIT/FL
PROJECT NUMBER	093-82538
SAMPLE ID	C-8
SAMPLE DEPTH	8.0 - 9.0'
SAMPLE TYPE	Core

093-82538
PEF/FGD POND DESIGN & PERMIT/FL

TECH	AK
DATE	3/18/2009
CHECK	
REVIEW	

STORMWATER CALCULATIONS ASH STORAGE/DISPOSAL AREA VERTICAL EXPANSION

CRYSTAL RIVER ENERGY COMPLEX
CRYSTAL RIVER, FLORIDA

Prepared for: Progress Energy Florida, Inc.
15760 West Powerline Street
Crystal River, Florida 34428

Prepared by: Golder Associates Inc.
9428 Baymeadows Road, Suite 400
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KENNETH B. KARABLY
LICENSE
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STATE OF FLORIDA
PROFESSIONAL ENGINEER

Kenneth B. Karably
Florida Professional Engineer
No. 42366
Date: 7/22/2010

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Golder Associates

Golder Associates	SUBJECT	ASH STORAGE/DISPOSAL AREA VERTICAL RECONFIGUREATION STORMWATER CALCULATIONS			
	Job No.	083-82671.1	Made by	SFS	Date June 2010
	Ref.		Checked	CFB	Sheet 1 of 64
			Reviewed	KBK	

PURPOSE

The purpose of this calculation package is to verify that the proposed vertical reconfiguration of the ash disposal area at the Crystal River Energy Complex (CREC) and modifications to the existing permitted ash disposal area stormwater runoff system will meet the NPDES storage requirements and that design high water elevations will fall below top of bank elevations for a 25-year, 24-hour storm event and a 100-year, 24-hour storm event. This calculation package supercedes the stormwater calculation package dated March 2010 for the horizontal reconfiguration of the ash storage/disposal area.

BACKGROUND

The ash disposal area stormwater management system is permitted under NPDES Permit No. FL0036366. According to the NPDES permit, the ash disposal area runoff treatment system shall be capable of containing a 10-year, 24-hour rainfall event at the internal outfall I-C40. (FL0036366, Condition I.A.16). Attenuation of peak storm discharges to historic levels is not required because the receiving water body is tidally influenced (connected to the Gulf of Mexico) (Jacobs, 2006).

METHOD

Stormwater discharges and pond routing are estimated using the software package SMADA Version 6.43 for Windows written by Dr. R.D. Eaglin of the University of Central Florida. The program uses procedures presented in the Soil Conservation Service's TR-55 (SCS TR-55, 1986).

PROPOSED ASH DISPOSAL AREA RECONFIGURATION

WATERSHED AREA

The proposed vertical reconfiguration of the ash disposal area is both to expand vertically (increased height by approximately 40 feet) and to steepen side-slopes to a 3 horizontal to 1 vertical (3H:1V) configuration (increased from 4 horizontal to 1 vertical (4H:1V)). The proposed reconfiguration of the landfill is still within the boundaries established in the original SCA. The proposed disposal area reconfiguration and pond modifications are shown in Attachment 1. The watershed for the ash disposal pond is approximately 95.5 acres (again within the limits permitted under the original SCA). The proposed pond configuration is consistent to that which was previously presented to FDEP in the horizontal reconfiguration stormwater package dated March 2010. The watershed is also shown in Attachment 1.

STAGE-AREA STORAGE

The proposed pond design is consistent with that which was presented in the horizontal reconfiguration stormwater calculations dated March 2010. The pond contours (elevations are in site vertical datum) are as follows:

Item	Elevation
Bottom	92.00
Overflow Weir (from survey)	95.75
Top of Berm Elevation	97.00

The areas for each contour were measured with AutoCAD and the table with elevations, stage, area, and accumulated volume is presented in Attachment 2.

POND ROUTING

The 10-year, 24-hour storm event was routed through the pond to ensure that the volume of runoff generated by the event was retained. A check was made to ensure the safe management of the volume generated by a 25-year, 24-hour storm and 100-year, 24-hour storm events.

The following parameters were used in the generation of the hydrographs:

- **Design Rainfall**: Attachment 3 (SWFWMD) shows the location of the CREC facility on 10-year, 25-year, and 100-year rainfall maps. The CREC facility is located in Citrus County, Florida which falls under a SCS Type II Florida Modified rainfall distribution. The design storm event rainfall distributions and rainfall totals are presented in Attachment 4. The rainfall depths are summarized below:

Return Period (24-hour duration)	Rainfall Depth (inches)
10-year	7.0
25-year	8.6
100-year	11.5

- **Curve Number**: The composite Curve Number was calculated for the watershed for Hydrologic Group D soils. The composite CN of 89.3 was calculated based on the footprint area, ponds, ditches, and other areas. Pond areas were modeled as an impervious surface. The ash disposal area was modeled as open space with fair grass cover. Roads, ditches and other areas were conservatively modeled as paved surfaces. Attachment 5 presents the composite curve number and pertinent runoff curve number table (SCS TR-55, 1986).

- **Time of Concentration**: The average time of concentration for the final cover watershed was calculated based on 6 drainage basins (T1 through T6). The flow path for the time of concentration for each basin starts at the top of the ash disposal area from where it sheet flows to the rim ditch, then it travels down the ditch to the downlet pipe and either into a perimeter ditch or directly to the pond system. The average time of concentration was calculated at 18 minutes. Attachment 6 presents the average time of concentration calculation. Using the average time of concentration is a conservative estimate because by using less than the longest time of concentration, the entire area will not be contributing to the peak discharge.

- **Hydrographs**: The peak runoff of the 10-year, 25-year and 100-year, 24-hour hydrographs are shown below (Attachment 7 presents the rainfall hydrographs):

Storm Event	Peak Flow (cfs)
10-year, 24-hour	367.1
25-year, 24-hour	462.9
100-year, 24-hour	634.3

- **Spillway**: The overflow spillway (NPDES internal outfall I-C40) was surveyed to confirm the crest elevation and width. The spillway was modeled as a broad crested weir with an invert elevation of 95.75 feet and base width of 108 feet.

- **Results**: The routing was done assuming that the starting water elevation in the pond was 93 feet (seasonal high water level). The pond routing calculations are presented in Attachment 8 and summarized below:

Storm Event	Runoff Volume (acre-feet)	Peak Pond Discharge (cfs)	Peak Stage Elevation (feet)
10-year, 24-hour	45.7	0.0	95.7
25-year, 24-hour	58.2	17.5	95.9
100-year, 24-hour	80.9	94.8	96.1

The proposed final cover stormwater system will meet the NPDES requirement in terms of capability to contain the 10-year, 24-hour storm event and peak stages for both the 25-year and 100-year storm events fall below the top of bank elevation of 97 feet.

STORMWATER CHANNEL DESIGN

The stormwater management system will consist of side-slope bench ditches, rim ditches, drop inlet structures, downlet pipes, energy dissipaters, and perimeter ditches. The rational formula using the 100-year storm event was

used to estimate the peak discharges to size these facilities. The SCR TR-55 was used to determine the time of concentration and Manning's formula used to size channels.

- **Areas**: A watershed division plan is shown in Attachment 1. All the areas marks with a Tx (T1, T2, etc.) are areas contributing to rim ditches, areas marked with Ix are areas contributing to the intermediate bench ditches. Areas marked with a Bx are areas contributing either to the perimeter ditches or directly to the stormwater pond system.

- **Time of Concentration**: The flow path for the time of concentration for section of channel starts at the top of the disposal area in areas Tx from where it sheet flows to the rim ditch, then travels down through the ditch via a downlet pipe and enters either a the perimeter channel or directly into the stormwater pond system. The top of the landfill travel was at 2% slope and the side-slopes was with an average slope of 33%. Manning's roughness coefficient was estimated at n=0.24 for sheet flow. Water then flows in the ditch to empty into the downlet pipe. The time inside the downlet pipe was not taken into consideration because it was not significant. Once the water flows into the perimeter channel, it travels the remaining distance to reach the exit point of the sub-watershed. The different distances and times of concentrations are presented in Attachment 9.

- **Rest of Data for Rational Formula**: The rational formula flow is equal to the product of the rainfall density, area, and runoff coefficient (Q=C x I x A). The average intensity rainfall was taken from the DOT curves taking the time of concentration as the duration of the storm. Attachment 10 includes data from DOT showing the site location (Zone 5) and rainfall intensities. The C coefficient for rational formula was taken from the St. Johns River Water Management District Applicant's Handbook: Regulation of Stormwater Management Systems. The average "C" for 'Grass' for sandy soils was used and affected by a coefficient of 1.25 to account for the 100-year return period. The C value was selected based on the average slope; either between 2% and 7% for top areas or over 7% for side slope areas.

  C = 0.31 for top areas
  C = 0.38 for side slope areas

  The table for the different C coefficients, formulas, and peak flow from area presented in Attachment 10.

- **Areas and Peak Flows**: Instead of calculating peak flows for each area contributing to each rim ditch, the largest contributing watershed, T3-A, was used to determine the peak flow for all rim ditches. The largest contributing watershed, T3, was used to size downlet pipes and drop inlet structures for the rim ditches.

  The peak flow for the bench ditches was calculated using the largest contributing watershed, I11-A. The largest contributing area, I3, was used to size the downlet pipes from the bench ditches and drop inlet structures from the intermediate benches.

  The peak flow for the northwest and west perimeter ditches was calculated using their individual contributing watersheds. Attachment 10 presents the rational formula calculation results.

  The table below summarizes the contributing areas for each section:

Design Element (Area)	Contributing Watershed	Area (acres)	Peak Flow (cfs)
Rim Ditch	T3-A	0.7	1.8
Rim Ditch Downlet Pipe	T3	1.4	3.4
Bench Ditch	I11-A	1.0	3.7
Bench Ditch Downlet Pipe	I4	3.8	14.3
Access Ramp Ditch	B5	2.1	8.1
Northwest Perimeter Ditch	B5,B6,I11,I12,T1	9.6	26.9
West Perimeter Ditch	B4,I10,T6	5.3	16.1

- **Channel Design**: The rim-ditches were designed as trapezoidal with 3H:1V side slopes, base width of 2 feet and 2 feet deep. The bench ditches were designed as triangular, with 3H:1V inner slope, 3.6H:1V outer slope and 2 feet deep. The perimeter ditches were designed as trapezoidal with 3H:1V side slopes, a base width of 6 feet, and 2 feet deep. The slopes were designed at 0.5% for rim ditches, bench ditches, and the perimeter ditches. A Manning coefficient of 0.03 was chosen to reflect channels lined with grass in good condition. The access ramp ditch was designed as trapezoidal with 3H:1V side-slopes, a base width of 3 feet, 2 feet depth, and with a slope of approximately 10%. A summary of the results of channels dimensioning for the perimeter channels, bench ditches and rim ditches is presented in Attachment 11.

- **Downlet Pipe and Drop Inlet Structure for Bench and Rim Ditches**: Downlet pipes will be designed to convey the flow of water collected in the rim and bench ditches and transport it down to the stormwater pond system or perimeter channels, a separate pipe will be used for the bench ditches. The total flow calculated was 3.4 cfs for the rim drop inlet and 14.3 cfs for the bench channels. FDOT Type C drop inlet boxes and FDOT Type E inlet boxes were selected for the rim and bench ditches, respectively. The downlet pipes conveying flow from the rim inlet box to the perimeter channel was selected as a 12-inch HDPE pipe. The downlet pipe conveying flow from the side-slope bench drop inlets was selected as a 18-inch diameter HDPE pipe. See Attachment 12 for pipe sizing spreadsheet calculations.

  The flow through the grates was checked using the maximum head (0.39 and 0.79 foot, for the rim ditch and bench ditch, respectively) of the approaching channel during peak flow conditions The capacity of the drop inlet boxes was also checked with the flow controlled by the orifice in the downlet pipe. The maximum head build-up from the peak flow of the berm-ditches was sufficient to get the maximum flow through the grates and into the downlet pipes. The formulas used and calculations are presented in Attachment 12.

Drop Inlet and Downlet Pipe	Peak Flow (cfs)	Head during Peak Flow (feet)	Type of Drop Inlet	Pipe Diameter (inches)
Rim Ditch	3.4	0.39	Type C Grate	12
Bench Ditch	14.3	0.79	Type E Grate	18

PREVIOUS STROMWATER CONFIGURATION

The previous configuration (prior to horizontal reconfiguration) of the ash disposal area and its associated stormwater management system is shown in Attachment 13. The watershed for the existing configuration pond is the same as the proposed reconfiguration pond at 95.5 acres.

The existing configuration pond contour elevations, stage, area, and accumulated volume is presented in a table in Attachment 13 (the contours were developed from survey information and pond design information and the area for each contour was measured in AutoCAD).

The composite curve number was calculated at 89.9 for the existing configuration watershed (see Attachment 13).

The time of concentration flow path for the existing ash disposal configuration starts at the top of the ash disposal area from where it sheet flows to the side-slope, then it travels down the side-slope under shallow concentration flow conditions and enters a western perimeter ditch, and then flows down the ditch into the pond system. The calculation of the time of concentration is shown in Attachment 13.

HYDROGRAPHS AND POND ROUTING

Rainfall hydrographs for the existing configuration watershed were developed for the 10-year, 25-year, and 100-year, 24-hour design storms (Attachment 14). These hydrographs were routed through the existing configuration pond (overflow spillway consistent with that described above). The routing was down assuming that the starting water elevation in the pond was 93 feet (seasonal high water level). The pond routing calculations are presented in Attachment 14 and summarized below:

Storm Event	Peak Flow (cfs)	Runoff Volume (acre-feet)	Peak Pond Discharge (cfs)	Peak Stage Elevation (feet)
10-year, 24-hour	226.6	46.2	0	95.5
25-year, 24-hour	284.2	58.7	11.3	95.8
100-year, 24-hour	387.3	81.5	54.5	96.0

The proposed reconfiguration peak discharges and stage elevations are not significantly different from the existing configuration pond routing results.

REFERENCES

Jacobs Engineering Inc, Drainage Report for Progress Energy Clean Air Project - North Plant (Units 4 &5), November 2006.

Florida Department of Environmental Protection, August 15, 2005. Industrial Wastewater Permit No. FL0036366 (NPDES), Progress Energy Florida, Inc., Crystal River Units 4 and 5.

Soil Conservation Service, 1986, Urban Hydrology for Small Watershed - Technical Release 55.

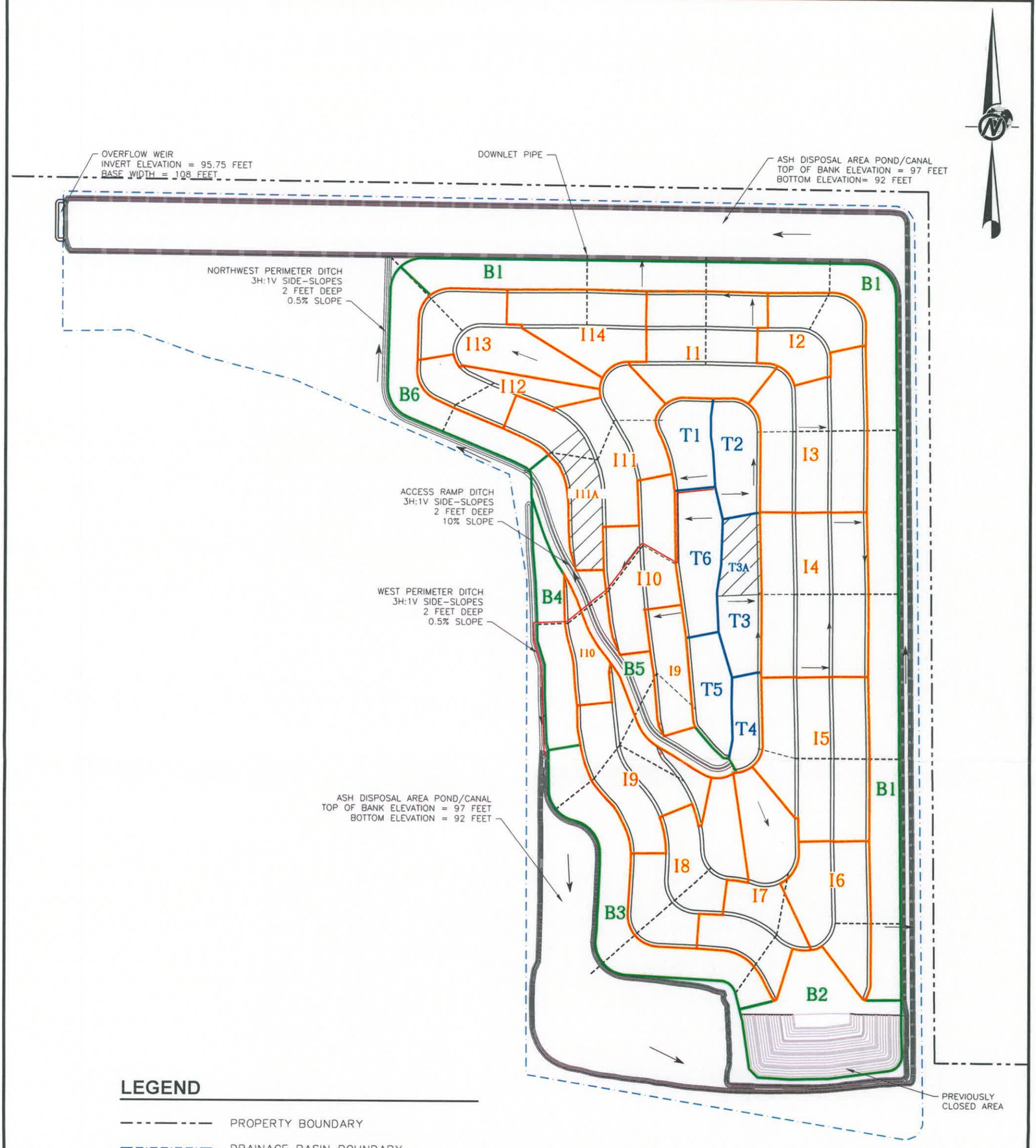
Southwest Florida Water Management District, Environmental Resource Permitting Information Manual, Part D - Project Design Aids, July 1996.

Malcom, H. Rooney, 1989; Elements of Urban Stormwater Design; North Carolina State University, Raleigh, NC.

Golder Associates Inc., Ash Storage/Disposal Area Horizontal Reconfiguration Stormwater Calculations, March 2010.

ATTACHMENT 1

Drawing file: final cover_stormwater_rev2_012110.dwg Jan 21, 2010 - 2:30pm



LEGEND

- PROPERTY BOUNDARY
- DRAINAGE BASIN BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- DOWNLET PIPE
- DIRECTION OF STORMWATER FLOW
- **Tx** TOP DRAINAGE AREA
- **Ix** SIDE-SLOPE DRAINAGE AREA
- **Bx** BASE-SLOPE DRAINAGE AREA

300 0 300
SCALE FEET

FIGURE 1

REVIEW	VBK 1/22/10
CHECK	SFS
CADD	SFS 01/05/10
DESIGN	
REV. 0 SCALE AS SHOWN	
FILE No.	
PROJECT No. 083-82671.1	

TITLE

PROPOSED FINAL COVER RECONFIGURATION STORMWATER MANAGMENT SYSTEM

PROJECT

PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
ASH DISPOSAL AREA RECONFIGURATION

Golder Associates
Jacksonville, Florida

ATTACHMENT 2

STAGE-AREA-VOLUMES CURVES

Project ID: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project #: **083-82671.1**

Bottom area = 630,603 ft2
Bottom elevation = 92.0

Volume 1 $V(i+1) = V(i) + (A(i+1)+A(i)) * 0.5 * (h(i+1) - h(i))$

Elevation (ft)	Stage (h) (ft)	Area (ft2)	Area (acres)	Accum. Volume 1 (ft3)	Accum. Volume 1 acre-feet	Notes
92.0	0.0	**630,603**	14.48	0	0.00	Pond bottom
93.0	1.0	**675,078**	15.50	652,841	14.99	Approximate Seasonal High Groundwater
94.0	2.0	**718,214**	16.49	1,349,487	30.98	
95.0	3.0	**761,384**	17.48	2,089,286	47.96	
95.75	3.8	**793,899**	18.23	2,672,517	61.35	Spillway Elevation
96.0	4.0	**804,108**	18.46	2,872,268	65.94	
97.0	5.0	**847,324**	19.45	3,697,984	84.89	Top of Berm

ATTACHMENT 3

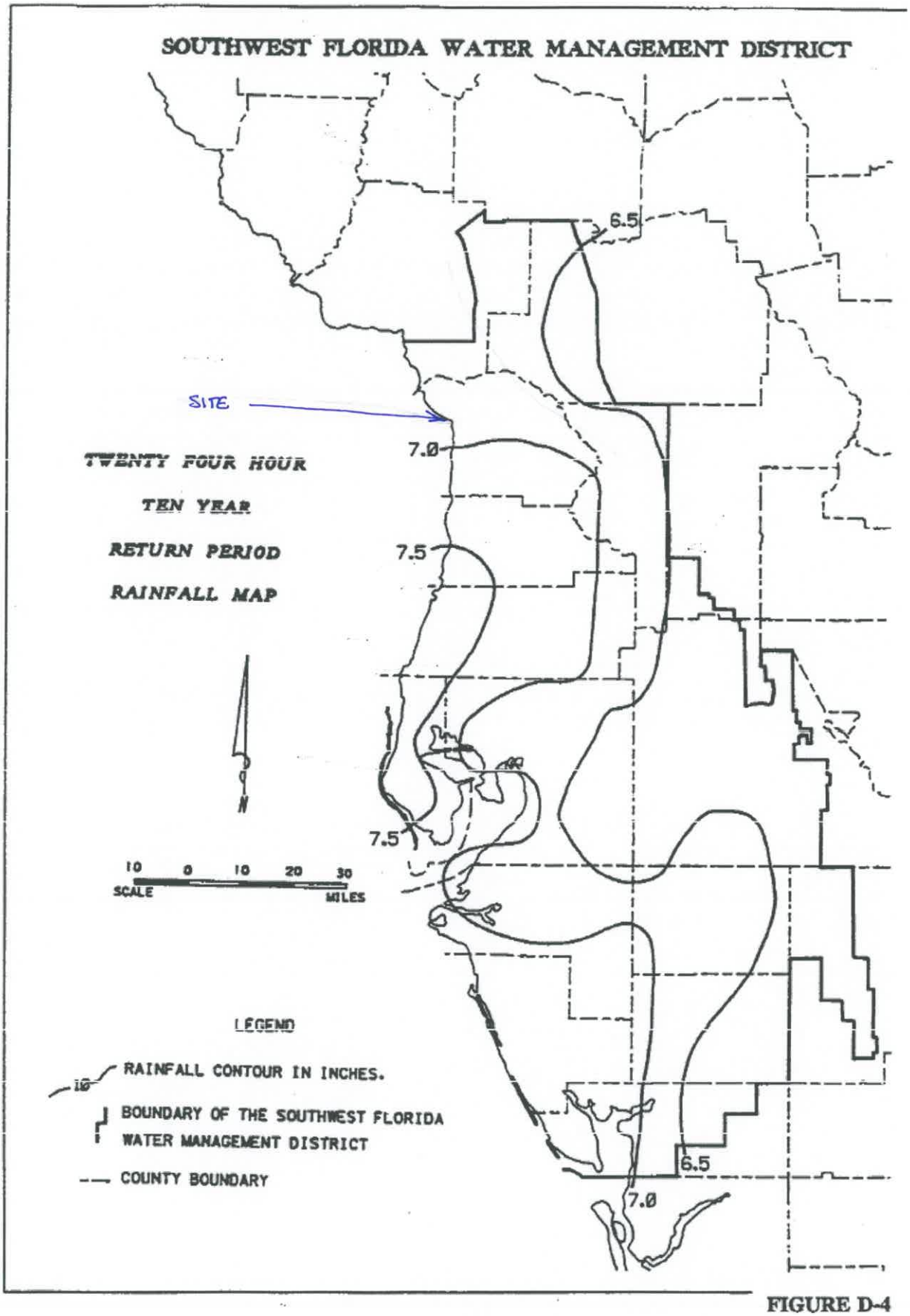

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SITE
TWENTY FOUR HOUR
TEN YEAR
RETURN PERIOD
RAINFALL MAP
6.5
7.0
7.5
7.5
6.5
7.0
N
10 0 10 20 30
SCALE
MILES
LEGEND
10 RAINFALL CONTOUR IN INCHES.
BOUNDARY OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
COUNTY BOUNDARY

FIGURE D-4

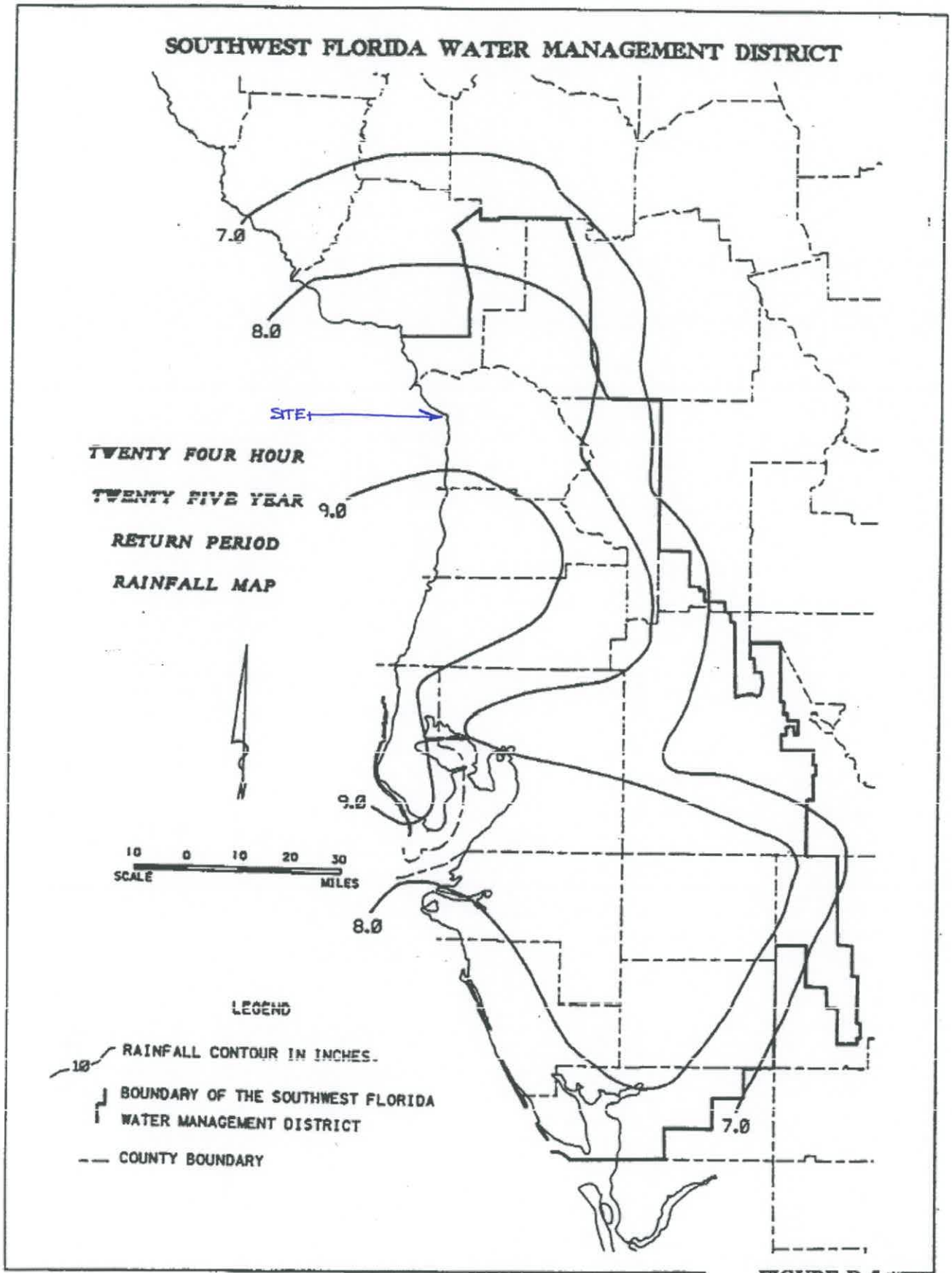

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
7.0
8.0
SITE
TWENTY FOUR HOUR
TWENTY FIVE YEAR
RETURN PERIOD
RAINFALL MAP
9.0
N
9.0
10 0 10 20 30
SCALE
MILES
8.0
LEGEND
10 RAINFALL CONTOUR IN INCHES.
BOUNDARY OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
COUNTY BOUNDARY
7.0

FIGURE D-5

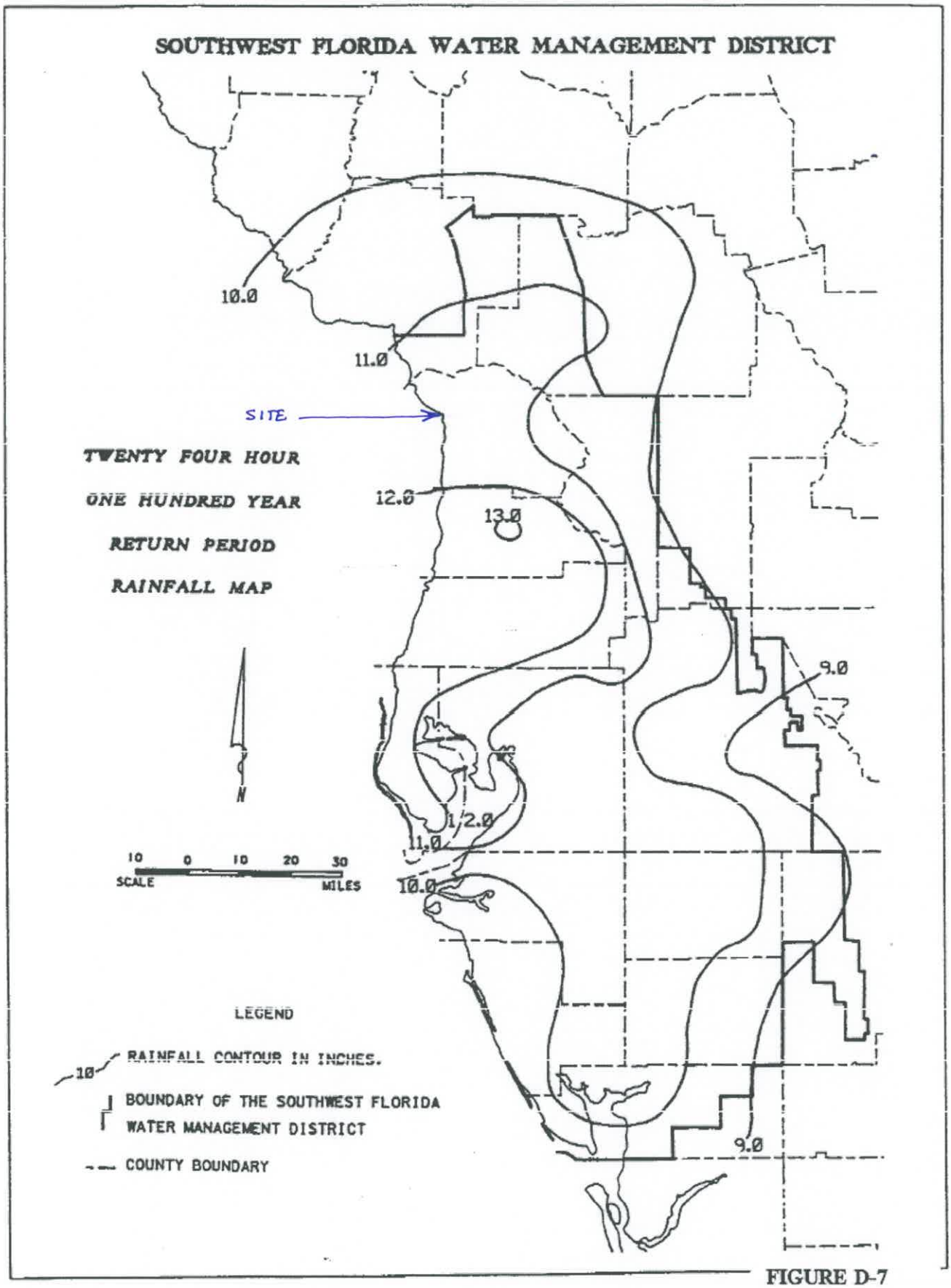

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
10.0
11.0
SITE
TWENTY FOUR HOUR
ONE HUNDRED YEAR
RETURN PERIOD
RAINFALL MAP
12.0
13.0
9.0
N
10 0 10 20 30
SCALE
MILES
12.0
11.0
10.0
9.0
LEGEND
10 RAINFALL CONTOUR IN INCHES.
BOUNDARY OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
COUNTY BOUNDARY

FIGURE D-7

ATTACHMENT 4

10-YEAR, 24-HOUR STORM EVENT RAINFALL

Time (hr)	Time HHMM	Rain (in)	Cumulative (in)
0.500	00030	0.042	0.042
1.000	00100	0.042	0.084
1.500	00130	0.049	0.133
2.000	00200	0.042	0.175
2.500	00230	0.049	0.224
3.000	00300	0.049	0.273
3.500	00330	0.056	0.329
4.000	00400	0.049	0.378
4.500	00430	0.056	0.434
5.000	00500	0.063	0.497
5.500	00530	0.063	0.560
6.000	00600	0.063	0.623
6.500	00630	0.070	0.693
7.000	00700	0.077	0.770
7.500	00730	0.084	0.854
8.000	00800	0.084	0.938
8.500	00830	0.098	1.036
9.000	00900	0.112	1.148
9.500	00930	0.119	1.267
10.00	01000	0.140	1.407
10.50	01030	0.175	1.582
11.00	01100	0.224	1.806
11.50	01130	0.350	2.156
12.00	01200	2.093	4.249
12.50	01230	0.784	5.033
13.00	01300	0.266	5.299
13.50	01330	0.196	5.495
14.00	01400	0.154	5.649
14.50	01430	0.133	5.782
15.00	01500	0.112	5.894
15.50	01530	0.105	5.999
16.00	01600	0.091	6.090
16.50	01630	0.084	6.174
17.00	01700	0.077	6.251
17.50	01730	0.077	6.328
18.00	01800	0.063	6.391
18.50	01830	0.070	6.461
19.00	01900	0.056	6.517
19.50	01930	0.063	6.580
20.00	02000	0.056	6.636
20.50	02030	0.049	6.685
21.00	02100	0.049	6.734
21.50	02130	0.049	6.783
22.00	02200	0.049	6.832
22.50	02230	0.049	6.881
23.00	02300	0.042	6.923
23.50	02330	0.042	6.965
24.00	00000	0.035	7.000
		7.00	

25-YEAR, 24-HOUR STORM EVENT RAINFALL

Time (hr)	Time HHMM	Rain (in)	Cumulative (in)
0.500	00030	0.052	0.052
1.000	00100	0.052	0.103
1.500	00130	0.060	0.163
2.000	00200	0.052	0.215
2.500	00230	0.060	0.275
3.000	00300	0.060	0.335
3.500	00330	0.069	0.404
4.000	00400	0.060	0.464
4.500	00430	0.069	0.533
5.000	00500	0.077	0.611
5.500	00530	0.077	0.688
6.000	00600	0.077	0.765
6.500	00630	0.086	0.851
7.000	00700	0.095	0.946
7.500	00730	0.103	1.049
8.000	00800	0.103	1.152
8.500	00830	0.120	1.273
9.000	00900	0.138	1.410
9.500	00930	0.146	1.556
10.00	01000	0.172	1.728
10.50	01030	0.215	1.943
11.00	01100	0.275	2.219
11.50	01130	0.430	2.648
12.00	01200	2.571	5.220
12.50	01230	0.963	6.183
13.00	01300	0.327	6.509
13.50	01330	0.241	6.750
14.00	01400	0.189	6.939
14.50	01430	0.163	7.103
15.00	01500	0.138	7.240
15.50	01530	0.129	7.369
16.00	01600	0.112	7.481
16.50	01630	0.103	7.584
17.00	01700	0.095	7.679
17.50	01730	0.095	7.773
18.00	01800	0.077	7.851
18.50	01830	0.086	7.937
19.00	01900	0.069	8.006
19.50	01930	0.077	8.083
20.00	02000	0.069	8.152
20.50	02030	0.060	8.212
21.00	02100	0.060	8.272
21.50	02130	0.060	8.332
22.00	02200	0.060	8.393
22.50	02230	0.060	8.453
23.00	02300	0.052	8.504
23.50	02330	0.052	8.556
24.00	00000	0.043	8.599
		8.60	

100-YEAR, 24-HOUR STORM EVENT RAINFALL

Time (hr)	Time HHMM	Rain (in)	Cumulative (in)
0.500	00030	0.069	0.069
1.000	00100	0.069	0.138
1.500	00130	0.080	0.218
2.000	00200	0.069	0.287
2.500	00230	0.080	0.368
3.000	00300	0.080	0.448
3.500	00330	0.092	0.540
4.000	00400	0.080	0.620
4.500	00430	0.092	0.712
5.000	00500	0.103	0.816
5.500	00530	0.103	0.919
6.000	00600	0.103	1.022
6.500	00630	0.115	1.137
7.000	00700	0.126	1.264
7.500	00730	0.138	1.402
8.000	00800	0.138	1.539
8.500	00830	0.161	1.700
9.000	00900	0.184	1.884
9.500	00930	0.195	2.079
10.00	01000	0.230	2.309
10.50	01030	0.287	2.596
11.00	01100	0.368	2.964
11.50	01130	0.574	3.538
12.00	01200	3.435	6.973
12.50	01230	1.287	8.260
13.00	01300	0.437	8.696
13.50	01330	0.322	9.018
14.00	01400	0.253	9.271
14.50	01430	0.218	9.489
15.00	01500	0.184	9.673
15.50	01530	0.172	9.845
16.00	01600	0.149	9.995
16.50	01630	0.138	10.132
17.00	01700	0.126	10.259
17.50	01730	0.126	10.385
18.00	01800	0.103	10.489
18.50	01830	0.115	10.603
19.00	01900	0.092	10.695
19.50	01930	0.103	10.799
20.00	02000	0.092	10.891
20.50	02030	0.080	10.971
21.00	02100	0.080	11.051
21.50	02130	0.080	11.132
22.00	02200	0.080	11.212
22.50	02230	0.080	11.293
23.00	02300	0.069	11.362
23.50	02330	0.069	11.431
24.00	00000	0.057	11.488
		11.49	

ATTACHMENT 5

COMPOSITE CURVE NUMBER

Project ID: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project #: **083-82671.1**

Area Type	Area (acres)	Curve Number (CN)
Ash Disposal Area	62.0	84
Ponds	19.4	100
Ditches and Other Areas	14.1	98
	95.5	

Composite Curve Number 89.3

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

ASH DISPOSAL AREA

DITCHES AND OTHER AREAS

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

ATTACHMENT 6

Time of Concentration - TR-55 Worksheet

Project ID: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**
Project #: **083-82671.1**

TRAVEL TIME PARAMETERS

Sheet Flow		Rim Ditch		Northwest Ditch		West Ditch	
P =	5	n =	0.03	n =	0.03	n =	0.03
s =	0.02	A =	1.24	A =	9.36	A =	6.51
n =	0.24	WP =	4.47	WP =	12.51	WP =	10.93
		Rh =	0.28	Rh =	0.75	Rh =	0.59
		s =	0.005	s =	0.005	s =	0.005
		v =	1.49	v =	2.89	v =	2.47

	TRAVEL DISTANCES (FT)				TRAVEL TIMES (HOURS)					
ID	Top of BSA	Rim Ditch	Northwest Ditch	West Ditch	Sheet Flow (Top of BSA)	Rim Ditch Flow	Northwest Ditch	West Ditch	**TOC (hr)**	**TOC (min)**
T1	170	225	930	0	0.291	0.042	0.089	0.000	**0.422**	**25**
T2	110	250	0	0	0.205	0.046	0.000	0.000	**0.252**	**15**
T3	110	250	0	0	0.205	0.046	0.000	0.000	**0.252**	**15**
T4	150	240	0	0	0.263	0.045	0.000	0.000	**0.308**	**18**
T5	95	220	0	0	0.183	0.041	0.000	0.000	**0.224**	**13**
T6	140	140	0	400	0.249	0.026	0.038	0.045	**0.358**	**22**

AVERAGE TIME OF CONCENTRATION 18

Notes
P = rainfall for 2-yr, 24-hour storm (inches)
s = watercourse slope (ft/ft)
n = Manning's roughness coefficient
v = velocity (ft/sec) [from chart for shallow concentration flow, calculated in channel travel]
A = Area (ft2) - see Attachment 11
WP = Wet Perimeter (ft) - see Attachment 11
Rh = Hydraulic Radius (ft) [Area/Wet Perimeter]

ATTACHMENT 7

SMADA 6.0 for Windows
Watershed Information

Watershed Total Area (acres)	:95.48
Impervious Area (acres)	:0.00
Time of Concentration (min)	:18.0
% Impervious Directly Connected	:00.00

Additional Abstraction

Over Pervious Area (inches)	:0.00
Over Impervious Area (inches)	:0.00

Infiltration Characteristics:

Max Infiltration Capacity (in)	:999.00
SCS Curve Number for Pervious	:89.3
Initial Abstraction Factor	:0.20

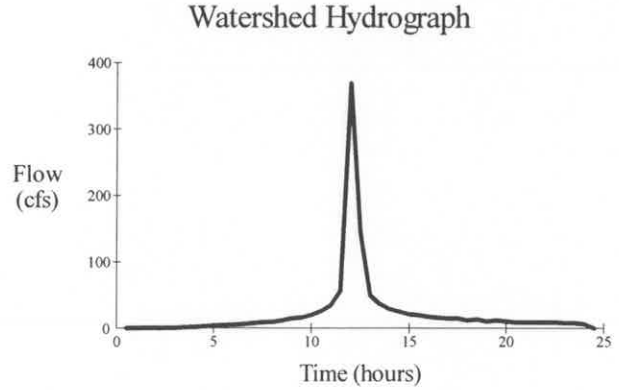
10-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH

Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.042	0.042	0.042	0.000	0.000	0.000
1.000	00100	0.042	0.084	0.042	0.000	0.000	0.000
1.500	00130	0.049	0.133	0.049	0.000	0.000	0.000
2.000	00200	0.042	0.175	0.042	0.000	0.000	0.000
2.500	00230	0.049	0.224	0.049	0.000	0.000	0.000
3.000	00300	0.049	0.273	0.048	0.001	0.174	0.174
3.500	00330	0.056	0.329	0.051	0.005	1.020	1.019
4.000	00400	0.049	0.378	0.041	0.008	1.563	1.563
4.500	00430	0.056	0.434	0.043	0.013	2.465	2.464
5.000	00500	0.063	0.497	0.045	0.018	3.537	3.537
5.500	00530	0.063	0.560	0.041	0.022	4.250	4.250
6.000	00600	0.063	0.623	0.038	0.025	4.878	4.877
6.500	00630	0.070	0.693	0.038	0.032	6.068	6.068
7.000	00700	0.077	0.770	0.039	0.038	7.368	7.367
7.500	00730	0.084	0.854	0.038	0.046	8.760	8.759
8.000	00800	0.084	0.938	0.035	0.049	9.416	9.416
8.500	00830	0.098	1.036	0.037	0.061	11.704	11.703
9.000	00900	0.112	1.148	0.038	0.074	14.192	14.191
9.500	00930	0.119	1.267	0.036	0.083	15.891	15.891
10.00	01000	0.140	1.407	0.038	0.102	19.599	19.598
10.50	01030	0.175	1.582	0.042	0.133	25.638	25.636
11.00	01100	0.224	1.806	0.046	0.178	34.304	34.300
11.50	01130	0.350	2.156	0.058	0.292	56.137	56.128
12.00	01200	2.093	4.249	0.185	1.908	367.215	367.086
12.50	01230	0.784	5.033	0.036	0.748	143.966	144.058
13.00	01300	0.266	5.299	0.010	0.256	49.241	49.280
13.50	01330	0.196	5.495	0.007	0.189	36.386	36.392
14.00	01400	0.154	5.649	0.005	0.149	28.645	28.648
14.50	01430	0.133	5.782	0.004	0.129	24.776	24.777
15.00	01500	0.112	5.894	0.003	0.109	20.889	20.890
15.50	01530	0.105	5.999	0.003	0.102	19.603	19.603
16.00	01600	0.091	6.090	0.003	0.088	17.004	17.005
16.50	01630	0.084	6.174	0.002	0.082	15.707	15.708
17.00	01700	0.077	6.251	0.002	0.075	14.408	14.408
17.50	01730	0.077	6.328	0.002	0.075	14.416	14.416
18.00	01800	0.063	6.391	0.002	0.061	11.802	11.803
18.50	01830	0.070	6.461	0.002	0.068	13.119	13.119
19.00	01900	0.056	6.517	0.001	0.055	10.500	10.501
19.50	01930	0.063	6.580	0.002	0.061	11.818	11.817
20.00	02000	0.056	6.636	0.001	0.055	10.509	10.510
20.50	02030	0.049	6.685	0.001	0.048	9.199	9.199
21.00	02100	0.049	6.734	0.001	0.048	9.202	9.202
21.50	02130	0.049	6.783	0.001	0.048	9.205	9.205
22.00	02200	0.049	6.832	0.001	0.048	9.207	9.207
22.50	02230	0.049	6.881	0.001	0.048	9.210	9.210
23.00	02300	0.042	6.923	0.001	0.041	7.897	7.897
23.50	02330	0.042	6.965	0.001	0.041	7.899	7.899
24.00	00000	0.035	7.000	0.001	0.034	6.584	6.584
24.50	00030	0.000	7.000	0.000	0.000	0.000	0.003
			7.000	1.257	5.741	5.741	

Totals for Watershed in inches over 95.48 acres

Rational Coefficient = 0.820 Peak Flow (cfs) = 367.09



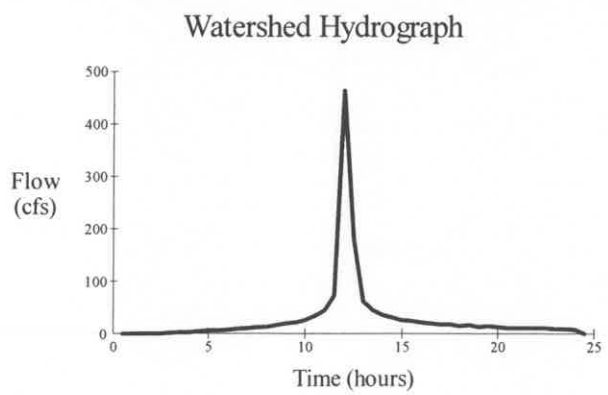
25-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH

Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.052	0.052	0.052	0.000	0.000	0.000
1.000	00100	0.052	0.103	0.052	0.000	0.000	0.000
1.500	00130	0.060	0.163	0.060	0.000	0.000	0.000
2.000	00200	0.052	0.215	0.052	0.000	0.000	0.000
2.500	00230	0.060	0.275	0.059	0.001	0.197	0.197
3.000	00300	0.060	0.335	0.054	0.006	1.166	1.166
3.500	00330	0.069	0.404	0.056	0.013	2.460	2.459
4.000	00400	0.060	0.464	0.045	0.016	3.008	3.007
4.500	00430	0.069	0.533	0.047	0.022	4.285	4.284
5.000	00500	0.077	0.611	0.047	0.030	5.759	5.759
5.500	00530	0.077	0.688	0.043	0.034	6.618	6.618
6.000	00600	0.077	0.765	0.039	0.038	7.362	7.361
6.500	00630	0.086	0.851	0.040	0.046	8.935	8.935
7.000	00700	0.095	0.946	0.039	0.055	10.623	10.623
7.500	00730	0.103	1.049	0.039	0.064	12.404	12.403
8.000	00800	0.103	1.152	0.035	0.068	13.133	13.133
8.500	00830	0.120	1.273	0.037	0.084	16.109	16.108
9.000	00900	0.138	1.410	0.037	0.100	19.289	19.288
9.500	00930	0.146	1.556	0.035	0.111	21.357	21.356
10.00	01000	0.172	1.728	0.037	0.135	26.071	26.069
10.50	01030	0.215	1.943	0.040	0.175	33.761	33.758
11.00	01100	0.275	2.219	0.043	0.232	44.719	44.714
11.50	01130	0.430	2.648	0.054	0.376	72.392	72.381
12.00	01200	2.571	5.220	0.166	2.405	463.021	462.860
12.50	01230	0.963	6.183	0.031	0.932	179.350	179.467
13.00	01300	0.327	6.509	0.009	0.318	61.205	61.253
13.50	01330	0.241	6.750	0.006	0.235	45.190	45.197
14.00	01400	0.189	6.939	0.004	0.185	35.556	35.560
14.50	01430	0.163	7.103	0.004	0.160	30.740	30.742
15.00	01500	0.138	7.240	0.003	0.135	25.908	25.910
15.50	01530	0.129	7.369	0.003	0.126	24.306	24.307
16.00	01600	0.112	7.481	0.002	0.110	21.078	21.079
16.50	01630	0.103	7.584	0.002	0.101	19.467	19.468
17.00	01700	0.095	7.679	0.002	0.093	17.853	17.854
17.50	01730	0.095	7.773	0.002	0.093	17.861	17.861
18.00	01800	0.077	7.851	0.001	0.076	14.619	14.620
18.50	01830	0.086	7.937	0.002	0.084	16.249	16.248
19.00	01900	0.069	8.006	0.001	0.068	13.003	13.005
19.50	01930	0.077	8.083	0.001	0.076	14.633	14.632
20.00	02000	0.069	8.152	0.001	0.068	13.011	13.012
20.50	02030	0.060	8.212	0.001	0.059	11.387	11.388
21.00	02100	0.060	8.272	0.001	0.059	11.390	11.390
21.50	02130	0.060	8.332	0.001	0.059	11.392	11.392
22.00	02200	0.060	8.393	0.001	0.059	11.395	11.395
22.50	02230	0.060	8.453	0.001	0.059	11.397	11.397
23.00	02300	0.052	8.504	0.001	0.051	9.771	9.772
23.50	02330	0.052	8.556	0.001	0.051	9.773	9.773
24.00	00000	0.043	8.599	0.001	0.042	8.145	8.146
24.50	00030	0.000	8.599	0.000	0.000	0.000	0.003
			8.599	1.288	7.309	7.309	

Totals for Watershed in inches over 95.48 acres

Rational Coefficient = 0.850 Peak Flow (cfs) = 462.86



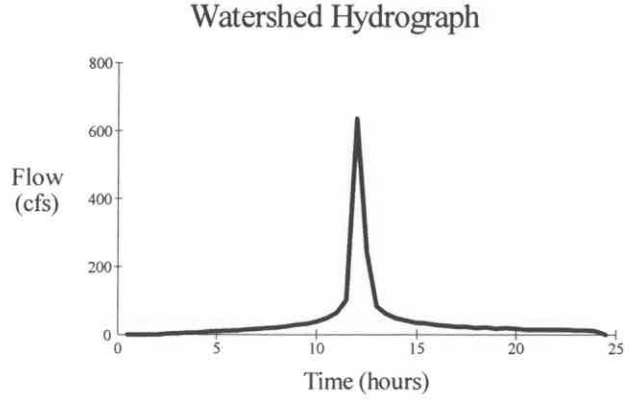
100-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH

Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.069	0.069	0.069	0.000	0.000	0.000
1.000	00100	0.069	0.138	0.069	0.000	0.000	0.000
1.500	00130	0.080	0.218	0.080	0.000	0.000	0.000
2.000	00200	0.069	0.287	0.067	0.002	0.349	0.349
2.500	00230	0.080	0.368	0.070	0.011	2.028	2.027
3.000	00300	0.080	0.448	0.062	0.019	3.566	3.565
3.500	00330	0.092	0.540	0.063	0.029	5.641	5.640
4.000	00400	0.080	0.620	0.049	0.032	6.086	6.086
4.500	00430	0.092	0.712	0.050	0.042	8.063	8.062
5.000	00500	0.103	0.816	0.050	0.053	10.263	10.262
5.500	00530	0.103	0.919	0.045	0.059	11.325	11.324
6.000	00600	0.103	1.022	0.040	0.063	12.220	12.219
6.500	00630	0.115	1.137	0.040	0.075	14.467	14.466
7.000	00700	0.126	1.264	0.039	0.087	16.826	16.825
7.500	00730	0.138	1.402	0.038	0.100	19.272	19.271
8.000	00800	0.138	1.539	0.034	0.104	20.073	20.073
8.500	00830	0.161	1.700	0.035	0.126	24.266	24.264
9.000	00900	0.184	1.884	0.035	0.149	28.660	28.658
9.500	00930	0.195	2.079	0.032	0.163	31.342	31.341
10.00	01000	0.230	2.309	0.033	0.197	37.830	37.827
10.50	01030	0.287	2.596	0.035	0.252	48.450	48.445
11.00	01100	0.368	2.964	0.038	0.330	63.476	63.469
11.50	01130	0.574	3.538	0.047	0.528	101.566	101.550
12.00	01200	3.435	6.973	0.138	3.297	634.565	634.345
12.50	01230	1.287	8.260	0.025	1.261	242.803	242.964
13.00	01300	0.437	8.696	0.007	0.430	82.674	82.740
13.50	01330	0.322	9.018	0.005	0.317	60.993	61.002
14.00	01400	0.253	9.271	0.004	0.249	47.964	47.969
14.50	01430	0.218	9.489	0.003	0.215	41.450	41.453
15.00	01500	0.184	9.673	0.002	0.181	34.924	34.926
15.50	01530	0.172	9.845	0.002	0.170	32.755	32.756
16.00	01600	0.149	9.995	0.002	0.148	28.398	28.400
16.50	01630	0.138	10.132	0.002	0.136	26.222	26.223
17.00	01700	0.126	10.259	0.001	0.125	24.044	24.044
17.50	01730	0.126	10.385	0.001	0.125	24.050	24.050
18.00	01800	0.103	10.489	0.001	0.102	19.682	19.683
18.50	01830	0.115	10.603	0.001	0.114	21.873	21.872
19.00	01900	0.092	10.695	0.001	0.091	17.502	17.504
19.50	01930	0.103	10.799	0.001	0.102	19.693	19.692
20.00	02000	0.092	10.891	0.001	0.091	17.508	17.509
20.50	02030	0.080	10.971	0.001	0.080	15.322	15.323
21.00	02100	0.080	11.051	0.001	0.080	15.324	15.324
21.50	02130	0.080	11.132	0.001	0.080	15.326	15.326
22.00	02200	0.080	11.212	0.001	0.080	15.328	15.328
22.50	02230	0.080	11.293	0.001	0.080	15.330	15.330
23.00	02300	0.069	11.362	0.001	0.068	13.142	13.143
23.50	02330	0.069	11.431	0.001	0.068	13.143	13.143
24.00	00000	0.057	11.488	0.001	0.057	10.953	10.954
24.50	00030	0.000	11.488	0.000	0.000	0.000	0.005
			11.488	1.322	10.162	10.16	

Totals for Watershed in inches over 95.48 acres

Rational Coefficient = 0.885 Peak Flow (cfs) = 634.34



ATTACHMENT 8

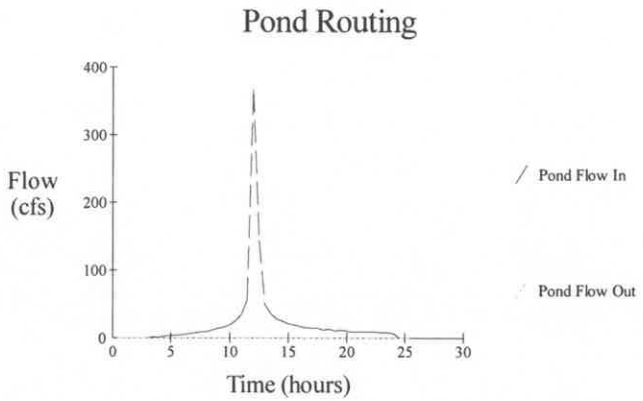
POND AND WEIR DESIGN (95.75 FT ELEVATION, 108 FEET WIDE)- (POND.PND)

Stage (ft)	Storage (ac-ft)	Weir 1 Q (cfs)	Weir 2 Q (cfs)	Discharge (cfs)
92.00	0.00	0.00	0.00	0.00
93.00	14.99	0.00	0.00	0.00
94.00	30.99	0.00	0.00	0.00
95.00	47.97	0.00	0.00	0.00
95.75	61.36	0.00	0.00	0.00
96.00	65.95	41.66	0.00	41.66
97.00	84.90	464.86	0.00	464.86

Weir Number1
Type : Broad Crested Rectangular
Equation : Q = C*H^n*(B-0.2H)
Weir Invert (ft) : 95.75
C: 3.09 n: 1.50
Base Width (ft) : 108.00

10-YEAR, 24-HOUR POND ROUTING

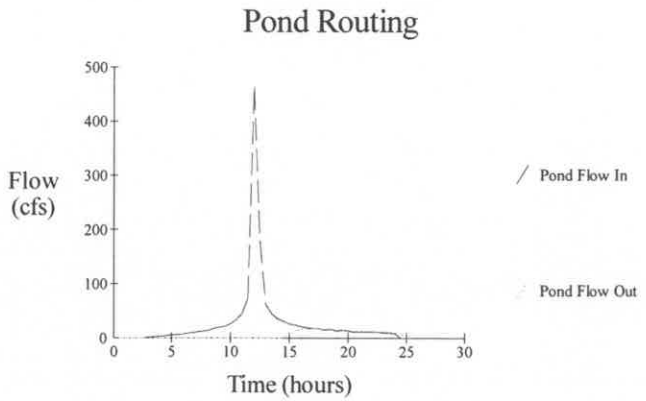
Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	14.99
1.00	0.00	0.00	93.00	14.99
1.50	0.00	0.00	93.00	14.99
2.00	0.00	0.00	93.00	14.99
2.50	0.00	0.00	93.00	14.99
3.00	0.17	0.00	93.00	15.00
3.50	1.02	0.00	93.00	15.04
4.00	1.56	0.00	93.01	15.10
4.50	2.46	0.00	93.01	15.20
5.00	3.54	0.00	93.02	15.34
5.50	4.25	0.00	93.03	15.51
6.00	4.88	0.00	93.04	15.71
6.50	6.07	0.00	93.06	15.95
7.00	7.37	0.00	93.08	16.25
7.50	8.76	0.00	93.10	16.61
8.00	9.42	0.00	93.13	17.00
8.50	11.70	0.00	93.16	17.47
9.00	14.19	0.00	93.19	18.05
9.50	15.89	0.00	93.23	18.70
10.00	19.60	0.00	93.28	19.49
10.50	25.64	0.00	93.35	20.53
11.00	34.30	0.00	93.43	21.91
11.50	56.13	0.00	93.57	24.14
12.00	367.09	0.00	94.41	38.02
12.50	144.06	0.00	94.82	44.89
13.00	49.28	0.00	94.96	47.32
13.50	36.39	0.00	95.05	48.88
14.00	28.65	0.00	95.12	50.10
14.50	24.78	0.00	95.18	51.13
15.00	20.89	0.00	95.23	52.01
15.50	19.60	0.00	95.27	52.83
16.00	17.00	0.00	95.31	53.54
16.50	15.71	0.00	95.35	54.20
17.00	14.41	0.00	95.38	54.80
17.50	14.42	0.00	95.42	55.39
18.00	11.80	0.00	95.44	55.89
18.50	13.12	0.00	95.47	56.43
19.00	10.50	0.00	95.50	56.87
19.50	11.82	0.00	95.53	57.36
20.00	10.51	0.00	95.55	57.80
20.50	9.20	0.00	95.57	58.18
21.00	9.20	0.00	95.59	58.56
21.50	9.20	0.00	95.61	58.94
22.00	9.21	0.00	95.64	59.32
22.50	9.21	0.00	95.66	59.70
23.00	7.90	0.00	95.68	60.04
23.50	7.90	0.00	95.69	60.36
24.00	6.58	0.00	95.71	60.64
24.50	0.00	0.00	95.71	60.67
25.00	0.00	0.00	95.71	60.67
25.50	0.00	0.00	95.71	60.67
Max:	367.09	0.00	95.71	60.67




```
Initial Pond Volume      :    014.990 ac-ft
+
Total Inflow Volume      :    045.676 ac-ft
-
Total Outflow Volume     :    000.000 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    060.667 ac-ft
Final Pond Volume (calc) :    060.667 ac-ft
-----------------------------------------------------
Difference (error)       :    000.000 ac-ft
```

25-YEAR, 24-HOUR POND ROUTING

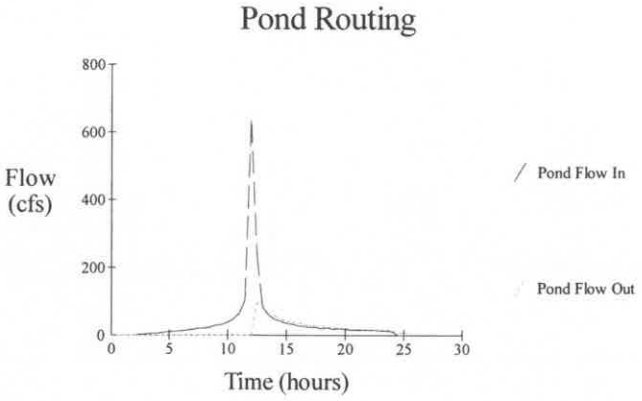
Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	14.99
1.00	0.00	0.00	93.00	14.99
1.50	0.00	0.00	93.00	14.99
2.00	0.00	0.00	93.00	14.99
2.50	0.20	0.00	93.00	15.00
3.00	1.17	0.00	93.00	15.04
3.50	2.46	0.00	93.01	15.14
4.00	3.01	0.00	93.02	15.26
4.50	4.28	0.00	93.03	15.43
5.00	5.76	0.00	93.04	15.66
5.50	6.62	0.00	93.06	15.93
6.00	7.36	0.00	93.08	16.23
6.50	8.93	0.00	93.10	16.60
7.00	10.62	0.00	93.13	17.03
7.50	12.40	0.00	93.16	17.53
8.00	13.13	0.00	93.19	18.07
8.50	16.11	0.00	93.23	18.73
9.00	19.29	0.00	93.28	19.51
9.50	21.36	0.00	93.34	20.39
10.00	26.07	0.00	93.40	21.44
10.50	33.76	0.00	93.49	22.81
11.00	44.71	0.00	93.60	24.61
11.50	72.38	0.00	93.78	27.49
12.00	462.86	0.00	94.83	45.00
12.50	179.47	0.00	95.31	53.59
13.00	61.25	0.00	95.48	56.60
13.50	45.20	0.00	95.59	58.54
14.00	35.56	0.00	95.68	60.05
14.50	30.74	0.00	95.75	61.34
15.00	25.91	8.22	95.80	62.27
15.50	24.31	13.37	95.83	62.83
16.00	21.08	15.91	95.85	63.11
16.50	19.47	17.08	95.85	63.24
17.00	17.85	17.37	95.85	63.27
17.50	17.86	17.53	95.86	63.29
18.00	14.62	16.69	95.85	63.20
18.50	16.25	16.51	95.85	63.18
19.00	13.00	15.48	95.84	63.07
19.50	14.63	15.17	95.84	63.03
20.00	13.01	14.52	95.84	62.96
20.50	11.39	13.57	95.83	62.86
21.00	11.39	12.88	95.83	62.78
21.50	11.39	12.41	95.82	62.73
22.00	11.39	12.08	95.82	62.69
22.50	11.40	11.87	95.82	62.67
23.00	9.77	11.24	95.82	62.60
23.50	9.77	10.78	95.81	62.55
24.00	8.15	9.98	95.81	62.46
24.50	0.00	7.03	95.79	62.13
25.00	0.00	4.79	95.78	61.89
25.50	0.00	3.27	95.77	61.72
Max:	462.86	17.53	95.86	63.29




```
Initial Pond Volume      :    014.990 ac-ft
+
Total Inflow Volume      :    058.155 ac-ft
-
Total Outflow Volume     :    011.477 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    061.721 ac-ft
Final Pond Volume (calc) :    061.668 ac-ft
-----------------------------------------------------
Difference (error)       :    000.053 ac-ft
```

100-YEAR, 24-HOUR POND ROUTING

Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	14.99
1.00	0.00	0.00	93.00	14.99
1.50	0.00	0.00	93.00	14.99
2.00	0.35	0.00	93.00	15.00
2.50	2.03	0.00	93.01	15.08
3.00	3.57	0.00	93.01	15.22
3.50	5.64	0.00	93.03	15.45
4.00	6.09	0.00	93.04	15.70
4.50	8.06	0.00	93.06	16.02
5.00	10.26	0.00	93.09	16.44
5.50	11.32	0.00	93.12	16.90
6.00	12.22	0.00	93.15	17.40
6.50	14.47	0.00	93.19	17.99
7.00	16.83	0.00	93.23	18.67
7.50	19.27	0.00	93.28	19.46
8.00	20.07	0.00	93.33	20.29
8.50	24.26	0.00	93.39	21.27
9.00	28.66	0.00	93.47	22.44
9.50	31.34	0.00	93.55	23.72
10.00	37.83	0.00	93.64	25.26
10.50	48.45	0.00	93.76	27.22
11.00	63.47	0.00	93.92	29.78
11.50	101.55	0.00	94.17	33.82
12.00	634.34	0.00	95.55	57.83
12.50	242.96	94.81	96.13	68.33
13.00	82.74	93.51	96.12	68.27
13.50	61.00	74.19	96.08	67.40
14.00	47.97	58.43	96.04	66.70
14.50	41.45	48.15	96.02	66.24
15.00	34.93	41.04	96.00	65.88
15.50	32.76	38.46	95.98	65.60
16.00	28.40	35.38	95.96	65.26
16.50	26.22	32.53	95.95	64.94
17.00	24.04	29.89	95.93	64.65
17.50	24.05	28.03	95.92	64.45
18.00	19.68	25.50	95.90	64.17
18.50	21.87	24.29	95.90	64.03
19.00	17.50	22.25	95.88	63.81
19.50	19.69	21.38	95.88	63.71
20.00	17.51	20.20	95.87	63.59
20.50	15.32	18.71	95.86	63.42
21.00	15.32	17.63	95.86	63.30
21.50	15.33	16.90	95.85	63.22
22.00	15.33	16.40	95.85	63.17
22.50	15.33	16.06	95.85	63.13
23.00	13.14	15.19	95.84	63.03
23.50	13.14	14.54	95.84	62.96
24.00	10.95	13.46	95.83	62.84
24.50	0.00	9.47	95.81	62.40
25.00	0.00	6.46	95.79	62.07
25.50	0.00	4.41	95.78	61.85
Max:	634.34	94.81	96.13	68.33




```
Initial Pond Volume      :    014.990 ac-ft
+
Total Inflow Volume      :    080.857 ac-ft
-
Total Outflow Volume     :    034.598 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    061.846 ac-ft
Final Pond Volume (calc) :    061.248 ac-ft
-------------------------------------------------------
---
Difference (error)       :    000.598 ac-ft
```

ATTACHMENT 9

Time of Concentration

Project: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project No.: **083-82671.1**

		Rim Ditch (T3A)	Rim Ditch Down Pipe (T3)	Bench Ditch (I11A)	Bench Ditch Down Pipe (I4)	Access Ramp Ditch	Northwest Ditch	West Ditch	
Sheet flow (maximum 300 feet) (top)									
Flow length (ft)	L=	**130**	**110**	**0**	**0**	**0**	**170**	**140**	
P for 2-year 24 hour storm (in)	P2=	**5**	**5**	**5**	**5**	**5**	**5**	**5**	
Land slope (ft/ft)	s=	**0.02**	**0.02**	**0.05**	**0.05**	**0.02**	**0.02**	**0.02**	
Manning's roughness coefficient for sheet flow	n=	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	
Tc sheet flow = 0.007*(n*L)^0.8/(P2^0.5*s^0.4)	Tc=	0.235	0.205	0.000	0.000	0.000	0.291	0.249	hour
Sheet flow (maximum 300 feet) (side-slope)									
Flow length (ft)	L=	**0**	**0**	**100**	**100**	**100**	**0**	**0**	
P for 2-year 24 hour storm (in)	P2=	**5**	**5**	**5**	**5**	**5**	**5**	**5**	
Land slope (ft/ft)	s=	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**	
Manning's roughness coefficient for sheet flow	n=	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	**0.24**	
Tc sheet flow = 0.007*(n*L)^0.8/(P2^0.5*s^0.4)	Tc=	0.000	0.000	0.062	0.062	0.062	0.000	0.000	hour
Channel travel									
Rim Ditch or Bench Ditch									
Manning	n=	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	
Channel slope	So=	**0.005**	**0.005**	**0.005**	**0.005**	**0.005**	**0.005**	**0.005**	ft/ft
Average Velocity	v=	**1.6**	**1.6**	**1.7**	**1.7**	**1.6**	**1.6**	**1.6**	ft/s
Length (ft)	L=	**0**	**250**	**0**	**250**	**0**	**225**	**140**	
Tc Channel travel (hr) =	Tc=	0.000	0.043	0.000	0.042	0.000	0.039	0.024	hour
Tc total =	**Tc=**	**0.23**	**0.25**	**0.06**	**0.10**	**0.06**	**0.33**	**0.27**	hour
		14	**15**	**4**	**6**	**4**	**20**	**16**	minutes

ATTACHMENT 10

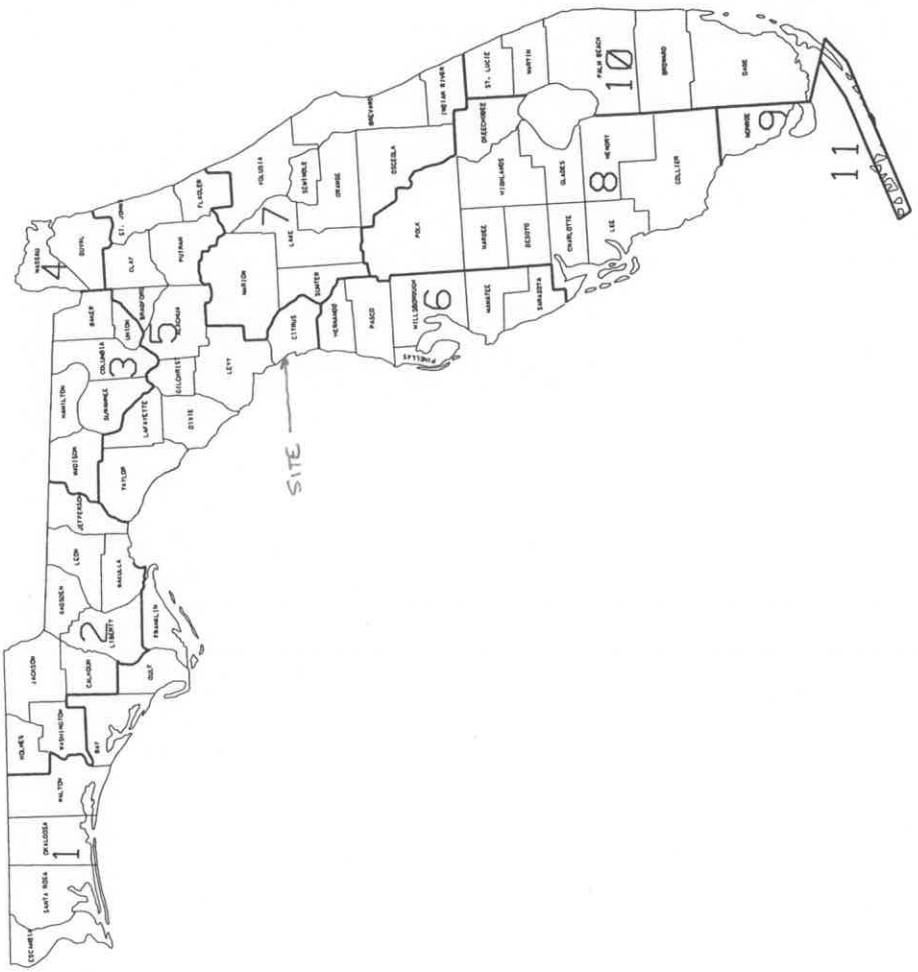
Peak Flows

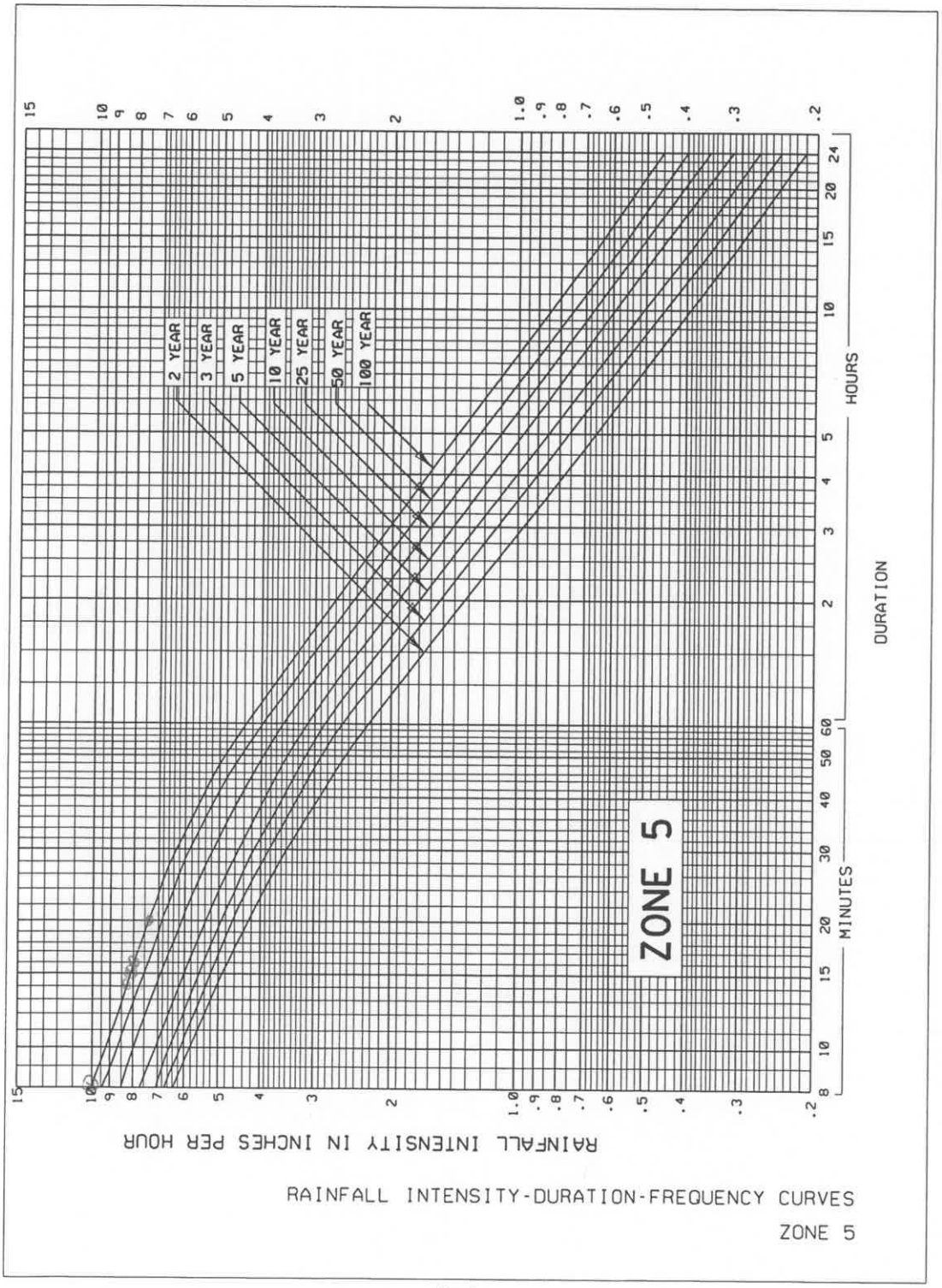
Project: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project No.: **083-82671.1**

CHANNEL ID (OWN CONTRIBUTING WATERSHED)		Rim Ditch (T3A)	Rim Ditch Down Pipe (T3)	Bench Ditch (I11A)	Bench Ditch Down Pipe (I4)	Access Ramp Ditch	Northwest Ditch	West Ditch	
i average for 100 year, 24 duration storm from DOT IDF curves in (in/hr) =	i=	**8.5**	**8.2**	**10**	**10**	**10**	**7.4**	**8.0**	zone 5
C for rational formula sandy average grass, steep slopes (>7%), *1.25 for 100-year storm	C=	**0.31**	**0.31**	**0.38**	**0.38**	**0.38**	**0.38**	**0.38**	
Areas (acre) =	A=	**0.7**	**1.4**	**1.0**	**3.8**	**2.1**	**9.6**	**5.3**	area
Q = C*i*A		**1.8**	**3.4**	**3.7**	**14.3**	**8.1**	**26.9**	**16.1**	**ft3/s**

ZONES FOR PRECIPITATION IDF CURVES DEVELOPED BY THE DEPARTMENT





RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

ZONE 5

Table 24-1. Runoff Coefficients (*C*) for a Design Storm Return Period of Ten Years or Less[1]

Slope	Land Use	Sandy Soils Min.	Sandy Soils Max.	Clay Soils Min.	Clay Soils Max.
Flat (0-2%)	Lawns	0.05	0.10	0.13	0.17
	Rooftops and pavement	0.95	0.95	0.95	0.95
	Pervious pavements[2]	0.75	0.95	0.90	0.95
	Woodlands	0.10	0.15	0.15	0.20
	Pasture, grass, and farmland[3]	0.15	0.20	0.20	0.25
	Residential				
	SFR: 1/2 acre lots and larger	0.30	0.35	0.35	0.45
	SFR: smaller lots and duplexes	0.35	0.45	0.40	0.50
	MFR: apartments, condominiums	0.45	0.60	0.50	0.70
	Commercial and Industrial	0.50	0.95	0.50	0.95
Rolling (2-7%)	Lawns	0.10	0.15	0.18	0.22
	Rooftops and pavements	0.95	0.95	0.95	0.95
	Pervious pavements[2]	0.80	0.95	0.90	0.95
	Woodlands	0.15	0.20	0.20	0.25
	Pasture, grass, and farmland[3]	0.20	0.25	0.25	0.30
	Residential				
	SFR: 1/2 acre lots and larger	0.35	0.50	0.40	0.55
	SFR: smaller lots and duplexes	0.40	0.55	0.45	0.60
	MFR: apartments, condominiums	0.50	0.70	0.60	0.80
	Commercial and Industrial	0.50	0.95	0.60	0.95
Steep (>7%)	Lawns	0.15	0.20	0.25	0.35
	Rooftops and pavements	0.95	0.95	0.95	0.95
	Pervious pavements[2]	0.85	0.95	0.90	0.95
	Woodlands	0.20	0.25	0.25	0.30
	Pasture, grass, and farmland[3]	0.25	0.35	0.30	0.40
	Residential				
	SFR: 1/2 acre lots and larger	0.40	0.55	0.50	0.65
	SFR: smaller lots and duplexes	0.45	0.60	0.55	0.70
	MFR: apartments, condominiums	0.60	0.75	0.65	0.85
	Commercial and Industrial	0.60	0.95	0.65	0.95

Sources: *Florida Department of Transportation, 1987; Wanielista, 1990*

[1] For 25- to 100-yr recurrence intervals, multiply coefficient by 1.1 and 1.25, respectively, and the product cannot exceed 1.0.

[2] Coefficients assume good ground cover and conservation treatment.

[3] Depends on depth and degree of permeability of underlying strata.

Note: SFR = Single Family Residential; MFR = Multi-Family Residential

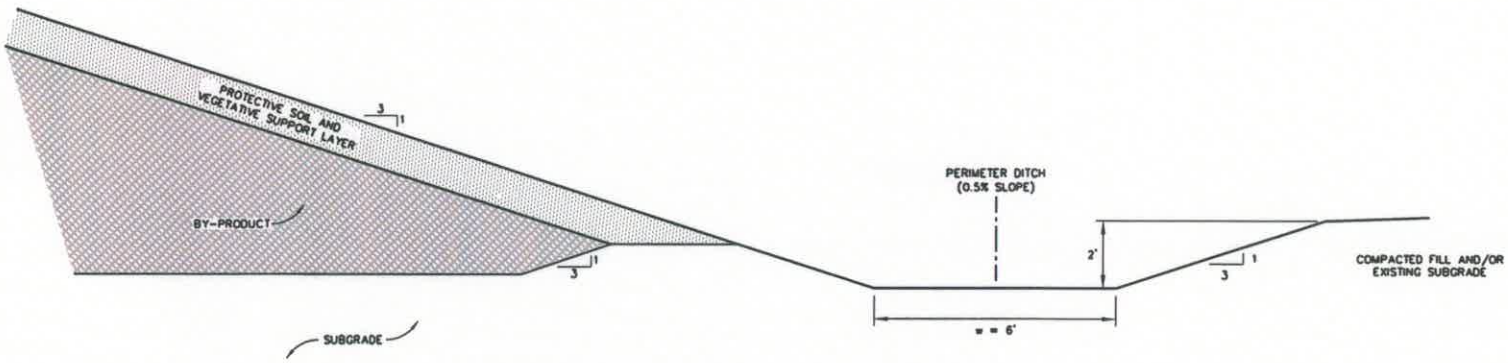
ATTACHMENT 11

CHANNEL DESIGN

Project: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

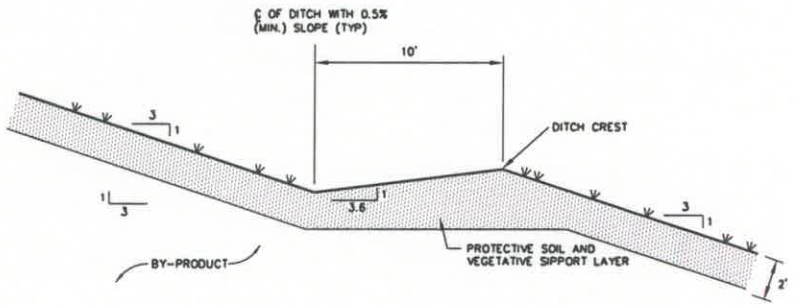
Project No.: **083-82671.1**

Channel ID	Side Slope 1 (Z1) (1V:Z1H)	Side Slope 2 (Z2) (1V:Z2H)	Slope (So) (ft/ft)	Base Width (B) (ft)	Manning (n)	Depth (Y) (ft)	Peak Flow (Q) (cfs)	Height of Water (H) (ft)	Velocity (v) (ft/s)	Freeboard (F) (ft)
Rim Ditch	3	3	0.005	2	0.03	2	1.84	0.39	1.49	1.61
Bench Ditch	3	3.6	0.005	0	0.03	2	3.78	0.79	1.84	1.21
Access Ramp Ditch	3	3	0.10	3	0.03	2	8.40	0.33	6.38	1.67
Northwest Ditch	3	3	0.005	6	0.03	2	27.10	1.03	2.89	0.97
West Ditch	3	3	0.005	6	0.03	2	16.16	0.78	2.48	1.22



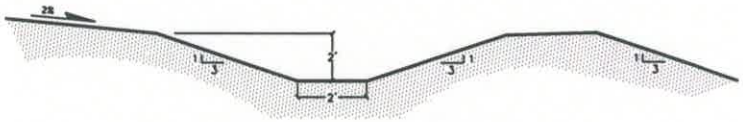
PERIMETER DITCH DETAIL

NOT TO SCALE



FINAL COVER BENCH DITCH

NOT TO SCALE



FINAL COVER RIM DITCH

NOT TO SCALE

ATTACHMENT 12

Orifices

The basic equation for orifices is:

$$Q = C_D A \sqrt{2gh} \qquad \text{(III-12)}$$

where:

Q = Discharge (cfs).

C_D = Coefficient of discharge (dimensionless). See below.

A = Cross-sectional area of flow at the orifice entrance (sq ft).

g = Acceleration of gravity (32.2 ft/sec2).

h = Driving head (ft), measured from the centroid of the orifice area to the water surface.

An idealized sketch of a culvert under inlet control illustrates the orifice application.

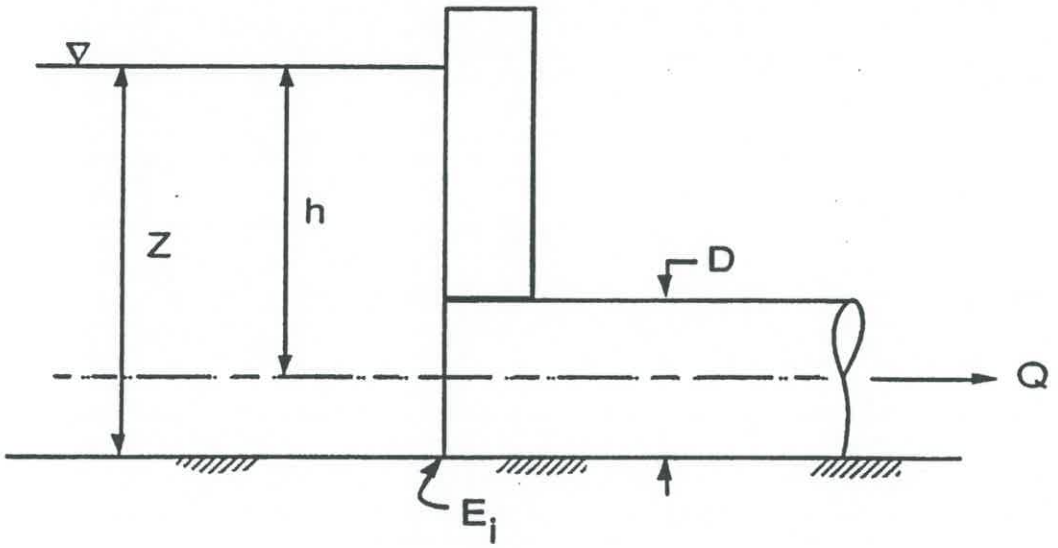


Figure III-5 Schematic section through an orifice.

Table III-2

Values of Coefficient of Discharge, Cd

Entrance Condition	Cd
Typical default value	0.60
Square-edged entrance	0.59
Concrete pipe, grooved end	0.65
Corr mtl pipe, mitred to slope	0.52
Corr mtl pipe, projecting from fill	0.51

Source: These values were back-calculated from the inlet-control culvert-capacity charts of Exhibits 11 and 12 for HW/D = 2.

(MALCOLM, 1989)

expected range of water level variation in the reservoir, the total outflow downstream of the dam is computed for each value of stage, and stage versus total discharge is plotted.

Weirs

Most popularly, two kinds of weirs are used -- sharp-crested and broad-crested weirs. For both, the basic equation is:

$$Q = Cw\ L\ H^{3/2} \qquad \text{(III-11)}$$

where:

Q = Discharge (cfs).

Cw = Weir coefficient (dimensionless). See sketches below.

L = Length of weir (ft), measured along the crest.

H = Driving head (ft), measured vertically from the crest of the weir to the water surface at a point far enough upstream to be essentially level.

The weir coefficient depends on the conditions that exist at the crest. For sharp-crested weirs, the value of Cw is theoretically 3.33. For broad-crested weirs Cw is 3.0. For the case of the free overfall, use Cw = 3.0. A useful reference is King, 1963.

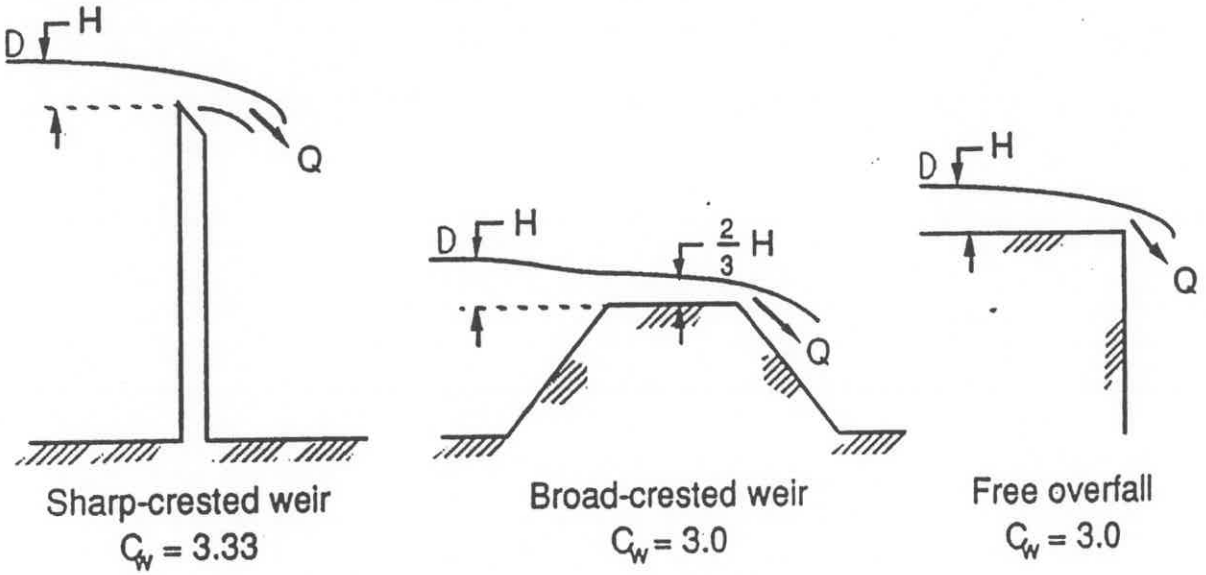


Figure III-4 Schematic sections through weirs.

(Malcom, 1989)

DROP INLETS IN RIM DITCH

Project ID: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project #: **083-82671.1**

RIM DITCH INLET BOX

Q as orifice in pipe (bottom of drop inlet)

Db diameter of pipe (ft) = **1**

Area of pipe = 0.785 ft2

Co = **0.6**

Q = Co*A*(2*g*Hb)^0.5

Depth of inlet = **2** ft

Maximum height of water above grate = **0.9** ft

Step Stage (ft) = **0.3**

Head above Flowline (h) (ft)	Depth from Bottom of Drop Inlet (ft)	Discharge (ft3/s)	Notes
0.0	0.50	0.0	
0.3	0.80	2.1	
0.6	1.10	2.9	
0.9	1.40	3.6	
1.2	1.70	4.1	
0.80	1.30	3.4	Design Flow
2.4	2.90	5.9	Maximum Flow

DROP INLETS ON BENCHES

Project ID: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project #: **083-82671.1**

BENCH INLET BOX

Q as orifice in pipe (bottom of drop inlet)

Db diameter of pipe (ft) =	**1.5**
Area of pipe =	1.76625 ft2
Co =	**0.6**
Q = Co*A*(2*g*Hb)^0.5	
Depth of inlet =	**3** ft
Maximum height of water above grate =	**0.9** ft
Step Stage (ft) =	**0.5**

Head above Flowline (h) (ft)	Depth from Bottom of Drop Inlet (ft)	Discharge (ft3/s)	Notes
0.0	0.75	0.0	
0.5	1.25	6.0	
1.0	1.75	8.5	
1.5	2.25	10.4	
2.0	2.75	12.0	
2.84	3.59	14.3	Design Flow
3.2	3.90	15.1	Maximum Flow

GRATE CAPACITY ANALYSIS

Project: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project No.: **083-82671.1**

RIM DITCH GRATE

Type "C" Inlet - Standard Grate

Length (in.)	**36**	
Width (in.)	**24**	
Area (sq. in.)	864.0	
Cross Bars		
# of long beams	**4**	
Length of long beams (in.)	**36**	
Width of long beams (in.)	**1.9**	approx.
Area of long beams (sq. in.)	273.6	

Total head	**0.39**	**ft**
Total open area of grate	**4.1**	**ft^2**
Grate open area, 1/2 plugged	**2.1**	**ft^2**
Area of individual grate opening	**0.5**	**ft^2**
Total grate perimeter	**10.00**	**ft**
Total capacity	**8.04**	**cfs**
1/2 plugged capacity	**4.02**	**cfs**

Discharge under falling head: $t = 2A(h_1^{.5} - h_2^{.5})/\{Ca(2g)^{.5}\}$ Ref. Brater & King, p. 4-6

let C = 0.6

h_1 = 0.25

Standard Grate

Grate 100% open	43.77	sec
Grate half plugged	87.53	sec
One opening	377.77	sec

GRATE CAPACITY ANALYSIS

Project: **PEF CREC ASH DISPOSAL AREA RECONFIGURATION**

Project No.: **083-82671.1**

BENCH DITCH GRATE

Type "E" Inlet - Standard Grate

Length (in.)	**36**	
Width (in.)	**32**	
Area (sq. in.)	1152.0	
Cross Bars		
# of long beams	**4**	
Length of long beams (in.)	**36**	
Width of long beams (in.)	**1.9**	approx.
Area of long beams (sq. in.)	269.1	

Total head	**0.79**	**ft**
Total open area of grate	**6.1**	**ft^2**
Grate open area, 1/2 plugged	**3.1**	**ft^2**
Area of individual grate opening	**0.5**	**ft^2**
Total grate perimeter	**11.33**	**ft**
Total capacity	**26.24**	**cfs**
1/2 plugged capacity	**13.12**	**cfs**

Discharge under falling head: $t = 2A(h_1^{.5} - h_2^{.5})/\{Ca(2g)^{.5}\}$ Ref. Brater & King, p. 4-6

let C = 0.6

h_1 = 0.25

Standard Grate

Grate 100% open	39.02	sec
Grate half plugged	78.04	sec
One opening	512.20	sec

SIZING PIPES AS FULL FLOW CIRCULAR CHANNELS

Project:		**PEF CREC ASH DISPOSAL AREA RECONFIGURATION**
Project No.:		**083-82671.1**
Pipe ID:		**RIM DITCH DONWLET PIPES**

PEAK FLOWS

	Q1=	**3.4** ft3/s

Sizing a pipe Q=1.49/n*A*R^(2/3)*S^(1/2)

For full flow of pipe R = d/4		
Total flow	Q=	3.4 ft3/s
No of pipes	No=	**1**
Q per pipe	Qi=	3.4 ft3/s
Manning's roughness	n=	**0.013**
Slope	So=	**0.33**
Pipe diameter =		0.51 ft
		6.1 in

Partial flow (vary Y1 until formula =0)

Chosen diameter (ft) =		**1**
Y1 (ft)		**0.249035783**
alpha		0.465189165
theta		2.211214323
Area	A=	0.176
Wet perimeter	WP=	1.106
1-(Q*n*WP^(2/3))/(1.486*A^(5/3)*So^0.5)=0		**2.4057E-05**
Velocity in pipe =		19.30 ft/s

SIZING PIPES AS FULL FLOW CIRCULAR CHANNELS

Project:		**PEF CREC ASH DISPOSAL AREA RECONFIGURATION**
Project No.:		**083-82671.1**
Pipe ID:		**BENCH DONWLET PIPES**

PEAK FLOWS

	Q1=	**14.3** ft3/s

Sizing a pipe Q=1.49/n*A*R^(2/3)*S^(1/2)

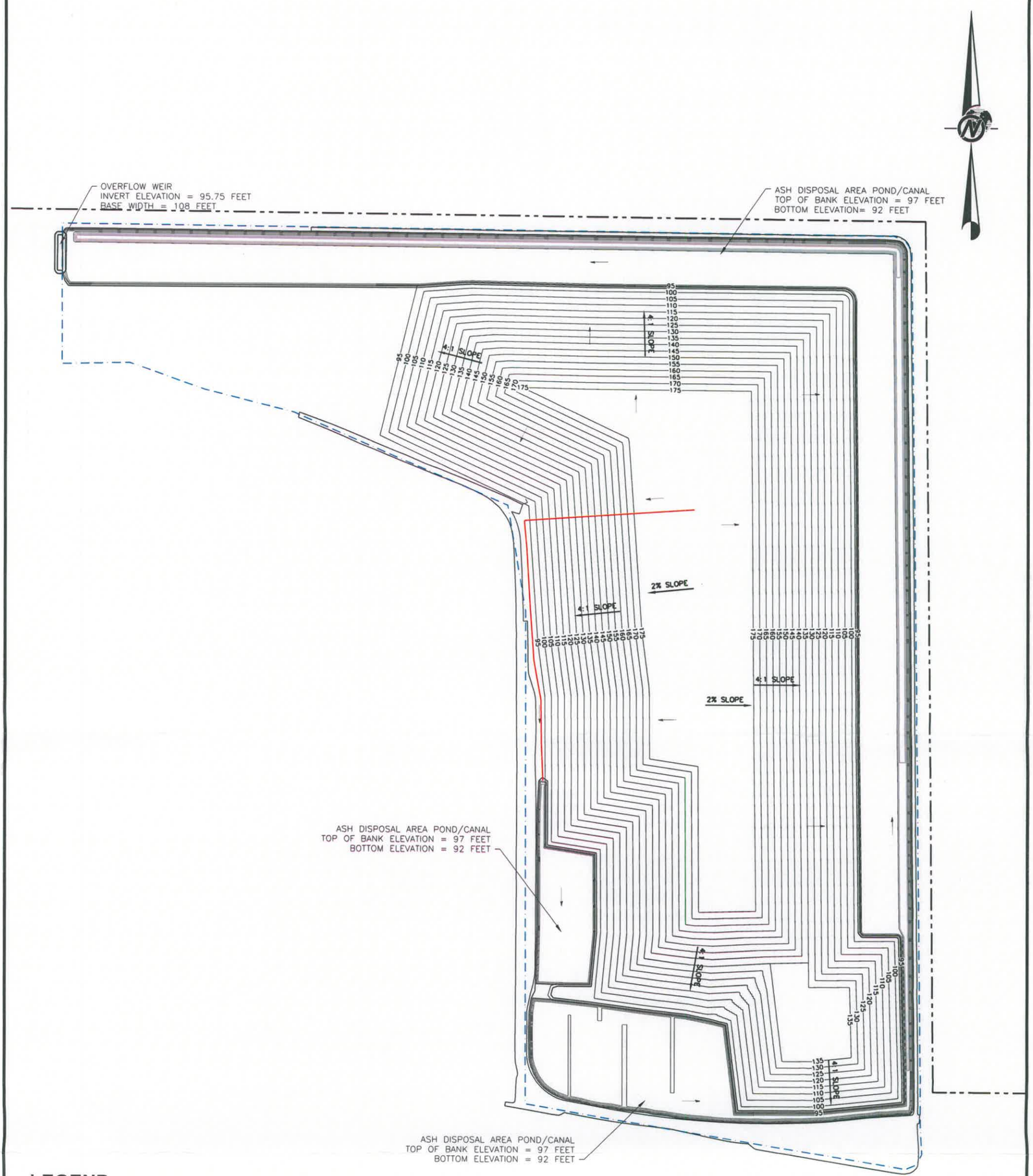
For full flow of pipe R = d/4		
Total flow	Q=	14.3 ft3/s
No of pipes	No=	**1**
Q per pipe	Qi=	14.3 ft3/s
Manning's roughness	n=	**0.013**
Slope	So=	**0.33**
Pipe diameter =		0.87 ft
		10.5 in

Partial flow (vary Y1 until formula =0)

Chosen diameter (ft) =		**1.5**
Y1 (ft)		**0.48120007**
alpha		0.344138346
theta		2.453315962
Area	A=	0.511
Wet perimeter	WP=	1.840
1-(Q*n*WP^(2/3))/(1.486*A^(5/3)*So^0.5)=0		**-6.01029E-05**
Velocity in pipe =		27.97 ft/s

ATTACHMENT 13

Drawing file: existing stormwater final cover.dwg Jan 21, 2010 - 2:32pm



LEGEND

- PROPERTY BOUNDARY
- DRAINAGE BASIN BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- DIRECTION OF STORMWATER FLOW

300 0 300
SCALE FEET

FIGURE 2

PROJECT No.	083-82671.1
FILE No.	
REV. 0	SCALE AS SHOWN
DESIGN	
CADD	SFS 01/21/10
CHECK	SR 9/22/2010
REVIEW	KBL 9/22/10

TITLE

EXISTING FINAL COVER CONFIGURATION STORMWATER MANAGEMENT SYSTEM

PROJECT

PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
ASH DISPOSAL AREA RECONFIGURATION

Golder Associates
Jacksonville, Florida

STAGE-AREA-VOLUMES CURVES

Project ID: **PEF CREC ASH DISPOSAL AREA EXISTING CONFIGURATION**

Project #: **083-82671.1**

Bottom area = 31,049 ft2
Bottom elevation = 90.0

Volume 1 V(i+1) = V(i) + (A(i+1)+A(i)) * 0.5 * (h(i+1) - h(i))

Elevation (ft)	Stage (h) (ft)	Area (ft2)	Area (acres)	Accum. Volume 1 (ft3)	Accum. Volume 1 acre-feet	Notes
90.0	0.0	**31,049**	0.71	0	0.00	Pond bottom
91.0	1.0	**73,389**	1.68	52,219	1.20	
92.0	2.0	**114,078**	2.62	145,953	3.35	
93.0	3.0	**310,520**	7.13	358,252	8.22	Approximate Seasonal High Groundwater
94.0	4.0	**913,599**	20.97	970,312	22.28	
95.0	5.0	**957,650**	21.98	1,905,937	43.75	
95.75	5.8	**991,458**	22.76	2,636,852	60.53	Spillway Elevation
96.0	6.0	**993,554**	22.81	2,884,979	66.23	
97.0	7.0	**916,997**	21.05	3,840,254	88.16	Top of Berm

COMPOSITE CURVE NUMBER

Project ID: **PEF CREC ASH DISPOSAL AREA EXISTING CONFIGURATION**

Project #: **083-82671.1**

Area Type	Area (acres)	Curve Number (CN)
Ash Disposal Area	58.4	84
Ponds	24.4	100
Ditches and Other Areas	12.7	98
	95.5	
	Composite Curve Number	89.9

Time of Concentration - TR-55 Worksheet

Project:	**PEF CREC ASH DISPOSAL AREA EXISTING CONFIGURATION**
Project No.:	**083-82671.1**

Sheet flow (maximum 300 feet)		Top of pile	
Flow length (ft)	L=	**255**	
P for 2-year 24 hour storm (in)	P2=	**5**	
Land slope (ft/ft)	s=	**0.02**	
Manning's roughness coefficient for sheet flow	n=	**0.24**	
Tc sheet flow = 0.007*(n*L)^0.8/(P2^0.5*s^0.4)	Tc=	0.402	hour

Shallow concentrated flow		Side Slope	
Flow length (ft)	L=	**345**	
Water Course slope (ft/ft)	s=	**0.25**	
Average velocity (ft/s) from chart	v=	**8.1**	
Tc shallow concentrated flow = L/(v*3600)	Tc=	0.012	hour

Shallow concentrated flow		Ditch	
Flow length (ft)	L=	**800**	
Water Course slope (ft/ft)	s=	**0.005**	
Average velocity (ft/s) from chart	v=	**1.1**	
Tc shallow concentrated flow = L/(v*3600)	Tc=	0.195	hour

Tc total =	**Tc=**	**0.61**	hour
		37	minutes

ATTACHMENT 14

EXISTING ASH DISPOSAL AREA CONFIGURATION

SMADA 6.0 for Windows
Watershed Information

Watershed Total Area (acres)	:95.50
Impervious Area (acres)	:0.00
Time of Concentration (min)	:37.0
% Impervious Directly Connected	:00.00
Additional Abstraction	
Over Pervious Area (inches)	:0.00
Over Impervious Area (inches)	:0.00
Infiltration Characteristics:	
Max Infiltration Capacity (in)	:999.00
SCS Curve Number for Pervious	:90
Initial Abstraction Factor	:0.20

10-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH EXISTING

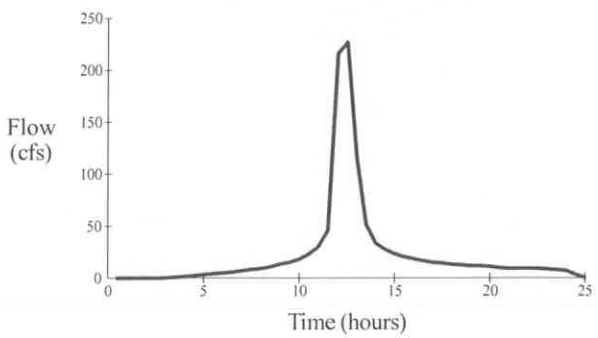
Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.042	0.042	0.042	0.000	0.000	0.000
1.000	00100	0.042	0.084	0.042	0.000	0.000	0.000
1.500	00130	0.049	0.133	0.049	0.000	0.000	0.000
2.000	00200	0.042	0.175	0.042	0.000	0.000	0.000
2.500	00230	0.049	0.224	0.049	0.000	0.000	0.000
3.000	00300	0.049	0.273	0.047	0.002	0.383	0.197
3.500	00330	0.056	0.329	0.049	0.007	1.323	0.832
4.000	00400	0.049	0.378	0.039	0.010	1.838	1.503
4.500	00430	0.056	0.434	0.042	0.014	2.784	2.278
5.000	00500	0.063	0.497	0.043	0.020	3.900	3.273
5.500	00530	0.063	0.560	0.039	0.024	4.610	4.165
6.000	00600	0.063	0.623	0.036	0.027	5.233	4.867
6.500	00630	0.070	0.693	0.036	0.034	6.455	5.805
7.000	00700	0.077	0.770	0.037	0.040	7.781	7.026
7.500	00730	0.084	0.854	0.036	0.048	9.194	8.388
8.000	00800	0.084	0.938	0.033	0.051	9.832	9.395
8.500	00830	0.098	1.036	0.035	0.063	12.166	10.974
9.000	00900	0.112	1.148	0.036	0.076	14.690	13.254
9.500	00930	0.119	1.267	0.034	0.085	16.387	15.337
10.00	01000	0.140	1.407	0.035	0.105	20.141	18.164
10.50	01030	0.175	1.582	0.039	0.136	26.258	22.947
11.00	01100	0.224	1.806	0.042	0.182	35.014	30.209
11.50	01130	0.350	2.156	0.053	0.297	57.091	45.570
12.00	01200	2.093	4.249	0.168	1.925	370.618	216.127
12.50	01230	0.784	5.033	0.032	0.752	144.703	226.625
13.00	01300	0.266	5.299	0.009	0.257	49.454	115.950
13.50	01330	0.196	5.495	0.006	0.190	36.534	51.319
14.00	01400	0.154	5.649	0.005	0.149	28.755	33.692
14.50	01430	0.133	5.782	0.004	0.129	24.867	27.453
15.00	01500	0.112	5.894	0.003	0.109	20.963	23.209
15.50	01530	0.105	5.999	0.003	0.102	19.671	20.648
16.00	01600	0.091	6.090	0.002	0.089	17.061	18.446
16.50	01630	0.084	6.174	0.002	0.082	15.759	16.626
17.00	01700	0.077	6.251	0.002	0.075	14.455	15.206
17.50	01730	0.077	6.328	0.002	0.075	14.462	14.575
18.00	01800	0.063	6.391	0.002	0.061	11.839	13.114
18.50	01830	0.070	6.461	0.002	0.068	13.160	12.751
19.00	01900	0.056	6.517	0.001	0.055	10.532	11.693
19.50	01930	0.063	6.580	0.001	0.062	11.853	11.445
20.00	02000	0.056	6.636	0.001	0.055	10.540	11.061
20.50	02030	0.049	6.685	0.001	0.048	9.225	9.982
21.00	02100	0.049	6.734	0.001	0.048	9.228	9.344
21.50	02130	0.049	6.783	0.001	0.048	9.231	9.229
22.00	02200	0.049	6.832	0.001	0.048	9.233	9.232
22.50	02230	0.049	6.881	0.001	0.048	9.236	9.234
23.00	02300	0.042	6.923	0.001	0.041	7.919	8.559
23.50	02330	0.042	6.965	0.001	0.041	7.920	8.037
24.00	00000	0.035	7.000	0.001	0.034	6.602	7.243
24.50	00030	0.000	7.000	0.000	0.000	0.000	3.329
25.00	00100	0.000	7.000	0.000	0.000	0.000	0.589
			7.000	1.188	5.810	5.810	

Totals for Watershed in inches over 95.50 acres

Rational Coefficient = 0.830 Peak Flow (cfs) = 226.62

Watershed Hydrograph



25-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH EXISTING

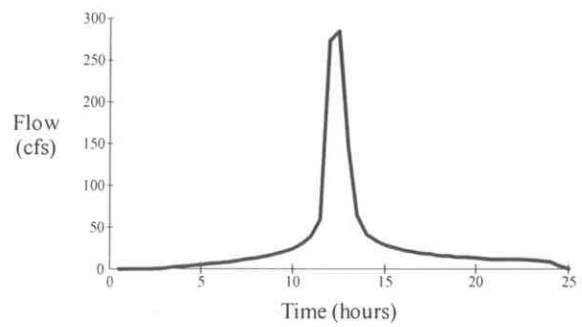
Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.052	0.052	0.052	0.000	0.000	0.000
1.000	00100	0.052	0.103	0.052	0.000	0.000	0.000
1.500	00130	0.060	0.163	0.060	0.000	0.000	0.000
2.000	00200	0.052	0.215	0.052	0.000	0.000	0.000
2.500	00230	0.060	0.275	0.058	0.002	0.418	0.215
3.000	00300	0.060	0.335	0.052	0.008	1.493	0.933
3.500	00330	0.069	0.404	0.054	0.015	2.848	2.093
4.000	00400	0.060	0.464	0.043	0.017	3.353	2.987
4.500	00430	0.069	0.533	0.044	0.024	4.680	3.989
5.000	00500	0.077	0.611	0.045	0.032	6.198	5.341
5.500	00530	0.077	0.688	0.041	0.037	7.047	6.498
6.000	00600	0.077	0.765	0.037	0.040	7.777	7.346
6.500	00630	0.086	0.851	0.037	0.049	9.380	8.535
7.000	00700	0.095	0.946	0.037	0.058	11.091	10.116
7.500	00730	0.103	1.049	0.036	0.067	12.888	11.861
8.000	00800	0.103	1.152	0.033	0.071	13.590	13.088
8.500	00830	0.120	1.273	0.034	0.086	16.609	15.078
9.000	00900	0.138	1.410	0.035	0.103	19.821	17.989
9.500	00930	0.146	1.556	0.033	0.114	21.878	20.591
10.00	01000	0.172	1.728	0.034	0.138	26.632	24.136
10.50	01030	0.215	1.943	0.036	0.179	34.392	30.193
11.00	01100	0.275	2.219	0.039	0.236	45.430	39.368
11.50	01130	0.430	2.648	0.049	0.381	73.329	58.772
12.00	01200	2.571	5.220	0.150	2.422	466.221	272.603
12.50	01230	0.963	6.183	0.028	0.935	180.020	284.187
13.00	01300	0.327	6.509	0.008	0.319	61.397	144.643
13.50	01330	0.241	6.750	0.005	0.235	45.323	63.728
14.00	01400	0.189	6.939	0.004	0.185	35.655	41.793
14.50	01430	0.163	7.103	0.003	0.160	30.822	34.036
15.00	01500	0.138	7.240	0.003	0.135	25.975	28.765
15.50	01530	0.129	7.369	0.002	0.127	24.367	25.582
16.00	01600	0.112	7.481	0.002	0.110	21.130	22.848
16.50	01630	0.103	7.584	0.002	0.101	19.514	20.589
17.00	01700	0.095	7.679	0.002	0.093	17.895	18.827
17.50	01730	0.095	7.773	0.002	0.093	17.902	18.043
18.00	01800	0.077	7.851	0.001	0.076	14.652	16.232
18.50	01830	0.086	7.937	0.001	0.085	16.285	15.781
19.00	01900	0.069	8.006	0.001	0.068	13.032	14.469
19.50	01930	0.077	8.083	0.001	0.076	14.665	14.161
20.00	02000	0.069	8.152	0.001	0.068	13.039	13.684
20.50	02030	0.060	8.212	0.001	0.059	11.411	12.348
21.00	02100	0.060	8.272	0.001	0.059	11.414	11.558
21.50	02130	0.060	8.332	0.001	0.059	11.416	11.415
22.00	02200	0.060	8.393	0.001	0.059	11.418	11.417
22.50	02230	0.060	8.453	0.001	0.059	11.420	11.419
23.00	02300	0.052	8.504	0.001	0.051	9.791	10.583
23.50	02330	0.052	8.556	0.001	0.051	9.792	9.937
24.00	00000	0.043	8.599	0.001	0.042	8.161	8.955
24.50	00030	0.000	8.599	0.000	0.000	0.000	4.116
25.00	00100	0.000	8.599	0.000	0.000	0.000	0.728
			8.599	1.215	7.381	7.381	

Totals for Watershed in inches over 95.50 acres

Rational Coefficient = 0.859 Peak Flow (cfs) = 284.19

Watershed Hydrograph



100-YEAR, 24-HOUR STORM EVENT HYRDOGRAPH EXISTING

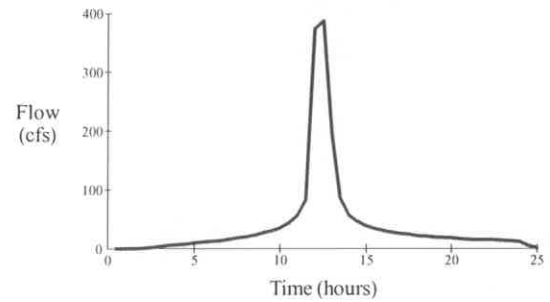
Hydrograph Type :SCS 484 Hydrograph

Time (hr)	Time HHMM	Rain (in)	C Rain (in)	Infiltration (in)	Excess (in)	Excess (cfs)	Outflow (cfs)
0.500	00030	0.069	0.069	0.069	0.000	0.000	0.000
1.000	00100	0.069	0.138	0.069	0.000	0.000	0.000
1.500	00130	0.080	0.218	0.080	0.000	0.000	0.000
2.000	00200	0.069	0.287	0.066	0.003	0.634	0.326
2.500	00230	0.080	0.368	0.068	0.013	2.471	1.521
3.000	00300	0.080	0.448	0.060	0.021	4.025	3.105
3.500	00330	0.092	0.540	0.060	0.032	6.168	4.987
4.000	00400	0.080	0.620	0.046	0.034	6.541	6.169
4.500	00430	0.092	0.712	0.047	0.045	8.569	7.549
5.000	00500	0.103	0.816	0.047	0.056	10.809	9.538
5.500	00530	0.103	0.919	0.042	0.062	11.844	11.141
6.000	00600	0.103	1.022	0.037	0.066	12.712	12.197
6.500	00630	0.115	1.137	0.037	0.078	14.981	13.800
7.000	00700	0.126	1.264	0.036	0.090	17.355	15.998
7.500	00730	0.138	1.402	0.035	0.103	19.807	18.402
8.000	00800	0.138	1.539	0.031	0.107	20.568	19.979
8.500	00830	0.161	1.700	0.032	0.129	24.797	22.672
9.000	00900	0.184	1.884	0.032	0.152	29.212	26.687
9.500	00930	0.195	2.079	0.030	0.166	31.873	30.185
10.00	01000	0.230	2.309	0.030	0.199	38.391	34.983
10.50	01030	0.287	2.596	0.032	0.255	49.069	43.293
11.00	01100	0.368	2.964	0.034	0.333	64.159	55.866
11.50	01130	0.574	3.538	0.042	0.532	102.444	82.473
12.00	01200	3.435	6.973	0.124	3.311	637.419	373.755
12.50	01230	1.287	8.260	0.023	1.264	243.381	387.328
13.00	01300	0.437	8.696	0.006	0.430	82.840	196.101
13.50	01330	0.322	9.018	0.004	0.317	61.108	86.006
14.00	01400	0.253	9.271	0.003	0.250	48.050	56.341
14.50	01430	0.218	9.489	0.003	0.216	41.521	45.862
15.00	01500	0.184	9.673	0.002	0.182	34.982	38.746
15.50	01530	0.172	9.845	0.002	0.170	32.808	34.449
16.00	01600	0.149	9.995	0.002	0.148	28.443	30.760
16.50	01630	0.138	10.132	0.001	0.136	26.263	27.713
17.00	01700	0.126	10.259	0.001	0.125	24.080	25.336
17.50	01730	0.126	10.385	0.001	0.125	24.085	24.277
18.00	01800	0.103	10.489	0.001	0.102	19.710	21.838
18.50	01830	0.115	10.603	0.001	0.114	21.904	21.227
19.00	01900	0.092	10.695	0.001	0.091	17.527	19.461
19.50	01930	0.103	10.799	0.001	0.102	19.721	19.044
20.00	02000	0.092	10.891	0.001	0.091	17.532	18.401
20.50	02030	0.080	10.971	0.001	0.080	15.343	16.603
21.00	02100	0.080	11.051	0.001	0.080	15.345	15.539
21.50	02130	0.080	11.132	0.001	0.080	15.346	15.345
22.00	02200	0.080	11.212	0.001	0.080	15.348	15.347
22.50	02230	0.080	11.293	0.001	0.080	15.350	15.349
23.00	02300	0.069	11.362	0.001	0.068	13.159	14.225
23.50	02330	0.069	11.431	0.001	0.068	13.160	13.355
24.00	00000	0.057	11.488	0.000	0.057	10.967	12.034
24.50	00030	0.000	11.488	0.000	0.000	0.000	5.531
25.00	00100	0.000	11.488	0.000	0.000	0.000	0.979
			11.488	1.246	10.238	10.23	

Totals for Watershed in inches over 95.50 acres

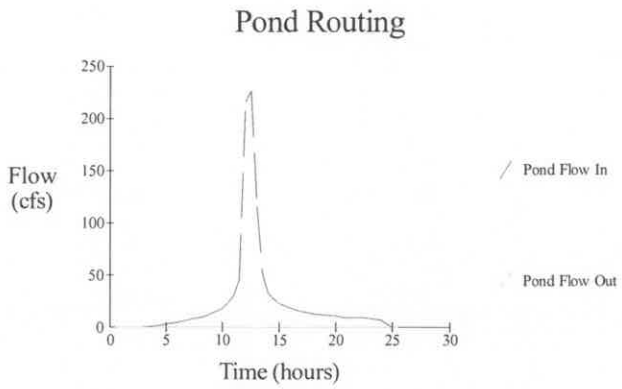
Rational Coefficient = 0.892 Peak Flow (cfs) = 387.33

Watershed Hydrograph



10-YEAR, 24-HOUR EXISTING POND ROUTING

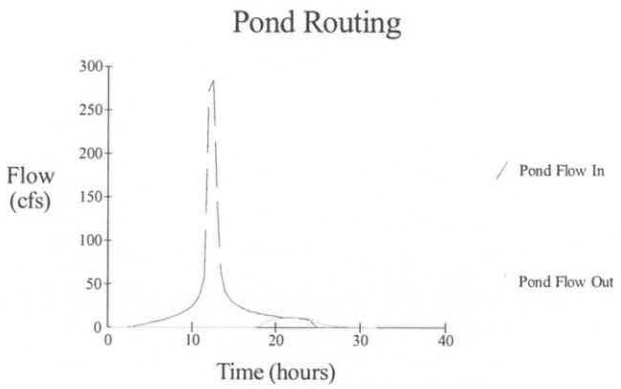
Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	8.22
1.00	0.00	0.00	93.00	8.22
1.50	0.00	0.00	93.00	8.22
2.00	0.00	0.00	93.00	8.22
2.50	0.00	0.00	93.00	8.22
3.00	0.20	0.00	93.00	8.23
3.50	0.83	0.00	93.00	8.26
4.00	1.50	0.00	93.01	8.32
4.50	2.28	0.00	93.01	8.41
5.00	3.27	0.00	93.02	8.54
5.50	4.17	0.00	93.03	8.71
6.00	4.87	0.00	93.05	8.91
6.50	5.80	0.00	93.07	9.14
7.00	7.03	0.00	93.09	9.43
7.50	8.39	0.00	93.11	9.77
8.00	9.40	0.00	93.14	10.15
8.50	10.97	0.00	93.17	10.60
9.00	13.25	0.00	93.21	11.14
9.50	15.34	0.00	93.25	11.76
10.00	18.16	0.00	93.30	12.50
10.50	22.95	0.00	93.37	13.43
11.00	30.21	0.00	93.46	14.65
11.50	45.57	0.00	93.59	16.47
12.00	216.13	0.00	94.11	24.70
12.50	226.62	0.00	94.55	34.02
13.00	115.95	0.00	94.79	39.26
13.50	51.32	0.00	94.90	41.65
14.00	33.69	0.00	94.97	43.12
14.50	27.45	0.00	95.02	44.28
15.00	23.21	0.00	95.07	45.25
15.50	20.65	0.00	95.11	46.12
16.00	18.45	0.00	95.14	46.89
16.50	16.63	0.00	95.17	47.58
17.00	15.21	0.00	95.20	48.22
17.50	14.58	0.00	95.23	48.82
18.00	13.11	0.00	95.25	49.37
18.50	12.75	0.00	95.28	49.90
19.00	11.69	0.00	95.30	50.39
19.50	11.45	0.00	95.32	50.86
20.00	11.06	0.00	95.34	51.32
20.50	9.98	0.00	95.36	51.74
21.00	9.34	0.00	95.37	52.13
21.50	9.23	0.00	95.39	52.51
22.00	9.23	0.00	95.41	52.89
22.50	9.23	0.00	95.43	53.27
23.00	8.56	0.00	95.44	53.63
23.50	8.04	0.00	95.46	53.96
24.00	7.24	0.00	95.47	54.26
24.50	3.33	0.00	95.48	54.42
25.00	0.59	0.00	95.48	54.45
25.50	0.00	0.00	95.48	54.46
Max:	226.62	0.00	95.48	54.46




```
Initial Pond Volume      :    008.220 ac-ft
+
Total Inflow Volume      :    046.236 ac-ft
-
Total Outflow Volume     :    000.000 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    054.456 ac-ft
Final Pond Volume (calc) :    054.456 ac-ft
-------------------------------------------------------
Difference (error)       :    000.000 ac-ft
```

25-YEAR, 24-HOUR EXISTING POND ROUTING

Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	8.22
1.00	0.00	0.00	93.00	8.22
1.50	0.00	0.00	93.00	8.22
2.00	0.00	0.00	93.00	8.22
2.50	0.21	0.00	93.00	8.23
3.00	0.93	0.00	93.00	8.26
3.50	2.09	0.00	93.01	8.35
4.00	2.99	0.00	93.02	8.46
4.50	3.99	0.00	93.03	8.63
5.00	5.34	0.00	93.04	8.84
5.50	6.50	0.00	93.06	9.10
6.00	7.35	0.00	93.08	9.40
6.50	8.54	0.00	93.11	9.75
7.00	10.12	0.00	93.14	10.16
7.50	11.86	0.00	93.17	10.65
8.00	13.09	0.00	93.21	11.18
8.50	15.08	0.00	93.25	11.80
9.00	17.99	0.00	93.31	12.53
9.50	20.59	0.00	93.37	13.37
10.00	24.14	0.00	93.44	14.35
10.50	30.19	0.00	93.52	15.57
11.00	39.37	0.00	93.64	17.16
11.50	58.77	0.00	93.80	19.51
12.00	272.60	0.00	94.35	29.89
12.50	284.19	0.00	94.90	41.59
13.00	144.64	0.00	95.20	48.14
13.50	63.73	0.00	95.33	51.11
14.00	41.79	0.00	95.41	52.93
14.50	34.04	0.00	95.47	54.37
15.00	28.76	0.00	95.53	55.58
15.50	25.58	0.00	95.58	56.65
16.00	22.85	0.00	95.62	57.60
16.50	20.59	0.00	95.66	58.46
17.00	18.83	0.00	95.69	59.25
17.50	18.04	0.00	95.73	60.00
18.00	16.23	1.08	95.76	60.67
18.50	15.78	4.98	95.78	61.20
19.00	14.47	7.51	95.80	61.55
19.50	14.16	9.28	95.81	61.79
20.00	13.68	10.45	95.81	61.95
20.50	12.35	10.98	95.82	62.02
21.00	11.56	11.15	95.82	62.05
21.50	11.41	11.23	95.82	62.06
22.00	11.42	11.28	95.82	62.06
22.50	11.42	11.31	95.82	62.07
23.00	10.58	11.14	95.82	62.05
23.50	9.94	10.84	95.82	62.00
24.00	8.95	10.36	95.81	61.94
24.50	4.12	8.82	95.80	61.73
25.00	0.73	6.76	95.79	61.45
25.50	0.00	4.99	95.78	61.21
26.00	0.00	3.67	95.77	61.03
26.50	0.00	2.70	95.77	60.89
27.00	0.00	1.99	95.76	60.79
27.50	0.00	1.46	95.76	60.72
28.00	0.00	1.08	95.76	60.67
28.50	0.00	0.79	95.75	60.63
29.00	0.00	0.58	95.75	60.60
29.50	0.00	0.43	95.75	60.58
30.00	0.00	0.32	95.75	60.57
30.50	0.00	0.23	95.75	60.55
31.00	0.00	0.17	95.75	60.55
31.50	0.00	0.13	95.75	60.54
32.00	0.00	0.09	95.75	60.54
Max:	284.19	11.31	95.82	62.07

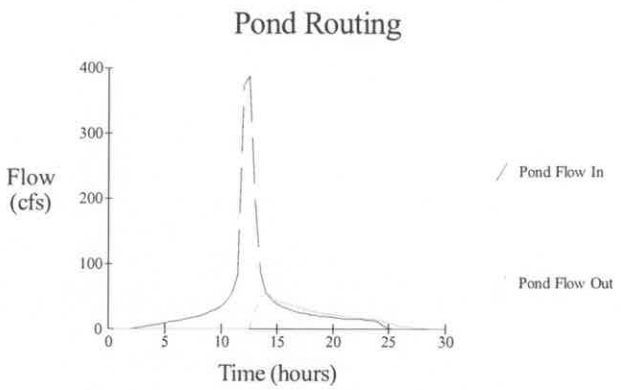



```
Initial Pond Volume      :    008.220 ac-ft
+
Total Inflow Volume      :    058.743 ac-ft
-
Total Outflow Volume     :    006.438 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    060.536 ac-ft
Final Pond Volume (calc) :    060.524 ac-ft
-------------------------------------------------------
Difference (error)       :    000.011 ac-ft
```

100-YEAR, 24-HOUR EXISTING POND ROUTING

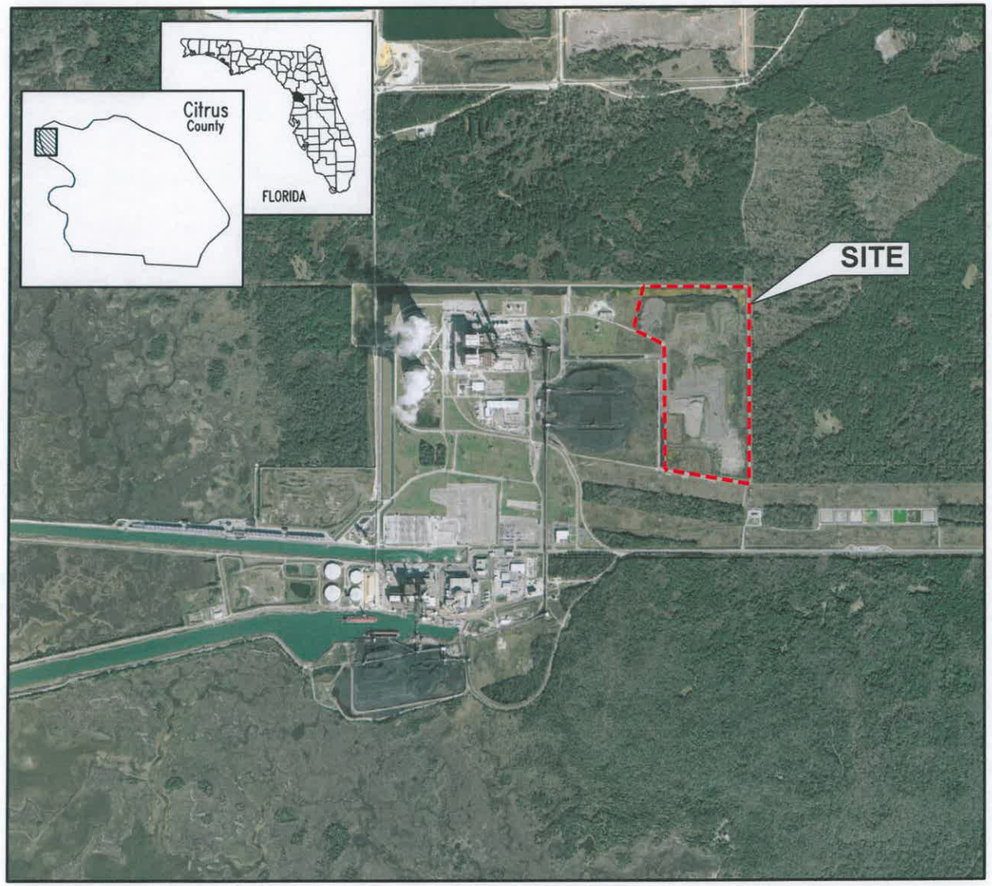
Time (hr)	Inflow (cfs)	Outflow (cfs)	Stage (ft)	Storage (ac-ft)
0.50	0.00	0.00	93.00	8.22
1.00	0.00	0.00	93.00	8.22
1.50	0.00	0.00	93.00	8.22
2.00	0.33	0.00	93.00	8.23
2.50	1.52	0.00	93.00	8.29
3.00	3.11	0.00	93.01	8.41
3.50	4.99	0.00	93.03	8.61
4.00	6.17	0.00	93.05	8.86
4.50	7.55	0.00	93.07	9.17
5.00	9.54	0.00	93.09	9.55
5.50	11.14	0.00	93.13	10.01
6.00	12.20	0.00	93.16	10.51
6.50	13.80	0.00	93.20	11.07
7.00	16.00	0.00	93.25	11.72
7.50	18.40	0.00	93.30	12.47
8.00	19.98	0.00	93.36	13.29
8.50	22.67	0.00	93.43	14.22
9.00	26.69	0.00	93.50	15.30
9.50	30.18	0.00	93.59	16.54
10.00	34.98	0.00	93.69	17.96
10.50	43.29	0.00	93.82	19.72
11.00	55.87	0.00	93.98	21.97
11.50	82.47	0.00	94.14	25.27
12.00	373.76	0.00	94.80	39.51
12.50	387.33	0.00	95.52	55.46
13.00	196.10	26.47	95.91	64.14
13.50	86.01	49.46	96.02	66.62
14.00	56.34	54.46	96.03	66.88
14.50	45.86	50.01	96.02	66.65
15.00	38.75	43.92	96.01	66.34
15.50	34.45	40.40	95.99	66.05
16.00	30.76	37.94	95.98	65.71
16.50	27.71	35.30	95.96	65.35
17.00	25.34	32.72	95.95	65.00
17.50	24.28	30.52	95.93	64.70
18.00	21.84	28.28	95.92	64.39
18.50	21.23	26.43	95.91	64.14
19.00	19.46	24.63	95.90	63.89
19.50	19.04	23.16	95.89	63.69
20.00	18.40	21.92	95.88	63.52
20.50	16.60	20.56	95.87	63.33
21.00	15.54	19.25	95.87	63.16
21.50	15.35	18.23	95.86	63.01
22.00	15.35	17.46	95.85	62.91
22.50	15.35	16.91	95.85	62.83
23.00	14.22	16.22	95.85	62.74
23.50	13.35	15.48	95.84	62.64
24.00	12.03	14.60	95.84	62.52
24.50	5.53	12.35	95.82	62.21
25.00	0.98	9.45	95.81	61.82
25.50	0.00	6.98	95.79	61.48
26.00	0.00	5.13	95.78	61.22
26.50	0.00	3.78	95.77	61.04
27.00	0.00	2.78	95.77	60.90
27.50	0.00	2.04	95.76	60.80
28.00	0.00	1.50	95.76	60.73
28.50	0.00	1.11	95.76	60.67
29.00	0.00	0.81	95.75	60.63
29.50	0.00	0.60	95.75	60.60
30.00	0.00	0.44	95.75	60.58
Max:	387.33	54.46	96.03	66.88

```
Initial Pond Volume      :    008.220 ac-ft
+
Total Inflow Volume      :    081.480 ac-ft
-
Total Outflow Volume     :    029.393 ac-ft
Total Percolation Volume :    000.000 ac-ft
=
Final Pond Volume (stage):    060.583 ac-ft
Final Pond Volume (calc) :    060.307 ac-ft
-------------------------------------------------------
Difference (error)       :    000.276 ac-ft
```



ASH STORAGE/DISPOSAL AREA
VERTICAL EXPANSION

PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA



REFERENCES

1.) IMAGERY, DEPARTMENT OF REVENUE, 2007.

SITE LOCATION MAP

1000 0 1000 2000
SCALE FEET

DRAWING No.	TITLE
DRAWING 1	COVER SHEET/SITE LOCATION MAP
DRAWING 2	EXISTING CONDITIONS
DRAWING 3	FINAL COVER PLAN
DRAWING 4	FINAL COVER CROSS SECTIONS
DRAWING 5	DETAILS
DRAWING 6	STORMWATER MANAGEMENT

Prepared for:

Progress Energy

Prepared by:

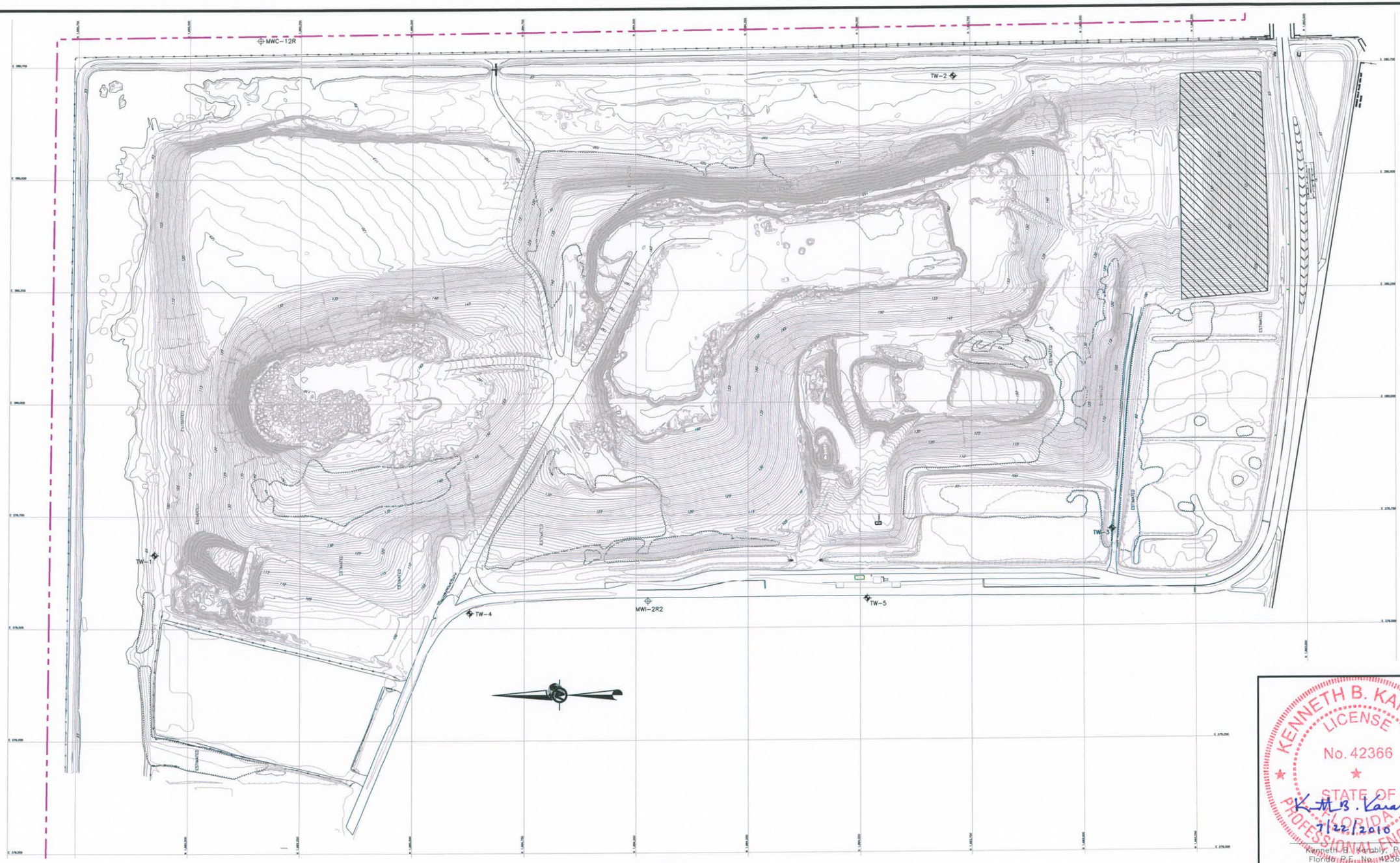
Golder Associates
Jacksonville, Florida

KENNETH B. KARABLY
LICENSE
No. 42366
STATE OF
FLORIDA
PROFESSIONAL ENGINEER
7/22/2010
Kenneth B. Karably, P.E.
Florida P.E. No. 42366

JULY 2010

DRAWING 1

PROJECT No. 083-82671.1 FILE No. 08382671G001 CADD SFS DATE 07/22/10



LEGEND

- EXISTING CONTOURS (SITE DATUM)
- PROPERTY BOUNDARY
- MWC-12R — EXISTING MONITORING WELL LOCATION
- TW-3 — TEMPORARY MONITORING WELL LOCATION
- PREVIOUSLY CLOSED AREA

REFERENCES

THIS TOPOGRAPHIC & QUANTITY SURVEY HAS BEEN PRODUCED BY PHOTOGRAMMETRIC METHODS BY: SOUTHERN RESOURCE MAPPING, INC.

THIS MAP REPRESENTS ACTUAL SITE CONDITIONS AT THE TIME OF AERIAL PHOTOGRAPHY TAKEN OCTOBER 13, 2009

100 0 100 200
SCALE FEET

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PROJECT
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA

TITLE
EXISTING CONDITIONS

Golder Associates
Jacksonville, Florida

PROJECT No.	083-82671.1		FILE No.	083826710002_RD	
DESIGN	KBK	11/25/09	SCALE	AS SHOWN	REV. 0
CADD	BCL	07/22/10	DRAWING 2		
CHECK	SFS	07/22/10			
REVIEW	KBK	07/22/10			

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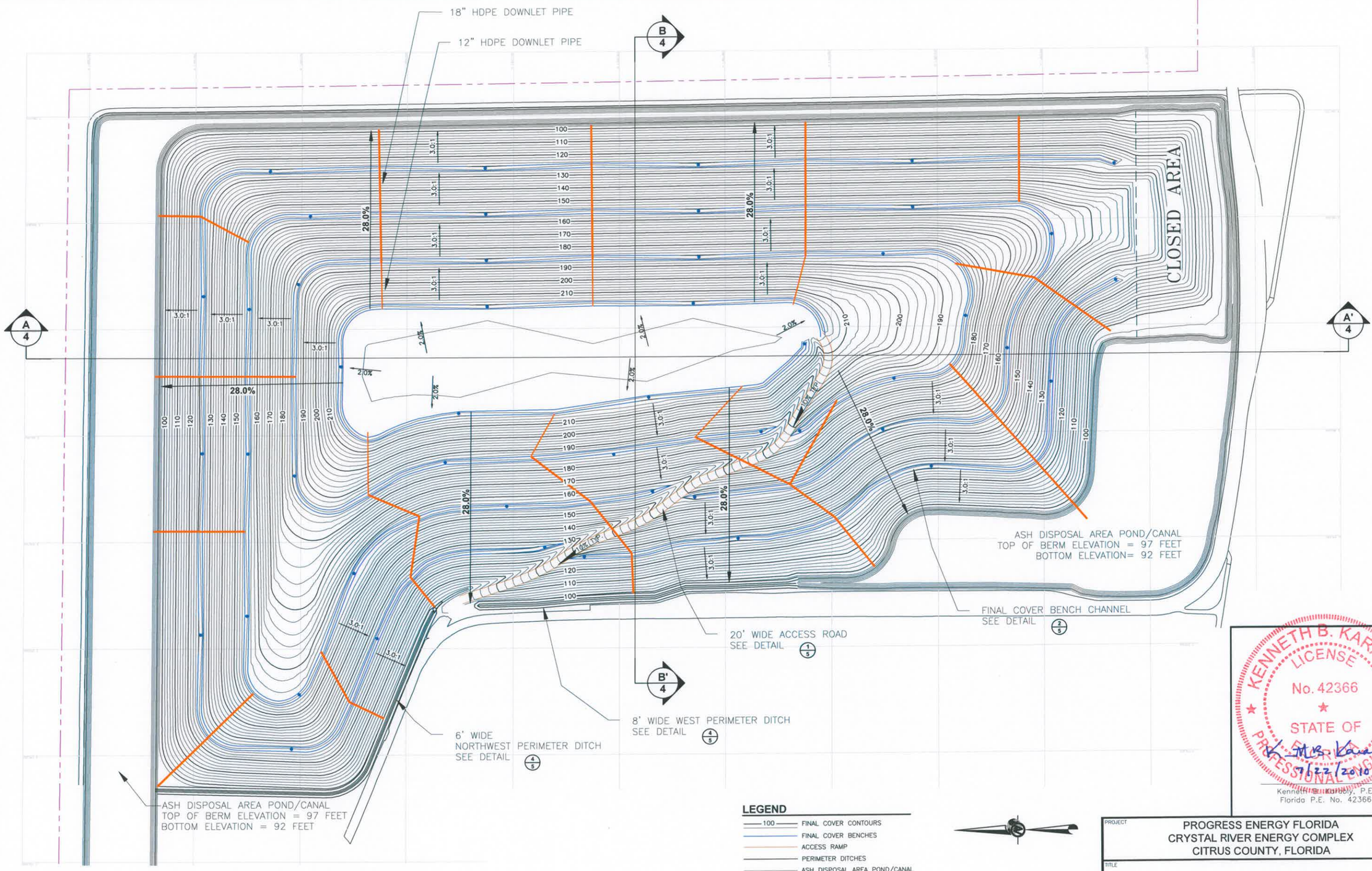

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PROJECT
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA

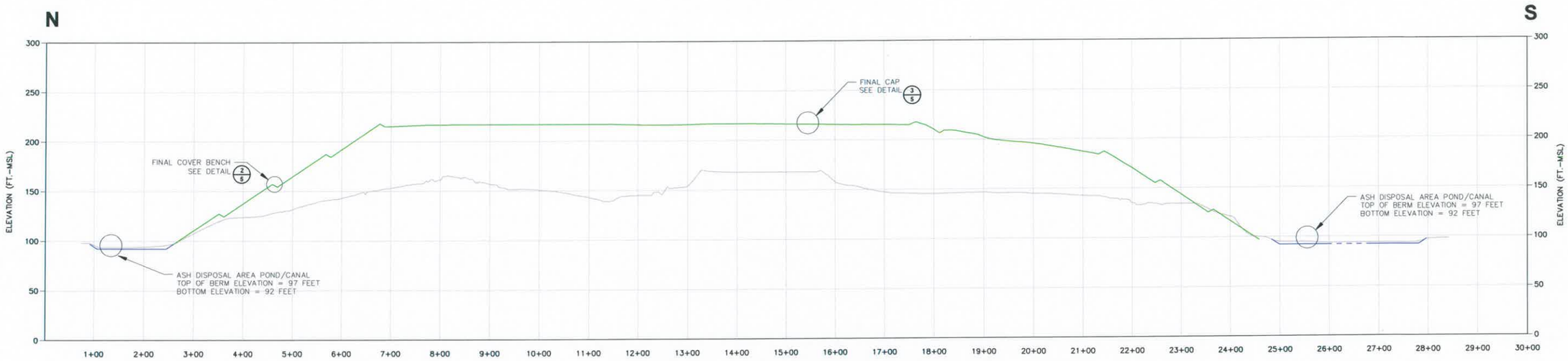
TITLE
FINAL COVER PLAN

Golder Associates
Jacksonville, Florida

PROJECT No.		083-82671	FILE No.	083826710003_RO	
DESIGN	SFS	11/25/09	SCALE	AS SHOWN	REV. 0
CADD	BCL	07/22/10			
CHECK	SFS	07/22/10			
REVIEW	KBK	07/22/10			

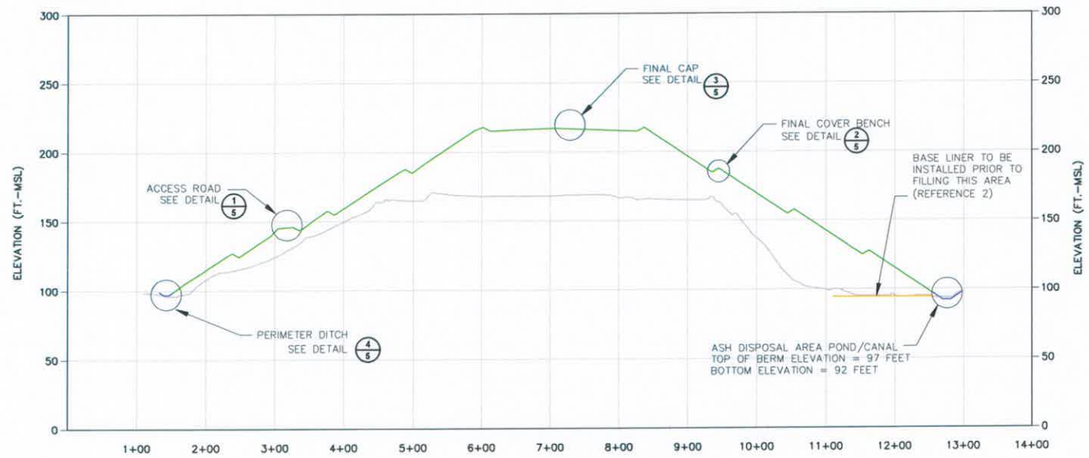
DRAWING 3

Drawing File: 083826710003_RO.dwg Aug 25, 2010 - 4:03pm



A/4 NORTH-SOUTH CROSS SECTION

SCALE 100 0 100 FEET
VERTICAL SCALE EXAGGERATED 2x



B/4 WEST-EAST CROSS SECTION

SCALE 100 0 100 FEET
VERTICAL SCALE EXAGGERATED 2x

LEGEND

- FINAL COVER
- EXISTING TOPOGRAPHY
- SUBGRADE
- PERIMETER DITCHES AND ASH DISPOSAL AREA POND/CANAL

REFERENCES

1. EXISTING TOPOGRAPHY FROM AERIAL SURVEY BY SOUTHERN RESOURCE MAPPING, INC. TAKEN OCTOBER 13, 2009.
2. BASE LINER DETAILS HORIZONTAL RECONFIGURATION SUPPORTING TECHNICAL INFORMATION AND DATED MARCH 18, 2010 AND REVISED SUPPORTING TECHNICAL INFORMATION DATED MAY 27, 2010.

NOTES

1. ALL ELEVATIONS SHOWN ARE RELATIVE TO SITE DATUM.

KENNETH B. KARABLY
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PROJECT
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA

TITLE
FINAL COVER CROSS SECTIONS

Golder Associates
Jacksonville, Florida

PROJECT No.		083-82671	FILE No.	083826716005_R0	
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CADD	BCL	07/22/10			
CHECK	SFS	07/22/10			
REVIEW	KBK	07/22/10			

DRAWING 4

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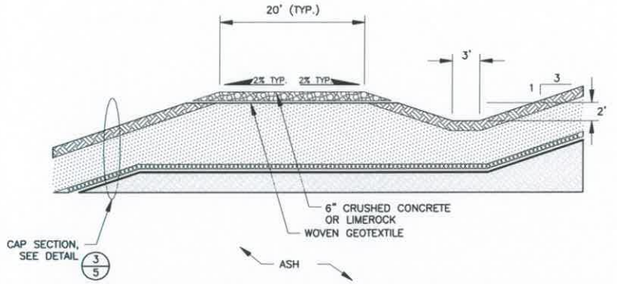
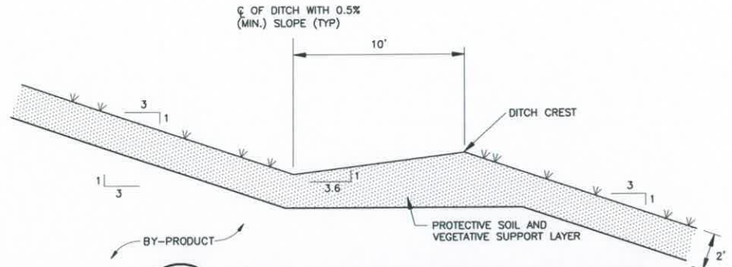


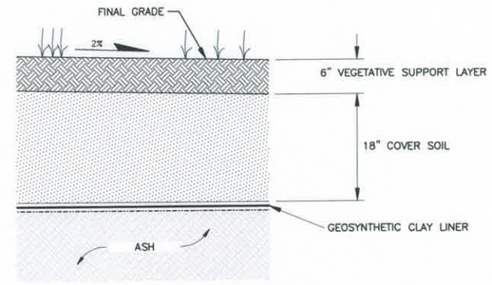
1/5 ACCESS ROAD ON FINAL COVER

NOT TO SCALE



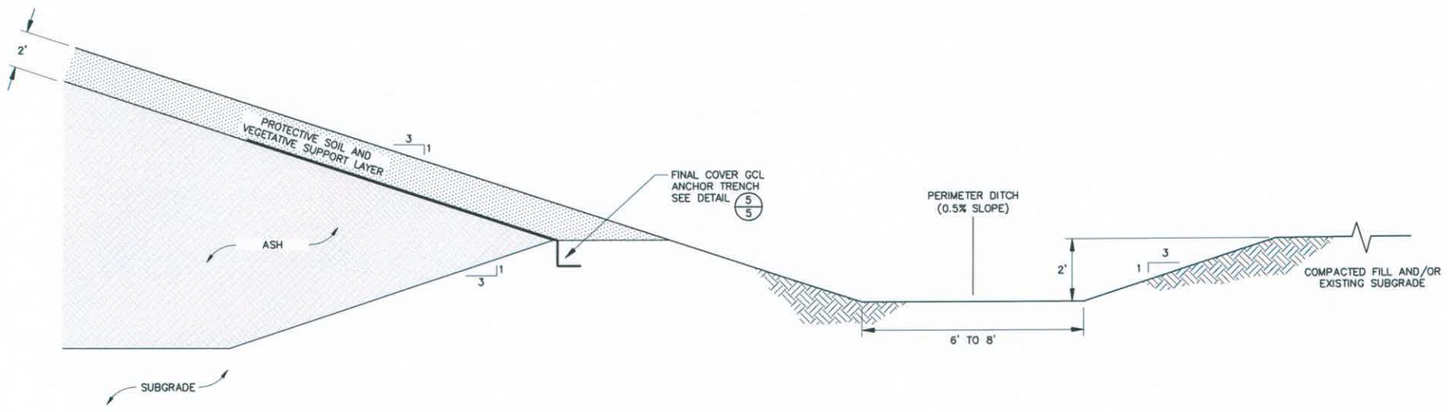
2/5 FINAL COVER BENCH CHANNEL

NOT TO SCALE



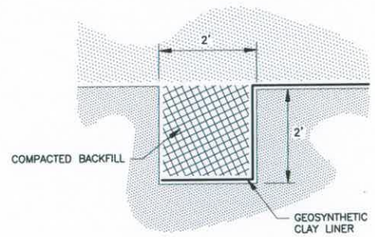
3/5 FINAL COVER SECTION (TOP OF ASA)

NOT TO SCALE



4/5 PERIMETER DITCH DETAIL

NOT TO SCALE



5/5 GCL ANCHOR TRENCH DETAIL

NOT TO SCALE

KENNETH B. KARABLY
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PROFESSIONAL ENGINEER

K. B. Karably
7/22/2010

Kenneth B. Karably, P.E.
Florida P.E. No. 42366

PROJECT
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA

TITLE
DETAILS

Golder Associates
Jacksonville, Florida

PROJECT No.		083-82671	FILE No.	08382671G006_R0	
DESIGN	KBK	11/25/09	SCALE	AS SHOWN	REV. 0
CADD	BCL	07/22/10			
CHECK	SFS	07/22/10	**DRAWING 5**		
REVIEW	KBK	07/22/10			

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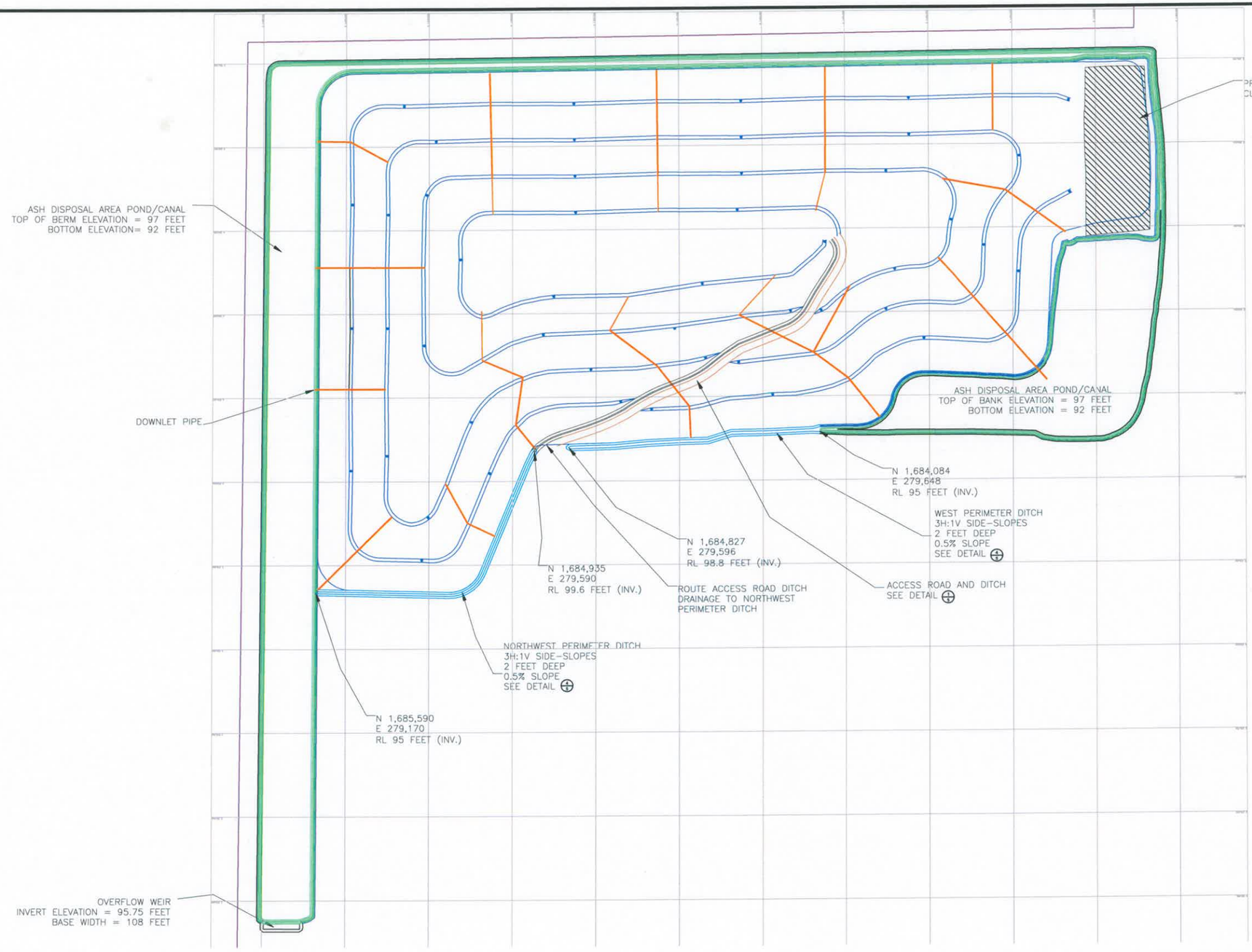

LEGEND

- FINAL COVER
- PERIMETER DITCHES
- ASH DISPOSAL AREA POND/CANAL
- 12 INCH DOWNLET PIPES
- 18 INCH DOWNLET PIPES
- PROPERTY BOUNDARY

NOTES

ALL ELEVATIONS SHOWN ARE RELATIVE TO SITE DATUM.

150 0 150 300
SCALE FEET

KENNETH B. KARABLY
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No. 42366
STATE OF FLORIDA
PROFESSIONAL ENGINEER
7/22/2010
Kenneth B. Karably, P.E.
Florida Reg. No. 42366

PROJECT
PROGRESS ENERGY FLORIDA
CRYSTAL RIVER ENERGY COMPLEX
CITRUS COUNTY, FLORIDA

TITLE
STORMWATER MANAGEMENT

Golder Associates
Jacksonville, Florida

PROJECT No.		083-82671	FILE No.	08382671G007_R0
DESIGN	SFS	11/25/09	SCALE	AS SHOWN REV. 0
CADD	BCL	07/22/10		
CHECK	SFS	07/22/10		**DRAWING 6**
REVIEW	KBK	07/22/10		

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