

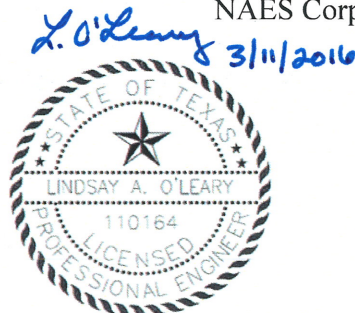
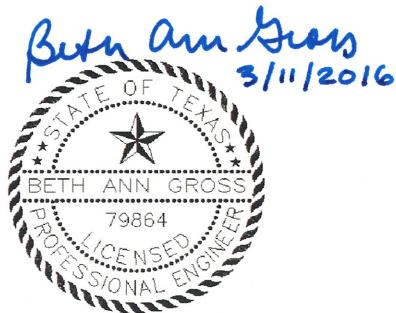
# GROUNDWATER MONITORING SYSTEM CERTIFICATION REPORT FOR SOLID WASTE DISPOSAL FACILITY

**Sandy Creek Energy Station  
Riesel, McLennan County, Texas**

*Submitted to*



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## **SECTION 1**

### **INTRODUCTION**

#### **1.1 Purpose**

The purpose of this report is to present the groundwater monitoring system for the Solid Waste Disposal Facility (SWDF) at the Sandy Creek Energy Station (Site) in Riesel, McLennan County, Texas and to demonstrate it complies with the United States Environmental Protection Agency's (EPA's) groundwater monitoring system requirements of the new Coal Combustion Residuals (CCR) Rule (40 CFR § 257.91).

This report was prepared by Mr. Alexander Brewster and Ms. Lindsay O'Leary, P.E. of Geosyntec Consultants (Geosyntec) and reviewed by Dr. Beth Gross, P.E., also of Geosyntec, in accordance with the senior review policies of the firm.

#### **1.2 Report Organization**

This report is organized as follows:

- Section 2, Background Information, describes the Site location, the SWDF layout and design, and the regional and site settings with respect to geology and hydrogeology;
- Section 3, Piezometers and Monitoring Wells, describes piezometer and well design, installation, construction, development, slug tests, and survey;
- Section 4, Considerations for Groundwater Monitoring System Design, describes the uppermost water bearing zone beneath the Site, observed groundwater elevations and flow directions, average flow rate, and SWDF features considered during design of the groundwater monitoring system;
- Section 5, Certification, provides certification of the groundwater monitoring system by qualified professional engineers; and
- Section 6, References, lists references that were used in development of this Report.

Appendices A to D, respectively, contain boring logs, monitoring well and piezometer data, State of Texas well reports, and survey data. Appendix E contains supplemental documentation on the geotechnical investigations that have been conducted at the Site.

## SECTION 2

### BACKGROUND INFORMATION

#### 2.1 Site Location

The 698-acre Sandy Creek Energy Station is located in southeast McLennan County approximately 17 miles southeast of Waco, Texas, west of the City of Riesel. It is bounded on the south by FM 1860 and on the west and north by Rattlesnake Road (Drawing 1).

#### 2.2 Description of SWDF

The SWDF is a CCR landfill located on the southwest corner of the Site (Drawing 1). It is operated under Texas Commission on Environmental Quality (TCEQ) Registration No. 88448 and used for disposal of CCR and incidental waste generated during coal combustion at the Site.

The SWDF will ultimately occupy approximately 65 acres and will consist of four cells, referred to as Cells 1 to 4 (Drawing 1). The base of Cell 1 was constructed approximately at grade, while the base of Cell 2 was constructed up to about 15 feet (ft) below grade. Subgrade elevations for the cells range from approximately 449 to 495 ft-mean sea level (ft-msl). Waste placement in the SWDF began in Cell 1 after start up of the Sandy Creek Energy Station in October 2011. Because the start up period took an extended period of time, only a small amount of waste was placed during the first year of landfill operation. Cell 2 was constructed in early 2014. As of November 2015, Cell 1 had been filled to its initial waste grades, and waste placement was occurring in the south end of Cell 2. Waste had not been placed on the north side of Cell 2. Based on the current waste generation rates, it is anticipated that Cell 3 will not be operational until 2022. The approximate design life of the SWDF is 35 years.

The liner system for the SWDF is designed to convey leachate to the south side of the landfill for removal. The liner system for Cell 1 consists of a 3-ft thick compacted clay liner (with hydraulic conductivity no greater than  $1 \times 10^{-7}$  centimeter/second [cm/s]) overlain by a 6-in. thick protective soil layer and then a leachate collection piping system with pipes at 50-ft spacings. The liner system for Cell 2 consists of, from bottom to top: a 3-ft thick compacted clay liner (with hydraulic conductivity no greater than  $1 \times 10^{-7}$  cm/s), double-sided geocomposite drainage layer for leachate collection, and 1-ft thick protective cover.

Leachate from the SWDF is piped to a leachate evaporation pond located southwest of Cell 2 (Figure 1). The pond has a composite liner consisting of a 2-ft thick compacted clay liner (with hydraulic conductivity no greater than  $1 \times 10^{-7}$  cm/s) overlain by a 60-mil thick high density polyethylene (HDPE) geomembrane.

## **2.3 Regional Setting**

### **2.3.1 Physiography**

As described by Black and Veatch Corporation (B&V) (2009), the Site lies in the Blackland Prairies province of the Gulf Coastal Plains. This province is located northeast of the Central Texas uplift and consists of chalks and marls that weather to clay soils.

### **2.3.2 Geology and Hydrogeology**

Two integrated geologic formations of the Taylor Group from the Upper Cretaceous period lie below the site. The uppermost is the Wolfe City Formation, which consists of marl, sand, sandstone, and clay interbedded with thin sandstone and sand lenses and was estimated by B&V (2009) to be approximately 150 ft thick at the Site. The Ozan Formation, primarily clay, grades upward into the Wolfe City and is reported to be 500 to 775 ft thick in the Waco area (Proctor et al., 1970).

Below the Taylor are three addition groups of the Upper Cretaceous period (Austin, Eagle Ford, and Woodbine) and two groups of the Lower Cretaceous period (Washita and Fredericksburg), which consist primarily of chalk, limestone, marl, clay, and shale and overlie the Trinity Group (American Association of Petroleum Geologists [AAPG], 1979). The Trinity Group includes, from top to bottom, the Paluxy, Glen Rose, and Travis Peak/Twin Mountains Formations, which compose the uppermost aquifer beneath the Site (George et al., 2011). The Trinity Aquifer, a major aquifer in Texas, generally consists of sands, gravels, and conglomerates interbedded with limestone, shale, clay and marl. There are no other minor or major aquifers in the vicinity of the Site (George et al., 2011). The Trinity Aquifer is located more than 1,000 ft below ground surface at the Site and has combined freshwater saturated thickness of approximately 1,000 ft (George et al., 2011). The overlying Cretaceous formations serve as confining units between the SWDF and the Trinity Aquifer. Due to the significant thickness of these units, the potential for landfill constituents to migrate from the SWDF to the Trinity Aquifer during the active life and post-closure care period does not exist. Therefore groundwater monitoring of the Trinity Aquifer beneath the Site is not warranted.

## **2.4 Site Setting**

### **2.4.1 Topography**

Natural grades at the Site range from approximately 415 to 520 ft-msl (Drawing 1 and Appendix E). With development, a number of the natural drainage features at the Site were filled with soil to create relatively flat areas for infrastructure construction. In the area of the SDWF, ground slopes to the southwest (Figure 1).

## 2.4.2 Stratigraphy

Three stratigraphic units were identified in soil borings conducted to depths of up to 100 ft at the Site (B&V, 2009, 2010; Geosyntec, 2010, 2015). From top to bottom, these strata generally consist of:

- Stratum I: 1 to 12-ft thick (typical), dry to moist, soft to firm, high plasticity, brown clay with trace amounts of rounded sand and gravel;
- Stratum II: within 10 to 45-ft below ground surface (typical), dry to moist, firm to stiff, high plasticity yellow-brown clay grading to gray with depth, with trace amounts of subrounded sand and gravel, occasional horizontal seams of fine sand in the upper portions of the stratum, and horizontal and vertical deposits of gypsum throughout the layer; and
- Stratum III: dry to moist, hard, high plasticity, fissile, gray clayshale with infrequent fine sand layers and very infrequent fissures and joints, typically found below depths of 50 ft in uplands and 25 ft in bottom valleys.

The locations and logs of the borings drilled in the vicinity of the SWDF and discussed in the B&V (2010) report are provided in Appendix E. The geologic cross section for the SWDF area developed by B&V (2010) is also included in Appendix E. In addition to Strata I to III, Geosyntec also encountered soil fill when drilling. The locations and logs of the borings drilled in 2010 and 2015 in the vicinity of the SWDF under the direction of Geosyntec are provided in Appendices A and E. The results of geotechnical laboratory tests conducted on soil samples collected by B&V and Geosyntec during subsurface investigation activities are also included in Appendix E.

Cells 1 and 2 of the SWDF as well as the leachate evaporation pond extend into Strata I and II clayey soils.

## 2.4.3 Hydrostratigraphy

While B&V (2009) found groundwater in Stratum II at depths of 14 to 43 ft below ground surface in some of the borings and all of the piezometers in the northwest portion of the Site, they did not encounter groundwater in borings drilled in the vicinity of the SWDF. B&V (2009) concluded that water flowed in cracks and fissures in the clay. The majority of the fissures were in-filled with sand and gypsum, indicating secondary mineralization and water flow at certain depths, and some fissures were stained with iron oxide. In the northwest portion of the Site free water was commonly encountered within the sand layers found in Stratum II at depths greater than 20 ft. The groundwater encountered in Stratum II is considered transient and perched and is not expected to be found in significant quantities. Hydraulic conductivity tests were conducted on four undisturbed soil samples collected from Stratum II. Measured vertical hydraulic

conductivities ranged from to  $4.6 \times 10^{-9}$  to  $6.6 \times 10^{-8}$  cm/s (Appendix E). Slug tests were conducted by Geosyntec in three borings drilled in 2010 in the vicinity of the leachate evaporation pond. Estimated horizontal hydraulic conductivities for Stratum II ranged from  $1.2 \times 10^{-4}$  to  $3.1 \times 10^{-4}$  cm/s over saturated soil thicknesses of approximately 7.8 to 12.5 ft.

Based their hydrogeologic characteristics, Stratum I is generally an unsaturated zone, Stratum II is the uppermost water bearing zone beneath the Site, and Stratum III is an aquitard or lower confining layer for Stratum II. The top of Stratum III generally follows topography and slopes to the southwest in the SWDF area.

EPA's new CCR Rule requires monitoring of groundwater in the uppermost aquifer beneath an active CCR landfill. As defined by 40 CFR §257.53, "*Aquifer* means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs." The uppermost aquifer, the Trinity Aquifer, is located more than 1,000 ft below ground surface and is isolated from the Site by thick Cretaceous confining units. With this significant hydraulic isolation, there is no need to monitor the Trinity. As is standard practice in Texas and other states for landfills sited over clay formations, the uppermost water bearing zone is often considered an "aquifer" for groundwater monitoring purposes. Although Stratum II is not an aquifer and does not yield useable quantities of water for water supply, it is anticipated to yield sufficient groundwater for a groundwater monitoring program.

## SECTION 3

### PIEZOMETERS AND MONITORING WELLS

#### 3.1 Overview

In August and September 2010, Geosyntec directed the drilling of five soil borings (GB-1 to GB-5) in the vicinity of the current leachate evaporation pond to collect geotechnical data and evaluate groundwater levels in the pond area as part of the pond design. The subsurface investigation program was completed under the direction of Edward B. Dolan, P.G., a licensed geoscientist in the State of Texas. Boring locations are shown on Figure 1. Piezometers were constructed in borings GB-1 to GB-4 and screened in Stratum II above the Stratum II/Stratum III interface. While water levels were recorded in Piezometers GB-2 to GB-4, Piezometer GB-1 remained dry. Slug tests were conducted in Piezometers GB-2 to GB-4. Piezometers GB-1 and GB-4 were decommissioned prior to pond construction.

In September 2015, Geosyntec directed the drilling of five additional borings (GB-6, GB-7, BW-1, MW-1, and MW-2) in the SWDF area as part of the development of the proposed groundwater monitoring system. The subsurface investigation program was completed under the direction of Lindsay A. O'Leary, P.E., a licensed professional engineer in the State of Texas. Boring locations are shown on Figure 1. Borings GB-6 and GB-7 were dry and were plugged and abandoned; piezometers were installed in BW-1, MW-1, and MW-2 and screened in Stratum II above the Stratum II/Stratum III interface.

Based on the location of the piezometers relative to SWDF, four piezometers are proposed to be used as wells in the groundwater monitoring system. Well BW-1 will serve as the background well, and Wells MW-1, MW-2, and MW-3 (former GB-3) will serve as downgradient wells. Piezometer GB-2 will be retained for water level measurements to provide more control for evaluating groundwater flow directions and gradients.

Boring logs are provided in Appendices A and E. Well and piezometer construction logs are included in Appendices B and E. State of Texas well reports are provided in Appendices C and E. Piezometer and well survey information is presented in Appendix D. The remainder of this section primarily describes the design, installation, construction, and development of Piezometer GB-2 and Wells BW-1, MW-1, MW-2, and MW-3.

#### 3.2 Piezometer and Well Design and Installation

A Geosyntec engineer provided oversight of piezometer installation in 2010 and groundwater monitoring well installation in 2015. Prior to conducting field work at the Site, Geosyntec prepared a Site-specific Health and Safety Plan (HASP) and a Task Hazard Analysis (THA), contacted the Texas utility notification services and NAES regarding underground utilities and

other subsurface lines, and attended a Site-specific health and safety orientation. During field work at the Site, Geosyntec conducted daily safety briefings and utilized the appropriate professional protective equipment (PPE) prescribed in the HASP.

Drilling performed in 2010 used both rotary wash and hollow stem auger; in 2015, the hollow stem auger method was used. Soil cores were collected continuously using a five-foot long CME core barrel, and the core lithology was logged by a Geosyntec engineer in general accordance with American Society for Testing and Materials (ASTM) D 2487. Thin-walled tube samples were also collected at select locations for geotechnical laboratory testing. Drilling equipment was cleaned prior to use at the Site and after completing work at each borehole location. Soil cores and drill cuttings were distributed to the land surface in the vicinity of each borehole. Cleaning water and development water were placed in 55-gallon steel drums with lids, labeled with non-hazardous waste identification decals, and staged on wooden pallets for subsequent management by NAES.

During the 2010 field activities, five borings (GB-1 to GB-5) were drilled 17 to 32 ft below ground surface by Total Support Services of Austin, Texas, a Texas licensed water well driller. Four of the five borings (GB-1 to GB-4) were completed as piezometers; GB-5 was plugged with a cement-bentonite grout mixture. In general, piezometers were installed through Strata I and II and approximately 1-ft into Stratum III and were screened 10 ft from the Stratum II/Stratum III interface upward. Piezometers GB-2 to GB-4 subsequently yielded water; Piezometer GB-1 remained dry. Slug tests were subsequently conducted in Piezometers GB-2 to GB-4. Piezometers GB-1 and GB-4 were plugged and abandoned on 12 April 2011, prior to the construction of the leachate evaporation pond (Fugro Consultants, Inc., 2011).

During the 2015 field activities, five borings (GB-6, GB-7, BW-1, MW-1, and MW-2) were drilled 25 to 50 ft below ground surface by Best Drilling Services, Inc. (Best) of Friendswood, Texas, a Texas licensed water well driller. Groundwater was observed in borings BW-1 and MW-1 after the boreholes were left open overnight. Boring MW-2 was initially observed to be dry, but groundwater was observed five days after well development. These three borings (BW-1, MW-1, and MW-2) were completed as piezometers with a similar design to those installed in 2010. Two borings (GB-6 and GB-7) were observed to be dry boreholes with little evidence of water transmission (sand seams, iron oxide staining, gypsum seams). These borings were plugged with a cement-bentonite grout mixture. Geosyntec also observed groundwater in previously-installed Piezometers GB-2 and GB-3.

Based on the observation of groundwater in Piezometer GB-3 in September 2015 and the geographical location of the piezometer relative to the SWDF and leachate evaporation pond, Piezometer GB-3 was redesignated as Well MW-3 and incorporated into the groundwater monitoring network. Although groundwater was also observed in Piezometer GB-2, the piezometer was not considered for use as a well because it is located approximately 40 ft south of the proposed limit of waste (i.e., SWDF footprint) (Figure 1) and will ultimately be overlain

by approximately 25 ft of structural fill placed during construction of the southwest portion of the SWDF perimeter berm.

### **3.3 Piezometer and Well Construction**

The Geosyntec engineer logging the borings determined where to set the piezometer and well screens based on the observations of the geologic strata encountered. Boring logs included in Appendix A contain details on the materials accounted and groundwater levels observed at the time of drilling. Details on the piezometer and well construction materials, dimensions, elevations, and locations are included in Appendix B.

The piezometer and wells were constructed with new 2-in. diameter polyvinyl chloride (PVC) casings, screens, and bottom caps supplied in clean plastic bags. All PVC joints were flush threaded. Screens had 0.01-inch slots, which are compatible with the gradation of the sand pack used to fill the annulus between the borehole and the well casing. As described below, all piezometers and wells were cased in a manner that maintains the integrity of the borehole.

The piezometer or well, consisting of a solid casing and slotted screen, was set at the elevation determined by the Geosyntec engineer. The sand pack was then installed by slowly pouring the sand material into the borehole, around the piezometer or well, to approximately 1 to 2 ft above the piezometer or well screen. Then, a 2-ft thick (minimum) bentonite seal was constructed above the sand pack. For BW-1, MW-1, and MW-2, after the bentonite was hydrated, a cement/bentonite grout was gravity fed into the borehole from the top of the bentonite seal to approximately 2 ft below ground surface. For GB-2 and MW-3, due to the proximity of the sand pack to the ground surface, hydrated bentonite chips were placed in the borehole between the top of the sand pack and the concrete pad. The above-ground (i.e., stick-up) piezometer or well was completed by filling the remainder of the borehole with concrete and constructing a concrete pad around it. The stick-up portion of the piezometer or well extended through the concrete pad and was housed in a locking aluminum well casing (i.e., protective outer casing). Concrete bollards (i.e., protection posts) were installed at each corner of the concrete pad. State of Texas well reports documenting the piezometer or well construction were submitted by the drillers to the Texas Water Development Board. Copies of the reports are provided in Appendix C.

### **3.4 Piezometer and Well Development**

Geosyntec developed Piezometer GB-2 and Well MW-3 in 2010 using a surging and purging technique with a surge block and submersible pump. Best developed Wells BW-1, MW-1, and MW-2 and purged Well MW-3 in September 2015 using a submersible pump to surge and purge. The following details the development activities.

Each piezometer and well was first gauged using an electronic water level indicator to obtain the depth to water. For Piezometer GB-2 and Well MW-3, a surge block was used to suspend sediments in water and facilitate sediment removal. A submergible pump was then used to

remove the water and sediment. The pump was periodically raised and lowered along the piezometer or well screen (i.e., surged) in order to induce flow out through the screen and thereby flush the fine sediments from the filter pack. After Piezometer GB-2 and Well MW-3 were pumped dry, pumping ceased. Development was resumed six days later after allowing natural recharge to occur. Water quality parameters were measured during well development and used, along with water clarity, to evaluate when development was complete (i.e., water quality parameters had stabilized and the purged water was clear). The water quality parameters and volumes of water removed from the wells were recorded.

For BW-1, MW-1, and MW-2, a submersible pump was used to surge and purge the wells until they were pumped dry. Then potable water was added through the PVC casing and pumping was resumed. This process continued until the water remained visibly clear, at which time the well was pumped dry once more (i.e., removing added potable water). Approximately 80 to 100 gallons of water was added to and pumped from each well. The water quality parameters and volumes of water removed from the wells were measured and recorded.

MW-3 was originally developed in 2010 and subsequently purged in 2015. Best intermittently pumped five gallons of water from MW-3 and then pumped the well dry. MW-3 was allowed to recharge and then pumped intermittently at approximately 5-minute intervals until approximately 10 gallons of water was removed. MW-3 produced visibly clear water throughout purging. The water quality parameters and volumes of water removed were measured and recorded during the process.

Field equipment used for well development was cleaned prior to use between wells, and new tubing was used in each well.

### **3.5 Slug Testing**

In September 2010, Geosyntec performed falling head permeability tests in Piezometers GB-2 and GB-4 and Well MW-3. The tests were performed using a solid “slug” to generate water level changes and a pressure transducer/data logger set up to monitor the water level response in the piezometers and well over time. Estimated horizontal hydraulic conductivities for Stratum II ranged from  $1.2 \times 10^{-4}$  to  $3.1 \times 10^{-4}$  cm/s (0.34 to 0.88 ft/day) over saturated soil thicknesses of approximately 7.8 to 12.5 ft. The calculated geometric mean hydraulic conductivity is  $2.0 \times 10^{-4}$  cm/s (0.55 ft/day). Estimated transmissivities ranged from 2.9 to 10.9 ft<sup>2</sup>/day.

### **3.6 Piezometer and Well Survey**

The physical locations, ground surface elevations (at the edge of concrete pads), and top of the inner PVC casing elevations were surveyed by Walker Partners of Waco, Texas. The survey data are provided in Appendix D.

## SECTION 4

### CONSIDERATIONS FOR GROUNDWATER MONITORING SYSTEM DESIGN

#### 4.1 Overview

As required by 40 CFR § 257.91, a groundwater monitoring system for a CCR unit, such as the SWDF, must consist of a sufficient number of appropriately located wells to yield groundwater samples from the uppermost aquifer that represent the quality of background groundwater and the quality of groundwater passing the waste boundary of the CCR. Although the rule requires a minimum of one upgradient and three downgradient monitoring wells, the number, spacing and depths of the monitoring wells must be determined based on hydrogeology of the site including aquifer thickness, groundwater flow rates, and direction.

#### 4.2 Thickness of Uppermost Water Bearing Zone

As described in Section 2.4.3, Stratum II is the uppermost water bearing zone beneath the Site and is considered the “uppermost aquifer” for the groundwater monitoring purposes. Based on the boring logs for the monitoring wells, the thickness of the water bearing zone within Stratum II (i.e., the zone with sand or gypsum lenses or iron oxide staining) is on the order of 8 ft in the vicinity of Well BW-1 and 10 to 18-ft thick along the southern boundary of the SWDF.

#### 4.3 Groundwater Elevations and Flow Directions

Groundwater levels in piezometers and wells installed in 2010 and 2015 have been periodically recorded since they were installed and developed. Following stabilization of groundwater levels in the wells recently installed in September 2015, NAES personnel have been recording depth to water (DTW) measurements for Wells BW-1 and MW-1 through MW-3 and Piezometer GB-2 on a monthly basis (Table 1). Groundwater elevations were then calculated by subtracting the DTW measurements from the surveyed elevations of the tops of casings. The top of casing elevations and calculated monthly groundwater elevations are presented in Table 1. Based on the available groundwater data, groundwater elevations on the southern boundary of the SWDF in late 2010 and early 2011 are similar to groundwater elevations in late 2015 and early 2016. It is recommended that groundwater level data continue to be collected and evaluated to further assess the seasonal and temporal fluctuations in the groundwater table and, thus, groundwater flow.

Groundwater elevations observed in October, November, and December 2015 were plotted on a Site map, and potentiometric surfaces for each of these dates were contoured (Figures 2 through 4). Groundwater elevations for January 2016 were not plotted. Observed groundwater elevations, potentiometric surface maps, and the boring logs show that groundwater elevations in Stratum II generally mimics the natural ground surface topography at the site (Drawing 1) as well as the

elevation changes of the top of Stratum III. Based on these features, groundwater flow is expected to flow to the southwest. The potentiometric surfaces in Figures 2 to 4 are consistent with this Site conceptual model. The Site conceptual model is consistent with those for other Texas Sites located in similar hydrogeologic settings.

Based on the potentiometric surfaces, natural ground surface topography, top of Stratum III elevations, and locations of the SWDF and leachate evaporation pond, Well BW-1 is considered an upgradient or background well for the SWDF, and Wells MW-1 to MW-3 are considered downgradient wells. Given that only Cells 1 and 2 of the SWDF have been constructed and that these cells have only been fully operational for a relatively short period, it may also be appropriate to use groundwater samples from Wells MW-1 to MW-3 along with those from Well BW-1 to establish background conditions for the SWDF.

#### **4.4 Average Groundwater Flow Velocity**

The average velocity of groundwater moving through Stratum II was calculated using Darcy's equation:

$$v = ki/n_e$$

where  $v$  = average groundwater velocity (ft/day),  $k$  = average hydraulic conductivity (ft/day),  $i$  = average hydraulic gradient (ft/ft), and  $n_e$  = effective porosity (dimensionless).

Using a geometric mean horizontal hydraulic conductivity estimated from slug tests of 0.55 ft/day, an assumed effective porosity for the clay of 0.05 (i.e., five percent of the soil matrix volume is composed of connected voids), and an average hydraulic gradient of 0.021 ft/ft, the calculated average horizontal groundwater flow rate is 0.24 ft/day (86 ft/yr).

#### **4.5 SWDF Features**

##### **4.5.1 Landfill Liner Grades and Sumps**

The liner system for Cells 1 and 2 is designed with a compacted clay liner and leachate collection system graded to convey leachate to the southwest corner of the cells. Leachate heads in the cells are anticipated to be highest at these locations and, therefore, the potential for leachate migration into the compacted clay liner is greater at these locations than elsewhere in the cells. Monitoring well MW-1 is located downgradient of the Cell 2 sump, and Monitoring Well MW-2 is located downgradient of the Cell 1 sump and the leachate evaporation pond. Based on the available groundwater data, Monitoring Well MW-3 is located downgradient of the sump of future Cell 3 and the leachate evaporation pond, and an additional well may be required in the future to monitor Cell 4.

#### **4.5.2 Leachate Evaporation Pond**

The existing leachate evaporation pond was constructed with a geomembrane/compacted clay composite liner. While small in footprint area compared to the SWDF, the leachate evaporation pond is operated with a higher hydraulic head than that anticipated for the SWDF. In consideration of the leachate evaporation pond, groundwater monitoring wells MW-2 and MW-3 are located hydraulically down-gradient of the pond and the SWDF.

#### **4.5.3 Stormwater Pond and Swales**

The existing stormwater pond and the drainage channel located along the eastern and southern perimeter of the SWDF (Figure 1) represents locations where accumulated surface water could potentially influence the groundwater flow direction by providing a source of additional recharge to Stratum II. However, these features were designed to drain rather than retain flow. The stormwater pond was constructed with a bleed pipe to drain the stormwater pond to approximately 1 ft deep within three days of the design storm. The drainage channels along the eastern and southern perimeter of the SWDF are designed to drain storm water offsite or to the stormwater pond.

#### **4.6 Conclusions**

Based on the thickness of the uppermost water bearing zone, groundwater flow direction and velocity, and SWDF features, including liner system grades and sumps, the groundwater monitoring system described in this report consists of a sufficient number of appropriately located wells to yield samples of groundwater representative of background conditions and conditions downgradient of the SWDF.

## SECTION 5

### CERTIFICATION

We hereby certify as a qualified professional engineers that based on the information presented in this Groundwater Monitoring System Certification Report, the groundwater monitoring system for the SWDF has been designed and constructed to meet the requirements of 40 CFR §257.91.



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## SECTION 6

### REFERENCES

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## TABLE

Table 1  
Monitoring Well and Piezometer Construction Details and Groundwater Elevations  
SWDF Groundwater Monitoring Network, Sandy Creek Energy Station, Reisel, Texas

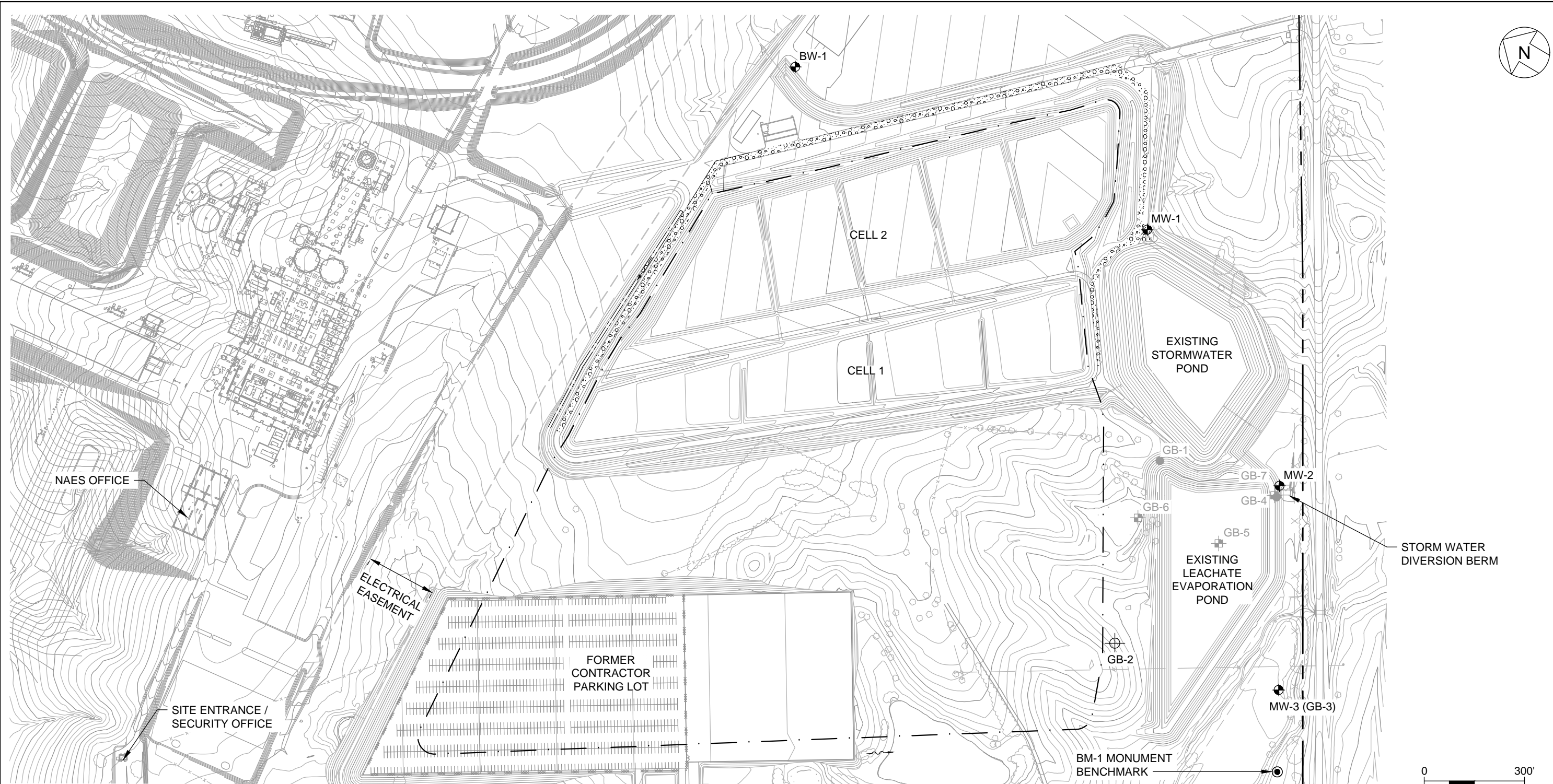
ID	Top of Casing Elevation (ft msl)	Well Depth (ft BTOC)	Casing Height (ft)	Screen Length (ft)	Screen Interval (ft bgs)	Well Diameter (inches)	06-Oct-15		04-Nov-15		02-Dec-15		19-Jan-16	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft msl)	Depth to Water (ft BTOC)	Groundwater Elevation (ft msl)	Depth to Water (ft BTOC)	Groundwater Elevation (ft msl)	Depth to Water (ft BTOC)	Groundwater Elevation (ft msl)
Monitoring Wells														
BW-1	485.57	41.50	2.87	10.0	28.30 - 38.30	2	20.80	464.77	17.60	467.97	20.10	465.47	20.20	465.37
MW-1	465.87	37.25	3.02	10.0	23.90 - 33.90	2	13.60	452.27	13.40	452.47	12.50	453.37	12.40	453.47
MW-2	442.15	22.60	2.97	10.0	9.30 - 19.30	2	13.95	428.20	12.40	429.75	12.10	430.05	13.50	428.65
MW-3	430.06	19.95	2.97	10.0	5.98 - 15.98	2	12.60	417.46	8.60	421.46	7.70	422.36	8.40	421.66
Piezometer														
GB-2	447.45	22.10	2.83	10.0	9.02 - 19.02	2	13.20	434.25	13.40	434.05	11.80	435.65	11.10	436.35

Notes:

1. ft msl indicates feet above mean sea level, ft bgs indicates feet below ground surface, and ft BTOC indicates ft below top of casing.
2. Top of casing elevations are taken from the survey data provided in Appendix D.
3. Monitoring well construction details are taken from the well construction logs provided in Appendix B.
4. Groundwater elevation is calculated by subtracting the recorded depth to water (ft BTOC) from the surveyed top of casing elevation (ft msl).
5. The groundwater elevation in MW-3 (GB-3) was measured by Geosyntec on 28 September 2010 (421.38 ft msl) and 26 April 2011 (419.48 ft msl).
6. The groundwater elevation in GB-2 was measured by Geosyntec on 28 September 2010 (436.08 ft msl) and 26 April 2011 (434.25 ft msl).
7. The groundwater elevation in former GB-4, located near current MW-2 was measured by Geosyntec on 28 September 2010 (430.42 ft msl).

## **FIGURES**

P:\CADD\PROJECTS\S\SANDY CREEK PP\ENG DESIGN\CCR RULE COMPLIANCE (TXL0526.01)\GROUNDWATER REPORT (TXL0526.02)\TXL052602F01

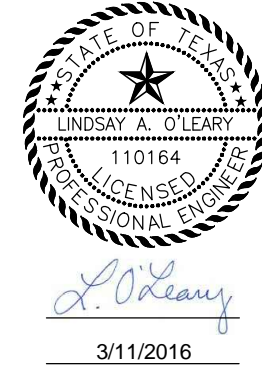


NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING EXISTING TOPOGRAPHY DATED APRIL 2006 AND DESIGN GRADES DATED OCTOBER 2007 FROM BLACK & VEATCH CORPORATION; DESIGN GRADES DEVELOPED BY GEOSYNTEC CONSULTANTS, INC. FOR THE LEACHATE EVAPORATION POND AND CELL 2 DATED APRIL 2011 AND APRIL 2014, RESPECTIVELY; AND AREA 59 EXISTING TOPOGRAPHY SURVEY CONDUCTED BY WALKER PARTNERS DATED 9 MAY 2013.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1988 (NAD-88). STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD-83).
3. MONITORING WELL LOCATIONS BASED ON SURVEY PERFORMED IN SEPTEMBER 2015 BY WALKER PARTNERS.

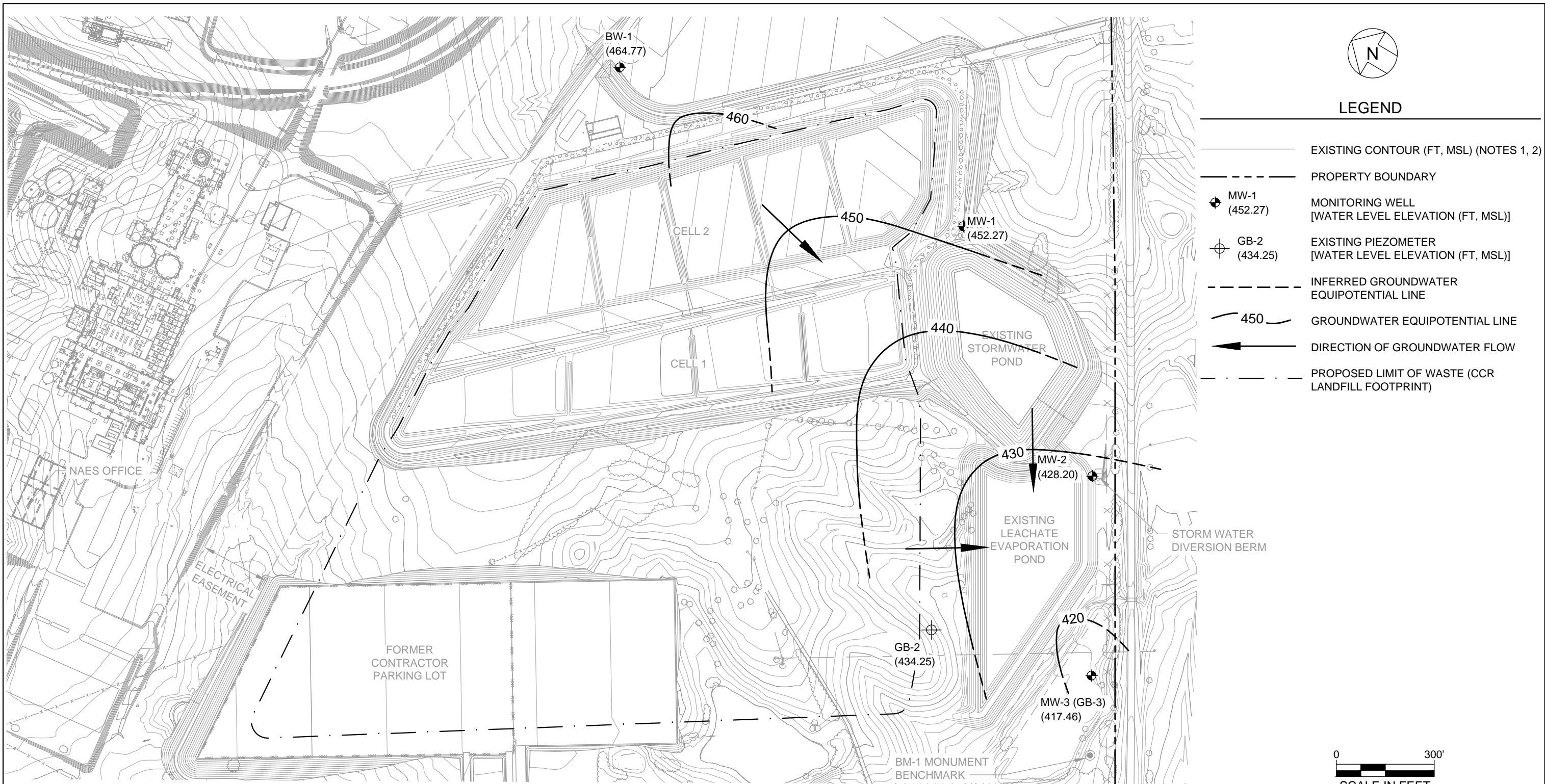
LEGEND

- EXISTING CONTOUR (FT,MSL) (NOTES 1, 2)
- PROPERTY BOUNDARY
- PROPOSED LIMIT OF WASTE (CCR LANDFILL FOOTPRINT)
- MONITORING WELL
- DRY BOREHOLE (PLUGGED)
- HISTORIC PIEZOMETER (PLUGGED AND ABANDONED)
- EXISTING PIEZOMETER



MONITORING WELL LOCATION MAP	
TX ENG. FIRM REGISTRATION NO. 1182	
PROJECT NO: TXL0526	MARCH 2016
FIGURE 1	

P:\CADD\PROJECTS\S\SANDY CREEK PP\ENG DESIGN\CCR RULE COMPLIANCE (TXL0526.01)\GROUNDWATER REPORT (TXL0526.02)\TXL052602F02



NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING EXISTING TOPOGRAPHY DATED APRIL 2006 AND DESIGN GRADES DATED OCTOBER 2007 FROM BLACK & VEATCH CORPORATION; DESIGN GRADES DEVELOPED BY GEOSYNTEC CONSULTANTS, INC. FOR THE LEACHATE EVAPORATION POND AND CELL 2 DATED APRIL 2011 AND APRIL 2014, RESPECTIVELY; AND AREA 59 EXISTING TOPOGRAPHY SURVEY CONDUCTED BY WALKER PARTNERS DATED 9 MAY 2013.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1988 (NAD-88). STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD-83).
3. MONITORING WELL LOCATIONS BASED ON SURVEY PERFORMED IN SEPTEMBER 2015 BY WALKER PARTNERS. WATER LEVELS WERE MEASURED ON 6 OCTOBER 2015 BY NAES PERSONNEL.



POTENTIOMETRIC SURFACE MAP  
(OCTOBER 2015)

**Geosyntec**  
consultants  
TX ENG. FIRM REGISTRATION NO. 1182

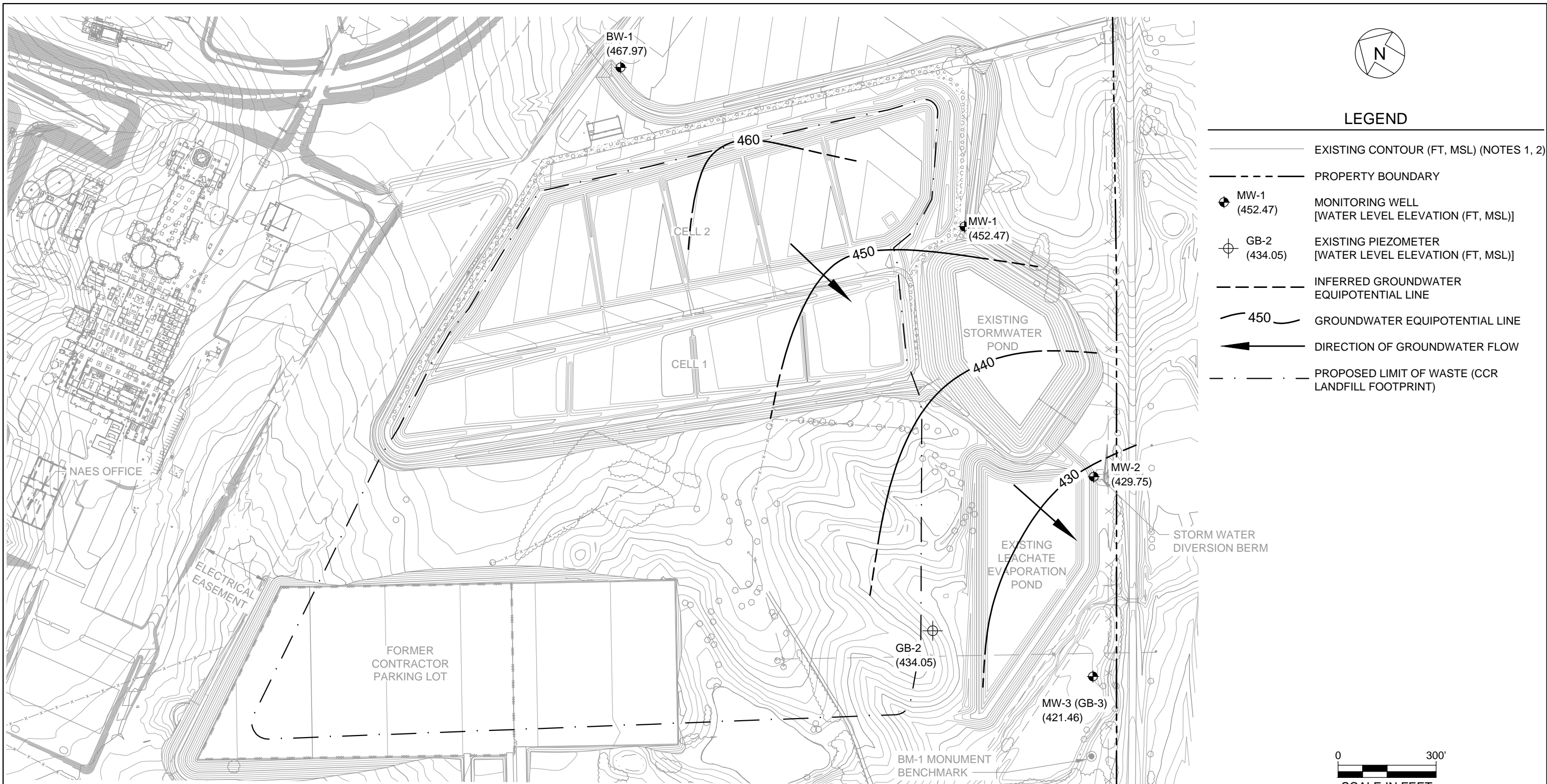
PROJECT NO: TXL0526

MARCH 2016

FIGURE

2


P:\CADD\PROJECTS\S\SANDY CREEK PP\ENG DESIGN\CCR RULE COMPLIANCE (TXL0526.01)\GROUNDWATER REPORT (TXL0526.02)\TXL052602F03



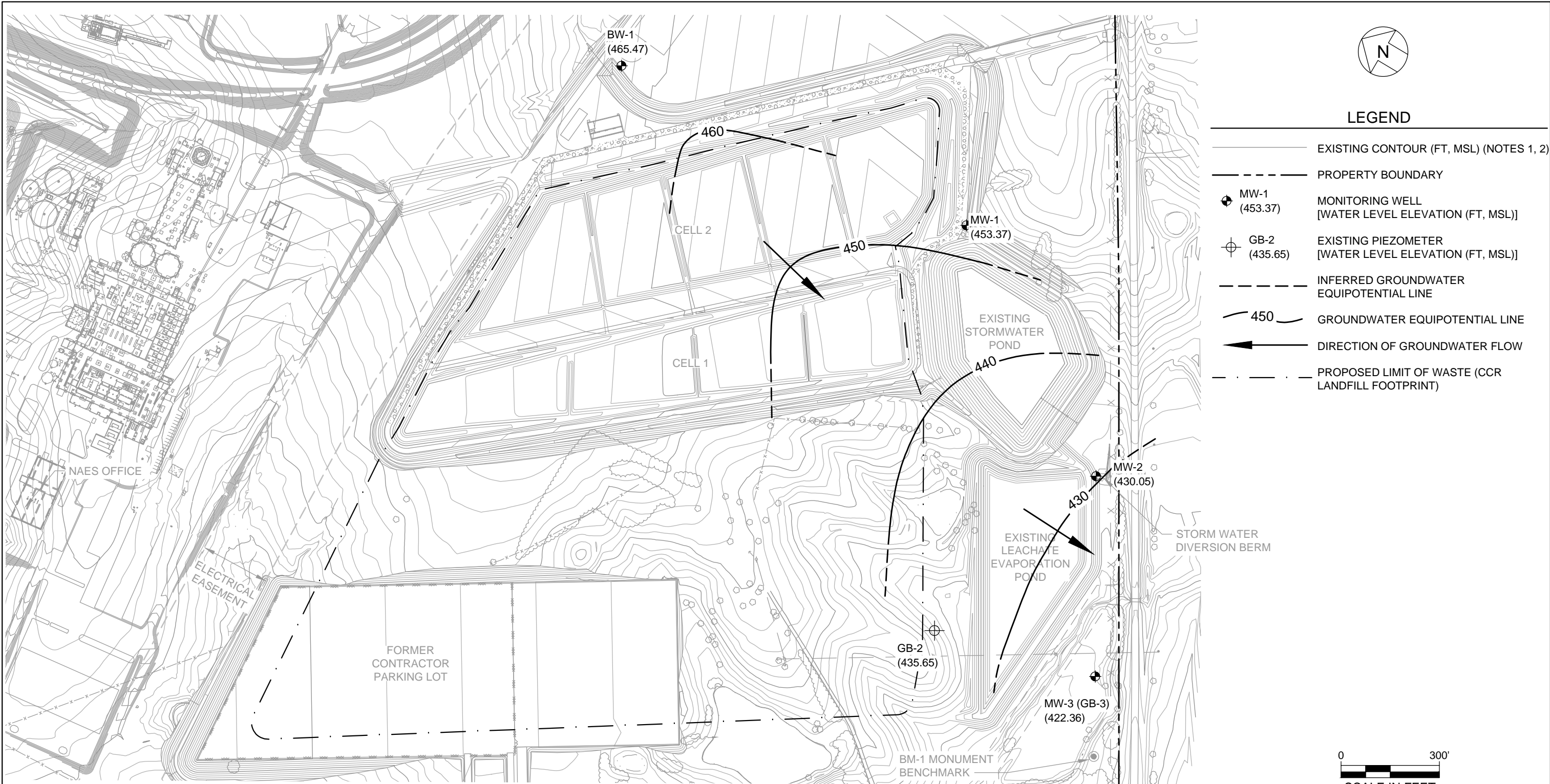
NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING EXISTING TOPOGRAPHY DATED APRIL 2006 AND DESIGN GRADES DATED OCTOBER 2007 FROM BLACK & VEATCH CORPORATION; DESIGN GRADES DEVELOPED BY GEOSYNTEC CONSULTANTS, INC. FOR THE LEACHATE EVAPORATION POND AND CELL 2 DATED APRIL 2011 AND APRIL 2014, RESPECTIVELY; AND AREA 59 EXISTING TOPOGRAPHY SURVEY CONDUCTED BY WALKER PARTNERS DATED 9 MAY 2013.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1988 (NAD-88). STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD-83).
3. MONITORING WELL LOCATIONS BASED ON SURVEY PERFORMED IN SEPTEMBER 2015 BY WALKER PARTNERS. WATER LEVELS WERE MEASURED ON 4 NOVEMBER 2015 BY NAES PERSONNEL.



POTENTIOMETRIC SURFACE MAP (NOVEMBER 2015)		
 TX ENG. FIRM REGISTRATION NO. 1182		FIGURE
PROJECT NO: TXL0526	MARCH 2016	3


P:\CADD\PROJECTS\S\SANDY CREEK PP\ENG DESIGN\CCR RULE COMPLIANCE (TXL0526.01)\GROUNDWATER REPORT (TXL0526.02)\TXL052602F04



NOTES:

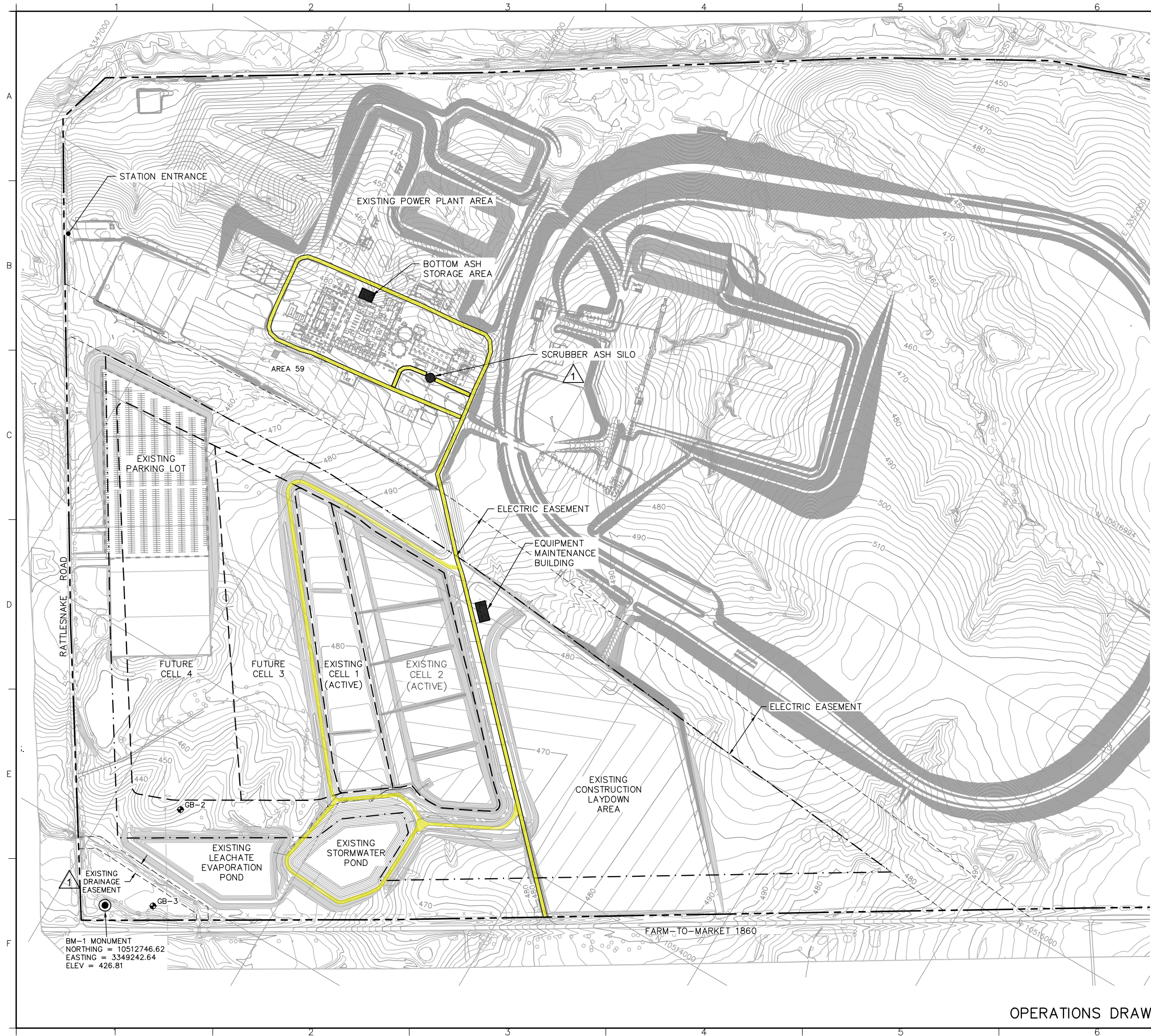
1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING EXISTING TOPOGRAPHY DATED APRIL 2006 AND DESIGN GRADES DATED OCTOBER 2007 FROM BLACK & VEATCH CORPORATION; DESIGN GRADES DEVELOPED BY GEOSYNTEC CONSULTANTS, INC. FOR THE LEACHATE EVAPORATION POND AND CELL 2 DATED APRIL 2011 AND APRIL 2014, RESPECTIVELY; AND AREA 59 EXISTING TOPOGRAPHY SURVEY CONDUCTED BY WALKER PARTNERS DATED 9 MAY 2013.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1988 (NAD-88). STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD-83).
3. MONITORING WELL LOCATIONS BASED ON SURVEY PERFORMED IN SEPTEMBER 2015 BY WALKER PARTNERS. WATER LEVELS WERE MEASURED ON 2 DECEMBER 2015 BY NAES PERSONNEL.



POTENTIOMETRIC SURFACE MAP (DECEMBER 2015)		
 TX ENG. FIRM REGISTRATION NO. 1182		FIGURE
PROJECT NO: TXL0526	MARCH 2016	4

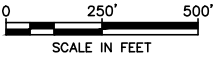
## **DRAWINGS**

DRAWING: Austin P:\CADD\Projects\5\Sandy Creek PP\OPERATIONS\CELL 2 OPERATIONS (TXL0208.07.01)\DRAWINGS\TXL020807-OP-00.dwg PLOTTED: Dec 12, 2014 - 1:44pm



LEGEND

- 500 EXISTING GROUND ELEVATION (FT, MSL) (NOTES 1, 2)
- EXISTING SURFACE WATER LINE
- x x x EXISTING SITE FENCE
- EXISTING TREE LINE
- EXISTING ROAD
- EXISTING BUILDING
- PROPERTY BOUNDARY
- DEED RECORDED LIMITS OF WASTE
- CELL BOUNDARY
- N 10514500  
E 3349500 STATE PLANE COORDINATES
- GB-3 EXISTING PIEZOMETER
- SWDF OPERATIONS ACCESS ROAD



NOTES:

- THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING EXISTING TOPOGRAPHY DATED APRIL 2006 AND DESIGN GRADES DATED OCTOBER 2007 FROM BLACK & VEATCH CORPORATION; DESIGN GRADES DEVELOPED BY GEOSYNTEC CONSULTANTS, INC. FOR THE LEACHATE EVAPORATION POND AND CELL 2 DATED APRIL 2011 AND APRIL 2014, RESPECTIVELY; AND AREA 59 EXISTING TOPOGRAPHY SURVEY CONDUCTED BY WALKER PARTNERS DATED 9 MAY 2013.
- ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1988. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD-83).

9/24/2014	ADDED DRAINAGE EASEMENT AND SCRUBBER ASH SILO REFERENCE	JJV	MZI	
6/10/2014	ISSUE FOR CONSTRUCTION	JJV	MZI	
REV	DATE	DESCRIPTION	DRN	APP

**NAES**  
NAES CORPORATION  
2161 RATTLESNAKE ROAD  
RIESEL, TEXAS 76682  
PHONE: 254-896-4314

**Geosyntec**  
consultants  
GEOSYNTEC CONSULTANTS, INC.  
TEXAS ENG. FIRM REGISTRATION NO. 1182  
8217 SHOAL CREEK BLVD., SUITE 200  
AUSTIN, TEXAS 78757  
PHONE: 512.451.4003

TITLE: SITE LAYOUT

PROJECT: OPERATIONS PLAN – SOLID WASTE DISPOSAL FACILITY (CELL 2)

SITE: SANDY CREEK ENERGY STATION

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.		DESIGN BY: MZI	DATE: JUNE 2014
	SIGNATURE	DRAWN BY: JJV/KH	PROJECT NO.: TXL0208.07.01
6/10/2014	DATE	CHECKED BY: MZI	FILE: TXL020807-OP-00
		REVIEWED BY: BG	DRAWING NO.: 1 OF 16
		APPROVED BY: MZI	

**APPENDIX A**

**BORING LOGS FOR GROUNDWATER MONITORING  
WELLS (BW-1 and MW-1 to MW-3) AND  
PIEZOMETER (GB-2)**

Project: **Sandy Creek Energy Station**  
 Project Location: **2161 Rattlesnake Road Riesel, TX 76682**  
 Project Number: **TXL0526 / 02**

## Key to Log of Boring Sheet 1 of 1






















Elevation (feet, MSL)	Depth (feet)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log
1	2	3	4	5	6
<p><b>COLUMN DESCRIPTIONS</b></p> <div> <div> <p>1 Elevation (feet, MSL): Elevation (feet, MSL)</p> <p>2 Depth (feet): Depth in feet below the ground surface.</p> <p>3 USCS Symbol: Type of material encountered.</p> </div> <div> <p>4 Graphic Log: Graphic depiction of the subsurface material encountered.</p> <p>5 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.</p> <p>6 Well Log: Graphical representation of well installed upon completion of drilling and sampling.</p> </div> </div> <p><b>FIELD AND LABORATORY TEST ABBREVIATIONS</b></p> <div> <div> <p>CHEM: Chemical tests to assess corrosivity</p> <p>COMP: Compaction test</p> <p>CONS: One-dimensional consolidation test</p> <p>LL: Liquid Limit, percent</p> </div> <div> <p>PI: Plasticity Index, percent</p> <p>SA: Sieve analysis (percent passing No. 200 Sieve)</p> <p>UC: Unconfined compressive strength test, Qu, in ksf</p> <p>WA: Wash sieve (percent passing No. 200 Sieve)</p> </div> </div> <p><b>MATERIAL GRAPHIC SYMBOLS</b></p> <div> <div> <p> Bentonite plug</p> <p> Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)</p> <p> Claystone</p> </div> <div> <p> Portland Cement Concrete</p> <p> Gravel</p> <p> Grout</p> <p> Poorly graded SAND (SP)</p> </div> </div> <p><b>TYPICAL SAMPLER GRAPHIC SYMBOLS</b></p> <div> <div> <p> Auger sampler</p> <p> Bulk Sample</p> <p> 3-inch-OD California w/ brass rings</p> </div> <div> <p> CME Sampler</p> <p> Grab Sample</p> <p> 2.5-inch-OD Modified California w/ brass liners</p> </div> <div> <p> Pitcher Sample</p> <p> 2-inch-OD unlined split spoon (SPT)</p> <p> Shelby Tube (Thin-walled, fixed head)</p> </div> </div> <p><b>OTHER GRAPHIC SYMBOLS</b></p> <div> <p> Water level (at time of drilling, ATD)</p> <p> Water level (after waiting)</p> <p> Minor change in material properties within a stratum</p> <p> Inferred/gradational contact between strata</p> <p> Queried contact between strata</p> </div> <p><b>GENERAL NOTES</b></p> <p>1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.</p> <p>2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.</p>					

Figure A-1

Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

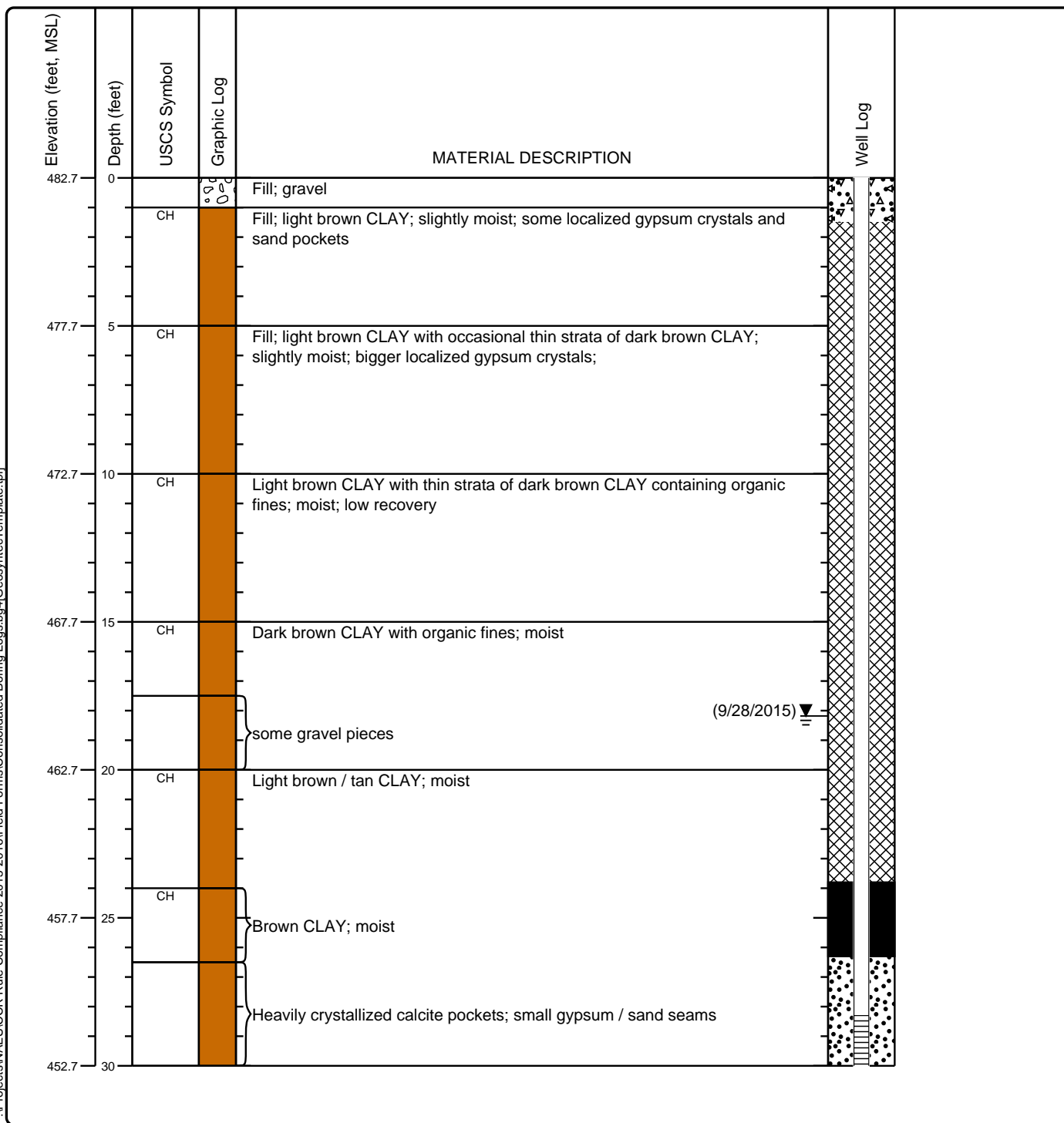
Project Number: **TXL0526 / 02**

# Log of Boring BW-1

Sheet 1 of 2

Date(s) Drilled <b>9/21/2015 and 9/22/2015</b>	Logged By <b>Alexander Brewster</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>5" and 8.25" HSA (Note 1)</b>	Total Depth of Borehole <b>50 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Best Drilling Services, Inc.</b>	Approximate Surface Elevation <b>482.70 (ft, MSL)</b>
Groundwater Level and Date Measured <b>464.52 (ft, MSL) (9/28/2015)</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>UTM: N 10515061.29', E 3350322.30'. N-NE of Landfill Cell 2; between the warehouse and laydown yard; near the eastern corner of a stormwater swale.</b>	

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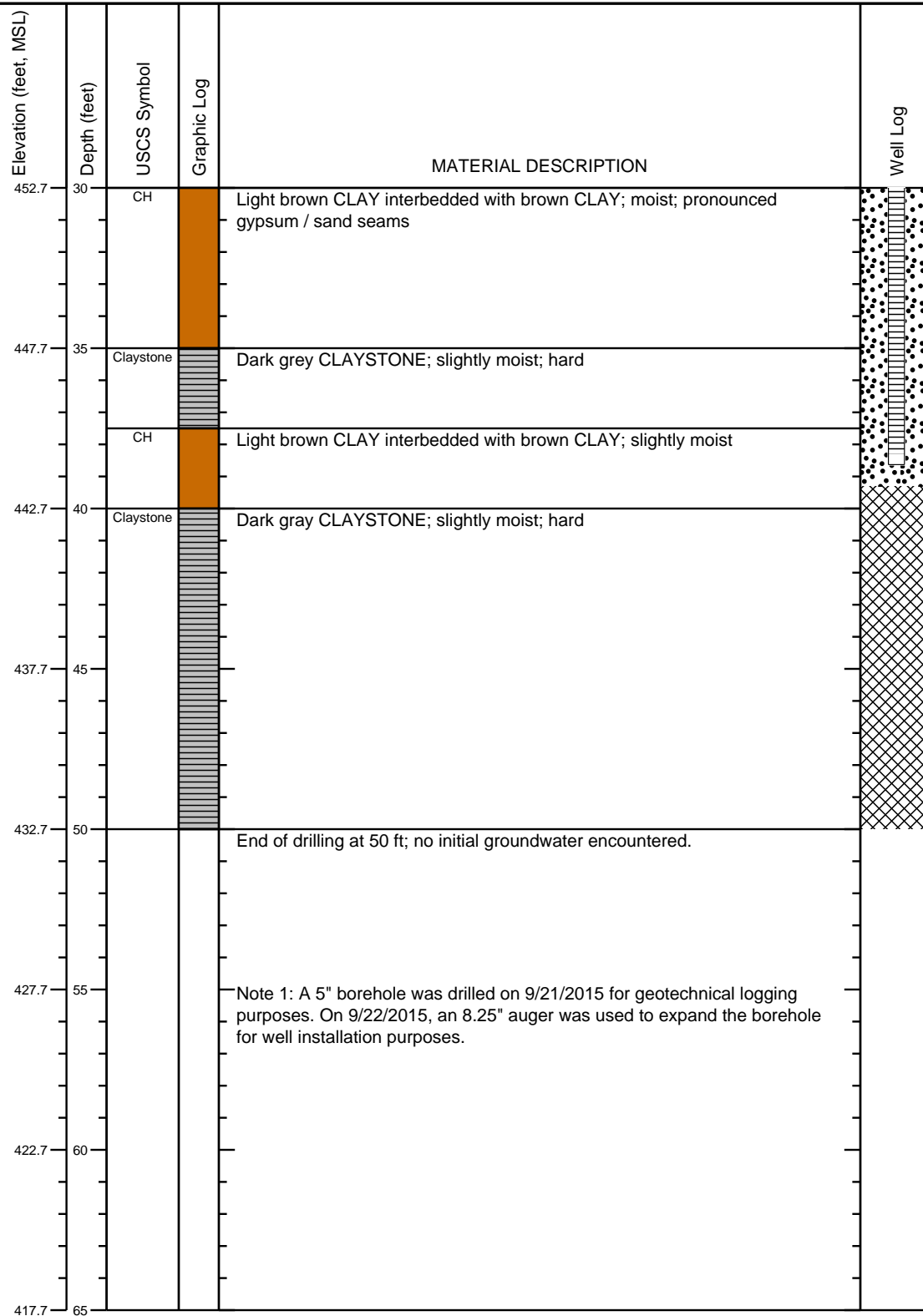
Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

Project Number: **TXL0526 / 02**

## Log of Boring BW-1

Sheet 2 of 2



Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

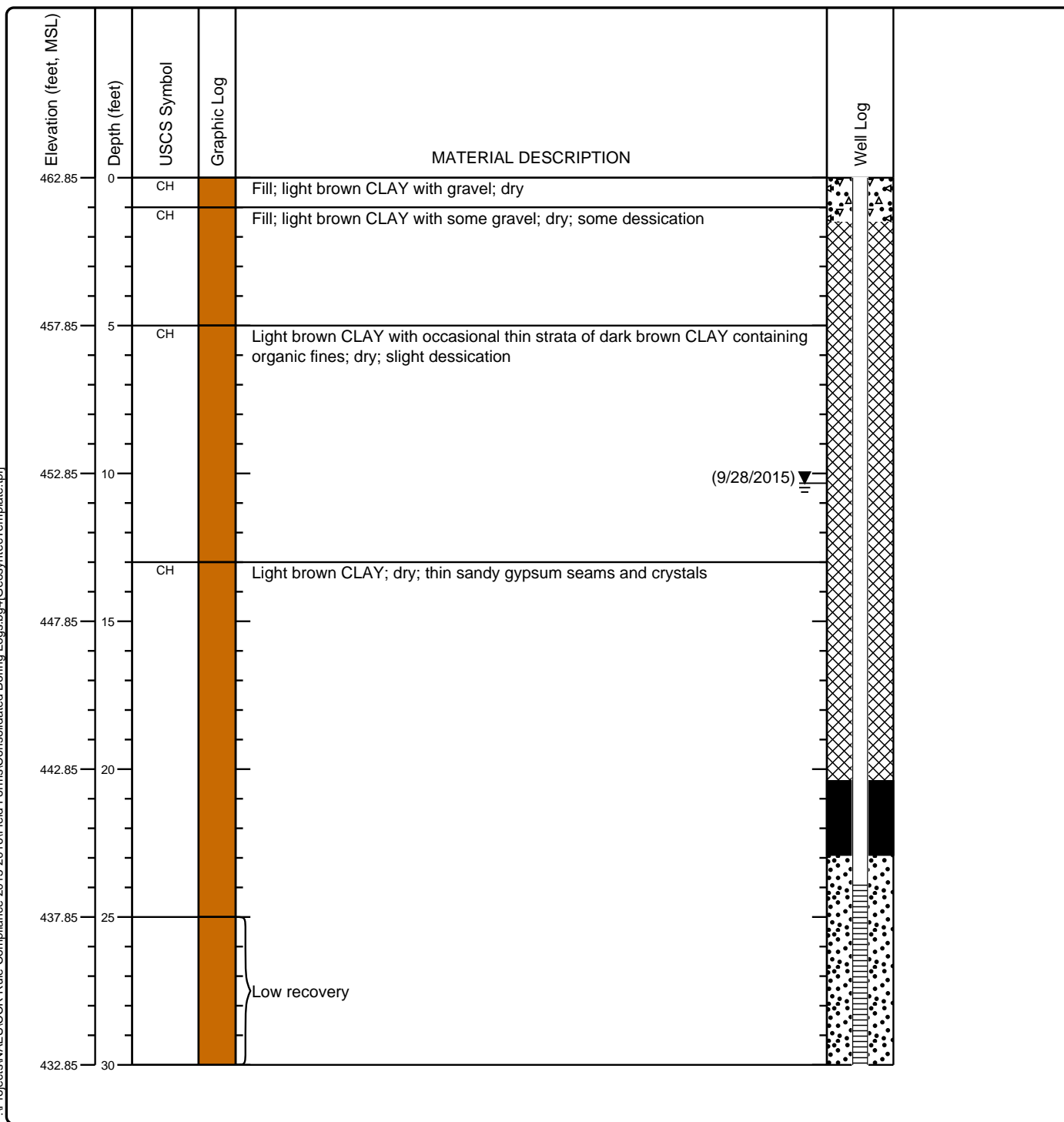
Project Number: **TXL0526 / 02**

# Log of Boring MW-1

Sheet 1 of 2

Date(s) Drilled <b>9/21/2015</b>	Logged By <b>Alexander Brewster</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.25" HSA</b>	Total Depth of Borehole <b>45 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Best Drilling Services, Inc.</b>	Approximate Surface Elevation <b>462.85 (ft, MSL)</b>
Groundwater Level and Date Measured <b>452.52 (ft, MSL) (9/28/2015)</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>UTM: N 10513907.71', E 3350439.78'. S of Landfill Cell 2; near northeastern edge of stormwater pond.</b>	

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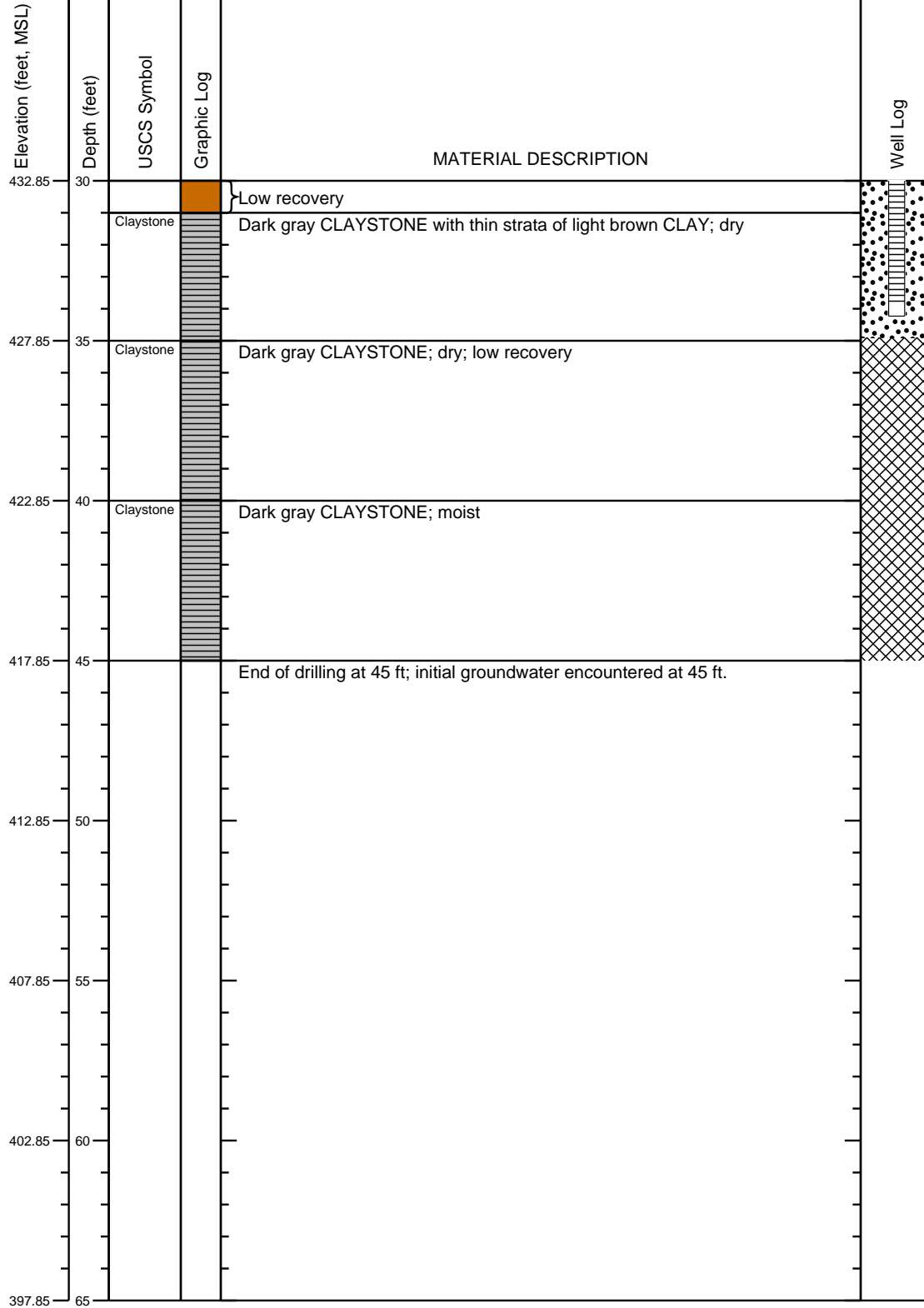
Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

Project Number: **TXL0526 / 02**

## Log of Boring MW-1

Sheet 2 of 2



Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

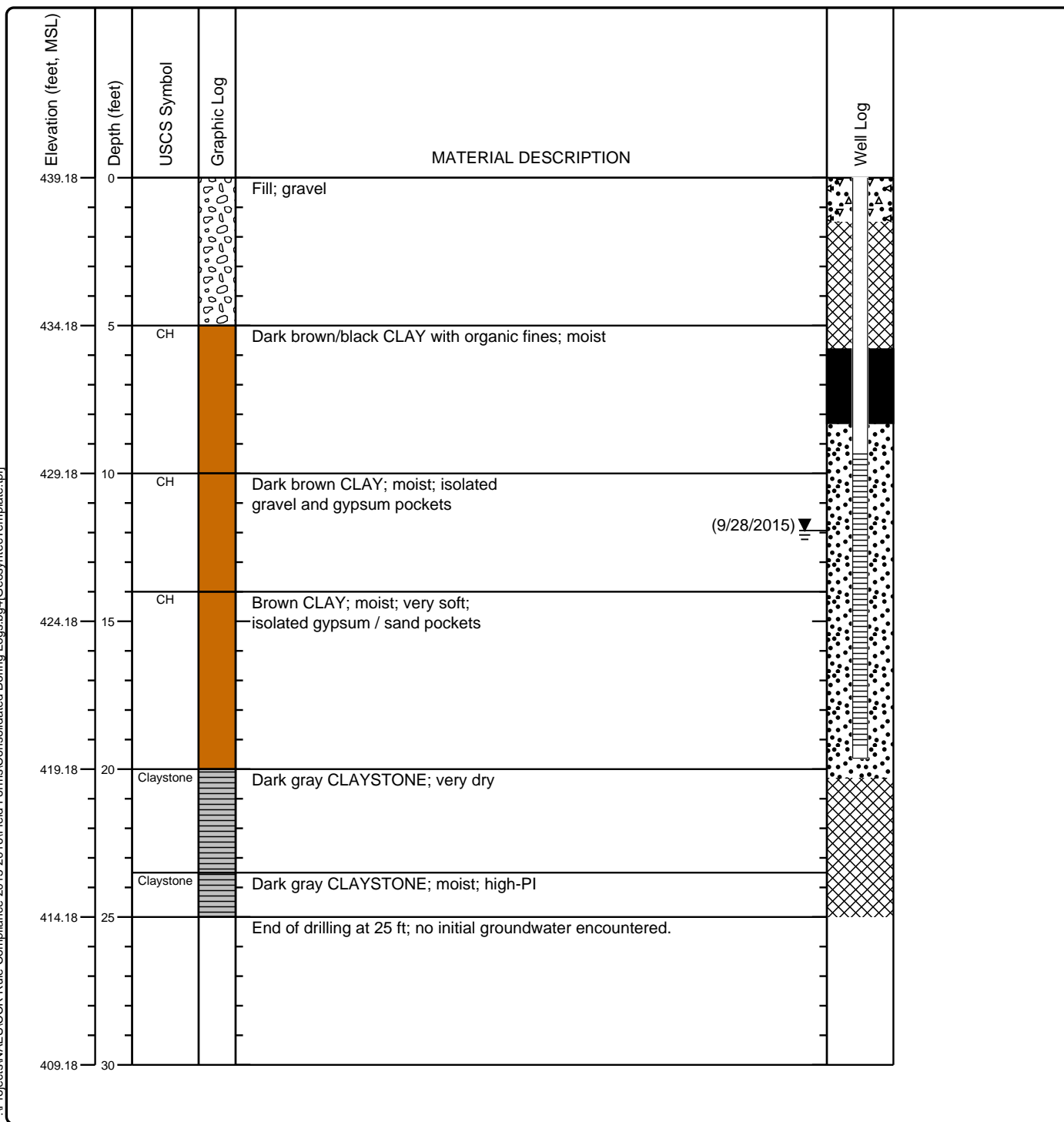
Project Number: **TXL0526 / 02**

# Log of Boring MW-2

Sheet 1 of 1

Date(s) Drilled <b>9/23/2015</b>	Logged By <b>Alexander Brewster</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.25" HSA</b>	Total Depth of Borehole <b>25 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Best Drilling Services, Inc.</b>	Approximate Surface Elevation <b>439.18 (ft, MSL)</b>
Groundwater Level and Date Measured <b>427.25 (ft, MSL) (9/28/2015)</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>UTM: N 10513176.91', E 3349982.33'. SE of leachate evaporation pond.</b>	

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Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

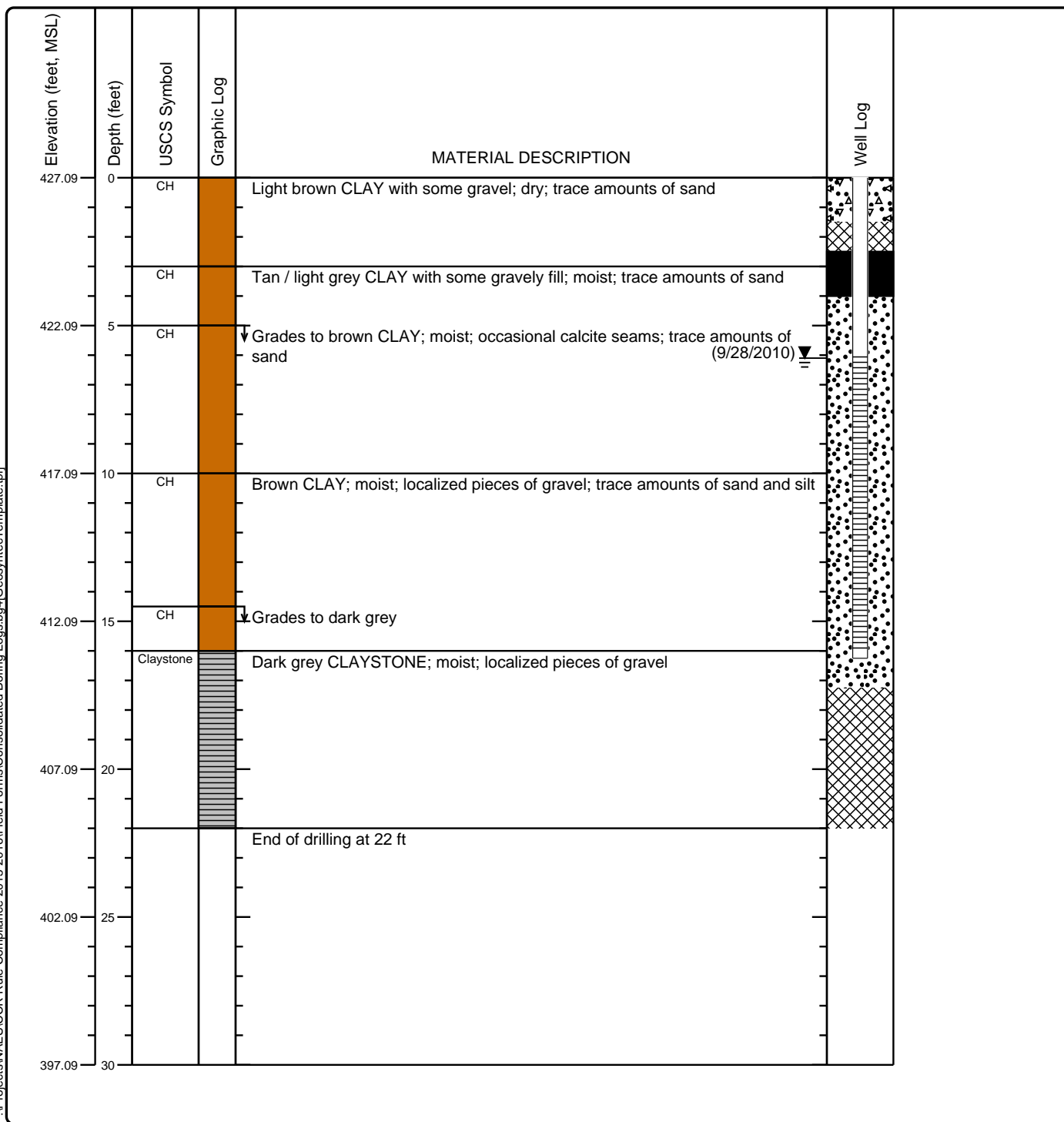
Project Number: **TXL0084 / 03**

# Log of Boring MW-3 (GB-3)

Sheet 1 of 1

Date(s) Drilled <b>9/1/2010</b>	Logged By <b>M. Zahirul Islam</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.25" HSA</b>	Total Depth of Borehole <b>22 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Total Support Services, Inc.</b>	Approximate Surface Elevation <b>427.09 (ft, MSL) (based on Oct 2015 survey)</b>
Groundwater Level and Date Measured <b>420.99 (ft, MSL) (9/28/2010)</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Cement Bentonite Grout</b>	Location <b>UTM: N 10512867.54', E 3349455.27' (based on Oct 2015 survey). SW of leachate evaporation pond.</b>	

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Project: **Sandy Creek Energy Station**

Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

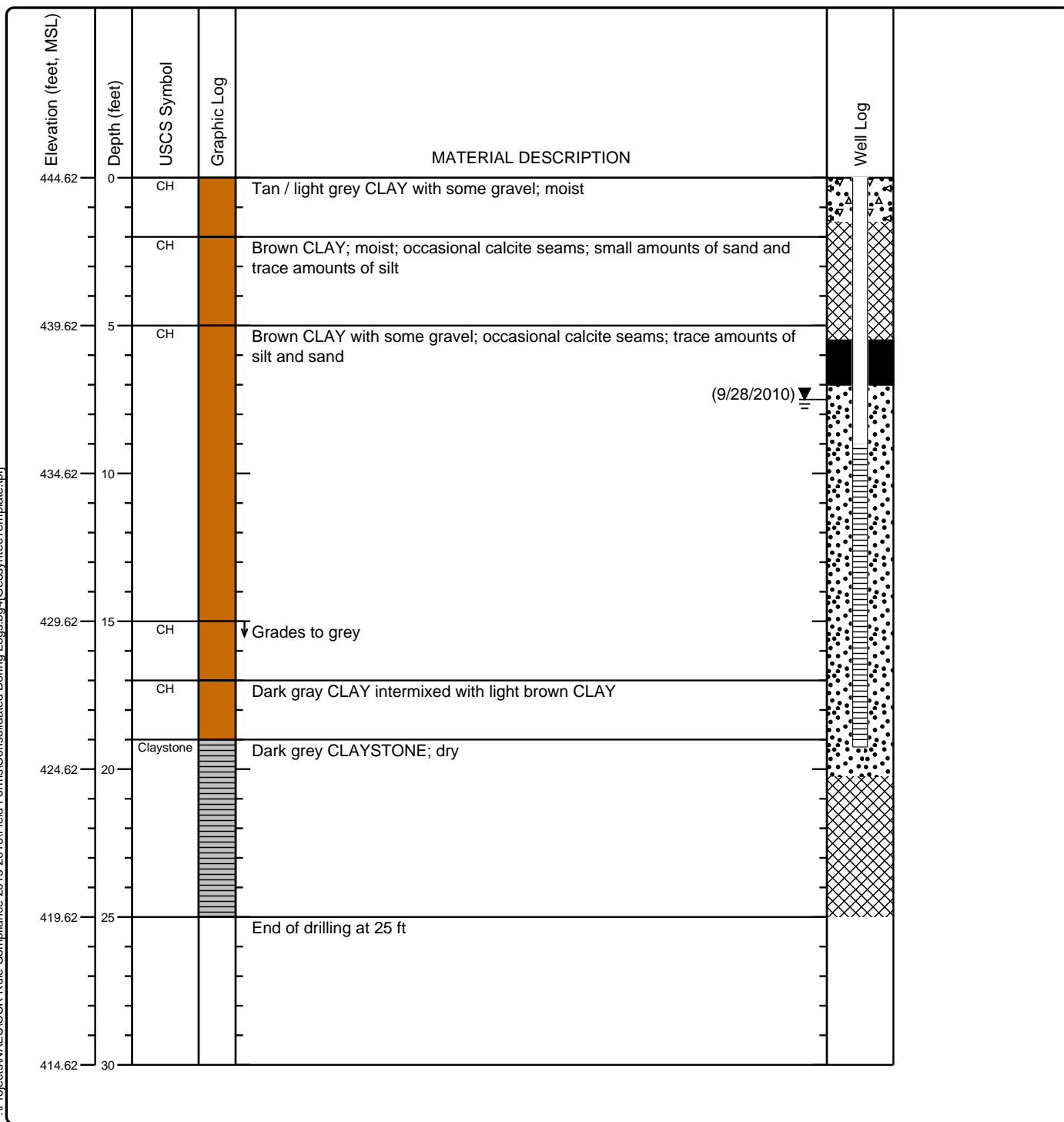
Project Number: **TXL0084 / 03**

# Log of Boring GB-2

Sheet 1 of 1

Date(s) Drilled <b>8/31/2010 and 9/1/2010</b>	Logged By <b>M. Zahirul Islam</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.25" HSA</b>	Total Depth of Borehole <b>25 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Total Support Services, Inc.</b>	Approximate Surface Elevation <b>444.62 (ft, MSL) (based on Oct 2015 survey)</b>
Groundwater Level and Date Measured <b>437.12 (ft, MSL) (9/22/2010)</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>UTM: N 10513360.72', E 33494325.82' (based on Oct 2015 survey). Approximately 65 ft N of western corner of leachate evaporation pond.</b>	

P:\Projects\NAES\CCR Rule Compliance 2015-2016\Field Forms\Consolidated Boring\_Logs.bq4[GeosyntecTemplate.tpl]



## **APPENDIX B**

### **MONITORING WELL AND PIEZOMETER DATA**

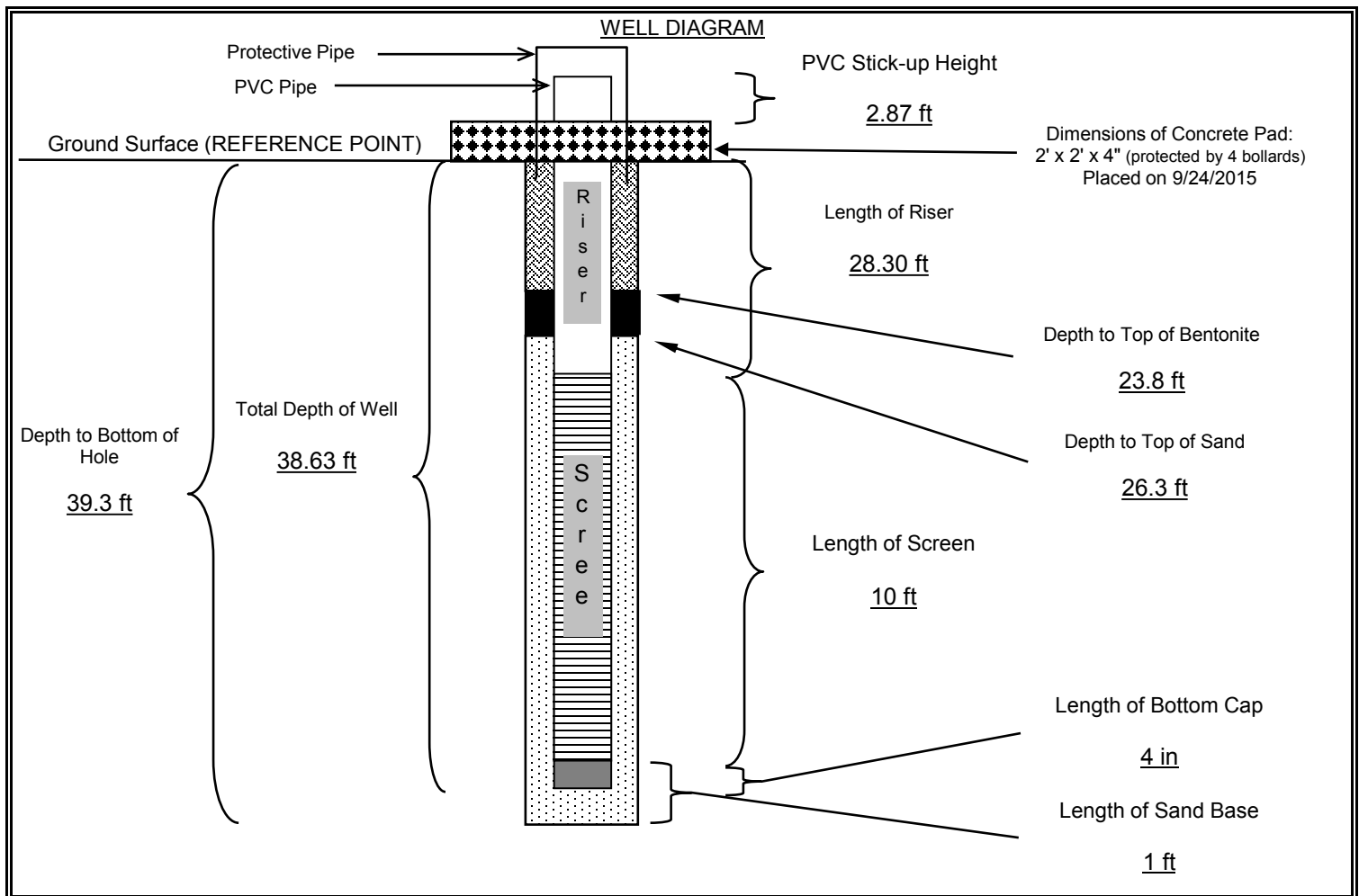
- Well and Piezometer Construction Logs
- Water Level Measurements

# WELL CONSTRUCTION DIAGRAM - EPA TYPE II WELL (STICK-UP)



JOB NAME: NAES Sandy Creek	BW-1
JOB NO.: TXL0526 / 02	
DATE/TIME: 9/22/2015 0830	WELL NO.:
WELL LOCATION: NNE of Cell 2	FIELD REP: Lindsay O'Leary

GROUND SURFACE ELEVATION:	482.70	(ft, msl)	BENTONITE TYPE:	Enviroplug Med. (for plug); High Yield Bentonite Gel (for CB grout)
TOP OF SCREEN ELEVATION:	454.40	(ft, msl)	MANUFACTURER:	Wyo-Ben (for plug); N/A (for CB grout)
BOTTOM OF WELL ELEVATION:	444.07	(ft, msl)	CEMENT TYPE:	Quikrete Portland Cement Type I/II
TOP OF PVC RISER ELEVATION (TOC):	485.57	(ft, msl)	CEMENT MANUFACTURER:	Quikrete
NORTHING:	10515061.29	EASTING:	3350322.30	SAND PACK TYPE AND SIZE:
SCREEN MATERIAL:	SCH 40 PVC	SAND MANUFACTURER:	Unimin	
RISER MATERIAL:	SCH 40 PVC	DRILLING CONTRACTOR:	Best Drilling Services, Inc. (Friendswood, TX)	
RISER MANUFACTURER:	N/A	AMOUNT BENTONITE USED IN PLUG:	0.5 bags	50 lbs
RISER DIAMETER:	2	(in)	Length:	31.17 (ft)
SCREEN DIAMETER:	2	(in)	Length:	10 (ft)
BOREHOLE DIAMETER:	8.25	(in)	AMOUNT CEMENT USED:	1.5 bags 50 lbs
DRILLING TECHNIQUE:	HSA	Size:	8.25 (in)	AMOUNT SAND USED:
				10 bags 50 lbs
			STATIC WATER:	21.05 (9/28/2015)
				ft below TOC
			ENCOUNTERED WATER:	45 (See Boring Log)
				depth from ground (ft)



	Cement/Bentonite Grout		Sand Pack		Neat Concrete		Bentonite		Bottom Cap
--	------------------------	--	-----------	--	---------------	--	-----------	--	------------

QA/QC	INSTALLED BY: Best Drilling Services, Inc. (Lawrence Tobola)	OBSERVED BY: Lindsay O'Leary, PE
	DATE: 9/22/2015	CHECKED BY: Alex Brewster
		DATE: 10/9/2015

# WELL CONSTRUCTION DIAGRAM - EPA TYPE II WELL (STICK-UP)



JOB NAME: NAES Sandy Creek

JOB NO.: TXL0526 / 02

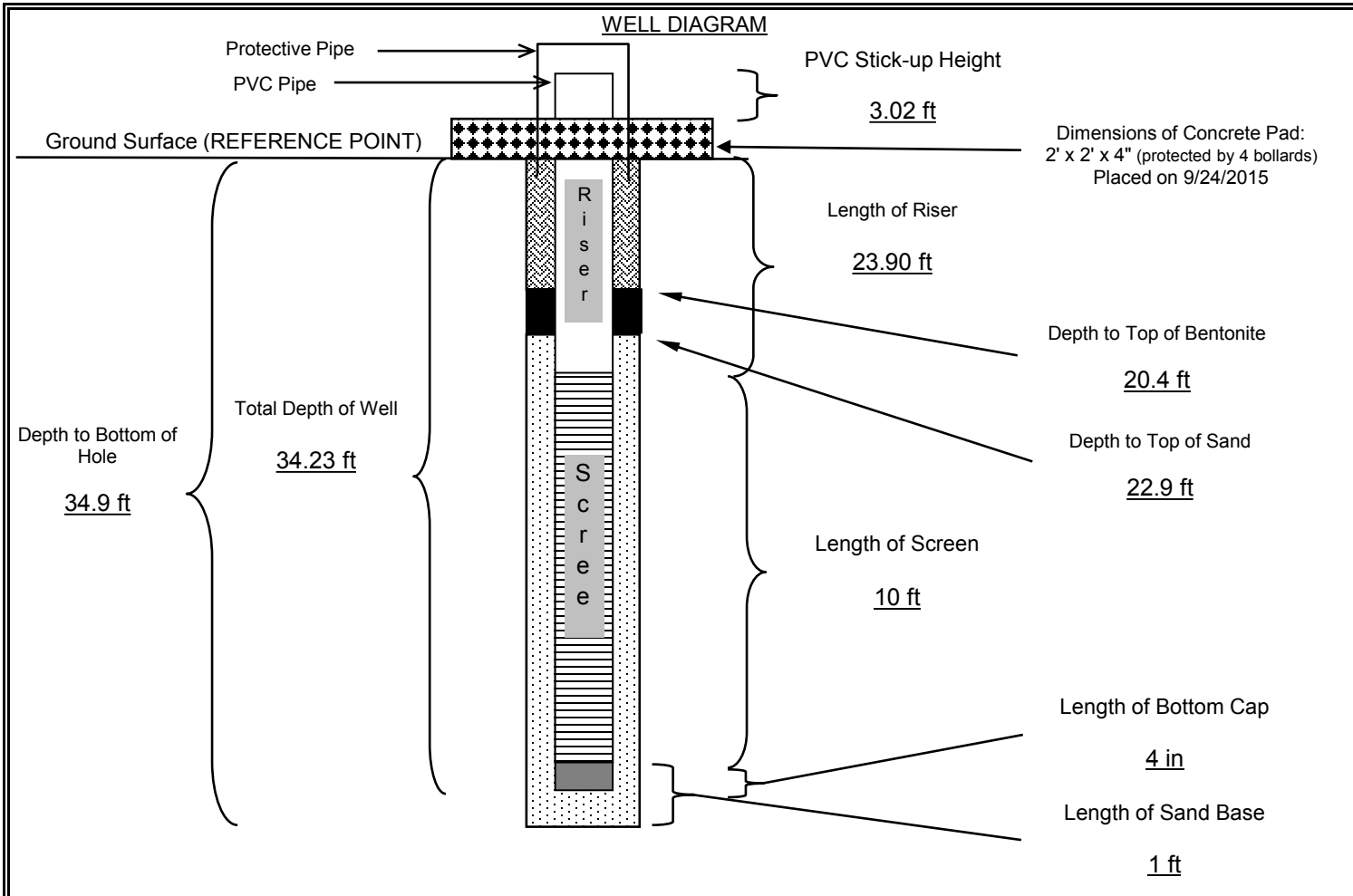
DATE/TIME: 9/21/2015 1355 WELL NO.:

WELL LOCATION: South of Cell 2 FIELD REP: Lindsay O'Leary

MW-1

GROUND SURFACE ELEVATION: <u>462.85</u> (ft, msl)	BENTONITE TYPE: <u>Enviroplug Med. (for plug); High Yield Bentonite Gel (for CB grout)</u>
TOP OF SCREEN ELEVATION: <u>438.95</u> (ft, msl)	MANUFACTURER: <u>Wyo-Ben (for plug); N/A (for CB grout)</u>
BOTTOM OF WELL ELEVATION: <u>428.62</u> (ft, msl)	CEMENT TYPE: <u>Quikrete Portland Cement Type I/II</u>
TOP OF PVC RISER ELEVATION (TOC): <u>465.87</u> (ft, msl)	CEMENT MANUFACTURER: <u>Quikrete</u>
NORTHING: <u>10513907.71</u> EASTING: <u>3350439.78</u>	SAND PACK TYPE AND SIZE: <u>20/40 Silica</u>
SCREEN MATERIAL: <u>SCH 40 PVC</u>	SAND MANUFACTURER: <u>Unimin</u>
RISER MATERIAL: <u>SCH 40 PVC</u>	DRILLING CONTRACTOR: <u>Best Drilling Services, Inc. (Friendswood, TX)</u>
RISER MANUFACTURER: <u>N/A</u>	AMOUNT BENTONITE USED IN PLUG: <u>0.5 bags 50 lbs</u>
RISER DIAMETER: <u>2</u> (in) Length: <u>26.92</u> (ft)	AMOUNT BENTONITE USED IN BACKFILL GROUT: <u>0.3 bags 50 lbs</u>
SCREEN DIAMETER: <u>2</u> (in) Length: <u>10</u> (ft)	AMOUNT CEMENT USED: <u>1.0 bags 50 lbs</u>
BOREHOLE DIAMETER: <u>8.25</u> (in)	AMOUNT SAND USED: <u>7 bags 50 lbs</u>
DRILLING TECHNIQUE: <u>HSA</u> Size: <u>8.25</u> (in)	STATIC WATER: <u>13.35 (9/28/2015)</u> ft below TOC
ENCOUNTERED WATER: <u>40 (See Boring Log)</u> depth from ground (ft)	

**WELL DIAGRAM**



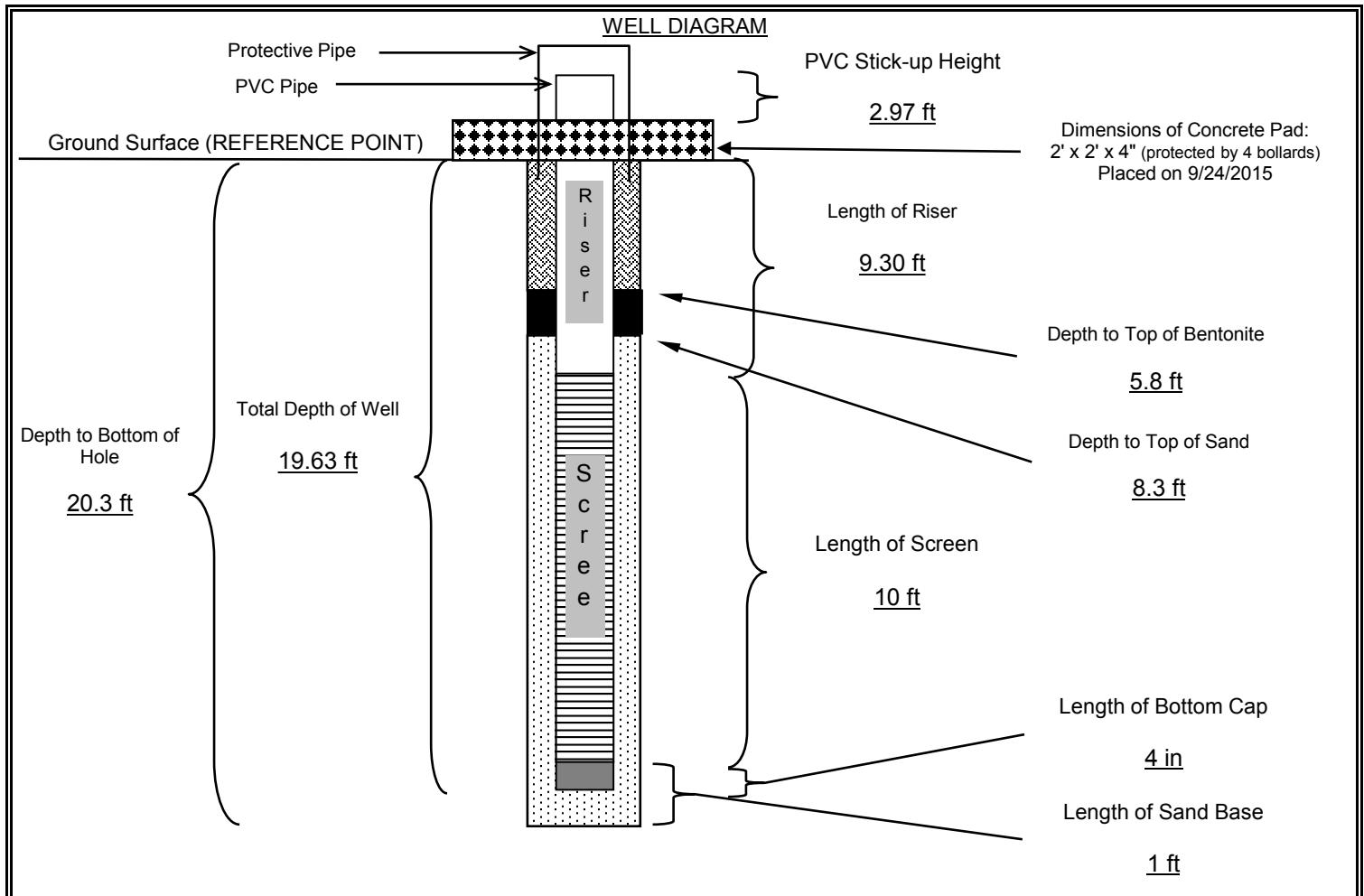
	Cement/Bentonite Grout		Sand Pack		Neat Concrete		Bentonite		Bottom Cap
QA/QC		INSTALLED BY: <u>Best Drilling Services, Inc. (Lawrence Tobola)</u>		OBSERVED BY: <u>Lindsay O'Leary, P.E.</u>					
		DATE: <u>9/21/2015</u>		CHECKED BY: <u>Alex Brewster</u>		DATE: <u>10/9/2015</u>			

# WELL CONSTRUCTION DIAGRAM - EPA TYPE II WELL (STICK-UP)



JOB NAME: <u>NAES Sandy Creek</u>		MW-2
JOB NO.: <u>TXL0526 / 02</u>		
DATE/TIME: <u>9/23/2015 1700</u>	WELL NO.: _____	
WELL LOCATION: <u>SE of leachate pond</u>		FIELD REP: <u>Lindsay O'Leary</u>

GROUND SURFACE ELEVATION:	439.18	(ft, msl)	BENTONITE TYPE:	Enviroplug Med. (for plug); High Yield Bentonite Gel (for CB grout)
TOP OF SCREEN ELEVATION:	429.88	(ft, msl)	MANUFACTURER:	Wyo-Ben (for plug); N/A (for CB grout)
BOTTOM OF WELL ELEVATION:	419.55	(ft, msl)	CEMENT TYPE:	Quikrete Portland Cement Type I/II
TOP OF PVC RISER ELEVATION (TOC):	442.15	(ft, msl)	CEMENT MANUFACTURER:	Quikrete
NORTHING:	10513176.91	EASTING:	3349982.33	SAND PACK TYPE AND SIZE:
			20/40 Silica	
SCREEN MATERIAL:	SCH 40 PVC		SAND MANUFACTURER:	Unimin
RISER MATERIAL:	SCH 40 PVC		DRILLING CONTRACTOR:	Best Drilling Services, Inc. (Friendswood, TX)
RISER MANUFACTURER:	N/A		AMOUNT BENTONITE USED IN PLUG:	0.5 bags 50 lbs
RISER DIAMETER:	2	(in)	Length:	12.27 (ft)
SCREEN DIAMETER:	2	(in)	Length:	10 (ft)
BOREHOLE DIAMETER:	8.25	(in)	AMOUNT CEMENT USED:	1.5 bags 50 lbs
DRILLING TECHNIQUE:	HSA	Size:	8.25 (in)	AMOUNT SAND USED:
			14.90 (9/28/2015)	8 bags 50 lbs
			STATIC WATER:	14.90 (9/28/2015)
			ENCOUNTERED WATER:	N/A
				ft below TOC
				depth from ground (ft)



	Cement/Bentonite Grout		Sand Pack		Neat Concrete		Bentonite		Bottom Cap
QA/QC	INSTALLED BY:	<u>Best Drilling Services, Inc. (Lawrence Tobola)</u>		OBSERVED BY:	<u>Lindsay O'Leary, P.E.</u>				
	DATE:	<u>9/23/2015</u>		CHECKED BY:	<u>Lindsay O'Leary</u>		DATE:	<u>10/9/2015</u>	

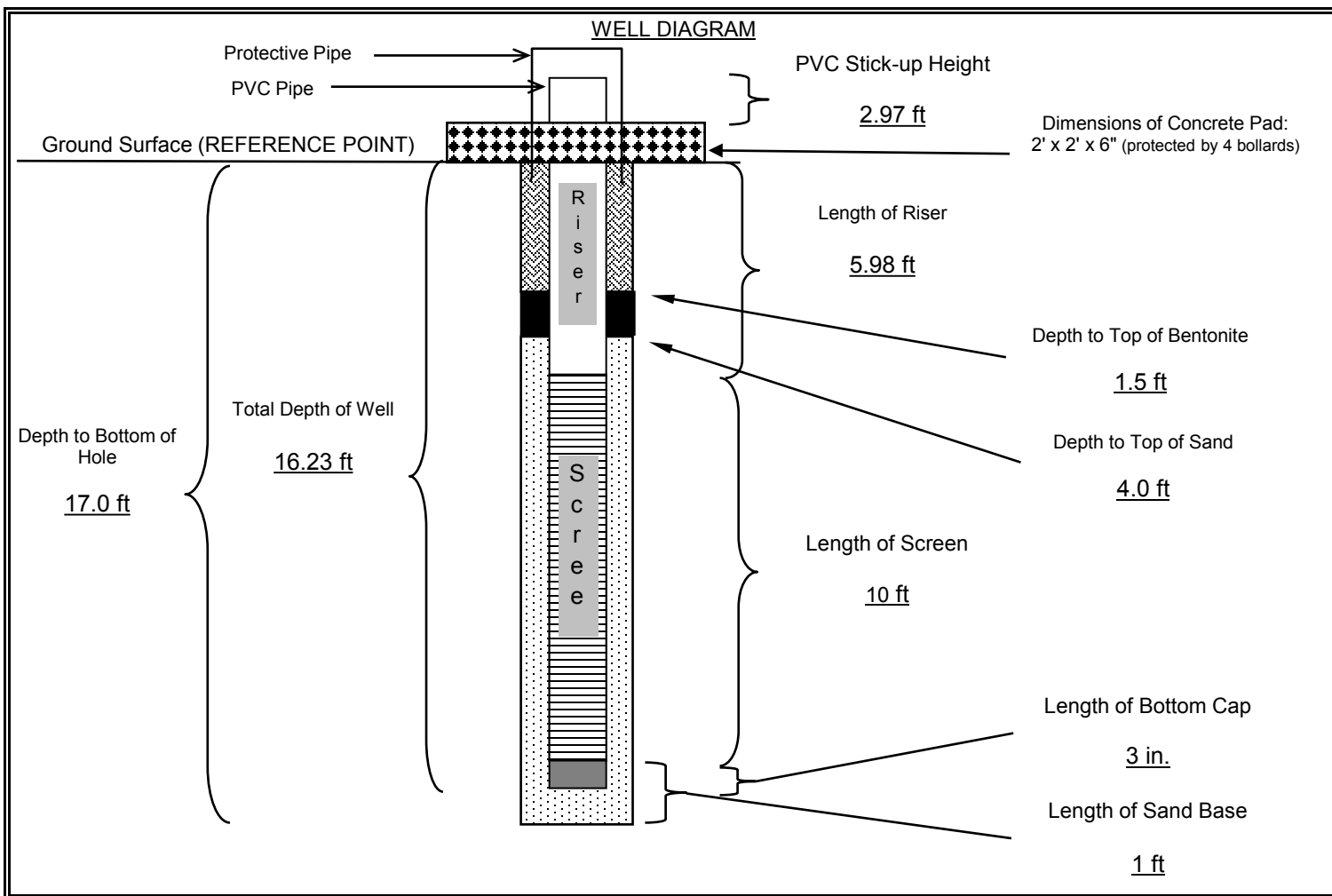
# WELL CONSTRUCTION DIAGRAM - EPA TYPE II WELL (STICK-UP)



JOB NAME: Leachate Evaporation Pond Design  
 JOB NO.: TXL0084-03  
 DATE/TIME: 9/1/2010 WELL NO.:  
 WELL LOCATION: FIELD REP: Zahirul Islam

**MW-3 (GB-3)**

GROUND SURFACE ELEVATION: 427.09 (ft, msl) BENTONITE TYPE: Western Bentonite  
 TOP OF SCREEN ELEVATION: 421.11 (ft, msl) MANUFACTURER: PDS  
 BOTTOM OF WELL ELEVATION: 410.11 (ft, msl) CEMENT TYPE: Not used, sealed with hydrated bentonite chips  
 TOP OF PVC RISER ELEVATION: 430.06 (ft, msl) CEMENT MANUFACTURER: N/A  
 NORTHING: 10512867.42 EASTING: 3349455.27 SAND PACK TYPE AND SIZE: Silica 20/40  
 SCREEN MATERIAL: PVC - Schedule 40 SAND MANUFACTURER: Unimin  
 RISER MATERIAL: PVC - Schedule 40 DRILLING CONTRACTOR: Total Support Services, Inc.  
 RISER MANUFACTURER: AMOUNT BENTONITE USED: 3 bags 40 lbs  
 RISER DIAMETER: 2 (in) Length: 8.95 (ft) AMOUNT CEMENT USED: N/A bags lbs  
 SCREEN DIAMETER: 2 (in) Length: 10 (ft) AMOUNT SAND USED: 7 bags 50 lbs  
 BOREHOLE DIAMETER: 8.25 (in) STATIC WATER: 6.08 ft (9/28/2010) depth from ground  
 DRILLING TECHNIQUE: Hollow stem Size: 8.25 (in) ENCOUNTERED WATER: Not Encountered depth from ground



	Cement/Bentonite Grout		Sand Pack		Neat Concrete		Bentonite		Bottom Cap
--	------------------------	--	-----------	--	---------------	--	-----------	--	------------

QA/QC	INSTALLED BY: <u>Total Support Services, Inc.</u>	OBSERVED BY: <u>Zahirul Islam</u>	
	DATE: <u>9/1/2010</u>	CHECKED BY: <u>Ed Dolan, P.G.</u>	DATE: <u>10/14/2010</u>

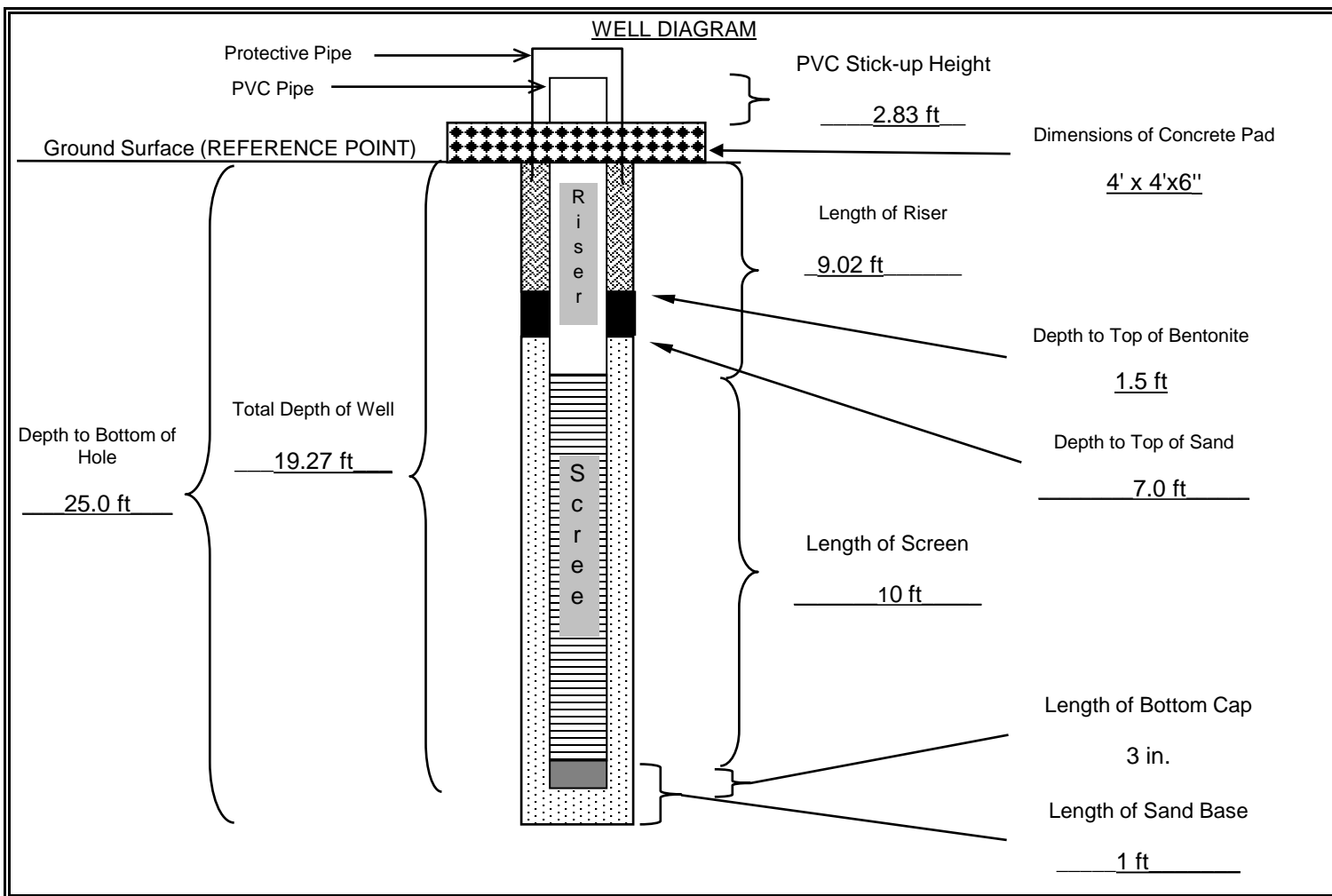
# WELL CONSTRUCTION DIAGRAM - EPA TYPE II WELL (STICK-UP)



JOB NAME: Leachate Evaporation Pond Design  
 JOB NO.: TXL0084-03  
 DATE/TIME: 8/31/2010 & 9/1/2010 WELL NO.:  
 WELL LOCATION: FIELD REP: Zahirul Islam

**GB-2**

GROUND SURFACE ELEVATION: 444.62 (ft, msl) BENTONITE TYPE: Western Bentonite  
 TOP OF SCREEN ELEVATION: 435.60 (ft, msl) MANUFACTURER: PDS  
 BOTTOM OF WELL ELEVATION: 425.60 (ft, msl) CEMENT TYPE: Not used, sealed with hydrated bentonite chips  
 TOP OF PVC RISER ELEVATION: 447.45 (ft, msl) CEMENT MANUFACTURER: N/A  
 NORTHING: 10513360.72 EASTING: 3349325.82 SAND PACK TYPE AND SIZE: Silica 20/40  
 SCREEN MATERIAL: PVC - Schedule 40 SAND MANUFACTURER: Unimin  
 RISER MATERIAL: PVC - Schedule 40 DRILLING CONTRACTOR: Total Support Services, Inc.  
 RISER MANUFACTURER: AMOUNT BENTONITE USED: 4 bags 40 lbs  
 RISER DIAMETER: 2 (in) Length: 11.85 (ft) AMOUNT CEMENT USED: N/A bags lbs  
 SCREEN DIAMETER: 2 (in) Length: 10 (ft) AMOUNT SAND USED: 7 bags 50 lbs  
 BOREHOLE DIAMETER: 8.25 (in) STATIC WATER: 7.50 ft (9/22/2010) depth from ground  
 DRILLING TECHNIQUE: Hollow stem Size: 8.25 (in) ENCOUNTERED WATER: Not Encountered depth from ground



Cement/Bentonite Grout Sand Pack Neat Concrete Bentonite Bottom Cap

QA/QC INSTALLED BY: Total Support Services, Inc. OBSERVED BY: Zahirul Islam  
 DATE: 8/31/2010 & 9/1/2010 CHECKED BY: Ed Dolan, P.G. DATE: 10/14/2010

# WATER LEVEL MEASUREMENTS

Site Name: <u>Sandy Creek Energy Station</u>	Sampling Personnel: <u>Darryl Sparks and Ty Brown</u>
Location: <u>2161 Rattlesnake Rd, Riesel, TX</u>	Field Conditions: <u>Varies</u>

ID	Date	Time	TOC Elevation (ft msl)	Depth to Water (ft BTOC)	GW Elevation (ft msl)	Field Observations
BW-1	10/6/2015	13:32	485.57	20.80	464.77	N/A
MW-1	10/6/2015	13:22	465.87	13.60	452.27	N/A
MW-2	10/6/2015	13:17	442.15	13.95	428.20	N/A
MW-3	10/6/2015	13:58	430.06	12.60	417.46	N/A
GB-2	10/6/2015	13:12	447.45	13.20	434.25	N/A
BW-1	11/4/2015	13:20	485.57	17.60	467.97	Rain Event 10/23-24/15; Lock installed
MW-1	11/4/2015	13:43	465.87	13.40	452.47	Rain Event 10/23-24/15; Lock installed
MW-2	11/4/2015	13:48	442.15	12.40	429.75	Rain Event 10/23-24/15; Lock installed
MW-3	11/4/2015	13:53	430.06	8.60	421.46	Rain Event 10/23-24/15; Lock installed
GB-2	11/4/2015	13:50	447.45	13.40	434.05	Rain Event 10/23-24/15; Lock installed
BW-1	12/2/2015	N/A	485.57	20.10	465.47	Rain preceding weekend (Approx. 1.5" total)
MW-1	12/2/2015	N/A	465.87	12.50	453.37	Rain preceding weekend (Approx. 1.5" total)
MW-2	12/2/2015	N/A	442.15	12.10	430.05	Rain preceding weekend (Approx. 1.5" total)
MW-3	12/2/2015	N/A	430.06	7.70	422.36	Rain preceding weekend (Approx. 1.5" total)
GB-2	12/2/2015	N/A	447.45	11.80	435.65	Rain preceding weekend (Approx. 1.5" total)
BW-1	1/19/2016	N/A	485.57	20.20	465.37	N/A
MW-1	1/19/2016	N/A	465.87	12.40	453.47	N/A
MW-2	1/19/2016	N/A	442.15	13.50	428.65	N/A
MW-3	1/19/2016	N/A	430.06	8.40	421.66	N/A
GB-2	1/19/2016	N/A	447.45	11.10	436.35	N/A

## Notes:

1. ft msl indicates feet above mean sea level and ft BTOC indicates ft below top of casing\*.
2. \*Depth is measured from the top of the inner well casing.
3. Monitoring well MW-3 was formerly labeled as piezometer GB-3.

Geosyntec Project No.: TXL0526

**APPENDIX C**

**STATE OF TEXAS WELL REPORTS FOR  
GROUNDWATER MONITORING WELLS AND  
PIEZOMETER**

## STATE OF TEXAS WELL REPORT for Tracking #408218

Owner:	<b>Sandy Creek Services, LLC</b>	Owner Well #:	<b>BW-1</b>
Address:	<b>P.O. Box 370 Riesel, TX 76682</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>2161 Rattlesnake Rd. Riesel, TX 76682</b>	Latitude:	<b>31° 28' 18.65" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 10" W</b>
		Elevation:	<b>483 ft. above sea level</b>
Type of Work:	<b>New Well</b>	Proposed Use:	<b>Monitor</b>

Drilling Start Date: **9/22/2015**      Drilling End Date: **9/22/2015**

	<i>Diameter (in.)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Borehole:	<b>8.25</b>	<b>0</b>	<b>50</b>

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Filter Material</i>	<i>Size</i>
Filter Pack Intervals:	<b>27.5</b>	<b>39.5</b>	<b>Sand</b>	<b>20/40</b>

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Description (number of sacks &amp; material)</i>
Annular Seal Data:	<b>0</b>	<b>24</b>	<b>Cement 1.5 Bags/Sacks</b>
	<b>24</b>	<b>26.5</b>	<b>Bentonite 0.5 Bags/Sacks</b>
	<b>26.5</b>	<b>39.5</b>	<b>Sand 10 Bags/Sacks</b>

Seal Method: **Tremie**

Sealed By: **Driller**

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

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

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

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

**Surface Completion by Driller**

Water Level: **20.5 ft. below land surface on 2015-10-13**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
<b>No Data</b>	<b>No Data</b>

Chemical Analysis Made: **No**

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

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

Company Information: **BEST DRILLING SERVICES, INC.**  
**P.O. BOX 845**  
**FRIENDSWOOD, TX 77549**

Driller Name: **Lawrence Tobola**

License Number: **3026**

Comments: **N-NE of Landfill Cell 2**

Lithology:  
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:  
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
<b>0</b>	<b>1</b>	<b>NO RECOVERY</b>
<b>1</b>	<b>5</b>	<b>CLAY, lt. brown</b>
<b>5</b>	<b>15</b>	<b>CLAY, lt. brown</b>
<b>15</b>	<b>20</b>	<b>CLAY, drk. brown</b>
<b>20</b>	<b>35</b>	<b>CLAY, lt. brown</b>
<b>35</b>	<b>37.5</b>	<b>CLAYSTONE, drk. gray</b>
<b>37.5</b>	<b>40</b>	<b>CLAY, lt. brown</b>
<b>40</b>	<b>50</b>	<b>CLAYEYSTONE, drk. gray</b>

<i>Dia (in.)</i>	<i>Type</i>	<i>Material</i>	<i>Sch./Gage</i>	<i>Top (ft.)</i>	<i>Bottom (ft.)</i>
<b>2</b>	<b>Riser</b>	<b>New Plastic (PVC)</b>	<b>40</b>	<b>0</b>	<b>28.5</b>
<b>2</b>	<b>Screen</b>	<b>New Plastic (PVC)</b>	<b>40 0.01</b>	<b>28.5</b>	<b>38.5</b>
<b>2</b>	<b>Bottom Cap</b>	<b>New Plastic (PVC)</b>		<b>38.5</b>	<b>39</b>

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

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

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

**Texas Department of Licensing and Regulation**  
**P.O. Box 12157**  
**Austin, TX 78711**  
**(512) 463-7880**

## STATE OF TEXAS WELL REPORT for Tracking #408201

Owner:	<b>Sandy Creek Services, LLC</b>	Owner Well #:	<b>MW-1</b>
Address:	<b>P.O. Box 370 Riesel, TX 76682</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>2161 Rattlesnake Rd. Riesel, TX 76682</b>	Latitude:	<b>31° 28' 07.21" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 09.04" W</b>
		Elevation:	<b>463 ft. above sea level</b>
Type of Work:	<b>New Well</b>	Proposed Use:	<b>Monitor</b>

Drilling Start Date: **9/21/2015**      Drilling End Date: **9/21/2015**

	<i>Diameter (in.)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Borehole:	<b>8.25</b>	<b>0</b>	<b>45</b>

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Filter Material</i>	<i>Size</i>
Filter Pack Intervals:	<b>23</b>	<b>35</b>	<b>Sand</b>	<b>20/40</b>

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Description (number of sacks &amp; material)</i>
Annular Seal Data:	<b>0</b>	<b>20.5</b>	<b>Cement 1 Bags/Sacks</b>
	<b>20.5</b>	<b>23</b>	<b>Bentonite 0.5 Bags/Sacks</b>
	<b>23</b>	<b>35</b>	<b>Sand 7 Bags/Sacks</b>

Seal Method: **Tremie**

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

Sealed By: **Driller**

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

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

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

**Surface Completion by Driller**

Water Level: **14 ft. below land surface on 2015-10-03**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
<b>No Data</b>	<b>No Data</b>

Chemical Analysis Made: **No**

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

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

Company Information: **BEST DRILLING SERVICES, INC.**  
**P.O. BOX 845**  
**FRIENDSWOOD, TX 77549**

Driller Name: **Lawrence Tobola**

License Number: **3026**

Comments: **South of Landfill Cell 2**

Lithology:  
DESCRIPTION & COLOR OF FORMATION MATERIAL

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
<b>0</b>	<b>1</b>	<b>CLAY, lt. brown with gravelly fill</b>
<b>1</b>	<b>5</b>	<b>CLAY, lt. brown with some gravelly fill</b>
<b>5</b>	<b>13</b>	<b>CLAY, lt. brown to drk. brown</b>
<b>13</b>	<b>31</b>	<b>CLAY, lt. brown</b>
<b>31</b>	<b>35</b>	<b>CLAYSTONE with thin strata of lt. brown CLAY</b>
<b>35</b>	<b>45</b>	<b>CLAYSTONE, drk. gray</b>

Casing:  
BLANK PIPE & WELL SCREEN DATA

<i>Dia (in.)</i>	<i>Type</i>	<i>Material</i>	<i>Sch./Gage</i>	<i>Top (ft.)</i>	<i>Bottom (ft.)</i>
<b>2</b>	<b>Riser</b>	<b>New Plastic (PVC)</b>	<b>40</b>	<b>-3</b>	<b>24</b>
<b>2</b>	<b>Screen</b>	<b>New Plastic (PVC)</b>	<b>40 0.01</b>	<b>24</b>	<b>34</b>
<b>2</b>	<b>Bottom Cap</b>	<b>New Plastic (PVC)</b>		<b>34</b>	<b>34.5</b>

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**Austin, TX 78711**  
**(512) 463-7880**

## STATE OF TEXAS WELL REPORT for Tracking #408213

Owner:	<b>Sandy Creek Services, LLC</b>	Owner Well #:	<b>MW-2</b>
Address:	<b>P.O. Box 370 Riesel, TX 76682</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>2161 Rattlesnake Rd Riesel, TX 76682</b>	Latitude:	<b>31° 28' 00.11" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 14.58" W</b>
		Elevation:	<b>439 ft. above sea level</b>
Type of Work:	<b>New Well</b>	Proposed Use:	<b>Monitor</b>

Drilling Start Date: **9/23/2015**      Drilling End Date: **9/23/2015**

	<i>Diameter (in.)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Borehole:	<b>8.25</b>	<b>0</b>	<b>25</b>

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Filter Material</i>	<i>Size</i>
Filter Pack Intervals:	<b>8</b>	<b>20.5</b>	<b>Sand</b>	<b>20/40</b>

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Description (number of sacks &amp; material)</i>
Annular Seal Data:	<b>0</b>	<b>6</b>	<b>Cement 1.5 Bags/Sacks</b>
	<b>6</b>	<b>8.5</b>	<b>Bentonite 0.6 Bags/Sacks</b>
	<b>8.5</b>	<b>20.5</b>	<b>Sand 8 Bags/Sacks</b>

Seal Method: **Tremie**

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

Sealed By: **Driller**

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

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

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

**Surface Completion by Driller**

Water Level: **13.5 ft. below land surface on 2015-10-13**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
<b>No Data</b>	<b>No Data</b>

Chemical Analysis Made: **No**

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

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

Company Information: **BEST DRILLING SERVICES, INC.**  
**P.O. BOX 845**  
**FRIENDSWOOD, TX 77549**

Driller Name: **Lawrence Tobola**

License Number: **3026**

Comments: **Southeast of existing Leachate Collection Pond**

Lithology:  
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:  
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
<b>0</b>	<b>5</b>	<b>Gravelly fill</b>
<b>5</b>	<b>10</b>	<b>CLAY, drk. brown/black</b>
<b>10</b>	<b>14</b>	<b>CLAY, drk. brown</b>
<b>14</b>	<b>20</b>	<b>CLAY, brown</b>
<b>20</b>	<b>23.5</b>	<b>CLAYSTONE, drk. gray</b>
<b>23.5</b>	<b>25</b>	<b>CLAYSTONE, drk. gray</b>

<i>Dia (in.)</i>	<i>Type</i>	<i>Material</i>	<i>Sch./Gage</i>	<i>Top (ft.)</i>	<i>Bottom (ft.)</i>
<b>2</b>	<b>Riser</b>	<b>New Plastic (PVC)</b>	<b>40</b>	<b>0.3</b>	<b>9.5</b>
<b>2</b>	<b>Screen</b>	<b>New Plastic (PVC)</b>	<b>40 0.01</b>	<b>9.5</b>	<b>19.5</b>
<b>2</b>	<b>Bottom Cap</b>	<b>New Plastic (PVC)</b>		<b>19.5</b>	<b>20</b>

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**Austin, TX 78711**  
**(512) 463-7880**

# STATE OF TEXAS WELL REPORT for Tracking #231669

Owner:	<b>SCPP</b>	Owner Well #:	<b>GB3 (MW-3)</b>
Address:	<b>2161 Rattlesnake Rd. Riesel, TX</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>Same Riesel, TX</b>	Latitude:	<b>31° 27' 57" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 20" W</b>
Elevation:	<b>No Data</b>	GPS Brand Used:	<b>No Data</b>

Type of Work:	<b>New Well</b>	Proposed Use:	<b>Monitor</b>
---------------	-----------------	---------------	----------------

Drilling Date:      Started: 8/30/2010  
                          Completed: 9/3/2010

Diameter of Hole:      Diameter: **8.25 in From Surface To 17 ft**

Drilling Method:      **Hollow Stem Auger**

Borehole              Other: **20/40 Silica Sand**  
 Completion:

Annular Seal Data:    1st Interval: **From 0 ft to 2 ft with Concrete (#sacks and material)**  
                              2nd Interval: **From 2 ft to 4 ft with Bentonite (#sacks and material)**  
                              3rd Interval: **No Data**  
                              Method Used: **Gravity**  
                              Cemented By: **Crew**  
                              Distance to Septic Field or other Concentrated Contamination: **No Data**  
                              Distance to Property Line: **No Data**  
                              Method of Verification: **No Data**  
                              Approved by Variance: **No Data**

Surface                **Surface Sleeve Installed**  
 Completion:

Water Level:          Static level: **No Data**  
                              Artesian flow: **No Data**

Packers:              **No Data**

Plugging Info:        Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump:        **No Data**

Well Tests:            **No Data**

Water Quality:        Type of Water: **No Data**  
                              Depth of Strata: **No Data**  
                              Chemical Analysis Made: **No Data**  
                              Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

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

Company                **Total Support Services**  
 Information:           **P.O. Box 81621**

**Austin , TX 78708**

Driller License  
Number: **54611**

Licensed Well  
Driller Signature: **Brian Kern**

Registered Driller  
Apprentice  
Signature: **No Data**

Apprentice  
Registration  
Number: **No Data**

Comments: **No Data**

---

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**Austin, TX 78711**  
**(512) 463-7880**

**DESC. & COLOR OF FORMATION MATERIAL**

From (ft) To (ft) Description  
**0 to 16 Tan and Gray Clay**  
**16 to 17 Gray Shale**

**CASING, BLANK PIPE & WELL SCREEN DATA**

Dia.	New/Used	Type	Setting From/To
<b>2</b>	<b>New</b>	<b>PVC Riser</b>	<b>0/6 Sched. 40</b>
<b>2</b>	<b>New</b>	<b>PVC Screen</b>	<b>6/16 0.010 Slotted</b>

## STATE OF TEXAS WELL REPORT for Tracking #231667

Owner: <b>SCPP</b>	Owner Well #: <b>GB2</b>
Address: <b>2161 Rattlesnake Rd. Riesel, TX</b>	Grid #: <b>39-33-2</b>
Well Location: <b>Same Riesel, TX</b>	Latitude: <b>31° 28' 01" N</b>
Well County: <b>McLennan</b>	Longitude: <b>096° 57' 22" W</b>
Elevation: <b>No Data</b>	GPS Brand Used: <b>No Data</b>

---

Type of Work: <b>New Well</b>	Proposed Use: <b>Monitor</b>
-------------------------------	------------------------------

Drilling Date:      Started: **8/30/2010**  
                          Completed: **9/3/2010**

Diameter of Hole:      Diameter: **8.25 in From Surface To 20 ft**

Drilling Method:      **Hollow Stem Auger**

Borehole Completion:      Other: **20/40 Silica Sand**

Annular Seal Data:      1st Interval: **From 0 ft to 2 ft with Concrete (#sacks and material)**  
                                  2nd Interval: **From 2 ft to 7 ft with Bentonite (#sacks and material)**  
                                  3rd Interval: **No Data**  
                                  Method Used: **Gravity**  
                                  Cemented By: **Crew**  
                                  Distance to Septic Field or other Concentrated Contamination: **No Data**  
                                  Distance to Property Line: **No Data**  
                                  Method of Verification: **No Data**  
                                  Approved by Variance: **No Data**

Surface Completion:      **Surface Sleeve Installed**

---

Water Level:      Static level: **No Data**  
                          Artesian flow: **No Data**

Packers:      **No Data**

Plugging Info:      Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump:      **No Data**

Well Tests:      **No Data**

---

Water Quality:      Type of Water: **No Data**  
                          Depth of Strata: **No Data**  
                          Chemical Analysis Made: **No Data**  
                          Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

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

Company Information:      **Total Support Services**  
                                  **P.O. Box 81621**

**Austin , TX 78708**

Driller License Number: **54611**

Licensed Well Driller Signature: **Brian Kern**

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

---

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**Austin, TX 78711**  
**(512) 463-7880**

**DESC. & COLOR OF FORMATION MATERIAL**

---

From (ft)	To (ft)	Description
0	19	Tan and Gray Clay
19	20	Gray Shale

**CASING, BLANK PIPE & WELL SCREEN DATA**

---

Dia.	New/Used	Type	Setting From/To
2	New	PVC Riser	0/9 Sched. 40
2	New	PVC Screen	9/19 0.010 Slotted

## **APPENDIX D**

### **SURVEY DATA**



OCTOBER 13, 2015

GEOSYNTEC CONSULTANTS, INC.  
8217 SHOAL CREEK BLVD., SUITE 200  
AUSTIN, TEXAS 78757

RE: SANDY CREEK ENERGY STATION WELL CONSTRUCTION DIAGRAMS

TO WHOM IT MAY CONCERN:

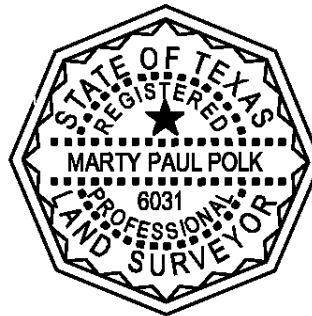
I HEREBY CERTIFY THE COORDINATES AND ELEVATIONS SHOWN IN THE TABLE BELOW ARE BASED UPON STATE PLANE COORDINATE SYSTEM, NAD 83, TEXAS CENTRAL ZONE, NAVD 88 AND REFERENCED TO BM-1 MONUMENT (NORTHING=10512746.62, EASTING 3349242.64, ELEV.=426.81) AS SHOWN ON THE PLANS PROVIDED BY GEOSYNTEC CONSULTANTS, INC., DATED DECEMBER 9, 2013, FOR THE SANDY CREEK ENERGY STATION.

Monitoring Well	Ground Surface Elevation	Top of PVC Riser Elevation	Northing	Easting
BW-1	482.70	485.57	10515061.29	3350322.30
MW-1	462.85	465.87	10513907.71	3350439.78
MW-2	439.18	442.15	10513176.91	3349982.33
GB-2	444.62	447.45	10513360.72	3349325.82
MW-3/GB-3	427.09	430.06	10512867.54	3349455.27
GB-6	453.39	N/A	10513492.63	3349684.20
GB-7	440.87	N/A	10513175.55	3349950.07

SINCERELY,

  
MARTY PAUL POLK, R.P.L.S. 6031

PROJ NO. 1-02580  
REVISED: DECEMBER 3, 2015



## **APPENDIX E**

### **SUPPLEMENTAL DOCUMENTATION**

- Geotechnical Design Report (B&V, 2009)
  - Section 4.0: Subsurface Investigation
  - Section 5.0: Subsurface Conditions
  - Figure 6-2: Atterberg Limit Data vs. Depth, All Data
  - Figure 6-3: Atterberg Limit Classification, All Data
- Engineering Report (B&V, 2010)
  - Section 3.0: Site Geology and Hydrogeology
  - Figure 3-1: Subsurface Investigation – Boring Location and Insitu Test Plan
  - Figure 5-1: Solid Waste Disposal Facility (SWDF) Area Cross Section
  - Appendix A: Boring, Piezometer, and Test Pit Logs
    - BV-101 thru BV-111; PZ-107; and TP-4
  - Appendix C: Laboratory Test Results
    - Hydraulic conductivity test for BV-102
- Geosyntec Boring Logs
  - GB-1 and GB-4 to GB-7
- Geotechnical Laboratory Test Data for Geosyntec Borings

**Sandy Creek Energy Station  
Riesel, Texas**



**Geotechnical Design Report  
Revision 0**

**SCPP Project 149060  
SCPP File No. 52.0106**

**April 2009**



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## 4.0 Subsurface Investigation

The subsurface investigation was performed to determine the site stratigraphy and geotechnical engineering parameters of the soils that underlie the proposed site area. The subsurface investigation was developed to gather detailed design information for use with data obtained from a previous geotechnical investigation.

The subsurface investigation was contracted to Professional Service Industries, Inc. (PSI) of Houston, Texas, under the geotechnical engineering direction of Sandy Creek Power Partners (SCPP). The exploration work consisted of soil borings with minimal rock coring, piezometer installations and test pits. Additional field work included pressuremeter testing, soil electrical resistivity field testing, double ring infiltrometer testing, in-situ shear vane testing, dynamic cone penetrometer testing, and crosshole seismic testing.

The initial subsurface location plan with the preliminary site layout is presented on Figures 4-1 and 4-2. The updated site and plant layout is shown in Figure 4-3, which includes movement of the cooling tower, removal of retaining ponds, and an updated arrangement of the rail line, among other minor changes. Planning, field supervision, and subsurface logging were performed by an SCPP geotechnical engineer. Fieldwork was completed in September 2007.

### 4.1 Field Testing Program

The subsurface investigation included 51 soil borings to depths of up to 100 feet, 4 test pits to 16 feet, 4 double-ring infiltrometer (DRI) tests, 4 piezometers to depths of 29.5 to 49.0 feet, and 40 electrical resistivity tests. Pressuremeter and shear vane tests were performed in situ during drilling. Two crosshole seismic tests were performed at locations of rotating-mass equipment.

The investigation was performed through July, August, and September of 2007. PSI was contracted to perform all drilling, sampling, and testing of soil and rock obtained during the investigation.

Initial surveying and staking of points was performed by Sherwood Surveying, LLC of Spring Branch, Texas. Coordinates were transformed from state plane to latitude and longitude for use with global positioning system (GPS) location equipment. Mean Sea Level (MSL) elevations were used for the investigation. Table 4-1 lists the coordinates, ground surface elevations, and depths for the soil borings, test pits, and piezometer locations, along with remarks identifying the particular field testing conducted within the boring as listed in Figure 4-3. Table 4-2 lists the coordinates and elevations for the soil electrical resistivity tests as listed in Figure 4-2.

Table 4-1  
Subsurface Investigation Locations

Location Number	Plant Grid (feet)		State Plane (feet)		Depth (feet)	Remarks
BV-1	5372.69	9138.98	10516296.99	3348576.40	41	PMT
BV-2	5302.16	9402.55	10516252.73	3348801.76	75	PMT
BV-3	5258.34	9704.39	10516244.84	3349106.65	46	VST
BV-4	5247.51	9930.16	10516260.72	3349332.13	46	PMT
BV-5	5210.50	9085.63	10516124.33	3348497.86	8	DCP
BV-6	5153.86	9495.83	10516116.47	3348911.88	73	THERM
BV-7	5123.01	9879.53	10516131.11	3349296.54	48	PIEZ
BV-8	5122.58	9207.76	10516051.43	3348629.51	68	VST
BV-9	5010.34	9654.83	10515969.98	3348895.34	50	VST
BV-10	5047.43	9815.58	10516029.54	3349082.33	63	VST
BV-11	5004.06	9940.97	10516005.45	3349247.07	85	PMT
BV-12	5066.09	9998.74	10516081.83	3349364.26	48	ERS
BV-13	5020.13	9998.74	10516043.01	3349427.06	46	VST
BV-14	4982.05	9228.74	10516005.20	3349431.55	83	PMT
BV-15 A,B,C	4989.27	9228.63	10515921.52	3348665.96	108	CST
BV-16	4967.44	9653.13	10515949.92	3349090.07	52	PMT
BV-17 A,B,C	4934.12	9937.68	10515950.40	3349376.57	99	CST
BV-18	4941.61	9057.00	10515853.94	3348501.16	48	PMT
BV-19	4882.26	9372.41	10515832.21	3348821.37	68	VST
BV-20	4882.26	9524.72	10515850.18	3348972.62	78	THERM
BV-21	4838.92	9223.59	10515771.61	3348678.70	78	ERS / PIEZ
BV-22	4751.65	9954.93	10515771.24	3349415.22	8	DCP
BV-23	5570.30	8223.48	10516379.91	3347599.29	38	
BV-24	6061.39	9280.50	10516992.27	3348590.98	78	PMT
BV-25	5046.39	8790.72	10515926.57	3348224.38	8	DCP
BV-26	5741.22	9237.12	10516669.21	3348585.69	37	VST
BV-27	5788.27	9772.89	10516779.15	3349112.17	48	
BV-28	5781.05	9971.82	10516795.44	3349310.56	38	
BV-29	5968.82	10854.20	10517086.00	3350164.62	33	PIEZ
BV-30	6207.80	11475.28	10517396.58	3350753.17	8	DCP
BV-31	5400.92	9503.72	10516362.74	3348890.57	77	PMT
BV-32	5517.78	9763.70	10516509.46	3349134.95	43	
BV-33	5512.53	9967.23	10516528.26	3349337.67	48	
BV-34	5331.33	10191.76	10516374.81	3349582.02	79	ERS
BV-35	5507.28	10741.94	10516614.44	3350107.59	45	PMT
BV-36	4875.69	10816.78	10515996.09	3350256.42	45	VST
BV-37	4244.12	11462.80	10515445.14	3350972.45	8	DCP
BV-38	4580.25	13097.57	10515971.80	3352556.14	8	
BV-39	6025.94	16242.36	10516038.78	3355508.42	8	DCP

Table 4-1  
Subsurface Investigation Locations

Location Number	Plant Grid (feet)		State Plane (feet)		Depth (feet)	Remarks
BV-101	4026.14	8999.50	10514938.08	3348552.06	43	PIEZ
BV-102	3335.46	9470.07	10514307.74	3349100.83	48	
BV-103	4055.68	10248.88	10515114.81	3349789.23	50	
BV-104	3609.90	9868.75	10514627.29	3349464.35	73	
BV-105	3689.96	10523.55	10514784.05	3350105.13	50	
BV-106	2448.49	9621.23	10513444.80	3349355.58	43	
BV-107	3101.00	10663.00	10514216.41	3350313.15	28	PIEZ
BV-108	2345.42	10497.71	10513445.85	3350238.09	37	
BV-109	2338.85	10190.45	10513403.08	3349933.75	50	
BV-110	2550.91	10393.32	10513637.59	3350110.19	38	
BV-111	2739.34	10464.88	10513833.14	3350159.02	50	
TP-1	5625.45	8352.16	10516449.85	3347720.56	13	TEST PIT
TP-2	5642.52	9813.60	10516639.22	3349169.78	15	TEST PIT
TP-3	5913.13	10663.96	10517008.25	3349982.28	15	TEST PIT
TP-4	2344.08	10330.80	10513424.83	3350072.50	14	TEST PIT

Abbreviations:

PMT= Pressuremeter Test

VST= In-situ Shear Vane Test

DCP= Dynamic Cone Penetrometer Test

ERS= Electrical Soil Resistivity Samples

PIEZ= Piezometer Installation

THERM= Thermal Resistivity Samples

CST= Crosshole Seismic Test

Table 4-2  
Electrical Resistivity Locations

Location Number	Plant Grid (ft)		State Plane (ft)	
	North	East	North	East
TSR1	8497	1827	10517084.64	3348669.69
TSR2	8085	1364	10516492.21	3348487.08
TSR3	7670	1010	10515953.85	3348399.41
TSR4	7587	677	10515710.31	3348157.58
TSR5	7453	1041	10515784.10	3348538.16
TSR6	7006	1292	10515531.89	3348984.52
TSR7	7119	1680	10515829.57	3349257.86
TSR8	7461	1740	10516153.00	3349132.26
TSR9	7663	2319	10516625.80	3349523.28
TSR10	7100	2178	10516070.79	3349693.67
TSR11	5861	1926	10514880.77	3350120.15
TSR12	6597	2494	10515804.44	3350225.15
TSR13	7519	3019	10516865.23	3350196.03
TSR14	7160	4167	10517152.97	3351363.42
TSR15	6014	4686	10516441.52	3352401.37
TSR16	5749	3341	10515517.74	3351388.68
TSR17	4520	2285	10513919.80	3351121.83
TSR18	8017	-25	10515713.31	3347333.81
MSR1	7831	1532	10516291.45	3348816.19
MSR2	6897	2812	10516243.94	3350164.22

#### **4.1.1 Soil Test Borings**

Fifty one borings were performed using a combination of rotary wash and solid and hollow stem auger. Borings BV-1 through BV-22 were located within the power block and tank areas. BV-23, 27, 28, 29, 32, and 33, were located within the storm water, wastewater, and coal pile ponds on the northern portion of the site. BV-5, 25, 30, 37, 38, and 39 were performed along the rail loop to the east of the power block area. BV-24 and 26 were located along the cooling tower alignment. BV-34, 35, and 36 were drilled in the coal handling and storage pile vicinity. Borings BV-101 through BV-111 were located in the proposed landfill and leachate pond areas. A test pit was performed in each of the four pond locations around the site, in accordance with TCEQ regulations

Borings were advanced with either a 4-1/2 inch solid stem auger, 8 inch outside diameter hollow stem auger, or 3-7/8 inch step bit using a bentonite slurry as drilling fluid. Borings were advanced to depths of 30 to 100 feet. The hollow stem auger was used in Borings BV-3, 8, 9, 10, 13, 19, 26, and 36 for in situ shear vane testing and Central Mine Equipment Company (CME) continuous barrel sampling. The 4-1/2 inch flighted auger was used for Borings BV-25, 30, 37, 38, and 39 because of ease of mobilization and shallow sampling depth. The remaining borings were performed with rotary wash techniques, including borings in which pressuremeter testing was included. Dual Shelby tube samplings were often used to create cavities for the wash bit that was brought on site to perform the pressuremeter tests. A 2-7/8 inch downward flow pressuremeter testing cavity was created in clays that refused a Shelby tube sampler.

Sampling of the in situ materials included the standard penetration test (SPT) that utilized a standard 2.0 inch outside diameter split spoon sampler, driven with a CME auto hammer and thin-walled Shelby tubes advanced with hydraulic down pressure from the rig. Continuous barrel sampling was also performed during hollow stem drilling, replacing the center bit.

Rotary-wash drilling was used for the majority of the borings, each piezometer, and for advancement of the pressuremeter. Hollow stem augers were used for identifying groundwater bearing seams and performing shear vane testing. Continuous sampling was utilized in the borings for the shear vane testing by pushing a CME barrel sampler ahead of the augers.

Borings were backfilled with bentonite chips through the open hole. An SSCP geotechnical engineer logged the borings and provided field classification of samples during the drilling work. The boring logs are presented in Appendix A.

#### **4.1.2 Rock Coring**

Five feet of rock coring was performed in BV-11, from 80 to 85 feet in the marl formation. An 1-7/8 inch core size, 5 foot long, NQ core barrel was used to cut and retrieve the sample, with thin bentonite mud as drilling fluid. Rock coring was not utilized at any other location during the investigation, as samples were obtainable with SPTs or tubes.

#### **4.1.3 Piezometers**

Four piezometers were installed in borings BV-7, 23, 21, and 107 to depths of 49.5, 39.0, 52.5, and 29.5 feet, respectively. The locations covered the landfill pond, power block, northern pond, and cooling tower area. As noted in Section 4.1, the piezometers were constructed in holes drilled by rotary wash methods and bentonite mud as fluid. Each borehole was flushed with 500 gallons of clear water prior to piezometer construction. Each piezometer was constructed with 10 foot sections of 2 inch diameter polyvinyl chloride (PVC) riser pipe and a 10 foot screen pipe with 0.010 inch slots, set to the bottom of the drilled hole. The interface of the yellow-brown clay with the hard gray clay was monitored, with water likely seeping in the sand-filled clay fissures located above and below the interface. Filter material consisting of medium to fine silica sand was installed along the screen and above to ensure adequate monitoring of the sand seams. The riser pipe was extended to 3 feet above the ground surface. The piezometer was developed by first surging, then bailing the well nearly dry with a manual bailer. Expelled water was initially dark and full of suspended solids, but became relatively clear as the hole was bailed to within 4 feet of the bottom. A dry hole was not immediately obtainable because of the inflow of water, but the water clarity became stable as the hole was emptied. Piezometer logs are included in Appendix B.

#### **4.1.4 Test Pits**

Four test pits were excavated within the site and were located in the proposed storm pond, wastewater pond, coal runoff pond, and landfill runoff pond, as preliminarily located in June 2007. The pits were excavated by Brazos Valley Excavating, Inc., (subcontracted by PSI) with a CAT 325 hydraulic trackhoe. Pits were dug to between 13 and 16 feet and logged by a SCPP engineer/geologist. Bag samples were obtained from each test pit. Each pit was subsequently backfilled and hoe-tamped to protect the livestock in the area. Additionally, shallow (1.5 to 3.0 foot deep) pits were dug to prepare a bed for DRI testing, which was required to provide a suitable test platform without large surficial cracks. Test pit logs are included in Appendix C.

#### **4.1.5 Geophysical Exploration**

Two seismic crosshole tests were performed at opposite ends of the power block, near Borings BV-15 and BV-17. The tests were performed on three 100 foot cased borings spaced at 15 feet. The initial intent was to use 10 foot spacings for the borings, but it was determined during sampling that the anticipated shear wave velocity of the clay necessitated the use of greater spacings. Five foot vertical testing intervals were utilized to sample each soil layer, to a maximum depth of 100 feet. Verticality of each casing was determined with a 2DVA-1000 deviation probe.

During testing, limited grading and grubbing activities occurred with a D-6 dozer, which induced some vibrations into the test. Overhead transmission lines are located approximately 200 yards from the site, which also added minor irregularity into the test. The high swelling nature of the clay made for difficulties in properly grouting the casings.

A refraction microtremor (ReMi) test was performed at the contractor's choice as a check between the two test locations. All testing was performed by PSI geoscientists. The geophysical report is included in Appendix D.

#### **4.1.6 Pressuremeter Testing**

Pressuremeter tests were performed in Borings BV-1, 2, 4, 11, 14, 16, 18, 24, 31, and 35 to determine in situ deformation properties of the soil strata. Pressuremeter testing was performed by sampling between SPT samples and Shelby tube samples at 5 foot intervals. Tests were conducted in the holes created by two Shelby tube samples where feasible in clay material. Tests were conducted in the clayshale layer by using rotary wash techniques and a downward flow bit, with bentonite slurry as drilling fluid to produce a smooth-walled hole. In several instances, the hole drilled for the probe was either too small or too large in diameter and was rejected for testing. Pressuremeter test results are provided in Appendix E

#### **4.1.7 Soil Electrical Resistivity Tests**

Soil electrical resistivity testing was performed over the property in strategic locations to efficiently model the site for grounding design. Twenty-six topsoil resistivity arrays were completed, along with four mid-soil resistivity arrays. Arrays were performed over the power block area, coal and cooling tower sites, and proposed railroad loop area. MSR-2 was offset 200 feet south to avoid deep ravines and inaccessible areas of the site. Electrical resistivity test results are provided in Appendix E.

Additional field test results are provided in Appendix E. Those included in Appendix E are Pressuremeter Tests, Electrical Resistivity Tests, Summary of Vane Shear Tests, Dynamic Cone Penetrometer Tests, and the Double Ring Infiltrometer Test.

## 4.2 Laboratory Testing Program

Numerous laboratory tests were assigned for the samples collected. A laboratory testing program was performed to classify and characterize the soils encountered during the investigation and to estimate relevant engineering properties of the soils. Triaxial tests included unconsolidated-undrained and consolidated-undrained. Remolded and recompacted soil was mixed with calculated amounts of cement or lime and used with unconsolidated-undrained testing.

The laboratory testing program was developed by B&V and performed by PSI and subcontractors. The laboratory tests included the following:

- Moisture Content--To determine the in situ water content of soil samples.
- Atterberg Limits--To determine the relative plasticity of the soil samples and to assist in classifying the fine-grained portion of the sample.
- California Bearing Ratio (CBR)--To determine suitability of a subgrade for use under a foundation or roadway.
- Clay Fraction--To determine the percentage of clay within a sample.
- Consolidation--To determine the compressibility of cohesive deposits.
- CU-Bar (Consolidated-Undrained with Pore Pressure Measurements) Triaxial Compression--To determine total and effective stress strength parameters.
- Grain Size Analyses--To determine the relative proportions of fine-grained soil particles and sand gradation found in the soil samples.
- Falling Head Permeability--To determine permeability of landfill and pond liner material.
- Lime Percentage--To determine the optimum amount of lime for soil modification.
- UU (Unconsolidated-Unconfined) Triaxial Compression--To determine representative undrained shear strengths of clay deposits under in situ confining stresses.
- UNC (Unconfined) Compression--To determine representative undrained compressive strengths of clay with no confining stress.
- Standard Proctor Tests--To determine the maximum dry density and optimum moisture contents of fill material.
- Soil Box Electrical Resistivity--To determine the resistivity of borrow sources.

- Swell Test--To determine free swell percentages and maximum swell pressures.
- Chemical Analysis--To determine the corrosive potential of foundation soils by measuring the pH, chloride, and sulfate content of foundation soils.

All laboratory testing was performed in general accordance with established American Society for Testing and Materials (ASTM) procedures. Results from the laboratory testing program are included in Appendix F.

### **4.3 Previous Investigation**

A previous investigation was performed by Morris-Flood and Associates in 2006 (Reference 5). During the investigation, eight soil borings were completed, along with a limited array of laboratory testing. Five borings were performed in the proposed power block area, two in the pond and landfill location, and one in the proposed railroad alignment. Borings were terminated at depths ranging from 30 to 60 feet. The boring logs indicated materials encountered as firm to hard, high plasticity clay. The SPT N values (and consistency) of the clay increased with depth, to over 50 blows per foot. A layer of Marl was identified under several of the deeper borings, past depths of 50 feet. The majority of deep clay samples were reported as sampled by thin-walled tube pushes, which was not reproduced by the sampling methods used for this investigation.

## 5.0 Subsurface Conditions

### 5.1 Regional Geology

The project site lies in the Blackland Prairies province of the Texas Gulf Coastal plains. They are the most inland Gulf Coast plains, located northeast of the Central Texas uplift, and consist of chalks and marls that weather to deep, black clay soils (Physiographic Map of Texas 1996).

Two integrated geologic formations of the Upper Cretaceous period lie below the site. The Lower Taylor Marl Formation (Ozan) grades upward to the Wolfe City Formation, of which both were sampled during the investigations. The Wolfe City formation is historically known to reach thicknesses of 300 feet, but based on its exposed width at the surface, a rough estimate of its thickness at the site would be 150 feet. The Wolfe City Formation consists of marl, sand, sandstone, and clay interbedded with thin sandstone and un-cemented sand lenses, and containing glauconite, phosphate and hematite nodules. It is generally dark gray to light gray and brown. (Geologic Atlas of Texas, Waco Sheet, Texas Bureau of Economic Geology, 1970.).

The geology of the Gulf Coastal Plains is complex due to cyclic deposition of sedimentary facies. Sediments were deposited under a fluvial-deltaic to shallow marine environments during the Miocene to the Pleistocene periods. Repeated sea-level changes and natural basin subsidence produced discontinuous beds of sand, silt, clay, and gravel (Chowdhury and Turco, 2005).

The formations directly underlying the site are considered to be a confining unit of the local aquifer. A local recharge zone of sandy deposits is located just northwest of the site running northeast to southwest. The most shallow principal aquifer beneath the site is the Trinity Aquifer, which would likely be encountered at least 1,000 feet below the ground surface. (*Groundwater Atlas of the United States*, USGS, Reston, VA, 1996.)

### 5.2 Site-Specific Geology

Three distinct soil layers are found within the site. A high plasticity, overconsolidated, firm, brown clay with fluvial gravel and cobble is underlain by a stiff, high plasticity, overconsolidated, yellow-brown clay. The yellow-brown clay grades to a hard, high plasticity, gray clayshale deposit. The clayshale layer is a completely weathered-decomposed layer of shale. Also encountered was a clayey rock locally termed marl, consisting of highly cemented plant and bone fragments with frequent sandstone, limestone, and gypsum nodules. The marl was encountered in only one boring, and no limits or extent of the material could be determined.

An approximate 6 inch topsoil layer overlies the site and contains organics. The yellow-brown clay ranges in thickness from 5 feet to 40 feet, and the gray clayshale has been measured in thickness from 20 to 40 feet. Frequent secondary mineralization and deposits of gypsum and fine sand are apparent to depths of up to 40 feet. Overconsolidation of the clays found onsite is from variations in historical water levels, sediment deposits over geologic history, and desiccation.

### 5.3 Geological Hazards

Liquefaction is not a concern at the site because of low seismic potential and no loose granular materials found onsite.

The majority of clays found in the upper 35 feet have a high potential for swelling. Seasonal shrink-swell patterns commonly leave 1.5 inch wide fissures in the upper 5 to 10 feet of soil. Swelling of the clays under lightly loaded structures built on shallow foundations and paved roads will have to be mitigated by techniques detailed in Section 7.2.

Land subsidence is not a concern at the site. Sinkholes are not common to the area, as the underlying rock is not prone to dissolution by surface water infiltration.

The majority of clay in the upper 35 feet is lightly to moderately overconsolidated. Below 35 feet, to the top of rock, the majority of clay sampled was highly overconsolidated. There is no risk of soil collapse caused by under consolidated deposits.

The nearest Cretaceous-aged fault is located more than 15 miles from the project area. There have been no recent geologic data that indicated any seismic-related ground surface movement in recent geologic history.

The average proposed elevation of the power block area is 480 feet (MSL). The lowest proposed plant elevation is 445 feet at the storm water retention pond berm. The Federal Emergency Management Agency (FEMA) 100 year flood elevation is approximately 425 feet. The site is not prone to flooding.

The risk of landslides is minimal at the current site. Some moderately steep hills exist, but consist of stiff clay that is sufficiently strong to withstand any driving forces from the natural slopes. Proposed earthwork plans indicate the removal of most steep valleys and hills, which would further eliminate any landslide or slope failure risk.

### 5.4 Seismicity

Seismic activity is generally not considered a hazard in the site area. The maximum peak ground acceleration for a 50 year event is 6.0 percent gravity (0.06g).

### 5.4.1 Probabilistic Seismicity

The site area has a low potential for seismic activity. The soil is classified as Site Class C based on the average soil properties for the upper 100 feet of the soil profile, as defined by the requirements in the 2003 International Building Code (IBC). Seismic design parameters are as follows (IBC 2003):

- Mapped spectral acceleration for 0.2 second short period ( $S_S$ ) = 10.1 percent, based on Site Class C.
- Mapped spectral acceleration for 1 second period ( $S_1$ ) = 4.3 percent, based on Site Class C.
- Seismic Importance Factor (IE) = 1.25.
- Structure Category = Category III.
- Seismic Use Group = Group II.
- Design spectral acceleration for 0.2 second short period ( $S_{DS}$ ) = 8.1 percent.
- Design spectral acceleration for 1.0 second short period ( $S_{D1}$ ) = 5.6 percent.

### 5.4.2 Deterministic Seismicity

Geologic evidence indicates very low risk for seismic movement or hazards. The United States Geological Survey (USGS, 2007) states, “The gulf-margin normal faults in Texas are assigned as Class B structures because of their low seismicity and because they may be decoupled from underlying crust, making it unclear if they can generate significant seismic ruptures that could cause damaging ground motion.”

Few earthquakes are recorded in southern Texas history, with even fewer creating much damage. The latest recorded significant earthquakes to impact the region are listed in Table 5-1 (USGS, 2007).

Table 5-1 Regional Latest Recorded Significant Earthquakes (USGS, 2007)		
Occurrence Date	Modified Mercalli Magnitude	Location
09/15/2007	2.7	100 miles NE of Austin
11/02/1981	3.2	90 miles NE of Austin
2/15/1974	4.5	Texas Panhandle
5/12/1969	3.3/3.4	El Paso
06/20/1966	4.8	Texas Panhandle

## 5.5 Site-Specific Ground Conditions

### 5.5.1 Site Stratigraphy

Three major layers have been identified under the site. Cross sections for the Power Block, Cooling Tower, and Coal Handling areas are shown in Figures 5-1, 5-2, and 5-3, respectively. Not all of the soil borings are included in the cross sections.

#### ***Layer 1: Brown Clay***

Layer 1 is a high plasticity, soft-to-firm clay with trace amounts of rounded sand and gravel of fluvial deposits. It contains organics in the top 6 inches and sustains wild plant growth. This layer is typically 1 to 12 feet thick and is found in every boring sampled onsite. Thinner deposits are found on the top and sides of hills, with thicker deposits up to 12 feet thick located in bottom valley areas. The upper 8 feet (where deposited) is highly desiccated from seasonal drying and exhibits vertical cracking up to 2 inches wide and 6 feet deep in the dry season. This layer is prone to substantial swelling. Average SPT N values were 5 blows per foot (bpf), with an average shear strength of 1.5 ksf. The average moisture content, liquid limit, and plastic limit were 30, 70, and 28 percent, respectively. The overconsolidation ratio ranged from 1.5 to 4.0.

#### ***Layer 2: Yellow-Brown Clay***

Layer 2 is a high plasticity, firm-to-stiff clay with trace amounts of subrounded sand and gravel. This layer ranges in depth from 10 feet to 45 feet and is found in every boring sampled onsite. The SPT N values ranged from 15 to 45, and increased linearly with depth. Shear strengths increased from 2.5 ksf at shallow depths to 4 ksf near the interface with clayshale. Occasional horizontal seams of fine gray sand were common in the upper elevations, while horizontal and vertical deposits of gypsum were identified within this layer. Free water was commonly encountered within the sand layers at depths greater than 20 feet. This layer is prone to swelling when exposed to excess water. At lower elevations, this layer grades to gray with no change in strength properties. Three sublayers were created for analysis to accurately capture the increasing strength of the deposit. The average moisture content, liquid limit, and plastic limits are 25, 68, and 25 percent, respectively. The overconsolidation ratio ranged from 2.0 to 4.0.

#### ***Layer 3: Clayshale***

Layer 3 is a moist-to-dry, high plasticity, hard, residual intermediate geomaterial typically found below depths of 50 feet in the upper hills and 25 feet in the bottom valleys. It was classified as a decomposed residual shale that had been weathered to a clay material. It is characterized as having a distinct horizontal fabric structure (fissile).

Fine sand layers were found infrequently, and typically were observed with iron oxide staining. Very infrequently fissures and joints were found with angles of 45 to 60 degrees. Average SPT N values were over 50 bpf, with occasional refusal on unweathered nodules. The average shear strength from unconfined compression and unconsolidated undrained triaxial tests was 7 ksf. The average moisture content, liquid limit, and plastic limits are 20, 67, and 25 percent, respectively. The overconsolidation ratio was estimated at over 6, due to a lack of quality undisturbed samples recovered.

### ***Marl***

Clayey limestone (Marl) was identified in one deep boring, BV-11 at a depth of 78.0 feet (elevation 404 feet). It was characterized as a soft rock with clay origins and random cemented inclusions with less than 10 percent gypsum content. The layer was identified by SPT refusal and required coring equipment for sampling. The average unconfined compressive strength was 40 ksf (280 pounds per square inch, psi) from rock core samples.

## **5.5.2 Groundwater Conditions**

Groundwater was encountered in all eight borings advanced with hollow stem augers, and in all piezometers installed onsite. Water strikes were encountered from 22 to 43 feet below ground surface (elevation 454 feet and 442 feet, respectively) in the power block area (Borings BV-7 and BV-11), and 14 feet below ground surface (elevation 411 feet) near the storm runoff pond (Boring BV-23). It was determined that the water flowed from cracks and fissures in the stiff clay. The majority of the fissures were in-filled with sand and gypsum, indicating secondary mineralization and water flow at certain depths. Iron oxide staining and secondary mineralization in near-surface soil indicates vertical water movement in recent history.

The water encountered is considered transient or perched, is not connected to the local aquifer, and is not expected to be found in large quantities. The nearest freshwater aquifer is located at a depth of over 1,000 feet below ground surface.

The permeability and infiltration rate of clays onsite were determined by both laboratory and in situ tests. Falling head permeability tests and DRI testing resulted in close agreement of the hydraulic properties. The infiltration rates during the DRI tests indicate the swelling nature of the high plasticity clay, with the initial inflow rates as much as 10 times those at the end of the test. This indicates that the system either became saturated or swelled and fissures closed during testing, with the latter verified by visual inspection. All soil encountered onsite was mostly clay with high plasticity. The natural permeability of these soils is generally very low ( $k < 10^{-8}$  centimeters per second).

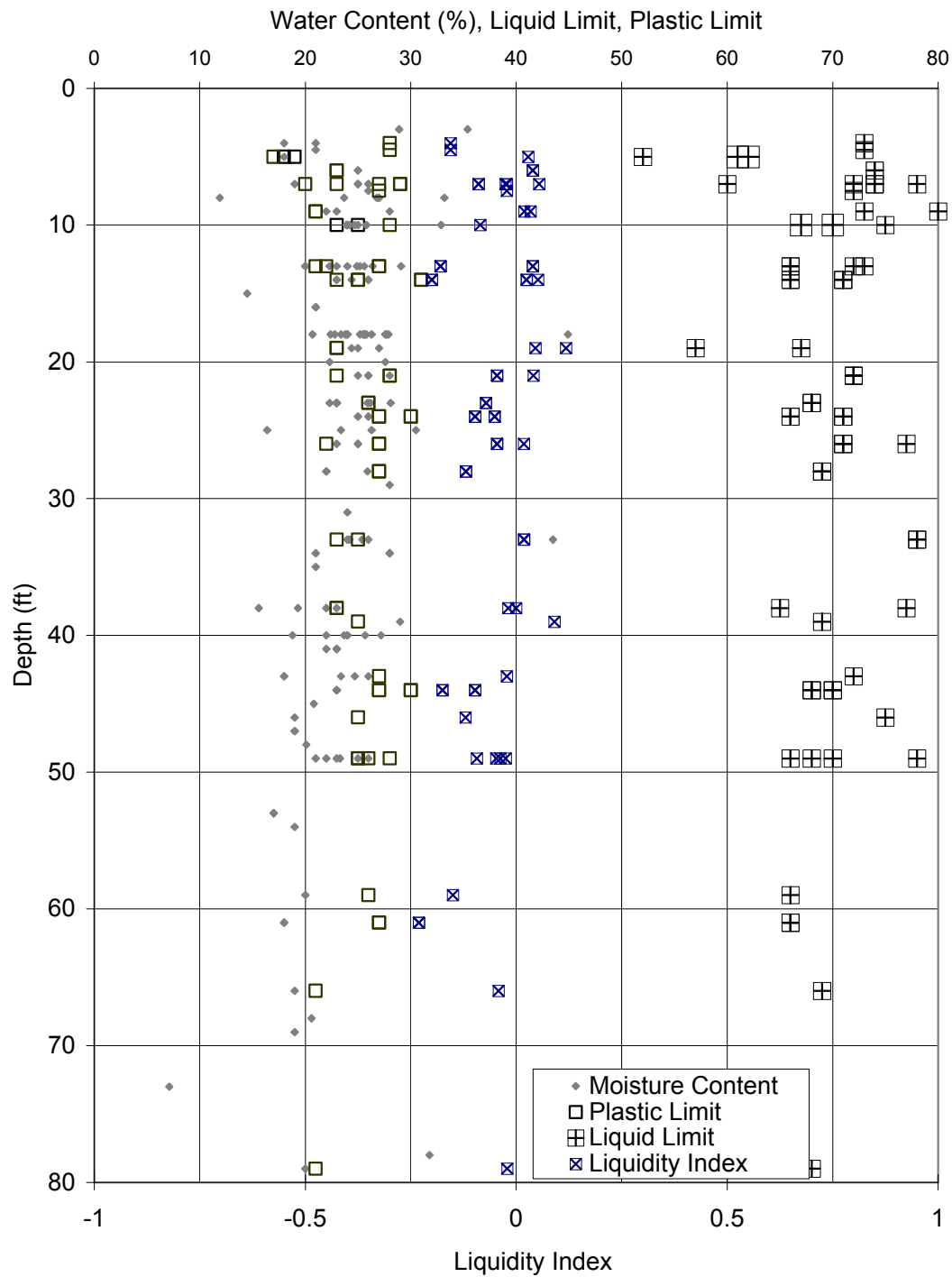


Figure 6-2  
Atterberg Limit Data vs. Depth, All Data

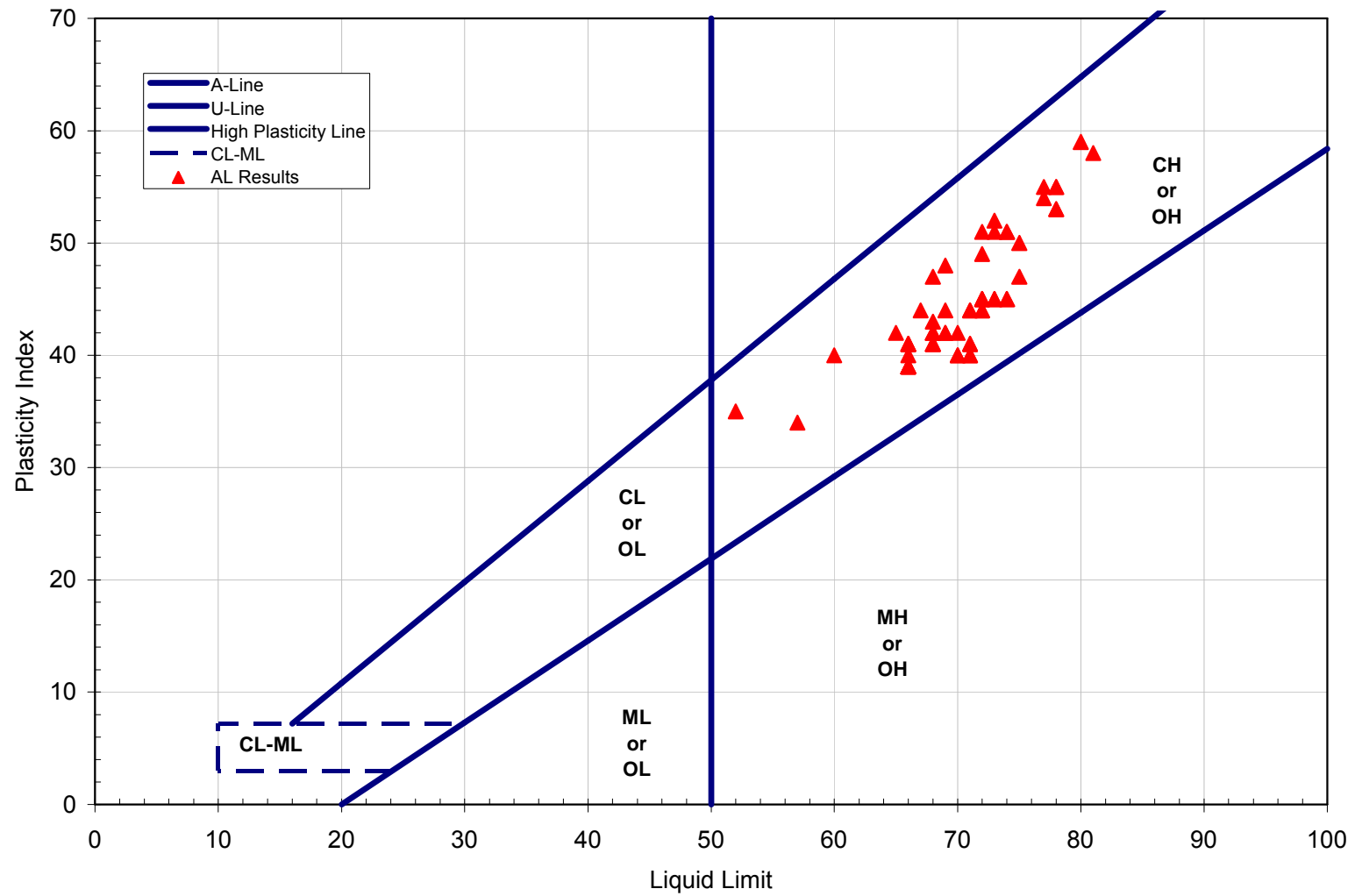


Figure 6-3  
Atterberg Limit Classification, All Data

**Sandy Creek Services, LLC**  
**Sandy Creek Energy Station**  
**Solid Waste Disposal Facility**

**Engineering Report**

**Revision 1**

**SCPP Project No. 149060**  
**SCPP File No. 52.0206**

**October 18, 2010**



**Sandy Creek Power Partners, L.P.**

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Figure 2-1	General Site Arrangement
Figure 3-1	Subsurface Investigation – Boring Location and Insitu Test Plan
Figure 5-1	Solid Waste Disposal Facility (SWDF) Area Cross Section
Figure 5-2	SPT N-values with Elevation

**Drawings**

As listed in Table 2-1 - Solid Waste Disposal Facility Drawings

## **3.0 Site Geology and Hydrogeology**

### **3.1 Regional Geology**

The project site lies in the Blackland Prairies province of the Texas Gulf Coastal plains. They are the most inland Gulf Coast plains, located northeast of the Central Texas uplift, and consist of chalks and marls that weather to deep, black clay soils (Physiographic Map of Texas 1996).

Two integrated geologic formations of the Upper Cretaceous period lie below the site. The Lower Taylor Marl Formation (Ozan) grades upward to the Wolfe City Formation, of which both were sampled during the investigations. The Wolfe City formation is historically known to reach thicknesses of 300 feet, but based on its exposed width at the surface, a rough estimate of its thickness at the site would be 150 feet. The Wolfe City Formation consists of marl, sand, sandstone, and clay interbedded with thin sandstone and un-cemented sand lenses, and containing glauconite, phosphate and hematite nodules. It is generally dark gray to light gray and brown. (Geologic Atlas of Texas, Waco Sheet, Texas Bureau of Economic Geology, 1970.).

The geology of the Gulf Coastal Plains is complex due to cyclic deposition of sedimentary facies. Sediments were deposited under a fluvial-deltaic to shallow marine environments during the Miocene to the Pleistocene periods. Repeated sea-level changes and natural basin subsidence produced discontinuous beds of sand, silt, clay, and gravel (Chowdhury and Turco, 2005).

The formations directly underlying the site are considered to be a confining unit of the local aquifer. A local recharge zone of sandy deposits is located just northwest of the site running northeast to southwest. The most shallow principal aquifer beneath the site is the Trinity Aquifer, which would likely be encountered at least 1,000 feet below the ground surface. (Groundwater Atlas of the United States, USGS, Reston, VA, 1996.)

### **3.2 Site-Specific Geology**

Three distinct soil layers are found within the site. A high plasticity, overconsolidated, firm, brown clay with fluvial gravel and cobble is underlain by a stiff, high plasticity, overconsolidated, yellow-brown clay. The yellow-brown clay grades to a hard, high plasticity, gray clayshale deposit. The clayshale layer is a completely weathered-decomposed layer of shale. Also encountered was a clayey rock locally termed marl, consisting of highly cemented plant and bone fragments with frequent sandstone, limestone, and gypsum nodules. The marl was encountered in only one boring, and no limits or extent of the material could be determined.

An approximate 6 inch topsoil layer overlies the site and contains organics. The yellow-brown clay ranges in thickness from 5 feet to 40 feet, and the gray clayshale has been measured in thickness from 20 to 40 feet. Frequent secondary mineralization and deposits of gypsum and fine sand are apparent to depths of up to 40 feet. Overconsolidation of the clays found onsite is from variations in historical water levels, sediment deposits over geologic history, and desiccation.

### **3.3 Subsurface Investigation**

The subsurface investigation was performed to determine the site stratigraphy and geotechnical engineering parameters of the soils that underlie the proposed site area. The subsurface investigation was developed to gather detailed design information for use with data obtained from a previous geotechnical investigation.

The subsurface investigation was contracted to Professional Service Industries, Inc. (PSI) of Houston, Texas, under the geotechnical engineering direction of SSCP. The exploration work within the storage area footprint consisted of soil borings, piezometer installations, and test pits.

#### **3.3.1 Field Testing Program**

The field investigation consisted of a total of eleven (11) soil borings, of which a piezometer was set in one (1) of the borings located on the southeast corners of the solid waste disposal facility site. The borings were 28 to 73 feet deep with most of the borings terminating in the clayshale layer. One (1) test pit was excavated to a depth of 16 feet in the stormwater runoff pond area. Field tests within the SWDF and stormwater runoff pond area are discussed in the following subsections.

The subsurface investigation locations are provided on Figure 3-1 (SCPP Drawing 149060-DS-0001, Revision C). Initial surveying and staking of points was performed by Sherwood Surveying, LLC of Spring Branch, Texas. Coordinates were transformed from state plane to latitude and longitude for use with global positioning system (GPS) location equipment. Mean Sea Level (MSL) elevations were used for the investigation. Table 3-1 lists the coordinates, ground surface elevations, and depths for the soil borings, test pits, and piezometer locations, along with remarks identifying the particular field testing conducted within the boring as listed in Figure 3-1.

Table 3-1 Subsurface Investigation Locations							
Location Number	Plant Grid (feet)		State Plane (feet)		Depth (feet)	Elevation (feet)	Remarks
BV-101	4026.14	8999.50	10514938.08	3348552.06	43	473.2	
BV-102	3335.46	9470.07	10514307.74	3349100.83	48		
BV-103	4055.68	10248.88	10515114.81	3349789.23	50	493.2	
BV-104	3609.90	9868.75	10514627.29	3349464.35	73	490.3	
BV-105	3689.96	10523.55	10514784.05	3350105.13	50	464.0	
BV-106	2448.49	9621.23	10513444.80	3349355.58	43		

**Table 3-1**  
**Subsurface Investigation Locations**

Location Number	Plant Grid (feet)		State Plane (feet)		Depth (feet)	Elevation (feet)	Remarks
BV-107	3101.00	10663.00	10514216.41	3350313.15	28		PIEZ
BV-108	2345.42	10497.71	10513445.85	3350238.09	37	443.7	
BV-109	2338.85	10190.45	10513403.08	3349933.75	50	441.6	
BV-110	2550.91	10393.32	10513637.59	3350110.19	38	439.6	
BV-111	2739.34	10464.88	10513833.14	3350159.02	50	446.0	
TP-4	2344.08	10330.80	10513424.83	3350072.50	14	438.0	TEST PIT

Abbreviations:

PIEZ= Piezometer Installation

### **3.3.1.1 Soil Test Borings**

Eleven soil borings were performed using rotary wash technique. Borings BV-101 through BV-107 were located within the SWDF areas. Borings BV-108 through BV-111 and test pit TP-4, were located within the stormwater runoff pond area.

Borings were advanced with 3-7/8 inch step bit using bentonite slurry as drilling fluid. Sampling of the in situ materials included the standard penetration test (SPT) that utilized a standard 2.0 inch outside diameter split spoon sampler, driven with a CME auto hammer and thin-walled Shelby tubes advanced with hydraulic down pressure from the rig. Borings, with the exception of piezometer borings, were backfilled with bentonite chips through the open hole. An SCPP geotechnical engineer logged the borings and provided field classification of samples during the drilling work. The boring logs are presented in Appendix A.

### **3.3.1.2 Piezometers**

One piezometer was installed in boring BV-107 at a depth of 19.0 feet, with a 10 foot screen. As noted in Section 3.3.1.1, the piezometer was constructed in borehole drilled by rotary wash methods and bentonite mud as fluid. The borehole was flushed with 500 gallons of clear water prior to piezometer construction. Each piezometer was constructed with 10 foot sections of 2 inch diameter polyvinyl chloride (PVC) riser pipe and a 10 foot screen pipe with 0.010 inch slots, set to the bottom of the drilled hole. The interface of the yellow-brown clay with the hard gray clay was monitored, with water likely seeping in the sand-filled clay fissures located above and below the interface. Filter material consisting of medium to fine silica sand was installed along the screen and above to ensure adequate monitoring of the sand seams. The riser pipe was extended to 3 feet above the ground surface. The piezometer was developed by first surging, then bailing the well nearly dry with a manual bailer. Expelled water was initially dark and full of suspended solids, but became relatively clear as the hole was bailed to within 4 feet of the bottom. A dry hole was not immediately obtainable because of the inflow of water, but the water clarity became stable as the hole was emptied. Piezometer log is included in Appendix A.

### **3.3.1.3 Field Permeability Tests**

The permeability and infiltration rate of clays onsite were determined by compacting the in situ material to the clay liner specifications in 3 lifts. Falling head permeability tests on samples from each lift and double ring infiltrometer (DRI) testing resulted in close agreement of the hydraulic properties. The infiltration rates during the DRI tests indicate the swelling nature of the high plasticity clay, with the initial inflow rates as much as 10 times those at the end of the test. This indicates that the system either became saturated or swelled and fissures closed during testing, with the latter verified by visual inspection. All soil encountered onsite was mostly clay with high plasticity. The natural permeability of these soils is generally very low ( $k < 10^{-8}$  centimeters per second). Field permeability tests data and interpretation is provided in Appendix B.

### **3.3.1.4 Test Pits**

One test pit was excavated within the stormwater runoff pond area. The pits were excavated by Brazos Valley Excavating, Inc., (subcontracted by PSI) with a CAT 325 hydraulic trackhoe. The test pit was dug to a depth of 13 feet and logged by a SCPP engineer/geologist. Bag samples were obtained from the test pit. The pit was subsequently backfilled and hoe-tamped to protect the livestock in the area. Test pit logs are included in Appendix A.

## **3.3.2 Laboratory Testing Program**

Numerous laboratory tests were assigned for the samples collected. A laboratory testing program was performed to classify and characterize the soils encountered during the investigation and to estimate relevant engineering properties of the soils. Triaxial tests included unconsolidated-undrained and consolidated-undrained. Remolded and recompacted soil was mixed with calculated amounts of cement or lime and used with unconsolidated-undrained testing.

The laboratory testing program was developed by SCPP and performed by PSI and subcontractors. The laboratory tests included the following:

- Moisture Content--To determine the in situ water content of soil samples.
- Atterberg Limits--To determine the relative plasticity of the soil samples and to assist in classifying the fine-grained portion of the sample.
- California Bearing Ratio (CBR)--To determine suitability of a subgrade for use under a foundation or roadway.
- Clay Fraction--To determine the percentage of clay within a sample.
- CU-Bar (Consolidated-Undrained with Pore Pressure Measurements) Triaxial Compression--To determine total and effective stress strength parameters.
- Grain Size Analyses--To determine the relative proportions of fine-grained soil particles and sand gradation found in the soil samples.
- Variable Head Permeability--To determine permeability of landfill and pond liner material.
- UU (Unconsolidated-Unconfined) Triaxial Compression--To determine representative undrained shear strengths of clay deposits under in situ confining stresses.

- Standard Proctor Tests--To determine the maximum dry density and optimum moisture contents of fill material.

All laboratory testing was performed in general accordance with established American Society for Testing and Materials (ASTM) procedures. Results from the laboratory testing program are included in Appendix C.

### **3.3.3 Previous Investigations**

A previous investigation was performed by Morris-Flood and Associates in 2006 . During the investigation, eight soil borings were completed, along with a limited array of laboratory testing. Two of the borings were performed in the proposed SWDF area. Borings were terminated at depths ranging from 30 to 60 feet. The boring logs indicated materials encountered as firm to hard, high plasticity clay. The SPT N values (and consistency) of the clay increased with depth, to over 50 blows per foot. A layer of Marl was identified under several of the deeper borings, past depths of 50 feet. The majority of deep clay samples were reported as sampled by thin-walled tube pushes, which were not reproduced by the sampling methods used by SCPP for this investigation.

## **3.4 Site-Specific Ground Conditions**

### **3.4.1 Site Stratigraphy**

Three major layers have been identified under the site.

#### **3.4.1.1 Brown Clay**

Layer 1 is a high plasticity, soft-to-firm clay with trace amounts of rounded sand and gravel of fluvial deposits. It contains organics in the top 6 inches and sustains wild plant growth. This layer is typically 1 to 12 feet thick and is found in every boring sampled onsite. Thinner deposits are found on the top and sides of hills, with thicker deposits up to 12 feet thick located in bottom valley areas. The upper 8 feet (where deposited) is highly desiccated from seasonal drying and exhibits vertical cracking up to 2 inches wide and 6 feet deep in the dry season. This layer is prone to substantial swelling. Average SPT N values were 5 blows per foot (bpf), with an average shear strength of 1.5 ksf. The average moisture content, liquid limit, and plastic limit were 30, 70, and 28 percent, respectively. The overconsolidation ratio ranged from 1.5 to 4.0.

#### **3.4.1.2 Yellow-Brown Clay**

Layer 2 is a high plasticity, firm-to-stiff clay with trace amounts of subrounded sand and gravel. This layer ranges in depth from 10 feet to 45 feet and is found in every boring sampled onsite. The SPT N values ranged from 15 to 45, and increased linearly with depth. Shear strengths increased from 2.5 ksf at shallow depths to 4 ksf near the interface with clayshale. Occasional horizontal seams of fine gray sand were common in the upper elevations, while horizontal and vertical deposits of gypsum were identified within this layer. Free water was commonly encountered within the sand layers at depths greater than 20 feet. This layer is prone to swelling when exposed to excess water. At lower elevations, this layer grades to gray with no change in strength properties. Three sublayers were created for analysis to accurately capture the increasing strength of the

deposit. The average moisture content, liquid limit, and plastic limits are 25, 68, and 25 percent, respectively. The overconsolidation ratio ranged from 2.0 to 4.0.

#### **3.4.1.3 Clayshale**

Layer 3 is a moist-to-dry, high plasticity, hard, residual intermediate geomaterial typically found below depths of 50 feet in the upper hills and 25 feet in the bottom valleys. It was classified as decomposed residual shale that had been weathered to a clay material. It is characterized as having a distinct horizontal fabric structure (fissile). Fine sand layers were found infrequently, and typically were observed with iron oxide staining. Very infrequently fissures and joints were found with angles of 45 to 60 degrees. Average SPT N values were over 50 bpf, with occasional refusal on unweathered nodules. The average shear strength from unconfined compression and unconsolidated undrained triaxial tests was 7 ksf. The average moisture content, liquid limit, and plastic limits are 20, 67, and 25 percent, respectively. The overconsolidation ratio was estimated at over 6, due to a lack of quality undisturbed samples recovered.

#### **3.4.1.4 Marl**

Clayey limestone (Marl) layer was not identified in SWDF borings to the depths explored. Based on the extent of this layer elsewhere in the power block area, the layer was characterized as a soft rock with clay origins and random cemented inclusions with less than 10 percent gypsum content. The layer was identified by SPT refusal and required coring equipment for sampling. The average unconfined compressive strength was 40 ksf (280 pounds per square inch, psi) from rock core samples.

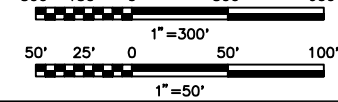
### **3.5 Groundwater Conditions**

Groundwater was not encountered in the SWDF area borings. In the power block area, groundwater was encountered in eight borings advanced with hollow stem augers, and in all piezometers installed onsite. Water strikes were encountered from 22 to 43 feet below ground surface (elevation 454 feet and 442 feet, respectively) in the power block area (Borings BV-7 and BV-11), and 14 feet below ground surface (elevation 411 feet) near the stormwater runoff pond (Boring BV-23). It was determined that the water flowed from cracks and fissures in the stiff clay. The majority of the fissures were in-filled with sand and gypsum, indicating secondary mineralization and water flow at certain depths. Iron oxide staining and secondary mineralization in near-surface soil indicates vertical water movement in recent history.

The water encountered is considered transient or perched, is not connected to the local aquifer, and is not expected to be found in large quantities. The nearest freshwater aquifer is located at a depth of over 1,000 feet below ground surface.

SCALE: 1"=300'  
DATE: 07/11/2007  
BY: SLS

NO.	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK	APP
C	04/11/2008	GENERAL REVISIONS	BEZ	JUD	
B	07/27/2007	REVISED TABLE	SLS	JUD	
A	07/20/2007	ISSUED FOR CONTRACT	SLS	JUD	
NO.					

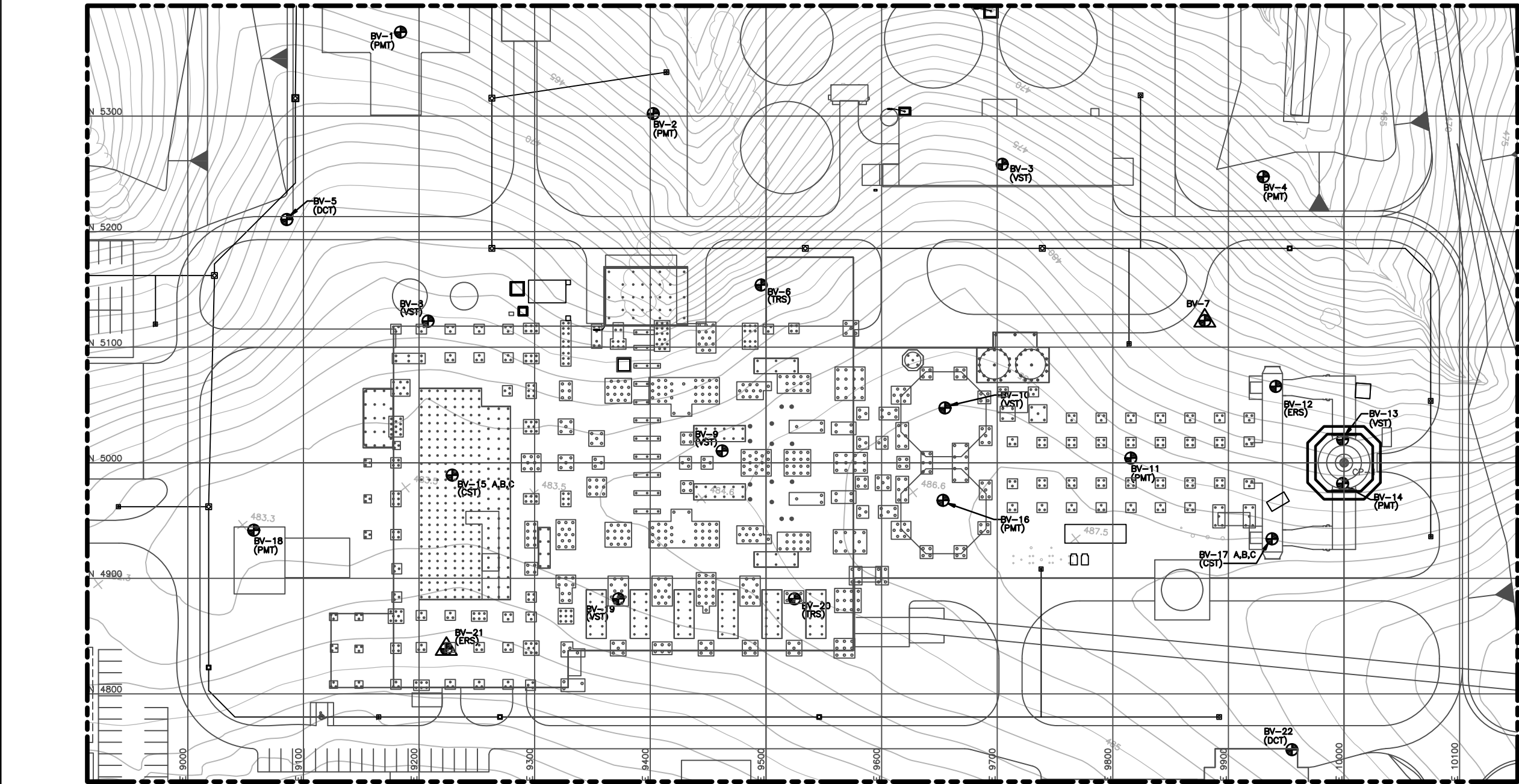
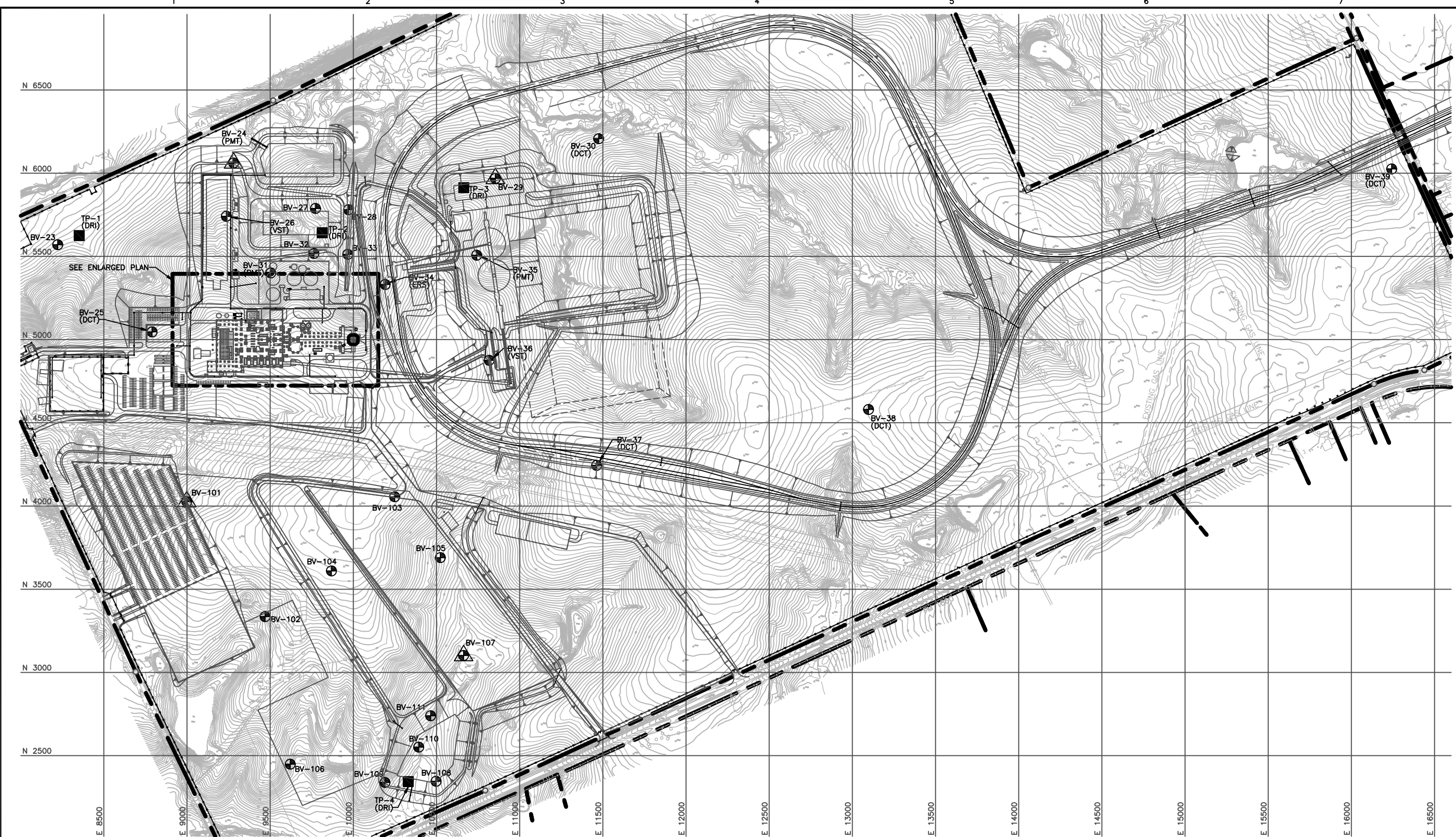


I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF TEXAS.

BLACK & VEATCH CORPORATION  
ENGINEER: JCB  
CHECKED: JCB  
DATE: \_\_\_\_\_

SANDY CREEK ENERGY STATION  
UNIT 1  
SUBSURFACE INVESTIGATION  
BORING LOCATION AND ISITU TEST PLAN

PROJECT: 149060-DS-0001  
DRAWING NUMBER: C  
CODE: \_\_\_\_\_  
AREA: \_\_\_\_\_



## BORING LOCATIONS

LOCATION NO.	PLANT GRID		STATE PLANE		SOIL DRILLING (FT)	ROCK/MARL DRILLING (FT)	REMARKS
	NORTHING	EASTING	NORTHING	EASTING			
BV-1	5372.69	9183.98	10516296.99	3348576.40	50	TOP	PRESSUREMETER TESTING
BV-2	5302.16	9402.55	10516252.73	3348801.76	50	30	PRESSUREMETER TESTING
BV-3	5258.34	9704.39	10516244.84	3349106.65	50	TOP	VANE SHEAR TEST
BV-4	5247.51	9930.16	10516260.72	3349332.13	50	TOP	PRESSUREMETER TESTING
BV-5	5210.50	9085.63	10516124.33	3348497.86	10	-	DYNAMIC CONE TEST
BV-6	5153.86	9495.83	10516116.47	3348911.88	50	30	THERMAL RESISTIVITY SAMPLE
BV-7	5123.01	9879.53	10516131.11	3349296.54	50	TOP	PIEZOMETER
BV-8	5122.58	9207.76	10516051.43	3348629.51	50	30	VANE SHEAR TEST
BV-9	5010.34	9462.12	10515969.98	3348895.34	50	30	VANE SHEAR TEST
BV-10	5047.43	9654.83	10516029.54	3349082.33	50	30	VANE SHEAR TEST
BV-11	5004.06	9815.58	10516005.45	3349247.07	50	30	PRESSURE METER TEST
BV-12	5066.09	9940.97	10516081.83	3349364.26	50	TOP	ELECTRICAL RESISTIVITY SAMPLE
BV-13	5020.13	9998.74	10516043.01	3349427.06	50	TOP	VANE SHEAR TEST
BV-14	4982.05	9998.74	10516005.20	3349431.55	50	30	PRESSUREMETER TESTING
BV-15 A,B,C	4989.27	9228.63	10515921.52	3348665.96	50	50	CROSSHOLE SEISMIC TEST; SAMPLE BORING "A"
BV-16	4967.44	9653.13	10515949.92	3349090.07	50	TOP	PRESSUREMETER TESTING
BV-17 A,B,C	4934.12	9937.68	10515950.40	3349376.57	50	50	CROSSHOLE SEISMIC TEST; SAMPLE BORING "A"
BV-18	4941.61	9057.00	10515853.94	3348501.16	50	TOP	PRESSUREMETER TESTING
BV-19	4882.26	9372.41	10515832.21	3348821.37	50	TOP	VANE SHEAR TEST
BV-20	4882.26	9524.72	10515850.18	3348972.62	50	30	THERMAL RESISTIVITY SAMPLE
BV-21	4838.92	9223.59	10515771.61	3348678.70	50	30	ELECTRICAL RESISTIVITY SAMPLE
BV-22	4751.65	9954.93	10515771.24	3349415.22	10	-	DYNAMIC CONE TEST
BV-23	5570.30	8223.48	10516379.91	3347599.29	60	TOP	
BV-24	6061.39	9280.50	10516992.27	3348590.98	50	30	PRESSUREMETER TESTING; PIEZOMETER
BV-25	5046.39	8790.72	10515926.57	3348224.38	10	-	DYNAMIC CONE TEST
BV-26	5741.22	9237.12	10516669.21	3348585.69	50	TOP	VANE SHEAR TEST
BV-27	5788.27	9772.89	10516779.15	3349112.17	50	TOP	
BV-28	5781.05	9971.82	10516795.44	3349310.56	50	TOP	
BV-29	5968.82	10854.20	10517086.00	3350164.62	50	TOP	PIEZOMETER
BV-30	6207.80	11475.28	10517396.58	3350753.17	10	-	DYNAMIC CONE TEST
BV-31	5400.92	9503.72	10516362.74	3348890.57	50	30	PRESSUREMETER TESTING
BV-32	5517.78	9763.70	10516509.46	3349134.95	50	TOP	
BV-33	5512.53	9967.23	10516528.26	3349337.67	50	TOP	
BV-34	5331.33	10191.76	10516374.81	3349582.02	50	30	ELECTRICAL RESISTIVITY SAMPLE
BV-35	5507.28	10741.94	10516614.44	3350107.59	50	TOP	PRESSUREMETER TESTING
BV-36	4875.69	10816.78	10515996.09	3350256.42	50	30	VANE SHEAR TEST
BV-37	4244.12	11462.80	10515445.14	3350972.45	10	-	DYNAMIC CONE TEST
BV-38	4580.25	13097.57	10515971.80	3352556.14	10	-	DYNAMIC CONE TEST
BV-39	6025.94	16242.36	10517778.39	3355508.42	10	-	DYNAMIC CONE TEST
BV-101	4026.14	8999.50	10514938.08	3348552.06	50	TOP	PIEZOMETER
BV-102	3335.46	9470.07	10514307.74	3349100.83	50	TOP	
BV-103	4055.68	10248.88	10515114.81	3349789.23	50	TOP	
BV-104	3609.90	9868.75	10514627.29	3349464.35	50	TOP	
BV-105	3689.96	10523.55	10514784.05	3350105.13	50	TOP	
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BV-108	2345.42	10497.71	10513445.85	3350238.09	50	TOP	
BV-109	2338.85	10190.45	10513403.08	3349933.75	50	TOP	
BV-110	2550.91	10393.32	10513637.59	3350110.19	50	TOP	
BV-111	2739.34	10464.88	10513833.14	3350159.02	50	TOP	
TP-1	5625.45	8352.16	10516449.85	3347720.56	15	-	
TP-2	5642.52	9813.60	10516639.22	3349169.78	15	-	
TP-3	5913.13	10663.96	10517008.25	3349982.28	15	-	
TP-4	2344.08	10330.80	10513424.83	3350072.50	15	-	

## LEGEND

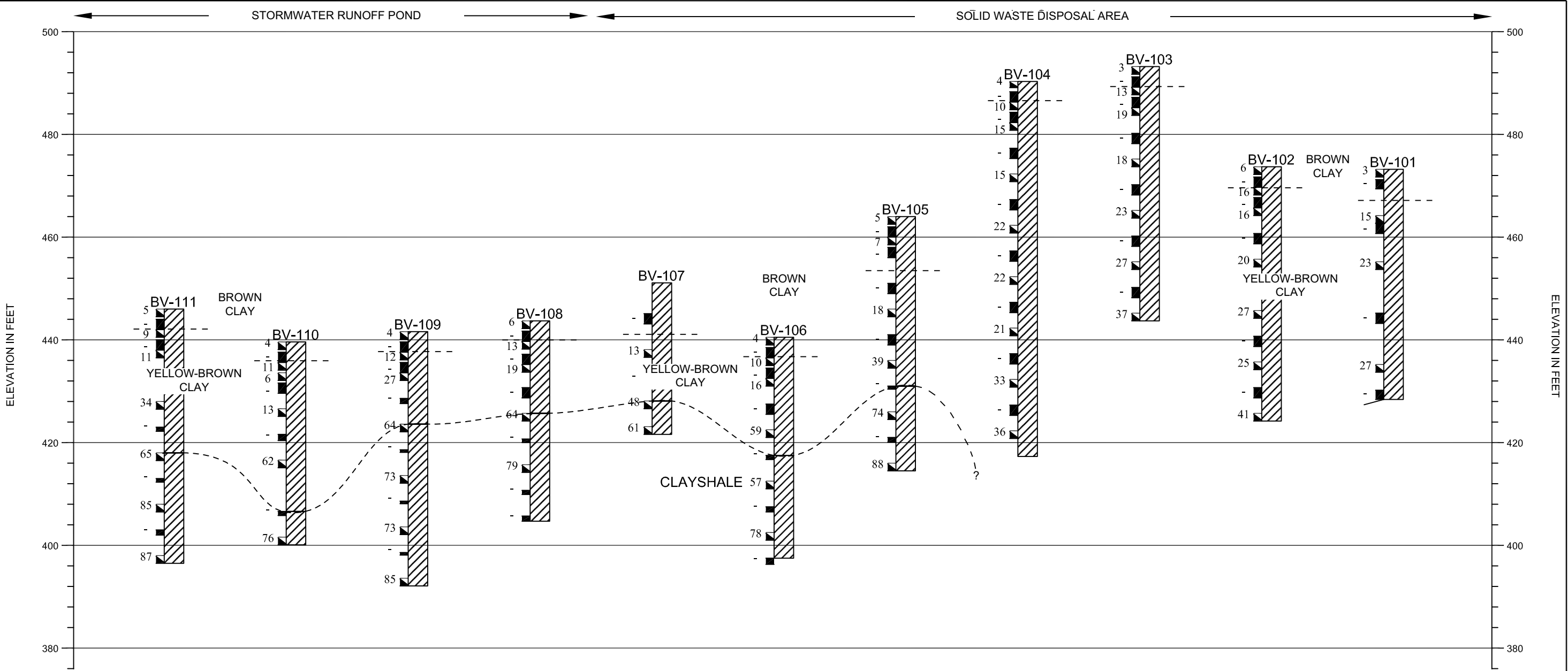
- BV-1 BORING LOCATION
- BV-1 BORING WITH PIEZOMETER LOCATION
- TP-1 TEST PIT LOCATION
- (PMT) PRESSUREMETER TESTING
- (VST) VANE SHEAR TEST
- (CST) CROSSHOLE SEISMIC TEST, SAMPLE BORING "A"
- (DCT) DYNAMIC CONE TEST
- (TRS) THERMAL RESISTIVITY SAMPLE
- (ERS) ELECTRICAL RESISTIVITY SAMPLE
- (DRI) DOUBLE RING INFILTROMETER

## NOTES

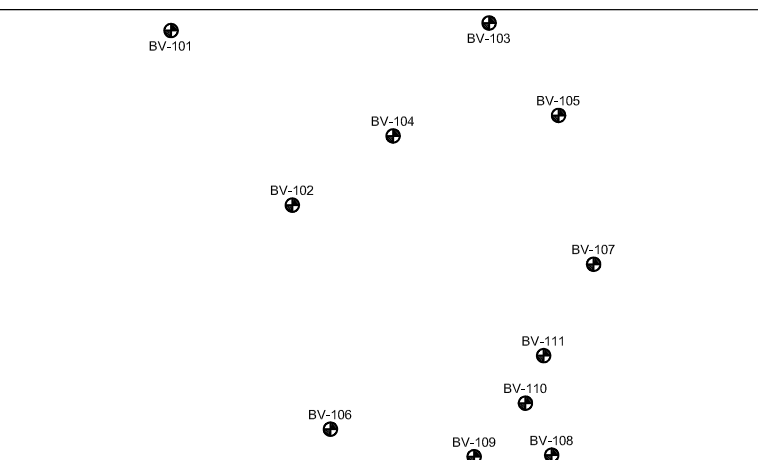
- ELECTRICAL RESISTIVITY SAMPLE TO BE TAKEN AT DESIGNATED LOCATIONS AT APPROXIMATE DEPTHS OF 2', 4', 10', 15', 20', 30', AND BOTTOM OF BORING.
- CROSSHOLE SEISMIC TEST REQUIRES 3'-100' CASED HOLES LOCATED IN A LINE AT 10' SPACING.
- THERMAL RESISTIVITY SAMPLE TO BE TAKEN AT DESIGNATED LOCATIONS AT DEPTHS INDICATED BY PURCHASER. SAMPLE TO BE PLACED IN SEALED 5 GALLON BUCKET.

FOR ENGINEERING REPORT  
FIGURE 3-1  
BORING LOCATION AND ISITU TEST PLAN


















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FOR CONSTRUCTION

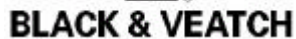


This cross section is included as part of the report and is based on interpretations of the soil borings presented in the report. Actual subsurface conditions may vary from those in this cross section due to conditions not detected during the subsurface investigation. Groundwater levels were generally not measured due to the use of rotary wash drilling.

PLAN VIEW		LEGEND		<table><tr><td colspan="2">PROJECT</td><td colspan="2">LOCATION</td></tr><tr><td colspan="2">Sandy Creek Energy Station</td><td colspan="2">Reisel, Texas</td></tr><tr><td colspan="4">CLIENT</td></tr><tr><td colspan="4">Sandy Creek Energy Associates</td></tr><tr><td colspan="4">PROJECT NO</td></tr><tr><td colspan="4">149060</td></tr><tr><td colspan="4">FOR ENGINEERING REPORT</td></tr><tr><td colspan="4">FIGURE 5-1</td></tr><tr><td colspan="4">SOLID WASTE DISPOSAL FACILITY (SWDF)</td></tr><tr><td colspan="4">AREA CROSS SECTION</td></tr></table>		PROJECT		LOCATION		Sandy Creek Energy Station		Reisel, Texas		CLIENT				Sandy Creek Energy Associates				PROJECT NO				149060				FOR ENGINEERING REPORT				FIGURE 5-1				SOLID WASTE DISPOSAL FACILITY (SWDF)				AREA CROSS SECTION			
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SOLID WASTE DISPOSAL FACILITY (SWDF)																																													
AREA CROSS SECTION																																													
	<div><div>CLAY/CLAYSHALE</div><div>Standard penetration test</div><div>Undisturbed thin wall Shelby tube</div></div>		<div><div>1</div><div>NR</div><div>80</div><div>---</div><div>INDICATES AN APPROXIMATE OR GRADUAL CHANGE</div><div>N-VALUE</div><div>N-VALUE NOT RECORDED</div><div>RQD Value</div></div>																																										
		Horizontal Scale: 1"=(proportional)'	Vertical Scale: 1"=20'																																										

**Appendix A**  
**Boring and Piezometer Logs**

CLIENT		PROJECT				PROJECT NO.								
Sandy Creek Energy Associates				Sandy Creek Energy Station				149060						
PROJECT LOCATION		COORDINATES		GROUND ELEVATION (DATUM)		TOTAL DEPTH								
Reisel, Texas		N 4026.0'		E 8990.0'		473.2 ft (MSL)		44.8 (feet)						
SURFACE CONDITIONS				COORDINATE SYSTEM		DATE START		DATE FINISHED						
Side of hill; weed cover				PLANT		08/08/2007		08/08/2007						
SOIL SAMPLING				LOGGED BY		CHECKED BY		APPROVED BY						
				JJ Deeken		V Bhadriraju		BL Christensen						
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS		
CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD								
SPT	1	2	1	2	3	0.2	0		472		CLAY; brown; soft; moist; low plasticity; w/some sand & gravel (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer. @4' PP=4.5 tsf		
TW	2	1.8	-	-	-	1.5	2		470				grading yellow-brown; stiff; w/some gypsum seams; trace cemented clay seams	
							4		468					
							6		466					
							8		464					
SPT	3	6	7	8	15	1.5	10		462					grading w/1/4" cemented clay nodules
							12		460					cemented clay nodules grades out
TW	4	2.0	-	-	-	2.0	14		458					
							16		456					
							18		454					grading w/some cementation
SPT	5	7	11	12	23	1.5	20		452					
							22		450					
							24		448					
							26		446					
							28		444					grading mottled gray
TW	6	2.0	-	-	-	1.4								



## BORING LOG

SHEET 2 OF 2

CLIENT										PROJECT										PROJECT NO.																			
Sandy Creek Energy Associates										Sandy Creek Energy Station										149060																			
PROJECT LOCATION					COORDINATES					GROUND ELEVATION (DATUM)					TOTAL DEPTH																								
Reisel, Texas					N 4026.0'					E 8990.0'					473.2 ft (MSL)					44.8 (feet)																			
SURFACE CONDITIONS										COORDINATE SYSTEM					DATE START					DATE FINISHED																			
Side of hill; weed cover										PLANT					08/08/2007					08/08/2007																			
SOIL SAMPLING										LOGGED BY					CHECKED BY					APPROVED BY																			
										JJ Deeken					V Bhadriraju					BL Christensen																			
SAMPLE TYPE SAMPLE NUMBER SET 6 INCHES 2ND 6 INCHES 3RD 6 INCHES N VALUE SAMPLE RECOVERY										DEPTH (FEET) SAMPLE TYPE ELEVATION (FEET) GRAPHIC LOG					CLASSIFICATION OF MATERIALS										REMARKS														
ROCK CORING CORE SIZE RUN NUMBER RUN LENGTH RUN RECOVERY RQD RECOVERY PERCENT RECOVERY RQD																																							
SPT										7					10					13					14					27					1.5				
TW										8					1.8					-					-					-					1.8				

CLIENT										PROJECT										PROJECT NO.										
Sandy Creek Energy Associates										Sandy Creek Energy Station										149060										
PROJECT LOCATION					COORDINATES										GROUND ELEVATION (DATUM)					TOTAL DEPTH										
Reisel, Texas					N 3335.0'										E 9470.0'					49.5 (feet)										
SURFACE CONDITIONS										COORDINATE SYSTEM					DATE START					DATE FINISHED										
High weeds; boring offset 150' east										Plant					8/3/07					8/3/07										
SOIL SAMPLING										LOGGED BY					CHECKED BY					APPROVED BY										
										JJ Deeken					V Bhadriraju					BL Christensen										
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS										REMARKS									
CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)																					
SPT	1	3	3	3	6	0.9	0		472		CLAY: brown; firm; moist; high plasticity (6" Topsoil)  @ 3.0' grading gray-brown; very stiff; w/some sand & 1" subrounded gravel sand grades out   																			

CLIENT										PROJECT										PROJECT NO.																								
Sandy Creek Energy Associates										Sandy Creek Energy Station										149060																								
PROJECT LOCATION										COORDINATES										GROUND ELEVATION (DATUM)										TOTAL DEPTH														
Reisel, Texas										N 3335.0'										E 9470.0'										49.5 (feet)														
SURFACE CONDITIONS															COORDINATE SYSTEM										DATE START										DATE FINISHED									
High weeds; boring offset 150' east															Plant										8/3/07										8/3/07									
SOIL SAMPLING										LOGGED BY										CHECKED BY										APPROVED BY														
										JJ Deeken										V Bhadriraju										BL Christensen														
SAMPLE TYPE SAMPLE NUMBER SET 6 INCHES 2ND 6 INCHES 3RD 6 INCHES N VALUE SAMPLE RECOVERY										DEPTH (FEET) SAMPLE TYPE ELEVATION (FEET) GRAPHIC LOG										CLASSIFICATION OF MATERIALS										REMARKS														
ROCK CORING																																												
CORE SIZE RUN NUMBER RUN LENGTH RUN RECOVERY RQD RECOVERY PERCENT RECOVERY RQD																																												
TW 10 2.0 - - - 2.0										30 32 34 36 38 40 42 44 46 48 50 52 54 56 58										442 440 438 436 434 432 430 428 426 424 422 420 418 416 414																								
SPT 11 9 11 14 25 1.5										38 40 42 44 46 48 50 52 54 56 58										436 434 432 430 428 426 424 422 420 418 416 414																								
TW 12 2.0 - - - 2.0										44 46 48 50 52 54 56 58										430 428 426 424 422 420 418 416 414																								
SPT 13 15 18 23 41 1.5										48 50 52 54 56 58										426 424 422 420 418 416 414																								
										50 52 54 56 58										424 422 420 418 416 414										Bottom of boring at 49.5'. Water level not recorded. Boring backfilled w/ bentonite chips.														

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-103

SHEET 1 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																						
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 4056.0' E 10249.0'					<b>GROUND ELEVATION (DATUM)</b> 493.2 ft (MSL)					<b>TOTAL DEPTH</b> 49.5 (feet)																	
<b>SURFACE CONDITIONS</b> Rolling hills, tall weeds										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 8/1/07					<b>DATE FINISHED</b> 8/1/07												
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> JJ Deeken					<b>CHECKED BY</b> JJ Deeken					<b>APPROVED BY</b> BL Christensen												
<table border="1"> <tr> <th>SAMPLE TYPE</th> <th>SAMPLE NUMBER</th> <th>SET 6 INCHES</th> <th>2ND 6 INCHES</th> <th>3RD 6 INCHES</th> <th>N VALUE</th> <th>SAMPLE RECOVERY</th> </tr> </table>										SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	<table border="1"> <tr> <th>DEPTH (FEET)</th> <th>SAMPLE TYPE</th> <th>ELEVATION (FEET)</th> <th>GRAPHIC LOG</th> <th>CLASSIFICATION OF MATERIALS</th> <th>REMARKS</th> </tr> </table>										DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY																										
DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS																											
<table border="1"> <tr> <th>CORE SIZE</th> <th>RUN NUMBER</th> <th>RUN LENGTH</th> <th>RUN RECOVERY</th> <th>RQD RECOVERY</th> <th>PERCENT RECOVERY</th> <th>RQD</th> </tr> </table>										CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD																
CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD																										
<table border="1"> <tr> <th>DEPTH (FEET)</th> <th>SAMPLE TYPE</th> <th>ELEVATION (FEET)</th> <th>GRAPHIC LOG</th> <th>CLASSIFICATION OF MATERIALS</th> <th>REMARKS</th> </tr> </table>										DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS																	
DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS																											
SPT	1	2	2	1	3	0.8	0		492		CLAY: brown; soft; moist; high plasticity (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer.																				
TW	2	2.0	-	-	-	2.0	2		490		grading stiff	@2' PP=2.0 tsf																				
SPT	3	2	5	8	13	1.5	4		488		grading yellow-brown & gray seams	@4' PP=2.5 tsf																				
TW	4	2.0	-	-	-	1.6	6		486			@6' PP=4.5 tsf																				
SPT	5	5	8	11	19	1.5	8		484		grading very stiff	Reacts w/HCL																				
							10		482																							
							12		480			PP=4.5 tsf																				
TW	6	2.0	-	-	-	2.0	14		478																							
							16		476																							
							18		474																							
SPT	7	6	8	10	18	1.5	20		472																							
							22		470																							
TW	8	2.0	-	-	-	2.0	24		468																							
							26		466																							
							28		464		grading w/quartz seams																					
SPT	9	7	11	12	23	1.5																										

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-103

SHEET 2 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates				<b>PROJECT</b> Sandy Creek Energy Station				<b>PROJECT NO.</b> 149060									
<b>PROJECT LOCATION</b> Reisel, Texas				<b>COORDINATES</b> N 4056.0' E 10249.0'				<b>GROUND ELEVATION (DATUM)</b> 493.2 ft (MSL)				<b>TOTAL DEPTH</b> 49.5 (feet)					
<b>SURFACE CONDITIONS</b> Rolling hills, tall weeds								<b>COORDINATE SYSTEM</b> Plant				<b>DATE START</b> 8/1/07		<b>DATE FINISHED</b> 8/1/07			
<b>SOIL SAMPLING</b>								<b>LOGGED BY</b> JJ Deeken				<b>CHECKED BY</b> JJ Deeken				<b>APPROVED BY</b> BL Christensen	
<b>SAMPLE TYPE</b>	<b>SAMPLE NUMBER</b>	<b>SET 6 INCHES</b>	<b>2ND 6 INCHES</b>	<b>3RD 6 INCHES</b>	<b>N VALUE</b>	<b>SAMPLE RECOVERY</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>				<b>REMARKS</b>		
<b>CORE SIZE</b>	<b>RUN NUMBER</b>	<b>RUN LENGTH</b>	<b>RUN RECOVERY</b>	<b>RQD RECOVERY</b>	<b>PERCENT RECOVERY</b>	<b>RQD</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>				<b>REMARKS</b>		
TW	10	2.0	-	-	-	2.0	30		462		grading iron oxide staining				PP=4.5 tsf		
							32		460		@ 36.0' quartz seams grades out						
							34		458								
							36		456								
SPT	11	7	12	15	27	1.5	38		454								
							40		452								
							42		450		grading blue-gray				PP=4.5 tsf		
							44		448								
							46		446								
							48		444		grading hard						
SPT	13	11	17	20	37	1.5	50		442								
							52		440								
							54		438								
							56		436								
							58		434								
															Bottom of boring at 49.5'. Water level not recorded. Boring backfilled with bentonite chips.		

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-104

SHEET 1 OF 3

<b>CLIENT</b> Sandy Creek Energy Associates				<b>PROJECT</b> Sandy Creek Energy Station				<b>PROJECT NO.</b> 149060					
<b>PROJECT LOCATION</b> Reisel, Texas				<b>COORDINATES</b> N 3609.0' E 9869.0'				<b>GROUND ELEVATION (DATUM)</b> 490.3 ft (MSL)					
<b>SURFACE CONDITIONS</b> Top of hill, tall weeds				<b>COORDINATE SYSTEM</b> Plant				<b>DATE START</b> 8/1/07		<b>DATE FINISHED</b> 8/1/07			
<b>SOIL SAMPLING</b>								<b>LOGGED BY</b> JJ Deeken		<b>CHECKED BY</b> V Bhadriraju		<b>APPROVED BY</b> BL Christensen	
<b>SAMPLE TYPE</b>	<b>SAMPLE NUMBER</b>	<b>SET 6 INCHES</b>	<b>2ND 6 INCHES</b>	<b>3RD 6 INCHES</b>	<b>N VALUE</b>	<b>SAMPLE RECOVERY</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>	<b>REMARKS</b>	
<b>CORE SIZE</b>	<b>RUN NUMBER</b>	<b>RUN LENGTH</b>	<b>RUN RECOVERY</b>	<b>RQD RECOVERY</b>	<b>PERCENT RECOVERY</b>	<b>RQD</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>	<b>REMARKS</b>	
SPT	1	2	2	2	4	1.2	0		490		CLAY: brown; soft; moist; high plasticity (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer.	
TW	2	2.0	-	-	-	1.7	2		488		grading stiff	@2' PP=1.75 tsf	
SPT	3	2	4	6	10	1.5	4		486		grading yellow-brown & occasional gray clay seams	@4' PP=2.0 tsf	
TW	4	2.0	-	-	-	2.0	6		484				
SPT	5	5	6	9	15	1.5	8		482			PP>4.5 tsf	
							10		480				
							12		478				
TW	6	2.0	-	-	-	2.0	14		476				
							16		474				
							18		472				
SPT	7	6	6	9	15	1.5	20		470				
							22		468				
TW	8	2.0	-	-	-	2.0	24		466		grading fissile		
							26		464				
							28		462		grading very stiff; w/1/4" quartz seams		
SPT	9	7	10	12	22	1.5							

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-104

SHEET 2 OF 3

CLIENT Sandy Creek Energy Associates										PROJECT Sandy Creek Energy Station										PROJECT NO. 149060																																									
PROJECT LOCATION Reisel, Texas										COORDINATES N 3609.0' E 9869.0'										GROUND ELEVATION (DATUM) 490.3 ft (MSL)										TOTAL DEPTH 73.0 (feet)																															
SURFACE CONDITIONS Top of hill, tall weeds															COORDINATE SYSTEM Plant										DATE START 8/1/07										DATE FINISHED 8/1/07																										
SOIL SAMPLING															LOGGED BY JJ Deeken										CHECKED BY V Bhadriraju										APPROVED BY BL Christensen																										
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
TW		10		2.0		-		-		-		2.0		30		-		460		-		grading w/some 1/8" quartz grains																				PP>4.5 tsf																			
SPT		11		7		10		12		22		1.5		32		-		458		-		grading iron oxide staining																																							
TW		12		2.0		-		-		-		2.0		34		-		456		-																																									
SPT		13		8		9		12		21		1.5		36		-		454		-																																									
TW		14		2.0		-		-		-		2.0		38		-		452		-																																									
SPT		15		10		14		19		33		1.5		40		-		450		-																																									
														42		-		448		-																																									
														44		-		446		-																																									
														46		-		444		-																																									
														48		-		442		-																																									
														50		-		440		-																																									
														52		-		438		-																																									
														54		-		436		-																																									
														56		-		434		-																																									
														58		-		432		-																																									

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-104

SHEET 3 OF 3

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																							
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 3609.0' E 9869.0'					<b>GROUND ELEVATION (DATUM)</b> 490.3 ft (MSL)					<b>TOTAL DEPTH</b> 73.0 (feet)																		
<b>SURFACE CONDITIONS</b> Top of hill, tall weeds										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 8/1/07					<b>DATE FINISHED</b> 8/1/07													
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> JJ Deeken					<b>CHECKED BY</b> V Bhadriraju					<b>APPROVED BY</b> BL Christensen													
<b>SAMPLE TYPE</b>		<b>SAMPLE NUMBER</b>		<b>SET 6 INCHES</b>		<b>2ND 6 INCHES</b>		<b>3RD 6 INCHES</b>		<b>N VALUE</b>		<b>SAMPLE RECOVERY</b>		<b>DEPTH (FEET)</b>		<b>SAMPLE TYPE</b>		<b>ELEVATION (FEET)</b>		<b>GRAPHIC LOG</b>		<b>CLASSIFICATION OF MATERIALS</b>										<b>REMARKS</b>	
<b>CORE SIZE</b>		<b>RUN NUMBER</b>		<b>RUN LENGTH</b>		<b>RUN RECOVERY</b>		<b>RQD RECOVERY</b>		<b>PERCENT RECOVERY</b>		<b>RQD</b>		<b>DEPTH (FEET)</b>		<b>SAMPLE TYPE</b>		<b>ELEVATION (FEET)</b>		<b>GRAPHIC LOG</b>		<b>CLASSIFICATION OF MATERIALS</b>										<b>REMARKS</b>	
TW		16		2.0		-		-		-		2.0		60		-		430				grading blue-gray & yellow-brown seams; quartz seams grades out										PP>4.5 tsf	
SPT		17		14		16		20		36		1.5		62		-		428															
														64		-		426															
														66		-		424															
														68		-		422															
														70		-		420															
														72		-		418															
														74		-		416															
														76		-		414															
														78		-		412															
														80		-		410		Bottom of boring at 73.0'. Water level not recorded. Boring backfilled w/ bentonite chips.													
														82		-		408															
														84		-		406															
														86		-		404															
														88		-		402															

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-105

SHEET 1 OF 2

CLIENT Sandy Creek Energy Associates					PROJECT Sandy Creek Energy Station					PROJECT NO. 149060																					
PROJECT LOCATION Reisel, Texas					COORDINATES N 3690.0' E 10524.0'					GROUND ELEVATION (DATUM) 464.0 ft (MSL)					TOTAL DEPTH 49.5 (feet)																
SURFACE CONDITIONS Side hill, tall weeds										COORDINATE SYSTEM Plant					DATE START 8/1/07					DATE FINISHED 8/1/07											
SOIL SAMPLING										LOGGED BY JJ Deeken					CHECKED BY V Bhadriraju					APPROVED BY BL Christensen											
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS					REMARKS				
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS					REMARKS				
SPT		1		2		2		3		5		0.8		0		CLAY		464		CLAY: brown; firm; moist; high plasticity (6" Topsoil)		Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer. @2' PP=2.0 tsf @3.5' PP=2.0 tsf @6' PP=2.8 tsf									
TW		2		2.0		-		-		-		1.5		2		CLAY		462		grading stiff											
SPT		3		3		3		4		7		1.5		4		CLAY		460		grading firm											
TW		4		2.0		-		-		-		1.7		6		CLAY		458		grading yellow-brown & gray seams; very stiff											
TW		5		2.0		-		-		-		2.0		8		CLAY		456		grading fissile											
SPT		6		6		8		10		18		1.5		14		CLAY		454		grading fissile											
SPT		7		7		7		7		7		1.5		16		CLAY		452		grading fissile											
SPT		8		8		8		8		18		1.5		18		CLAY		450		grading fissile											
TW		7		2.0		-		-		-		1.8		20		CLAY		448		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		22		CLAY		446		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		24		CLAY		444		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		26		CLAY		442		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		28		CLAY		440		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		30		CLAY		438		grading w/occasional cemented quartz seams											
SPT		8		12		15		24		39		1.5		32		CLAY		436		grading blue-gray; hard; gray seams grades out											
SPT		8		12		15		24		39		1.5		34		CLAY		436		grading blue-gray; hard; gray seams grades out											

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-105

SHEET 2 OF 2

CLIENT Sandy Creek Energy Associates										PROJECT Sandy Creek Energy Station										PROJECT NO. 149060																																									
PROJECT LOCATION Reisel, Texas										COORDINATES N 3690.0' E 10524.0'										GROUND ELEVATION (DATUM) 464.0 ft (MSL)										TOTAL DEPTH 49.5 (feet)																															
SURFACE CONDITIONS Side hill, tall weeds															COORDINATE SYSTEM Plant										DATE START 8/1/07										DATE FINISHED 8/1/07																										
SOIL SAMPLING															LOGGED BY JJ Deeken										CHECKED BY V Bhadriraju										APPROVED BY BL Christensen																										
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
TW		9		0.6		-		-		-		0.6		30		-		434		-		CLAYSHALE; gray; hard; moist; high plasticity; fissile																				TW refusal																			
SPT		10		21		32		42		74		1.5		38		-		426		-		grading w/frequent cemetations																																							
TW		11		0.9		-		-		-		0.9		42		-		422		-																																									
SPT		12		32		42		46		88		1.5		44		-		420		-																						Thick walled tube driven 100 blows																			
														46		-		418		-																																									
														48		-		416		-																																									
														50		-		414		-																						Bottom of boring at 49.5'. Water level not recorded. Boring backfilled w/ bentonite chips.																			
														52		-		412		-																																									
														54		-		410		-																																									
														56		-		408		-																																									
														58		-		406		-																																									

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-106


SHEET 1 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates				<b>PROJECT</b> Sandy Creek Energy Station				<b>PROJECT NO.</b> 149060					
<b>PROJECT LOCATION</b> Reisel, Texas				<b>COORDINATES</b> N 2448.0' E 9621.0'				<b>GROUND ELEVATION (DATUM)</b> TOTAL DEPTH 44.2 (feet)					
<b>SURFACE CONDITIONS</b> Valley, tall weeds				<b>COORDINATE SYSTEM</b> Plant				<b>DATE START</b> 8/3/07		<b>DATE FINISHED</b> 8/3/07			
<b>SOIL SAMPLING</b>								<b>LOGGED BY</b> JJ Deeken		<b>CHECKED BY</b> V Bhadriraju		<b>APPROVED BY</b> BL Christensen	
<b>SAMPLE TYPE</b>	<b>SAMPLE NUMBER</b>	<b>SET 6 INCHES</b>	<b>2ND 6 INCHES</b>	<b>3RD 6 INCHES</b>	<b>N VALUE</b>	<b>SAMPLE RECOVERY</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>	<b>REMARKS</b>	
<b>CORE SIZE</b>	<b>RUN NUMBER</b>	<b>RUN LENGTH</b>	<b>RUN RECOVERY</b>	<b>RQD RECOVERY</b>	<b>PERCENT RECOVERY</b>	<b>RQD</b>	<b>DEPTH (FEET)</b>	<b>SAMPLE TYPE</b>	<b>ELEVATION (FEET)</b>	<b>GRAPHIC LOG</b>	<b>CLASSIFICATION OF MATERIALS</b>	<b>REMARKS</b>	
SPT	1	2	2	2	4	1.0	0		440		CLAY; brown; soft; moist; high plasticity; w/trace coarse sand & 1" gravel (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer. @4' PP=2.2 tsf Gravel in SPT3	
TW	2	2.0	-	-	-	1.1	2		438		grading stiff		
SPT	3	2	5	5	10	0.1	4		436				
TW	4	2.0	-	-	-	2.0	6		434		grading dark gray; w/some gravel		
SPT	5	4	6	10	16	0.1	8		432		grading very stiff	Gravel in SPT5	
							10		430				
							12		428				
TW	6	2.0	-	-	-	1.8	14		426			PP>4.5 tsf	
							16		424				
SPT	7	14	26	33	59	1.5	18		422		grading hard; w/frequent light gray partings; occasional cemented clay seams; gravel grades out		
							20		420				
							22		418				
TW	8	0.8	-	-	-	0.8	24		416		CLAYSHALE; gray; hard; moist; high plasticity; fissile		
							26		414				
							28		412				
SPT	9	20	25	32	57	1.5							



## BORING LOG

SHEET 2 OF 2

CLIENT Sandy Creek Energy Associates										PROJECT Sandy Creek Energy Station										PROJECT NO. 149060																			
PROJECT LOCATION Reisel, Texas										COORDINATES N 2448.0' E 9621.0'										GROUND ELEVATION (DATUM) 44.2 (feet)																			
SURFACE CONDITIONS Valley, tall weeds										COORDINATE SYSTEM Plant										DATE START 8/3/07										DATE FINISHED 8/3/07									
SOIL SAMPLING										LOGGED BY JJ Deeken										CHECKED BY V Bhadriraju										APPROVED BY BL Christensen									
SAMPLE TYPE SAMPLE NUMBER SET 6 INCHES 2ND 6 INCHES 3RD 6 INCHES N VALUE SAMPLE RECOVERY										DEPTH (FEET) SAMPLE TYPE ELEVATION (FEET) GRAPHIC LOG										CLASSIFICATION OF MATERIALS										REMARKS									
ROCK CORING CORE SIZE RUN NUMBER RUN LENGTH RUN RECOVERY RQD RECOVERY PERCENT RECOVERY RQD																																							
TW 10 1.0 - - - 1.0										30 410 32 408 34 406 36 404 38 402 40 400 42 398 44 396 46 394 48 392 50 390 52 388 54 386 56 384 58 382																				Thick walled tube pushed 8", then driven 2".									
SPT 11 26 35 43 78 1.5																																							
TW 12 1.2 - - - 1.2																														Thick walled tube pushed 4", then driven 10".									
																														Bottom of boring at 44.2' Water level not recorded. Boring backfilled w/ bentonite chips.									

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-107

SHEET 1 OF 1

CLIENT Sandy Creek Energy Associates					PROJECT Sandy Creek Energy Station					PROJECT NO. 149060				
PROJECT LOCATION Reisel, Texas					COORDINATES N 3101.0' E 10663.0'					GROUND ELEVATION (DATUM) TOTAL DEPTH 29.5 (feet)				
SURFACE CONDITIONS Natural drainage path, brush cover					COORDINATE SYSTEM Plant					DATE START 08/09/2007				
DATE FINISHED 08/09/2007					LOGGED BY JJ Deeken					CHECKED BY V Bhadriraju				
APPROVED BY BL Christensen														

SOIL SAMPLING								DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY							
ROCK CORING													
CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD							
TW	1	2.0	-	-	-	1.2							
SPT	2	4	6	7	13	1.5							
TW	3	1.2	-	-	-	1.2							
SPT	4	16	20	28	48	1.5							
SPT	5	19	25	36	61	1.5							

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-108

SHEET 1 OF 2

CLIENT Sandy Creek Energy Associates					PROJECT Sandy Creek Energy Station					PROJECT NO. 149060																																																				
PROJECT LOCATION Reisel, Texas					COORDINATES N 2345.0' E 10497.0'					GROUND ELEVATION (DATUM) 443.7 ft (MSL)					TOTAL DEPTH 39.0 (feet)																																															
SURFACE CONDITIONS Hill; weeds										COORDINATE SYSTEM Plant					DATE START 08/02/2007					DATE FINISHED 08/02/2007																																										
SOIL SAMPLING										LOGGED BY JJ Deeken					CHECKED BY V Bhadriraju					APPROVED BY BL Christensen																																										
<table border="1"> <tr> <th>SAMPLE TYPE</th> <th>SAMPLE NUMBER</th> <th>SET 6 INCHES</th> <th>2ND 6 INCHES</th> <th>3RD 6 INCHES</th> <th>N VALUE</th> <th>SAMPLE RECOVERY</th> </tr> </table>										SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	<table border="1"> <tr> <th>DEPTH (FEET)</th> <th>SAMPLE TYPE</th> <th>ELEVATION (FEET)</th> </tr> </table>										DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	<table border="1"> <tr> <th>GRAPHIC LOG</th> </tr> </table>										GRAPHIC LOG	<table border="1"> <tr> <th>CLASSIFICATION OF MATERIALS</th> </tr> </table>										CLASSIFICATION OF MATERIALS	<table border="1"> <tr> <th>REMARKS</th> </tr> </table>										REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY																																																								
DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)																																																												
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CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD																																																								
DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)																																																												
GRAPHIC LOG																																																														
CLASSIFICATION OF MATERIALS																																																														
REMARKS																																																														
SPT	1	3	3	3	6	1.2	0		442		CLAY; brown; firm; moist; high plasticity; w/some sand & 1" gravel (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer. TW-2 disturbed @2' PP=3.2 tsf @4' PP=3.2 tsf																																																		
TW	2	2.0	-	-	-	2.0	2		440		grading yellow-brown																																																			
SPT	3	3	6	7	13	1.5	4		438		grading stiff																																																			
TW	4	2.0	-	-	-	2.0	6		436			TW4 PP=4.0 tsf																																																		
SPT	5	7	9	10	19	1.5	8		434		grading very stiff; w/some quartz sand																																																			
							10		432																																																					
TW	6	2.0	-	-	-	2.0	12		430		grading mottled dark gray	PP>4.5 tsf																																																		
							14		428																																																					
							16		426																																																					
SPT	7	16	26	38	64	1.5	18		424		CLAYSHALE; gray; hard; moist; high plasticity; fissile; w/occasional cementation @ 19.5' grading dark gray	PP>4.5 tsf																																																		
							20		422																																																					
TW	8	0.7	-	-	-	0.7	22		420			PP>4.5 tsf																																																		
							24		418																																																					
							26		416																																																					
SPT	9	20	33	46	79	1.5	28		414			PP>4.5 tsf																																																		

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-108

SHEET 2 OF 2

CLIENT Sandy Creek Energy Associates										PROJECT Sandy Creek Energy Station										PROJECT NO. 149060																																									
PROJECT LOCATION Reisel, Texas										COORDINATES N 2345.0' E 10497.0'										GROUND ELEVATION (DATUM) 443.7 ft (MSL)										TOTAL DEPTH 39.0 (feet)																															
SURFACE CONDITIONS Hill; weeds															COORDINATE SYSTEM Plant										DATE START 08/02/2007										DATE FINISHED 08/02/2007																										
SOIL SAMPLING															LOGGED BY JJ Deeken										CHECKED BY V Bhadriraju										APPROVED BY BL Christensen																										
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
TW		10		0.8		-		-		-		0.8		30				412																																											
												32				410																																													
												34				408																																													
												36				406																																													
TW		11		1.0		-		-		-		1.0		38				404																																											
														40				402																																											
														42				400																																											
														44				398																																											
														46				396																																											
														48				394																																											
														50				392																																											
														52				390																																											
														54				388																																											
														56				386																																											
														58				384																																											

Bottom of boring  
@ 39.0'. Water  
level not  
recorded. Boring  
backfilled w/  
bentonite chips.

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-109

SHEET 1 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																																																				
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 2339.0' E 10190.0'					<b>GROUND ELEVATION (DATUM)</b> 441.6 ft (MSL)					<b>TOTAL DEPTH</b> 49.5 (feet)																																															
<b>SURFACE CONDITIONS</b> Valley; tall weeds										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 08/02/2007					<b>DATE FINISHED</b> 08/02/2007																																										
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> JJ Deeken					<b>CHECKED BY</b> V Bhadriraju					<b>APPROVED BY</b> BL Christensen																																										
<table border="1"> <tr> <th>SAMPLE TYPE</th> <th>SAMPLE NUMBER</th> <th>SET 6 INCHES</th> <th>2ND 6 INCHES</th> <th>3RD 6 INCHES</th> <th>N VALUE</th> <th>SAMPLE RECOVERY</th> </tr> </table>										SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	<table border="1"> <tr> <th>DEPTH (FEET)</th> <th>SAMPLE TYPE</th> <th>ELEVATION (FEET)</th> </tr> </table>										DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	<table border="1"> <tr> <th>GRAPHIC LOG</th> </tr> </table>										GRAPHIC LOG	<table border="1"> <tr> <th>CLASSIFICATION OF MATERIALS</th> </tr> </table>										CLASSIFICATION OF MATERIALS	<table border="1"> <tr> <th>REMARKS</th> </tr> </table>										REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY																																																								
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GRAPHIC LOG																																																														
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CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD																																																								
DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)																																																												
GRAPHIC LOG																																																														
CLASSIFICATION OF MATERIALS																																																														
REMARKS																																																														
SPT	1	3	2	2	4	1.1	0		440		CLAY; brown; soft; moist; high plasticity (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer.  PP=2.0 tsf																																																		
TW	2	2.0	-	-	-	1.0	2		438		grading yellow-brown																																																			
SPT	3	3	6	6	12	1.4	4		436		grading stiff																																																			
TW	4	2.0	-	-	-	2.0	6		434		grading very stiff																																																			
SPT	5	8	12	15	27	1.5	8		432		grading very stiff																																																			
TW	6	1.0	-	-	-	1.0	10		430		grading dark gray																																																			
SPT	7	17	27	37	64	1.5	12		428		grading dark gray																																																			
TW	8	0.5	-	-	-	0.5	14		426		grading dark gray																																																			
SPT	9	21	32	41	73	1.5	16		424		grading dark gray																																																			
TW	10	0.5	-	-	-	0.5	18		422		grading dark gray																																																			
SPT	11	21	32	41	73	1.5	20		420		grading dark gray																																																			
TW	12	0.5	-	-	-	0.5	22		418		grading dark gray																																																			
SPT	13	21	32	41	73	1.5	24		416		grading dark gray																																																			
TW	14	0.5	-	-	-	0.5	26		414		grading dark gray																																																			
SPT	15	21	32	41	73	1.5	28		412		grading dark gray																																																			
TW	16	0.5	-	-	-	0.5	30		410		grading dark gray																																																			
SPT	17	21	32	41	73	1.5	32		408		grading dark gray																																																			
TW	18	0.5	-	-	-	0.5	34		406		grading dark gray																																																			
SPT	19	21	32	41	73	1.5	36		404		grading dark gray																																																			
TW	20	0.5	-	-	-	0.5	38		402		grading dark gray																																																			
SPT	21	21	32	41	73	1.5	40		400		grading dark gray																																																			
TW	22	0.5	-	-	-	0.5	42		398		grading dark gray																																																			
SPT	23	21	32	41	73	1.5	44		396		grading dark gray																																																			
TW	24	0.5	-	-	-	0.5	46		394		grading dark gray																																																			
SPT	25	21	32	41	73	1.5	48		392		grading dark gray																																																			
TW	26	0.5	-	-	-	0.5	50		390		grading dark gray																																																			
SPT	27	21	32	41	73	1.5	52		388		grading dark gray																																																			
TW	28	0.5	-	-	-	0.5	54		386		grading dark gray																																																			
SPT	29	21	32	41	73	1.5	56		384		grading dark gray																																																			
TW	30	0.5	-	-	-	0.5	58		382		grading dark gray																																																			
SPT	31	21	32	41	73	1.5	60		380		grading dark gray																																																			
TW	32	0.5	-	-	-	0.5	62		378		grading dark gray																																																			
SPT	33	21	32	41	73	1.5	64		376		grading dark gray																																																			
TW	34	0.5	-	-	-	0.5	66		374		grading dark gray																																																			
SPT	35	21	32	41	73	1.5	68		372		grading dark gray																																																			
TW	36	0.5	-	-	-	0.5	70		370		grading dark gray																																																			
SPT	37	21	32	41	73	1.5	72		368		grading dark gray																																																			
TW	38	0.5	-	-	-	0.5	74		366		grading dark gray																																																			
SPT	39	21	32	41	73	1.5	76		364		grading dark gray																																																			
TW	40	0.5	-	-	-	0.5	78		362		grading dark gray																																																			
SPT	41	21	32	41	73	1.5	80		360		grading dark gray																																																			
TW	42	0.5	-	-	-	0.5	82		358		grading dark gray																																																			
SPT	43	21	32	41	73	1.5	84		356		grading dark gray																																																			
TW	44	0.5	-	-	-	0.5	86		354		grading dark gray																																																			
SPT	45	21	32	41	73	1.5	88		352		grading dark gray																																																			
TW	46	0.5	-	-	-	0.5	90		350		grading dark gray																																																			
SPT	47	21	32	41	73	1.5	92		348		grading dark gray																																																			
TW	48	0.5	-	-	-	0.5	94		346		grading dark gray																																																			
SPT	49	21	32	41	73	1.5	96		344		grading dark gray																																																			
TW	50	0.5	-	-	-	0.5	98		342		grading dark gray																																																			
SPT	51	21	32	41	73	1.5	100		340		grading dark gray																																																			
TW	52	0.5	-	-	-	0.5	102		338		grading dark gray																																																			
SPT	53	21	32	41	73	1.5	104		336		grading dark gray																																																			
TW	54	0.5	-	-	-	0.5	106		334		grading dark gray																																																			
SPT	55	21	32	41	73	1.5	108		332		grading dark gray																																																			
TW	56	0.5	-	-	-	0.5	110		330		grading dark gray																																																			
SPT	57	21	32	41	73	1.5	112		328		grading dark gray																																																			
TW	58	0.5	-	-	-	0.5	114		326		grading dark gray																																																			
SPT	59	21	32	41	73	1.5	116		324		grading dark gray																																																			
TW	60	0.5	-	-	-	0.5	118		322		grading dark gray																																																			
SPT	61	21	32	41	73	1.5	120		320		grading dark gray																																																			
TW	62	0.5	-	-	-	0.5	122		318		grading dark gray																																																			
SPT	63	21	32	41	73	1.5	124		316		grading dark gray																																																			
TW	64	0.5	-	-	-	0.5	126		314		grading dark gray																																																			
SPT	65	21	32	41	73	1.5	128		312		grading dark gray																																																			
TW	66	0.5	-	-	-	0.5	130		310		grading dark gray																																																			
SPT	67	21	32	41	73	1.5	132		308		grading dark gray																																																			
TW	68	0.5	-	-	-	0.5	134		306		grading dark gray																																																			
SPT	69	21	32	41	73	1.5	136		304		grading dark gray																																																			
TW	70	0.5	-	-	-	0.5	138		302		grading dark gray																																																			
SPT	71	21	32	41	73	1.5	140		300		grading dark gray																																																			
TW	72	0.5	-	-	-	0.5	142		298		grading dark gray																																																			
SPT	73	21	32	41	73	1.5	144		296		grading dark gray																																																			
TW	74	0.5	-	-	-	0.5	146		294		grading dark gray																																																			
SPT	75	21	32	41	73	1.5	148		292		grading dark gray																																																			
TW	76	0.5	-	-	-	0.5	150		290		grading dark gray																																																			
SPT	77	21	32	41	73	1.5	152		288		grading dark gray																																																			
TW	78	0.5	-	-	-	0.5	154		286		grading dark gray																																																			
SPT	79	21	32	41	73	1.5	156		284		grading dark gray																																																			
TW	80	0.5	-	-	-	0.5	158		282		grading dark gray																																																			
SPT	81	21	32	41	73	1.5	160		280		grading dark gray																																																			
TW	82	0.5	-	-	-	0.5	162		278		grading dark gray																																																			
SPT	83	21	32	41	73	1.5	164		276		grading dark gray																																																			
TW	84	0.5	-	-	-	0.5	166		274		grading dark gray																																																			
SPT	85	21	32	41	73	1.5	168		272		grading dark gray																																																			
TW	86	0.5	-	-	-	0.5	170		270		grading dark gray																																																			
SPT	87	21	32	41	73	1.5	172		268		grading dark gray																																																			
TW	88	0.5	-	-	-	0.5	174		266		grading dark gray																																																			
SPT	89	21	32	41	73	1.5	176		264		grading dark gray																																																			
TW	90	0.5	-	-	-	0.5	178		262		grading dark gray																																																			
SPT	91	21	32	41	73	1.5	180		260		grading dark gray																																																			
TW	92	0.5	-	-	-	0.5	182		258		grading dark gray																																																			
SPT	93	21	32	41	73	1.5	184		256		grading dark gray																																																			
TW	94	0.5	-	-	-	0.5	186		254		grading dark gray																																																			
SPT	95	21	32	41	73	1.5	188		252		grading dark gray																																																			
TW	96	0.5	-	-	-	0.5	190		250		grading dark gray																																																			
SPT	97	21	32	41	73	1.5	192		248		grading dark gray																																																			
TW	98	0.5	-	-	-	0.5	194		246		grading dark gray																																																			
SPT	99	21	32	41	73	1.5	196		244		grading dark gray																																																			
TW	100	0.5	-	-	-	0.5	198		242		grading dark gray																																																			
SPT	101	21	32	41	73	1.5	200		240		grading dark gray																																																			
TW	102	0.5	-	-	-	0.5	202		238		grading dark gray																																																			
SPT	103	21	32	41	73	1.5	204		236		grading dark gray																																																			
TW	104	0.5	-	-	-	0.5	206		234		grading dark gray																																																			
SPT	105	21	32	41	73	1.5	208		232		grading dark gray																																																			
TW	106	0.5	-	-	-	0.5	210		230		grading dark gray																																																			
SPT	107	21	32	41	73	1.5	212		228		grading dark gray																																																			
TW	108	0.5	-	-	-	0.5	214		226		grading dark gray																																																			
SPT	109	21	32	41	73	1.5	216		224		grading dark gray																																																			
TW	110	0.5	-	-	-	0.5	218		222		grading dark gray																																																			
SPT	111	21	32	41	73	1.5	220		220		grading dark gray																																																			
TW	112	0.5	-	-	-	0.5	222		218		grading dark gray																																																			
SPT	113	21	32	41	73	1.5	224		216		grading dark gray																																																			
TW	114	0.5	-	-	-	0.5	226		214		grading dark gray																																																			
SPT	115	21	32	41	73	1.5	228		212		grading dark gray																																																			

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-109

SHEET 2 OF 2

CLIENT Sandy Creek Energy Associates										PROJECT Sandy Creek Energy Station										PROJECT NO. 149060																																									
PROJECT LOCATION Reisel, Texas										COORDINATES N 2339.0' E 10190.0'										GROUND ELEVATION (DATUM) 441.6 ft (MSL)										TOTAL DEPTH 49.5 (feet)																															
SURFACE CONDITIONS Valley; tall weeds															COORDINATE SYSTEM Plant										DATE START 08/02/2007										DATE FINISHED 08/02/2007																										
SOIL SAMPLING															LOGGED BY JJ Deeken										CHECKED BY V Bhadriraju										APPROVED BY BL Christensen																										
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS																				REMARKS																			
TW		10		0.5		-		-		-		0.5		30		-		410		-		-																				Tube end crushed.																			
														32		-		408																																											
														34		-		406																																											
														36		-		404																																											
SPT		11		22		32		41		73		1.5		38		-		402		-																																									
														40		-		400																																											
														42		-		398																																											
														44		-		396																																											
														46		-		394																																											
SPT		13		27		39		46		85		1.5		48		-		392		-																																									
														50		-		390																																											
														52		-		388																																											
														54		-		386																																											
														56		-		384																																											
														58		-		382																																											

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-110

SHEET 1 OF 2

CLIENT Sandy Creek Energy Associates					PROJECT Sandy Creek Energy Station					PROJECT NO. 149060																					
PROJECT LOCATION Reisel, Texas					COORDINATES N 2551.0' E 10393.0'					GROUND ELEVATION (DATUM) 439.6 ft (MSL)					TOTAL DEPTH 39.5 (feet)																
SURFACE CONDITIONS Valley/tall weeds										COORDINATE SYSTEM Plant					DATE START 8/3/07					DATE FINISHED 8/4/07											
SOIL SAMPLING										LOGGED BY DE Campbell					CHECKED BY V Bhadriraju					APPROVED BY BL Christensen											
SAMPLE TYPE		SAMPLE NUMBER		SET 6 INCHES		2ND 6 INCHES		3RD 6 INCHES		N VALUE		SAMPLE RECOVERY		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS					REMARKS				
CORE SIZE		RUN NUMBER		RUN LENGTH		RUN RECOVERY		RQD RECOVERY		PERCENT RECOVERY		RQD		DEPTH (FEET)		SAMPLE TYPE		ELEVATION (FEET)		GRAPHIC LOG		CLASSIFICATION OF MATERIALS					REMARKS				
SPT		1		WOH		2		2		4		1.2		0		CLAY		438		CLAY: brown; soft; moist; high plasticity; w/trace subrounded red fine gravel (6" Topsoil)		Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer. @2' PP=1.5 tsf  @ 10.0' grading mottled gray  PP=2.25 tsf									
TW		2		2.0		-		-		-		1.1		2		CLAY		436		grading stiff											
SPT		3		3		4		7		11		1.0		4		CLAY		434		grading yellow-brown; firm											
SPT		4		3		3		3		6		1.3		6		CLAY		432													
TW		5		2.0		-		-		-		2.0		8		CLAY		430													
														10		CLAY		428													
SPT		6		3		5		8		13		1.3		14		CLAY		426		grading w/trace cementation; gravel grades out											
														16		CLAY		424													
														18		CLAY		422													
TW		7		1.2		-		-		-		1.2		20		CLAY		420		grading gray											
														22		CLAY		418													
SPT		8		18		26		36		62		1.5		24		CLAY		416		grading hard; w/occasional cemented clay seams											
														26		CLAY		414													
														28		CLAY		412													
																CLAY		410													

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-110

SHEET 2 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																							
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 2551.0' E 10393.0'					<b>GROUND ELEVATION (DATUM)</b> 439.6 ft (MSL)					<b>TOTAL DEPTH</b> 39.5 (feet)																		
<b>SURFACE CONDITIONS</b> Valley/tall weeds										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 8/3/07					<b>DATE FINISHED</b> 8/4/07													
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> DE Campbell					<b>CHECKED BY</b> V Bhadriraju					<b>APPROVED BY</b> BL Christensen													
<b>SAMPLE TYPE</b>		<b>SAMPLE NUMBER</b>		<b>SET 6 INCHES</b>		<b>2ND 6 INCHES</b>		<b>3RD 6 INCHES</b>		<b>N VALUE</b>		<b>SAMPLE RECOVERY</b>		<b>DEPTH (FEET)</b>		<b>SAMPLE TYPE</b>		<b>ELEVATION (FEET)</b>		<b>GRAPHIC LOG</b>		<b>CLASSIFICATION OF MATERIALS</b>										<b>REMARKS</b>	
<b>CORE SIZE</b>		<b>RUN NUMBER</b>		<b>RUN LENGTH</b>		<b>RUN RECOVERY</b>		<b>RQD RECOVERY</b>		<b>PERCENT RECOVERY</b>		<b>RQD</b>		<b>DEPTH (FEET)</b>		<b>SAMPLE TYPE</b>		<b>ELEVATION (FEET)</b>		<b>GRAPHIC LOG</b>		<b>CLASSIFICATION OF MATERIALS</b>										<b>REMARKS</b>	
TW		9		0.8		-		-		-		0.8		30				408															
														32				406				CLAYSHALE: gray; hard; moist; high plasticity; fissile; w/trace cementation										Tube end crushed.	
														34				404															
														36				402															
														38				400															
SPT		10		22		34		43		76		1.5		40				398															
														42				396															
														44				394															
														46				392															
														48				390															
														50				388															
														52				386															
														54				384															
														56				382															
														58				380															

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-111

SHEET 1 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																																																				
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 2739.0' E 10465.0'					<b>GROUND ELEVATION (DATUM)</b> 446.0 ft (MSL)					<b>TOTAL DEPTH</b> 49.5 (feet)																																															
<b>SURFACE CONDITIONS</b> tall weeds in valley, heavy rain										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 08/02/2007					<b>DATE FINISHED</b> 08/02/2007																																										
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> JJ Deeken					<b>CHECKED BY</b> V Bhadriraju					<b>APPROVED BY</b> BL Christensen																																										
<table border="1"> <tr> <th>SAMPLE TYPE</th> <th>SAMPLE NUMBER</th> <th>SET 6 INCHES</th> <th>2ND 6 INCHES</th> <th>3RD 6 INCHES</th> <th>N VALUE</th> <th>SAMPLE RECOVERY</th> </tr> </table>										SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	<table border="1"> <tr> <th>DEPTH (FEET)</th> <th>SAMPLE TYPE</th> <th>ELEVATION (FEET)</th> </tr> </table>										DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	<table border="1"> <tr> <th>GRAPHIC LOG</th> </tr> </table>										GRAPHIC LOG	<table border="1"> <tr> <th>CLASSIFICATION OF MATERIALS</th> </tr> </table>										CLASSIFICATION OF MATERIALS	<table border="1"> <tr> <th>REMARKS</th> </tr> </table>										REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY																																																								
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REMARKS																																																														
SPT	1	2	2	3	5	1.2	0		446			CLAY; brown; firm; moist; high plasticity (6" Topsoil)	Boring advanced w/rotary wash using 3-7/8" step bit & bentonite mud as drilling fluid. SPT performed w/ autohammer.																																																	
TW	2	2.0	-	-	-	1.5	2		444																																																					
SPT	3	2	4	5	9	1.4	4		442			grading stiff																																																		
TW	4	2.0	-	-	-	1.8	6		440			grading yellow; w/trace sand	@6' PP=1.5 tsf																																																	
SPT	5	2	4	7	11	1.5	8		438			@ 9.0' grading yellow-brown	@8' PP=3.5 tsf																																																	
TW	6	2.0	-	-	-	2.0	10		436																																																					
							12		434																																																					
TW	6	2.0	-	-	-	2.0	14		432				PP>4.5 tsf																																																	
							16		430																																																					
SPT	7	10	15	19	34	1.5	18		428			grading hard; w/some sand @ 18.5' grading w/1" gravel	PP>4.5 tsf																																																	
							20		426			@ 19.5' grading gray-brown																																																		
TW	8	0.8	-	-	-	0.8	22		424																																																					
							24		422			grading w/occasional quartz seams																																																		
							26		420																																																					
SPT	9	20	27	38	65	1.5	28		418			CLAYSHALE; gray; hard; moist; high plasticity; fissile; w/trace cementation																																																		

**BLACK & VEATCH****BORING LOG**

BORING NO. BV-111

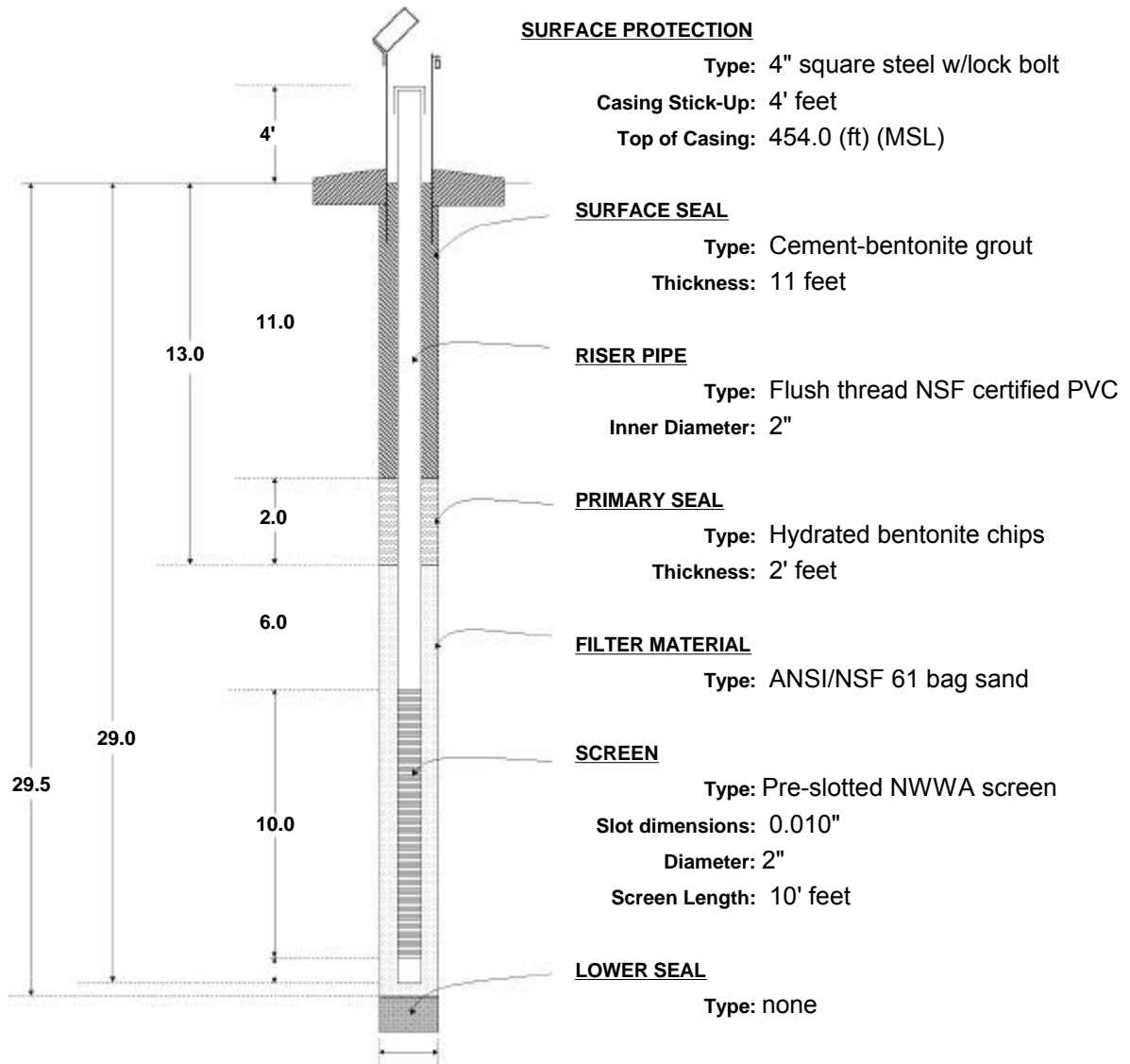
SHEET 2 OF 2

<b>CLIENT</b> Sandy Creek Energy Associates					<b>PROJECT</b> Sandy Creek Energy Station					<b>PROJECT NO.</b> 149060																																																					
<b>PROJECT LOCATION</b> Reisel, Texas					<b>COORDINATES</b> N 2739.0' E 10465.0'					<b>GROUND ELEVATION (DATUM)</b> 446.0 ft (MSL)					<b>TOTAL DEPTH</b> 49.5 (feet)																																																
<b>SURFACE CONDITIONS</b> tall weeds in valley, heavy rain										<b>COORDINATE SYSTEM</b> Plant					<b>DATE START</b> 08/02/2007					<b>DATE FINISHED</b> 08/02/2007																																											
<b>SOIL SAMPLING</b>										<b>LOGGED BY</b> JJ Deeken					<b>CHECKED BY</b> V Bhadriraju					<b>APPROVED BY</b> BL Christensen																																											
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SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N	VALUE	SAMPLE RECOVERY																																																								
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CLASSIFICATION OF MATERIALS																																																															
REMARKS																																																															
TW 10 0.7 - - - 0.7										30 416										[Hatched Box]										[Empty]										[Empty]																							
SPT 11 23 44 41 85 1.5										32 414										[Hatched Box]										[Empty]										[Empty]																							
TW 12 1.0 - - - 1.0										34 412										[Hatched Box]										[Empty]										[Empty]																							
SPT 13 30 40 47 87 1.5										36 410										[Hatched Box]										[Empty]										[Empty]																							
										38 408										[Hatched Box]										[Empty]										[Empty]																							
										40 406										[Hatched Box]										[Empty]										[Empty]																							
										42 404										[Hatched Box]										[Empty]										[Empty]																							
										44 402										[Hatched Box]										[Empty]										[Empty]																							
										46 400										[Hatched Box]										[Empty]										[Empty]																							
										48 398										[Hatched Box]										[Empty]										[Empty]																							
										50 396										[Hatched Box]										[Empty]										[Empty]																							
										52 394										[Hatched Box]										[Empty]										[Empty]																							
										54 392										[Hatched Box]										[Empty]										[Empty]																							
										56 390										[Hatched Box]										[Empty]										[Empty]																							
										58 388										[Hatched Box]										[Empty]										[Empty]																							
																														Bottom of boring @ 49.5'. Water level not recorded. Boring backfilled w/ bentonite chips.																																	

# Piezometer Log

 Piezometer NO. PZ-107  
 SHEET 1 OF 1

CLIENT Sandy Creek Energy Associates		PROJECT Sandy Creek Energy Station	PROJECT NO. 149060
PROJECT LOCATION Reisel, Texas	COORDINATES N 3101.0' E 10650.0'	GROUND ELEVATION (DATUM) 451.0 ft (MSL)	DATE 8/9/07
STRATUM MONITORED Interface of yellow-brown and gray clay, w/sand seams			
INSPECTOR JJ Deeken	CHECKED BY JJ Deeken	APPROVED BY BL Christensen	



## BORING DIAMETER

DIAMETER: 3 7/8"

\*Note-Diagram not shown to scale

**Installation Method:** Boring drilled to completion depth of 29.5' using rotary wash techniques & flushed until clear. Screen & riser pipe set on 6" sand base, primary filter set & primary seal set, then surged. Boring grouted to ground surface & surface protection placed.

**Notes:** 08/10/07 water level 6.0' below ground surface.  
08/30/07 water level 8.2' below ground surface.

**BLACK & VEATCH****TEST PIT LOG**

TEST-PIT NO. TP-4

SHEET 1 OF 1

<b>CLIENT - PROJECT</b> Sandy Creek Energy Associates - Sandy Creek Energy Station		<b>PROJECT NO.</b> 149060	
<b>PROJECT LOCATION</b> Reisel, Texas	<b>COORDINATES</b> N 2344.1' E 10330.8'	<b>GROUND ELEVATION (DATUM)</b> 438 ft (MSL)	<b>DATE</b> 8/21/07
<b>SURFACE CONDITIONS</b> Valley, ground wet; short weeds			
<b>EXCAVATION METHOD</b> CAT 334 Trackhoe			
<b>INSPECTOR</b> JJ Deeken		<b>CHECKED BY</b> JJ Deeken	<b>APPROVED BY</b> BL Christensen
<b>PLAN VIEW SKETCH, DIMENSIONS, AND NORTH ARROW</b>		<b>PROFILE VIEW SKETCH AND DIMENSIONS</b>	

SAMPLE NUMBER & TYPE	DEPTH (FEET)	CLASSIFICATION AND DESCRIPTION OF MATERIAL (HORIZONTAL SCALE IN FEET)
		0 6 12 18 24 30
	0	CLAY: dark brown; moist; high plasticity; w/some gravel; trace sand seams (6" Topsoil) @ 1.5' grading brown; w/some 3" gravel
	4	@ 4.5' grading w/trace gypsum crystalization @ 5.0' grading gray
	8	@ 7.5' sand & gravel grades out
		@ 9.0' grading w/light gray very fine sand in vertical fissures
	12	@ 11.0' grading slightly fissile
	16	

**REMARKS**

**Appendix C**  
**Laboratory Test Results**

<b>FALLING HEAD / RISING TAIL HYDRAULIC CONDUCTIVITY TEST</b> <b>( ASTM D-5084-90 )</b>											
Project No:		286-75083		Sample Identification:		BV-102, TW-4, 6-8 FEET					
Technician:		AG/KMV		Sample Description:		Light Gray and Brown Fat Clay					
Project : Sandy Creek Energy Station											
INITIAL CONDITIONS						FINAL CONDITIONS					
WATER CONTENT			SPECIMEN DATA			WATER CONTENT			SPECIMEN DATA		
Tare No.:	w		Length, in:	5.120		Tare No.:	d-1		Length, in:	5.370	
Wet+Tare, gms:	110.04		Diameter, in:	2.870		Wet+Tare, gms:	242.3		Diameter, in:	2.890	
Dry+Tare, gms:	95.59		Wet mass, gms:	1127.8		Dry+Tare, gms:	208.4		Wet mass, gms:	1181.8	
Tare Weight, gms:	21.37		Area, sq.cm.:	41.74		Tare Weight, gms:	85.1		Area, sq.cm.:	42.32	
Moisture, %	19.5		Volume, cc:	542.8		Moisture, %	27.4		Volume, cc:	577.2	
			Unit wet wt, pcf:	129.7					Unit wet wt, pcf:	127.8	
Specific Gravity:	2.70		Unit dry wt, pcf:	108.5		Specific Gravity:	2.70		Unit dry wt, pcf:	100.2	
Saturation, %:	95.2		Void Ratio:	0.552		Saturation, %:	108.8		Void Ratio:	0.681	
Perm. Cell No.:	7		Burret diam, cm:	1.123		Burret area, sq.cm.:	0.991		Burret factor, cm/cc:	1.009	
Cell Pressure, psi:	30.0		Head Pressure, psi:	30.0		Tail Pressure, psi:	28.0		Remarks:		
<b>PERMEABILITY MEASUREMENTS</b>											
Date	Time	Elapsed Time (sec)	Temp (C)	Pressure Diff. (psi)	Head Rdg (cc)	Tail Rdg (cc)	Head Change (cm)	Tail Change (cm)	Total Head (cm)	Permeability Kt (cm/sec)	Permeability K <sub>20</sub> (cm/sec)
1/3/2008	9:33:00 AM	0	24.0	2.0	0.2	24.2	0.000	0.000	164.82	0.00E+00	0.00E+00
1/4/2008	3:31:00 PM	1798	24.0	2.0	0.9	23.4	0.706	0.807	163.30	8.19E-07	7.43E-07
1/5/2008	9:25:00 AM	2872	24.0	2.0	1.2	23.0	0.303	0.404	162.60	2.41E-07	2.18E-07
1/7/2008	3:06:00 PM	6093	24.0	2.0	2.1	21.9	0.908	1.110	160.58	3.27E-07	2.97E-07
1/8/2008	8:15:00 AM	7122	24.0	2.0	2.4	21.6	0.303	0.303	159.97	8.47E-08	7.68E-08
1/9/2008	7:40:00 AM	8527	24.0	2.0	2.7	21.3	0.303	0.303	159.37	7.10E-08	6.44E-08
1/10/2008	7:30:00 AM	9957	25.0	2.0	3.1	21.0	0.404	0.303	158.66	7.12E-08	6.28E-08
1/11/2008	7:30:00 AM	11397	24.0	2.0	3.5	20.8	0.404	0.202	158.06	5.36E-08	4.86E-08
1/14/2008	7:30:00 AM	15717	24.0	2.0	4.4	20.2	0.908	0.605	156.54	9.78E-08	8.86E-08
Coefficient of Permeability, k = <b>6.61E-08</b> cm/sec (See Note) (k should be the average of the last 4 readings)											
Computed By: <u>KMV</u> Date: <u>01/08/08</u> Checked By: <u>KMV</u> Date: <u>01/08/08</u>											



**Project: Leachate Evaporation Pond Design**  
**Project Location: 2161 Rattlesnake Road, Riesel, TX 76682**  
**Project Number: TXL0084-03**

## Key to Log of Boring

Sheet 1 of 1

Elevation, feet	Depth, feet	Sample Type	Sample	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS					
1	2	3	4	5	6	7	8	9	10					
<b>COLUMN DESCRIPTIONS</b>														
1	<b>Elevation, feet:</b> Elevation (MSL, feet)						6	<b>USCS Symbol:</b> USCS symbol of the subsurface material.						
2	<b>Depth, feet:</b> Depth in feet below the ground surface.						7	<b>Graphic Log:</b> Graphic depiction of the subsurface material encountered.						
3	<b>Sample Type:</b> Type of soil sample collected at the depth interval shown.						8	<b>MATERIAL DESCRIPTION:</b> Description of material encountered. May include consistency, moisture, color, and other descriptive text.						
4	<b>Sample:</b> Type of soil sample collected at the depth interval shown.						9	<b>Well Log:</b> Graphical representation of well installed upon completion of drilling and sampling.						
5	<b>Relative Consistency:</b> Relative consistency of the subsurface material.						10	<b>REMARKS AND OTHER TESTS:</b> Comments and observations regarding drilling or sampling made by driller or field personnel.						
<b>FIELD AND LABORATORY TEST ABBREVIATIONS</b>														
<b>CHEM:</b> Chemical tests to assess corrosivity					<b>SA:</b> Sieve analysis (percent passing No. 200 Sieve)									
<b>COMP:</b> Compaction test					<b>UC:</b> Unconfined compressive strength test, Qu, in ksf									
<b>CONS:</b> One-dimensional consolidation test					<b>WA:</b> Wash sieve (percent passing No. 200 Sieve)									
<b>LL:</b> Liquid Limit, percent														
<b>PI:</b> Plasticity Index, percent														
<b>TYPICAL MATERIAL GRAPHIC SYMBOLS</b>														
Well graded GRAVEL (GW) Poorly graded GRAVEL (GP) Well graded GRAVEL with Silt (GW-GM) Well graded GRAVEL with Clay (GW-GC) Poorly graded GRAVEL with Silt (GP-GM) Poorly graded GRAVEL with Clay (GP-GC) Silty GRAVEL (GM) Clayey GRAVEL (GC) Well graded SAND (SW) Poorly graded SAND (SP) Well graded SAND with Silt (SW-SM)					Well graded SAND with Clay (SW-SC) Poorly graded SAND with Silt (SP-SM) Poorly graded SAND with Clay (SP-SC) Silty SAND (SM) Clayey SAND (SC) SILT, SILT w/SAND, SANDY SILT (ML) Lean CLAY, CLAY w/SAND, SANDY CLAY (CL) SILT, SILT w/SAND, SANDY SILT (MH) Fat CLAY, CLAY w/SAND, SANDY CLAY (CH) SILT, SILT with SAND, SANDY SILT (ML-MH) Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)					SILTY CLAY (CL-ML) Lean CLAY/PEAT (CL-OL) Fat CLAY/SILT (CH-MH) Fat CLAY/PEAT (CH-OH) Silty SAND to Sandy SILT (SM-ML) Silty SAND to Sandy SILT (SM-MH) Clayey SAND to Sandy CLAY (SC-CL) Clayey SAND to Sandy CLAY (SC-CH) SILT to CLAY (CL/ML) Silty to Clayey SAND (SM-SC)				
<b>TYPICAL SAMPLER GRAPHIC SYMBOLS</b>														
2-inch-OD unlined split spoon (SPT) 2.5-inch-OD Modified California w/ brass liners 3-inch-OD California w/ brass rings					Shelby Tube (Thin-walled, fixed head) Grab Sample Bulk Sample					Pitcher Sample Other sampler				
<b>OTHER GRAPHIC SYMBOLS</b>														
Water level (at time of drilling, ATD) Water level (after waiting a given time) Minor change in material properties within a stratum Inferred or gradational contact between strata Queried contact between strata														
<b>GENERAL NOTES</b>														
1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests. 2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.														

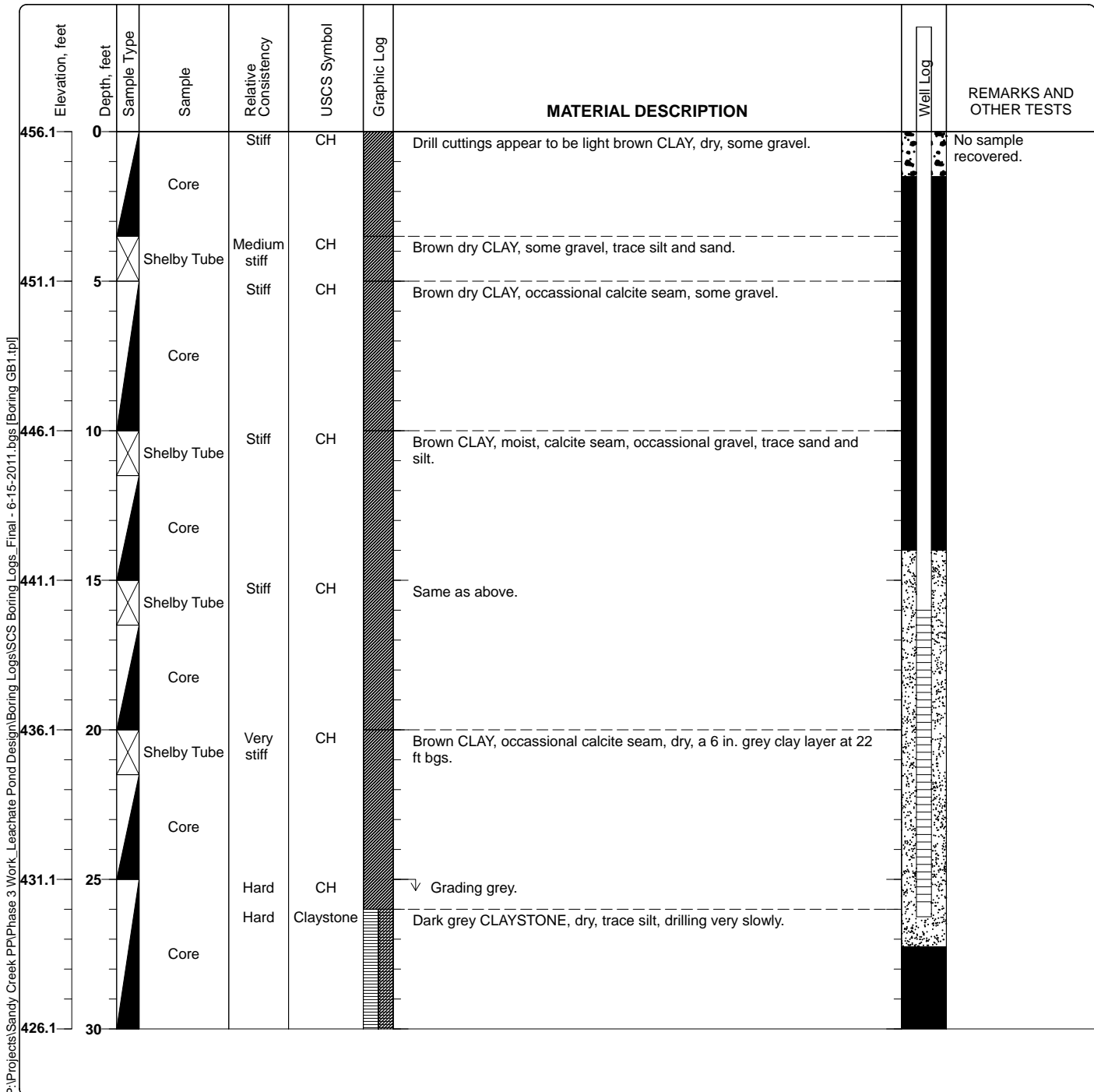
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**Project: Leachate Evaporation Pond Design**  
**Project Location: 2161 Rattlesnake Road, Riesel, TX 76682**  
**Project Number: TXL0084-03**

## Log of Boring GB-1

Sheet 1 of 2




Date(s) Drilled <b>08/30/2010</b>	Logged By <b>M. Zahirul Islam</b>	Checked By <b>Edward B. Dolan, P.G.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.2 inch HSA</b>	Total Depth of Borehole <b>32 feet bgs</b>
Drill Rig Type <b>Mobile B 59</b>	Drilling Contractor <b>Total Support Services, Inc.</b>	Approximate Surface Elevation <b>456.12 feet MSL</b>
Groundwater Level and Date Measured <b>Not Encountered</b>	Sampling Method(s) <b>Core</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>N 10513523.31, E 3349864.44</b>	



**Project: Leachate Evaporation Pond Design**  
**Project Location: 2161 Rattlesnake Road, Riesel, TX 76682**  
**Project Number: TXL0084-03**

## Log of Boring GB-1

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sample	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
426.1	30		Core		Claystone		Same as above.		
							Bottom of Boring at 32 feet bgs.		
421.1	35								
416.1	40								
411.1	45								
406.1	50								
401.1	55								
396.1	60								
391.1	65								

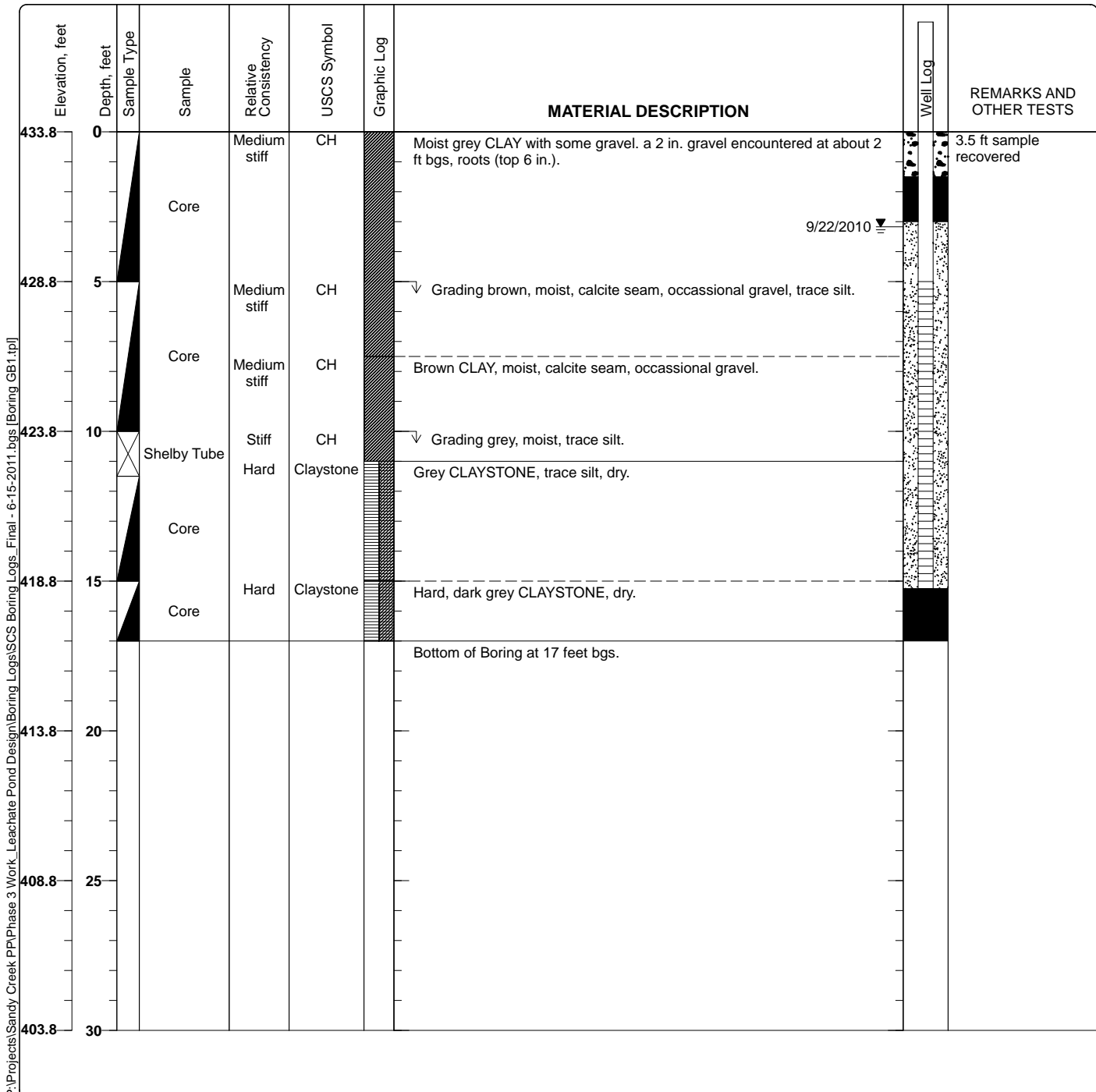
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**Project: Leachate Evaporation Pond Design**  
**Project Location: 2161 Rattlesnake Road, Riesel, TX 76682**  
**Project Number: TXL0084-03**

## Log of Boring GB-4

Sheet 1 of 1

Date(s) Drilled <b>08/30/2010 and 08/31/2010</b>	Logged By <b>M. Zahirul Islam</b>	Checked By <b>Edward B. Dolan, P.G.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.2 inch HSA</b>	Total Depth of Borehole <b>17 feet bgs</b>
Drill Rig Type <b>Mobile B 59</b>	Drilling Contractor <b>Total Support Services, Inc.</b>	Approximate Surface Elevation <b>433.75 feet MSL</b>
Groundwater Level and Date Measured <b>3.17 feet measured on 9/22/2010</b>	Sampling Method(s) <b>Core</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>N 10513167.81, E 3349948.58</b>	



**Project: Leachate Evaporation Pond Design**  
**Project Location: 2161 Rattlesnake Road, Riesel, TX 76682**  
**Project Number: TXL0084-03**

## Log of Boring GB-5

Sheet 1 of 1

Date(s) Drilled <b>09/01/2010</b>	Logged By <b>M. Zahirul Islam</b>	Checked By <b>Edward B. Dolan, P.G.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.2 inch HSA</b>	Total Depth of Borehole <b>20 feet bgs</b>
Drill Rig Type <b>Mobile B 59</b>	Drilling Contractor <b>Total Support Services, Inc.</b>	Approximate Surface Elevation <b>440.64 feet MSL</b>
Groundwater Level and Date Measured <b>Not Measured</b>	Sampling Method(s) <b>Core</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Well Completion</b>	Location <b>N 10513245.68, E 3349741.37</b>	

Elevation, feet	Depth, feet	Sample Type	Sample	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
440.6	0			Stiff	CH		Light grey CLAY, dry, some gravel.		
			Core	Stiff	CH		Grading brown, occasional calcite seam.		
435.6	5	Shelby Tube		Medium stiff	CH		Brown CLAY, calcite seam, moist, occasional gravel, trace sand and silt.		
			Core						
430.6	10	Shelby Tube		Medium stiff	CH		Grading grey, moist, occasional gravel, trace sand and silt.		
			Core						
425.6	15	Shelby Tube		Stiff	CH		Mixture of light brown and grey CLAY, occasional gravel, dry.		
			Core	Hard	Claystone		Hard, dark grey CLAYSTONE, trace silt, a 6 in. vertical fracture with iron stain at 19 ft bgs, dry.		
420.6	20						Bottom of Boring at 20 feet bgs.		
415.6	25								
410.6	30								

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Project: **Sandy Creek Energy Station**  
 Project Location: **2161 Rattlesnake Road Riesel, TX 76682**  
 Project Number: **TXL0526 / 02**

## Key to Log of Boring Sheet 1 of 1






















Elevation (feet, MSL)	Depth (feet)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log
1	2	3	4	5	6
<p><b>COLUMN DESCRIPTIONS</b></p> <div> <div> <p>1 Elevation (feet, MSL): Elevation (feet, MSL)</p> <p>2 Depth (feet): Depth in feet below the ground surface.</p> <p>3 USCS Symbol: Type of material encountered.</p> </div> <div> <p>4 Graphic Log: Graphic depiction of the subsurface material encountered.</p> <p>5 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.</p> <p>6 Well Log: Graphical representation of well installed upon completion of drilling and sampling.</p> </div> </div> <p><b>FIELD AND LABORATORY TEST ABBREVIATIONS</b></p> <div> <div> <p>CHEM: Chemical tests to assess corrosivity</p> <p>COMP: Compaction test</p> <p>CONS: One-dimensional consolidation test</p> <p>LL: Liquid Limit, percent</p> </div> <div> <p>PI: Plasticity Index, percent</p> <p>SA: Sieve analysis (percent passing No. 200 Sieve)</p> <p>UC: Unconfined compressive strength test, Qu, in ksf</p> <p>WA: Wash sieve (percent passing No. 200 Sieve)</p> </div> </div> <p><b>MATERIAL GRAPHIC SYMBOLS</b></p> <div> <div> <p> Bentonite plug</p> <p> Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)</p> <p> Claystone</p> </div> <div> <p> Portland Cement Concrete</p> <p> Gravel</p> <p> Grout</p> <p> Poorly graded SAND (SP)</p> </div> </div> <p><b>TYPICAL SAMPLER GRAPHIC SYMBOLS</b></p> <div> <div> <p> Auger sampler</p> <p> Bulk Sample</p> <p> 3-inch-OD California w/ brass rings</p> </div> <div> <p> CME Sampler</p> <p> Grab Sample</p> <p> 2.5-inch-OD Modified California w/ brass liners</p> </div> <div> <p> Pitcher Sample</p> <p> 2-inch-OD unlined split spoon (SPT)</p> <p> Shelby Tube (Thin-walled, fixed head)</p> </div> </div> <p><b>OTHER GRAPHIC SYMBOLS</b></p> <div> <p> Water level (at time of drilling, ATD)</p> <p> Water level (after waiting)</p> <p> Minor change in material properties within a stratum</p> <p> Inferred/gradational contact between strata</p> <p> Queried contact between strata</p> </div> <p><b>GENERAL NOTES</b></p> <p>1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.</p> <p>2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.</p>					

Figure A-1

Project: **Sandy Creek Energy Station**

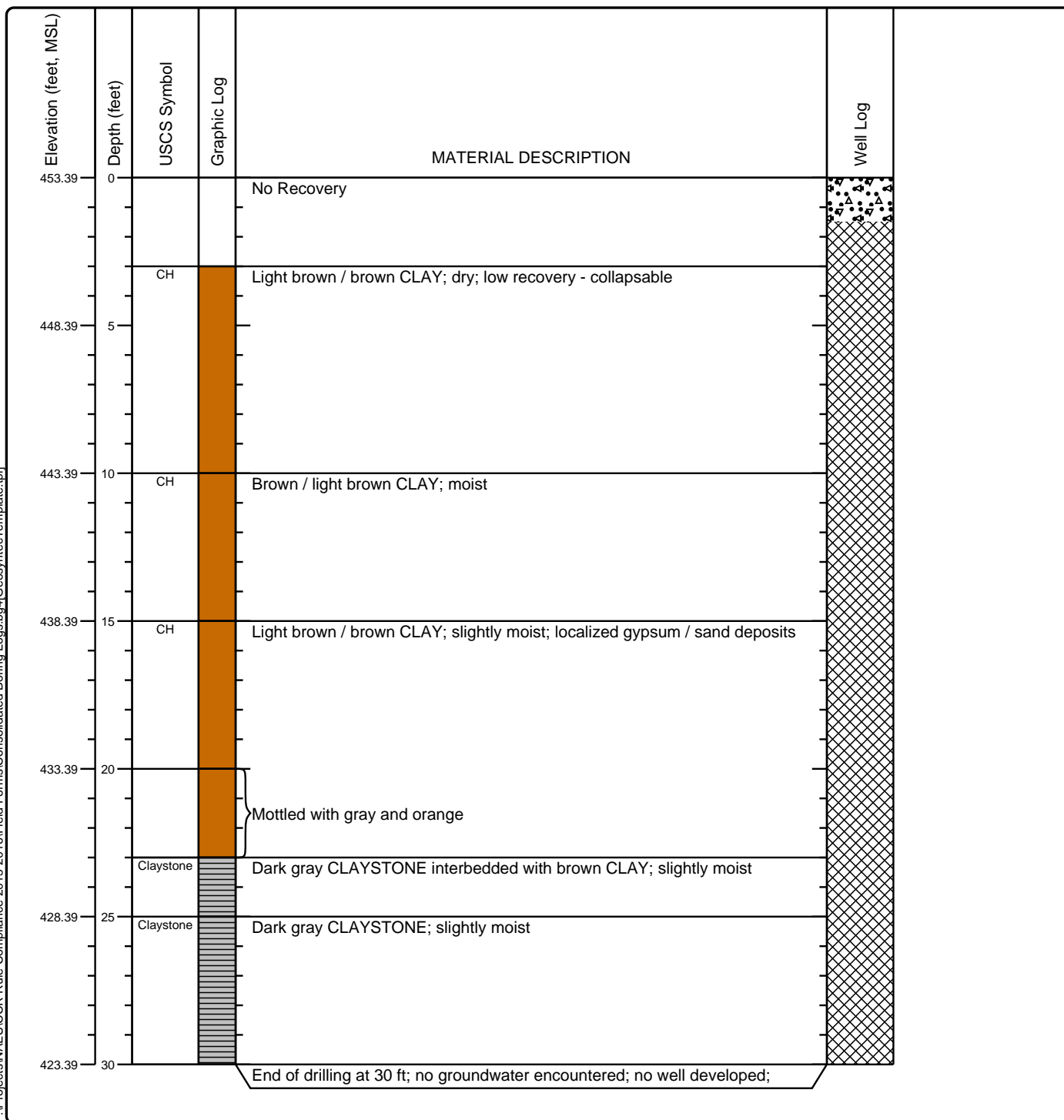
Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

Project Number: **TXL0526 / 02**

# Log of Boring GB-6

Sheet 1 of 1

Date(s) Drilled <b>9/22/2015</b>	Logged By <b>Alexander Brewster</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>5" HSA</b>	Total Depth of Borehole <b>30 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Best Drilling Services, Inc.</b>	Approximate Surface Elevation <b>453.39 (ft, MSL)</b>
Groundwater Level and Date Measured <b>Not encountered</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Cement Bentonite Grout</b>	Location <b>UTM: N 10513492.63', E 3349684.20'. SE of northern corner of existing leachate evaporation pond.</b>	



Project: **Sandy Creek Energy Station**

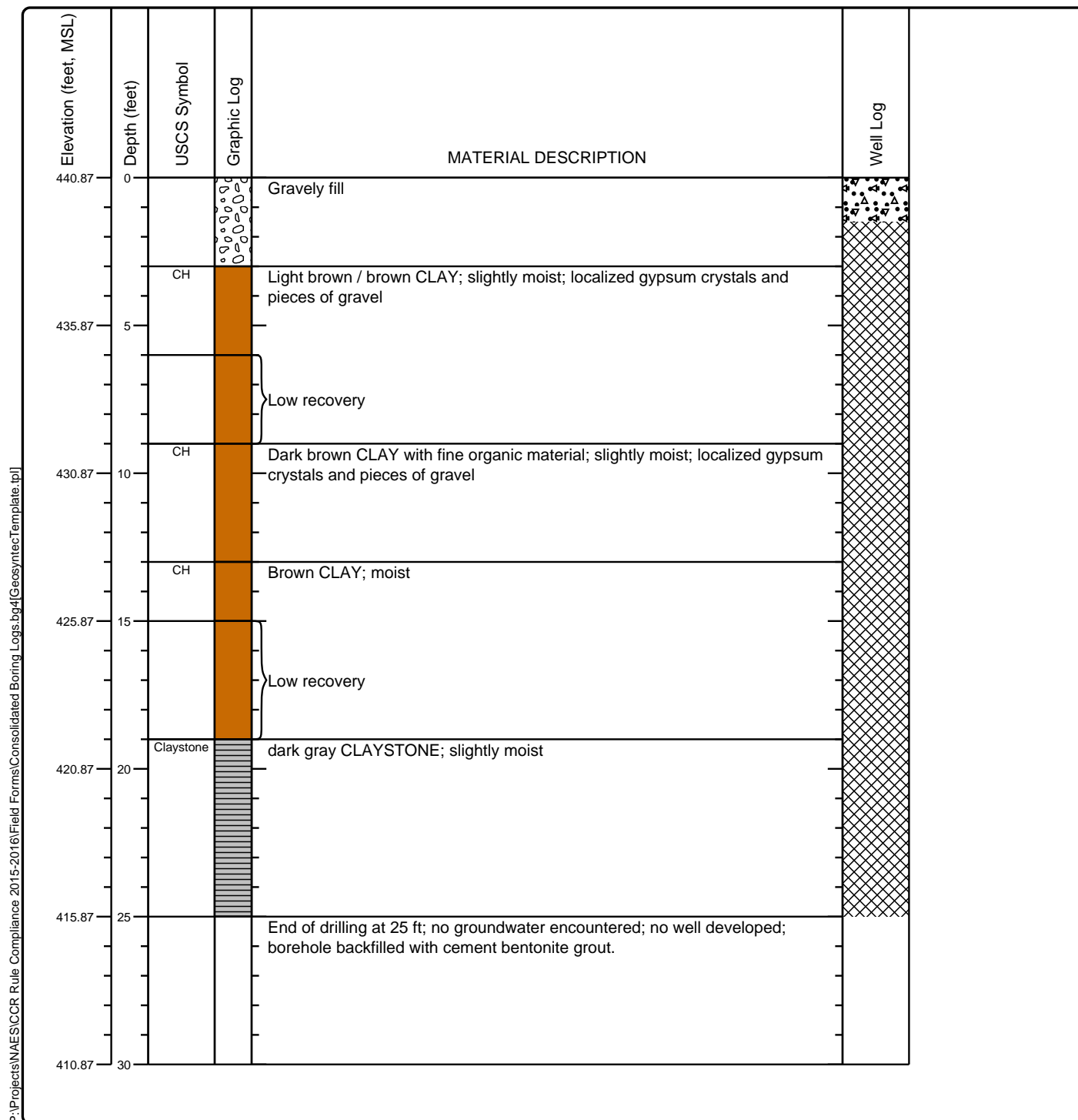
Project Location: **2161 Rattlesnake Road Riesel, TX 76682**

Project Number: **TXL0526 / 02**

# Log of Boring GB-7

Sheet 1 of 1

Date(s) Drilled <b>9/23/2015</b>	Logged By <b>Alexander Brewster</b>	Checked By <b>Lindsay O'Leary, P.E.</b>
Drilling Method <b>Hollow Stem Auger</b>	Drill Bit Size/Type <b>8.25" HSA</b>	Total Depth of Borehole <b>25 ft</b>
Drill Rig Type <b>Truck-Mounted CME</b>	Drilling Contractor <b>Best Drilling Services, Inc.</b>	Approximate Surface Elevation <b>440.87 (ft, MSL)</b>
Groundwater Level and Date Measured <b>Not encountered</b>	Sampling Method(s) <b>Core Barrel</b>	Hammer Data <b>N/A</b>
Borehole Backfill <b>Cement Bentonite Grout</b>	Location <b>UTM: N 10513175.55', E 3349950.07'. Approximately 65 ft W and 10 ft N of MW-2.</b>	



## STATE OF TEXAS WELL REPORT for Tracking #231664

Owner: <b>SCPP</b>	Owner Well #: <b>GB1</b>
Address: <b>2161 Rattlesnake Rd. Riesel, TX</b>	Grid #: <b>39-33-2</b>
Well Location: <b>Same Riesel, TX</b>	Latitude: <b>31° 28' 02" N</b>
Well County: <b>McLennan</b>	Longitude: <b>096° 57' 15" W</b>
Elevation: <b>No Data</b>	GPS Brand Used: <b>No Data</b>

Type of Work: <b>New Well</b>	Proposed Use: <b>Monitor</b>
-------------------------------	------------------------------

Drilling Date:      Started: **8/30/2010**  
                          Completed: **9/3/2010**

Diameter of Hole:      Diameter: **8.25 in From Surface To 27 ft**

Drilling Method:      **Hollow Stem Auger**

Borehole Completion:      Other: **20/40 Silica Sand**

Annular Seal Data:      1st Interval: **From 0 ft to 2 ft with Concrete (#sacks and material)**  
                                  2nd Interval: **From 2 ft to 14 ft with Bentonite (#sacks and material)**  
                                  3rd Interval: **No Data**  
                                  Method Used: **Gravity**  
                                  Cemented By: **Crew**  
                                  Distance to Septic Field or other Concentrated Contamination: **No Data**  
                                  Distance to Property Line: **No Data**  
                                  Method of Verification: **No Data**  
                                  Approved by Variance: **No Data**

Surface Completion:      **Surface Sleeve Installed**

Water Level:      Static level: **No Data**  
                          Artesian flow: **No Data**

Packers:      **No Data**

Plugging Info:      Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump:      **No Data**

Well Tests:      **No Data**

Water Quality:      Type of Water: **No Data**  
                          Depth of Strata: **No Data**  
                          Chemical Analysis Made: **No Data**  
                          Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

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

Company Information:      **Total Support Services**  
                                  **P.O. Box 81621**

**Austin , TX 78708**

Driller License Number: **54611**

Licensed Well Driller Signature: **Brian Kern**

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

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

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Please include the report's Tracking number (Tracking #231664) on your written request.

**Texas Department of Licensing & Regulation**  
**P.O. Box 12157**  
**Austin, TX 78711**  
**(512) 463-7880**

**DESC. & COLOR OF FORMATION MATERIAL**

From (ft) To (ft) Description  
**0 to 3 Brown Gravel Sand and Clay**  
**3 to 26 Tan and Gray Clay**  
**26 to 27 Gray Shale**

**CASING, BLANK PIPE & WELL SCREEN DATA**

Dia.	New/Used	Type	Setting From/To
<b>2</b>	<b>New</b>	<b>PVC Riser</b>	<b>0/16 Sched. 40</b>
<b>2</b>	<b>New</b>	<b>PVC Screen</b>	<b>16/26 0.010 Slotted</b>

### STATE OF TEXAS WELL REPORT for Tracking #231665

Owner: <b>SCPP</b>	Owner Well #: <b>GB4</b>
Address: <b>2161 Rattlesnake Rd. Riesel , TX</b>	Grid #: <b>39-33-2</b>
Well Location: <b>Same Riesel , TX</b>	Latitude: <b>31° 27' 59" N</b>
Well County: <b>McLennan</b>	Longitude: <b>096° 57' 19" W</b>
Elevation: <b>No Data</b>	GPS Brand Used: <b>No Data</b>

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Type of Work: <b>New Well</b>	Proposed Use: <b>Monitor</b>
-------------------------------	------------------------------

Drilling Date:      Started: **8/30/2010**  
                          Completed: **9/3/2010**

Diameter of Hole:    Diameter: **8.25 in From Surface To 16 ft**

Drilling Method:    **Hollow Stem Auger**

Borehole  
Completion:          Other: **20/40 Silica Sand**

Annular Seal Data:    1st Interval: **From 0 ft to 1 ft with Concrete (#sacks and material)**  
                              2nd Interval: **From 1 ft to 3 ft with Bentonite (#sacks and material)**  
                              3rd Interval: **No Data**  
                              Method Used: **Gravity**  
                              Cemented By: **Crew**  
                              Distance to Septic Field or other Concentrated Contamination: **No Data**  
                              Distance to Property Line: **No Data**  
                              Method of Verification: **No Data**  
                              Approved by Variance: **No Data**

Surface  
Completion:          **Surface Sleeve Installed**

---

Water Level:          Static level: **No Data**  
                              Artesian flow: **No Data**

Packers:            **No Data**

Plugging Info:       Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump:       **No Data**

Well Tests:          **No Data**

---

Water Quality:       Type of Water: **No Data**  
                              Depth of Strata: **No Data**  
                              Chemical Analysis Made: **No Data**  
                              Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

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

Company  
Information:          **Total Support Services**  
                              **P.O. Box 81621**

**Austin , TX 78708**

Driller License Number: **54611**

Licensed Well Driller Signature: **Brian Kern**

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

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

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**Texas Department of Licensing & Regulation**  
**P.O. Box 12157**  
**Austin, TX 78711**  
**(512) 463-7880**

**DESC. & COLOR OF FORMATION MATERIAL**

---

From (ft)	To (ft)	Description
0	to 11	Tan and Gray Clay
11	to 16	Gray Shale

**CASING, BLANK PIPE & WELL SCREEN DATA**

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Dia.	New/Used	Type	Setting From/To
2	New	PVC Riser	0/5 Sched. 40
2	New	PVC Screen	5/15 0.010 Slotted

**STATE OF TEXAS WELL REPORT for Tracking #231670**

Owner:	<b>SCPP</b>	Owner Well #:	<b>GB5</b>
Address:	<b>2161 Rattlesnake Rd. Riesel , TX</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>Same Riesel , TX</b>	Latitude:	<b>31° 28' 01" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 20" W</b>
Elevation:	<b>No Data</b>	GPS Brand Used:	<b>No Data</b>

Type of Work:	<b>New Well</b>	Proposed Use:	<b>Environmental Soil Boring</b>
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Drilling Date:      Started: **8/30/2010**  
                         Completed: **9/3/2010**

Diameter of Hole:      Diameter: **8.25 in From Surface To 20 ft**

Drilling Method:      **Hollow Stem Auger**

Borehole  
Completion:      **Open Hole**

Annular Seal Data:      1st Interval: **From 0 ft to 2 ft with Concrete (#sacks and material)**  
                                 2nd Interval: **From 2 ft to 20 ft with Bentonite (#sacks and material)**  
                                 3rd Interval: **No Data**  
                                 Method Used: **Gravity**  
                                 Cemented By: **Crew**  
                                 Distance to Septic Field or other Concentrated Contamination: **No Data**  
                                 Distance to Property Line: **No Data**  
                                 Method of Verification: **No Data**  
                                 Approved by Variance: **No Data**

Surface  
Completion:      **No Data**

Water Level:      Static level: **No Data**  
                         Artesian flow: **No Data**

Packers:      **No Data**

Plugging Info:      The well **was** plugged within 48 hours.  
                         Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump:      **No Data**

Well Tests:      **No Data**

Water Quality:      Type of Water: **No Data**  
                         Depth of Strata: **No Data**  
                         Chemical Analysis Made: **No Data**  
                         Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

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

Company Information: **Total Support Services  
P.O. Box 81621  
Austin , TX 78708**

Driller License Number: **54611**

Licensed Well Driller Signature: **Brian Kern**

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

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

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Please include the report's Tracking number (Tracking #231670) on your written request.

**Texas Department of Licensing & Regulation  
P.O. Box 12157  
Austin, TX 78711  
(512) 463-7880**

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**DESC. & COLOR OF FORMATION MATERIAL**

From (ft) To (ft) Description  
**0 to 19 Tan and Gray Clay**  
**19 to 20 Gray Shale**

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**CASING, BLANK PIPE & WELL SCREEN DATA**

**No Data**

## STATE OF TEXAS WELL REPORT for Tracking #408222

Owner:	<b>Sandy Creek Services, LLC</b>	Owner Well #:	<b>Location 3 (GB-6)</b>
Address:	<b>P.O. Box 370 Riesel, TX 76682</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>2161 Rattlesnake Rd Riesel, TX 76682</b>	Latitude:	<b>31° 28' 03.33" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 17.91" W</b>
		Elevation:	<b>453 ft. above sea level</b>
Type of Work:	<b>New Well</b>	Proposed Use:	<b>Environmental Soil Boring</b>

Drilling Start Date: **9/23/2015**      Drilling End Date: **9/23/2015**

	<i>Diameter (in.)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Borehole:	<b>8.15</b>	<b>0</b>	<b>25</b>

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Plugged**

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Description (number of sacks &amp; material)</i>
Annular Seal Data:	<b>0</b>	<b>25</b>	<b>CEMENT BENTONITE GROUT</b>

Seal Method: **Tremie**

Sealed By: **Driller**

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

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

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

Method of Verification: **No Data**

Surface Completion: **No Data**      **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

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Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
<b>No Data</b>	<b>No Data</b>

Chemical Analysis Made: **No**

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

---

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

Company Information: **BEST DRILLING SERVICES, INC.**  
**P.O. BOX 845**  
**FRIENDSWOOD, TX 77549**

Driller Name: **Lawrence Tobola**

License Number: **3026**

Comments: **No Data**

---

Lithology:  
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:  
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
<b>0</b>	<b>5</b>	<b>Gravelly fill</b>
<b>5</b>	<b>10</b>	<b>CLAY, drk. brown/black</b>
<b>10</b>	<b>14</b>	<b>CLAY, drk. brown</b>
<b>14</b>	<b>23</b>	<b>CLAY, brown</b>
<b>23</b>	<b>25</b>	<b>CLAYSTONE, drk. gray</b>

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
<b>No Data</b>			

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**P.O. Box 12157**  
**Austin, TX 78711**  
**(512) 463-7880**

## STATE OF TEXAS WELL REPORT for Tracking #408220

Owner:	<b>Sandy Creek Services, LLC</b>	Owner Well #:	<b>Location 5 (GB-7)</b>
Address:	<b>P.O. Box 370 Riesel, TX 76682</b>	Grid #:	<b>39-33-2</b>
Well Location:	<b>2161 Rattlesnake Rd. Riesel, TX 76682</b>	Latitude:	<b>31° 28' 00.11" N</b>
Well County:	<b>McLennan</b>	Longitude:	<b>096° 57' 14.95" W</b>
		Elevation:	<b>441 ft. above sea level</b>
Type of Work:	<b>New Well</b>	Proposed Use:	<b>Monitor</b>

Drilling Start Date: **9/23/2015**      Drilling End Date: **9/23/2015**

	<i>Diameter (in.)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Borehole:	<b>8.25</b>	<b>0</b>	<b>25</b>

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Plugged**

	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>	<i>Description (number of sacks &amp; material)</i>
Annular Seal Data:	<b>0</b>	<b>25</b>	<b>CEMENT BENTONITE GROUT</b>

Seal Method: **Tremie**

Sealed By: **Driller**

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

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

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

Method of Verification: **No Data**

Surface Completion: **No Data**      **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	<i>Description (number of sacks &amp; material)</i>	<i>Top Depth (ft.)</i>	<i>Bottom Depth (ft.)</i>
Plug Information:	<b>CEMENT BENTONITE GROUT</b>	<b>0</b>	<b>25</b>

Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
<b>No Data</b>	<b>No Data</b>

Chemical Analysis Made: **No**

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

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

Company Information: **BEST DRILLING SERVICES, INC.**  
**P.O. BOX 845**  
**FRIENDSWOOD, TX 77549**

Driller Name: **Lawrence Tobola**

License Number: **3026**

Comments: **30 ft west and 10 ft North of MW-2**

Lithology:  
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:  
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
<b>0</b>	<b>3</b>	<b>Gravelly fill</b>
<b>3</b>	<b>9</b>	<b>CLAY, lt. brown/brown</b>
<b>9</b>	<b>13</b>	<b>CLAY, drk. brown</b>
<b>13</b>	<b>19</b>	<b>CLAY, brown</b>
<b>19</b>	<b>25</b>	<b>CLAYEYSTONE, drk. gray</b>

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
<b>No Data</b>			

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**Austin, TX 78711**  
**(512) 463-7880**



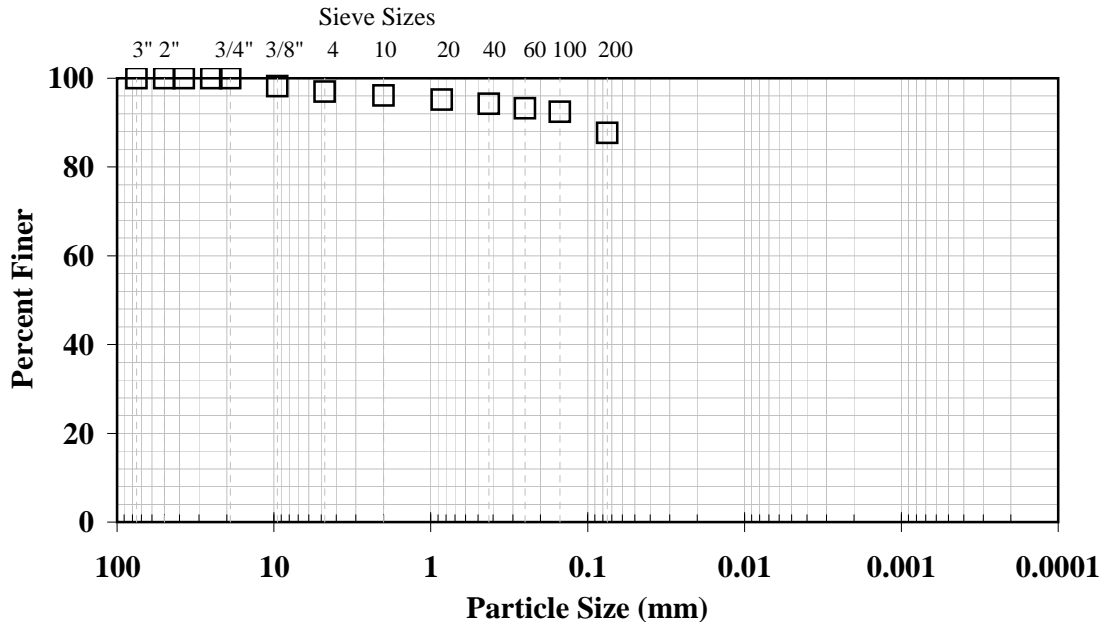
**TRI/ENVIRONMENTAL, INC.**

*A Texas Research International Company*

## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-1 (5-6 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	98.2
No. 4 (4.75 mm)	97.0
No. 10 (2.00 mm)	96.1
No. 20 (850 µm)	95.1
No. 40 (425 µm)	94.2
No. 60 (250 µm)	93.2
No. 100 (150 µm)	92.4
No. 200 (75 µm)	87.7

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

The as received moisture content was 20.46 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	64
Plastic Limit	19
Plastic Index	45
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

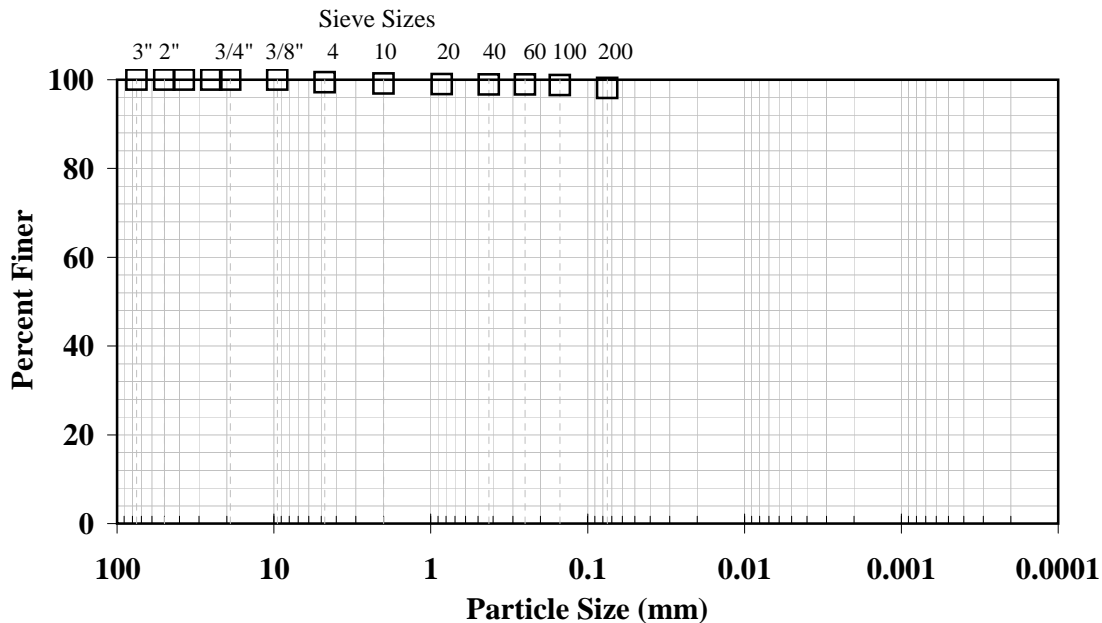
The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-1 (9-10 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	99.4
No. 10 (2.00 mm)	99.2
No. 20 (850 µm)	99.0
No. 40 (425 µm)	98.9
No. 60 (250 µm)	98.9
No. 100 (150 µm)	98.7
No. 200 (75 µm)	98.1

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

The as received moisture content was 22.31 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	67
Plastic Limit	20
Plastic Index	47
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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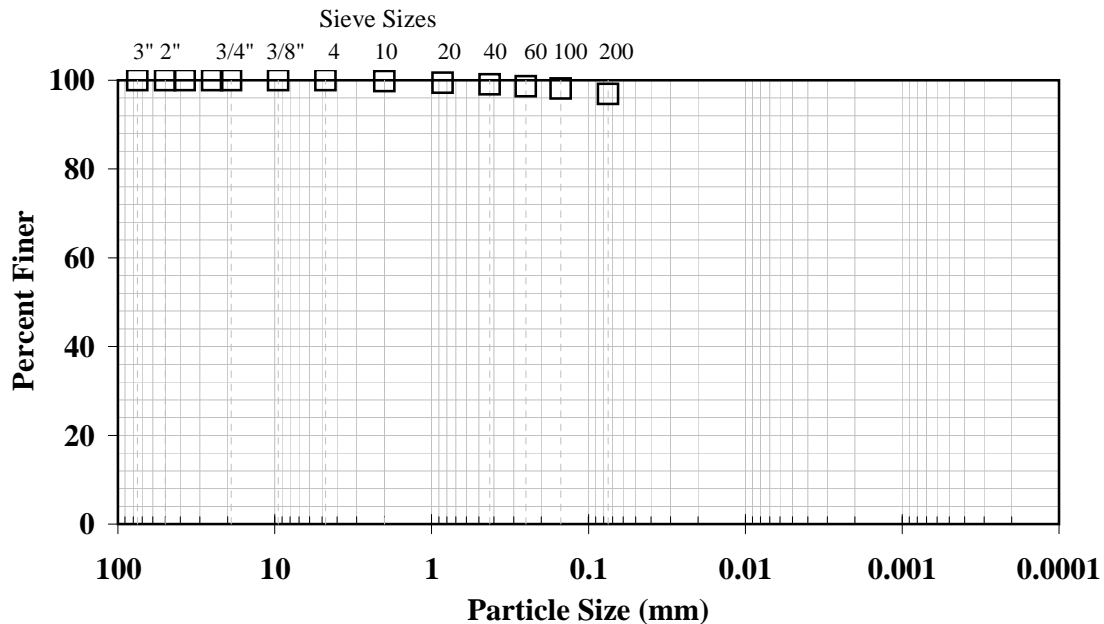
**TRI/ENVIRONMENTAL, INC.**

*A Texas Research International Company*

## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-1 (24-25 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	100.0
No. 10 (2.00 mm)	99.8
No. 20 (850 µm)	99.4
No. 40 (425 µm)	99.1
No. 60 (250 µm)	98.6
No. 100 (150 µm)	98.1
No. 200 (75 µm)	96.9

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	64
Plastic Limit	22
Plastic Index	42
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



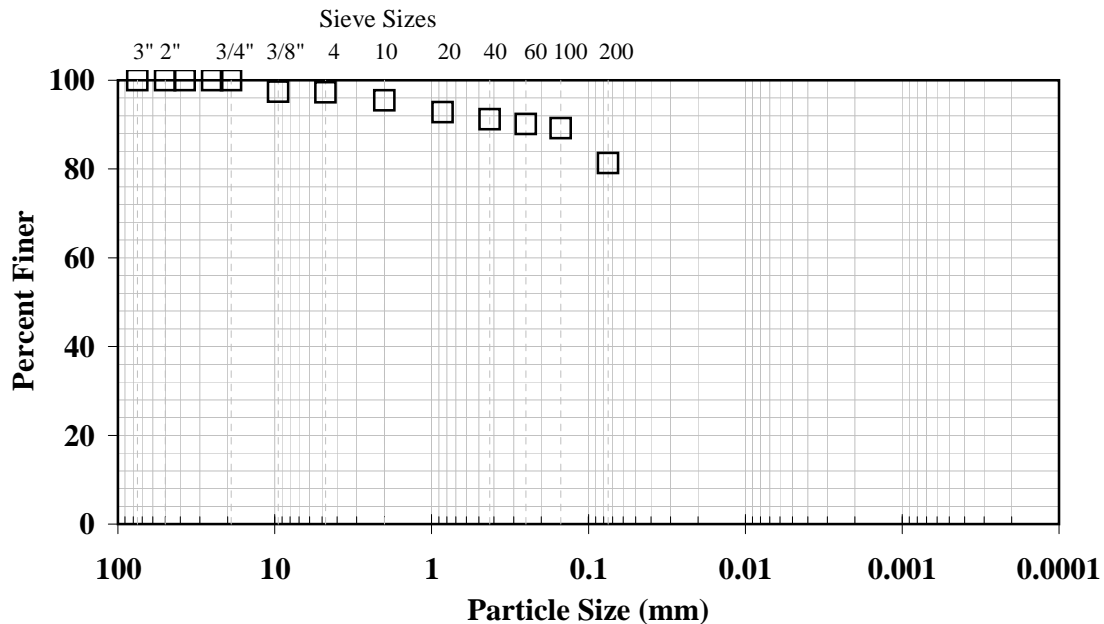
**TRI/ENVIRONMENTAL, INC.**

*A Texas Research International Company*

## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-2 (4-5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	97.4
No. 4 (4.75 mm)	97.3
No. 10 (2.00 mm)	95.5
No. 20 (850 µm)	92.8
No. 40 (425 µm)	91.2
No. 60 (250 µm)	90.2
No. 100 (150 µm)	89.2
No. 200 (75 µm)	81.3

Notes: Soil classifies as a fat clay with sand (CH) in accordance with ASTM D 2487.

The as received moisture content was 17.44 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	57
Plastic Limit	22
Plastic Index	35
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



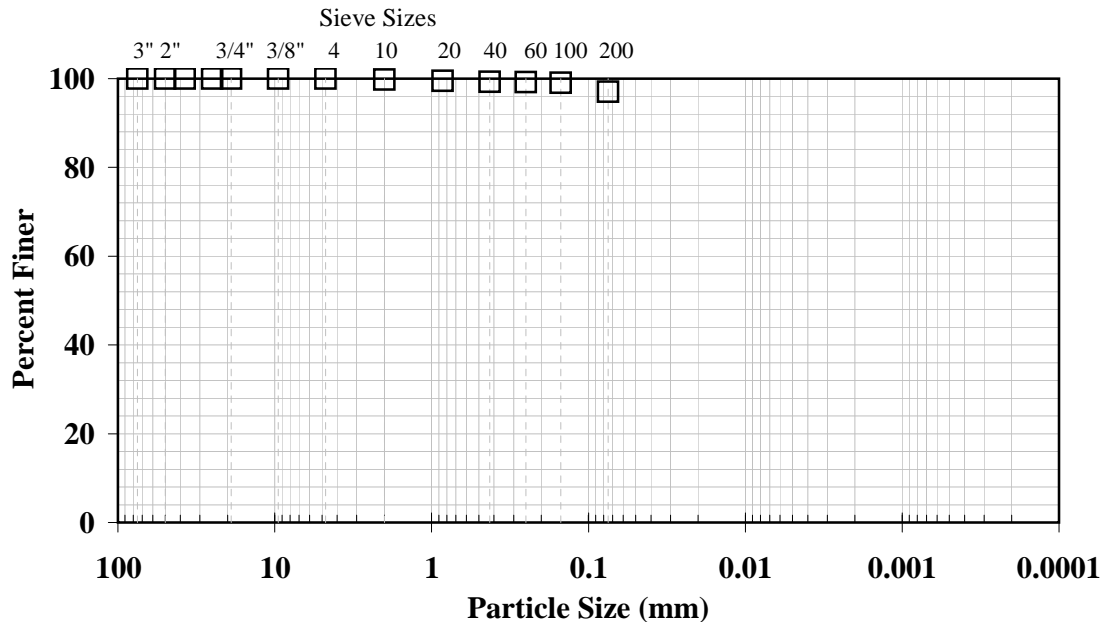
TRI/ENVIRONMENTAL, INC.

A Texas Research International Company

## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-2 (10-11.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	100.0
No. 10 (2.00 mm)	99.8
No. 20 (850 µm)	99.5
No. 40 (425 µm)	99.3
No. 60 (250 µm)	99.2
No. 100 (150 µm)	99.1
No. 200 (75 µm)	97.0

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	53
Plastic Limit	24
Plastic Index	29
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/20/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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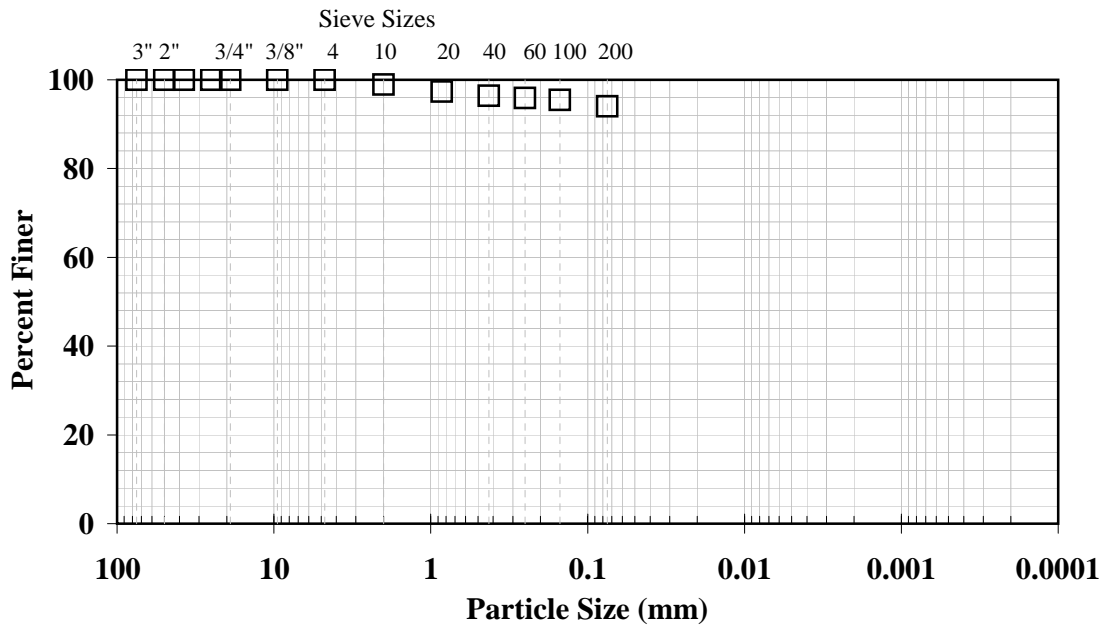
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-2 (15-16.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	100.0
No. 10 (2.00 mm)	98.9
No. 20 (850 µm)	97.3
No. 40 (425 µm)	96.4
No. 60 (250 µm)	95.9
No. 100 (150 µm)	95.5
No. 200 (75 µm)	94.0

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	66
Plastic Limit	24
Plastic Index	42
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/20/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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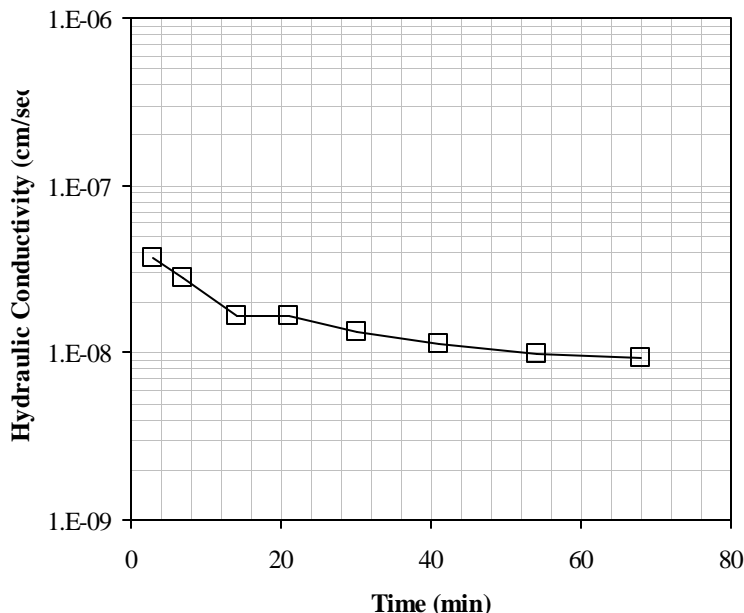


## Hydraulic Conductivity

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS)  
Leachate Evaporation Pond Design  
Sample: GB-2 (15-16.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 5084, Method F  
Test Date: 09/15/10

Hydraulic Conductivity vs. Time



Note: A B-value of 0.96 was achieved for the undisturbed specimen. Permeation measurements were made with a mercury U-tube. The effective confining pressure was 5 psi per test request.

INITIAL VALUES	
Avg. Sample Height (in)	2.02
Avg. Sample Diameter (in)	2.85
Wet Weight (g)	403.0
Area (in <sup>2</sup> )	6.38
Volume (cc)	210.7
Initial Water Content (%)	23.6
Total Density (pcf)	119.4
Dry Density (pcf)	96.6
G <sub>s</sub> (assumed)	2.65
Degree of Saturation (%)	87.9
Void Ratio	0.71
Porosity	0.42
1 Pore Volume (cc)	87.6

Hydraulic Conductivity

Time (min)	k at 20 deg C (cm/sec)
3	3.65E-08
7	2.80E-08
14	1.64E-08
21	1.68E-08
30	1.33E-08
41	1.12E-08
54	9.70E-09
68	9.25E-09

Average<sup>1</sup>: **1.1E-08**

1: Average corrected hydraulic conductivity ( $k_{20}$ ) is obtained from the last 4 average readings.

Cheng-Wei Chen, 09/20/10  
Analysis & Quality Review/Date  
Tested by: David Gonzales

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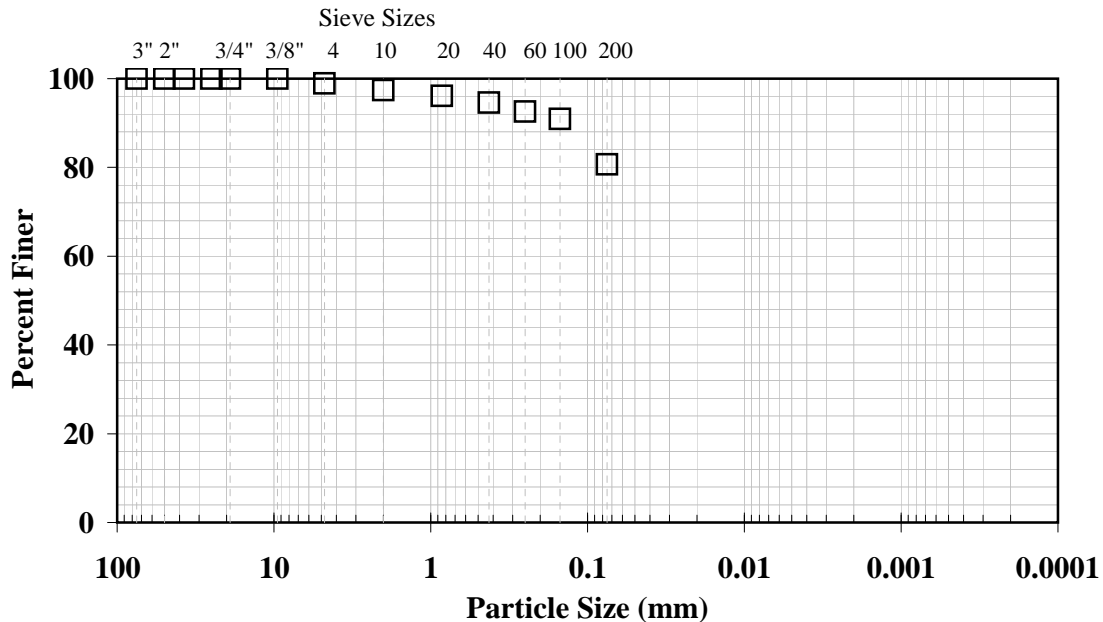
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-3 (1-2 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	98.9
No. 10 (2.00 mm)	97.4
No. 20 (850 µm)	96.1
No. 40 (425 µm)	94.6
No. 60 (250 µm)	92.6
No. 100 (150 µm)	90.9
No. 200 (75 µm)	80.7

Notes: Soil classifies as a fat clay with sand (CH) in accordance with ASTM D 2487.

The as received moisture content was 13.56 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	51
Plastic Limit	20
Plastic Index	31
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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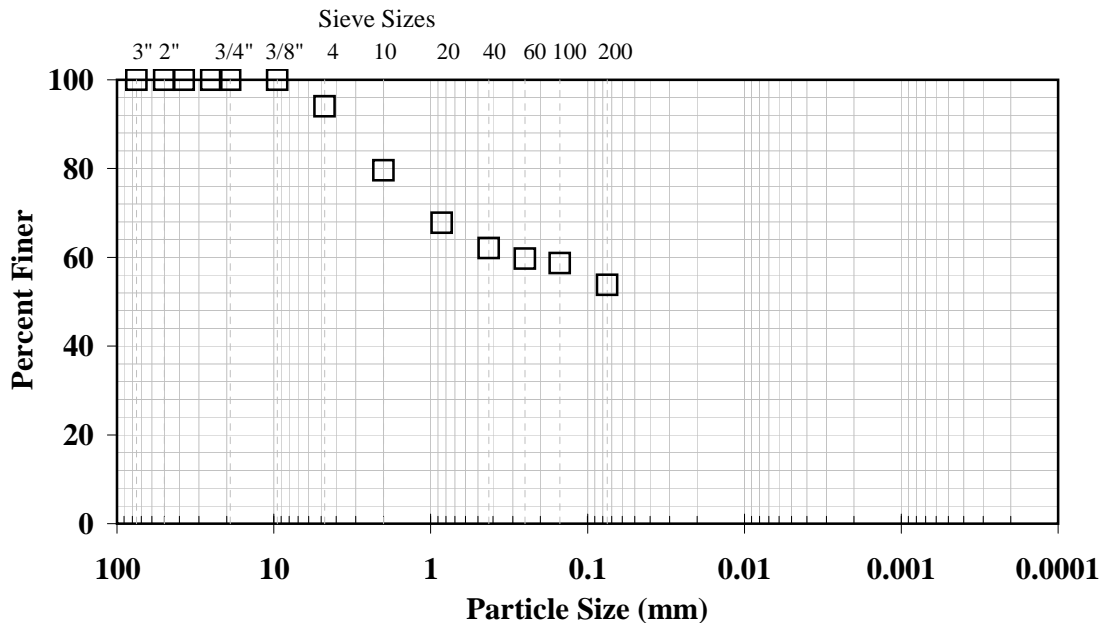
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
 Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
 Evaporation Pond Design  
 Sample: GB-3 (9-10 ft)

TRI Log#: E2347-08-03  
 Test Method: ASTM D 422  
 Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	94.0
No. 10 (2.00 mm)	79.6
No. 20 (850 µm)	67.8
No. 40 (425 µm)	62.1
No. 60 (250 µm)	59.7
No. 100 (150 µm)	58.7
No. 200 (75 µm)	53.8

Notes: Soil classifies as a sandy fat clay (CH) in accordance with ASTM D 2487.

The as received moisture content was 18.39 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	58
Plastic Limit	17
Plastic Index	41
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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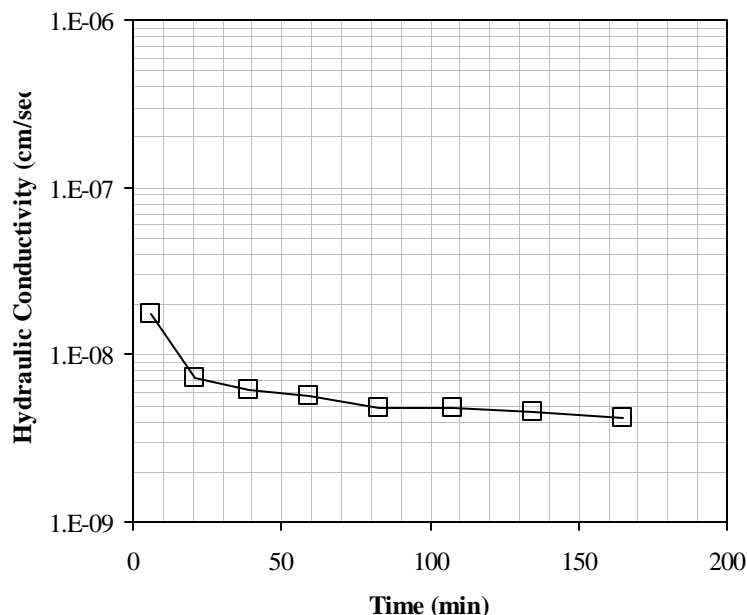


## Hydraulic Conductivity

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS)  
Leachate Evaporation Pond Design  
Sample: GB-3 (10-11.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 5084, Method F  
Test Date: 09/15/10

Hydraulic Conductivity vs. Time



Note: A B-value of 0.95 was achieved for the undisturbed specimen. Permeation measurements were made with a mercury U-tube. The effective confining pressure was 5 psi per test request.

### INITIAL VALUES

Avg. Sample Height (in)	1.97
Avg. Sample Diameter (in)	2.87
Wet Weight (g)	426.2
Area (in <sup>2</sup> )	6.46
Volume (cc)	208.2
Initial Water Content (%)	19.7
Total Density (pcf)	127.8
Dry Density (pcf)	106.8
G <sub>s</sub> (assumed)	2.65
Degree of Saturation (%)	95.0
Void Ratio	0.55
Porosity	0.35
1 Pore Volume (cc)	73.8

### Hydraulic Conductivity

Time (min)	k at 20 deg C (cm/sec)
6	1.76E-08
21	7.19E-09
39	6.13E-09
59	5.64E-09
83	4.82E-09
108	4.74E-09
135	4.50E-09
165	4.15E-09

Average<sup>1</sup>: **4.6E-09**

1: Average corrected hydraulic conductivity ( $k_{20}$ ) is obtained from the last 4 average readings.

Cheng-Wei Chen, 09/20/10  
Analysis & Quality Review/Date  
Tested by: David Gonzales

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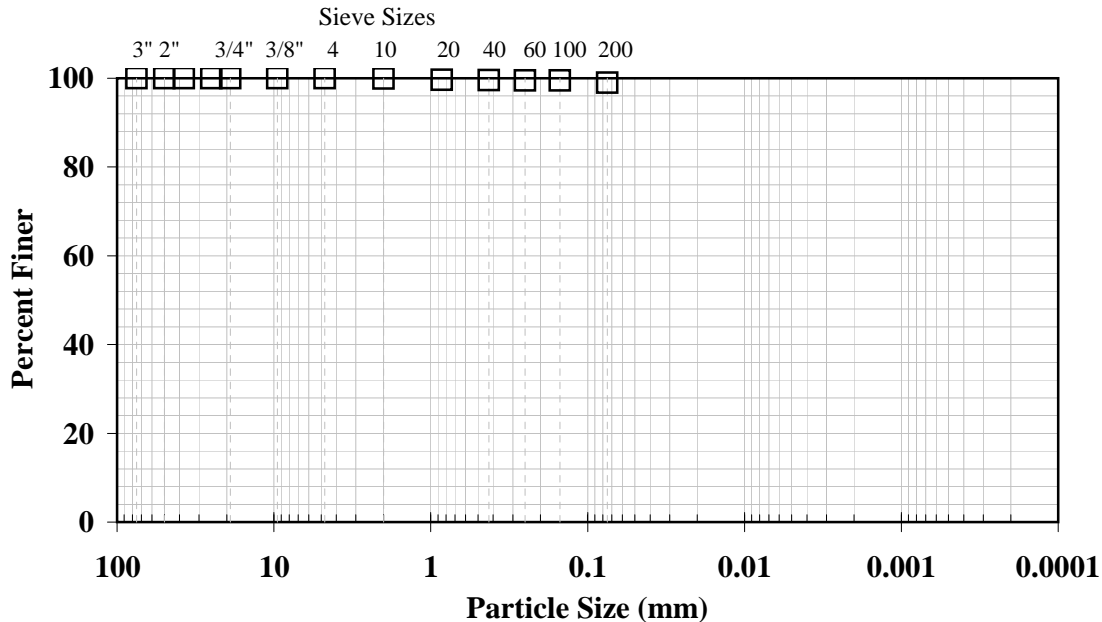
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-3 (21-22 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	100.0
No. 10 (2.00 mm)	99.9
No. 20 (850 $\mu$ m)	99.6
No. 40 (425 $\mu$ m)	99.5
No. 60 (250 $\mu$ m)	99.5
No. 100 (150 $\mu$ m)	99.5
No. 200 (75 $\mu$ m)	99.0

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	56
Plastic Limit	24
Plastic Index	32
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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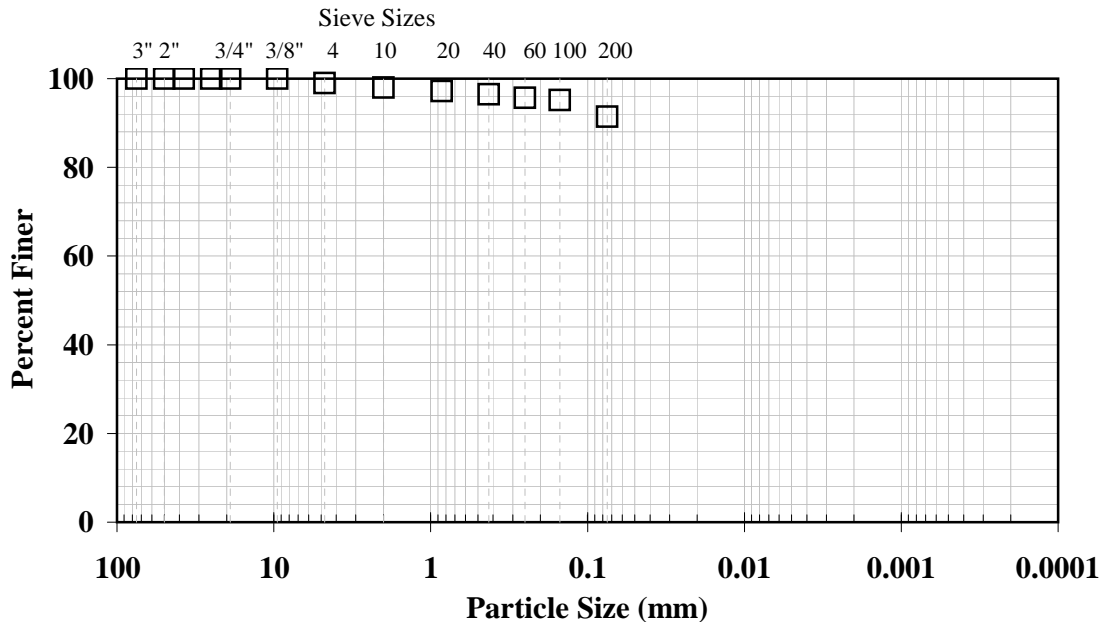
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-4 (4-5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	99.0
No. 10 (2.00 mm)	98.0
No. 20 (850 µm)	97.2
No. 40 (425 µm)	96.4
No. 60 (250 µm)	95.7
No. 100 (150 µm)	95.2
No. 200 (75 µm)	91.4

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

The as received moisture content was 25.08 % as determined by ASTM D 2216.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	68
Plastic Limit	23
Plastic Index	45
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/14/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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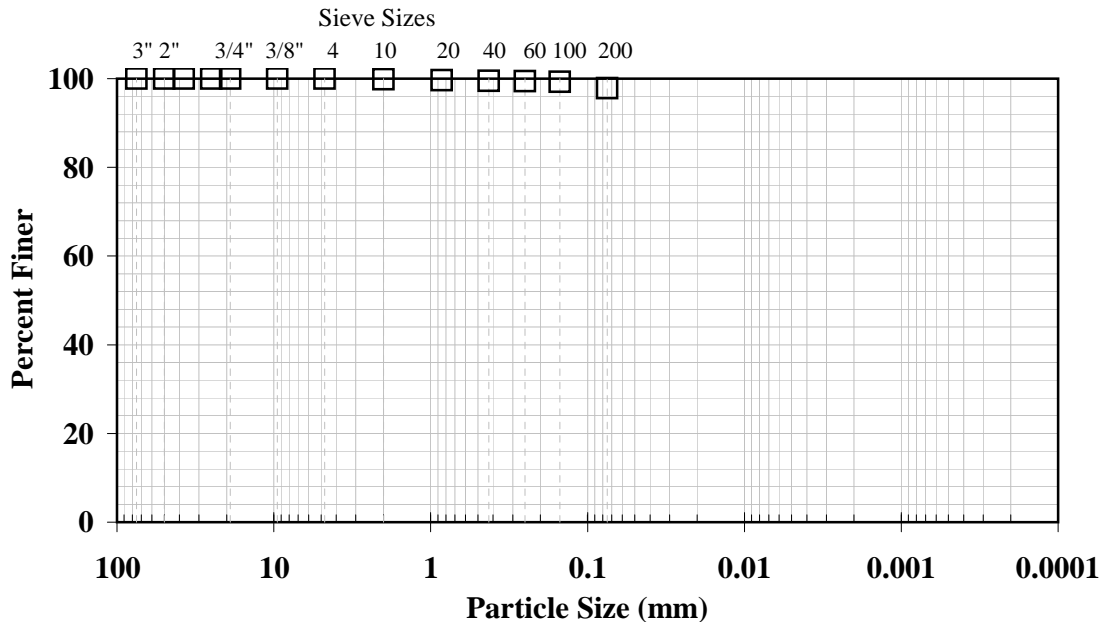
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-4 (10-11.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	100.0
No. 10 (2.00 mm)	99.8
No. 20 (850 µm)	99.6
No. 40 (425 µm)	99.5
No. 60 (250 µm)	99.4
No. 100 (150 µm)	99.3
No. 200 (75 µm)	97.8

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	61
Plastic Limit	25
Plastic Index	36
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/27/10

Quality Review/Date

Tested by: Adam Lewis & Olga Vasquez

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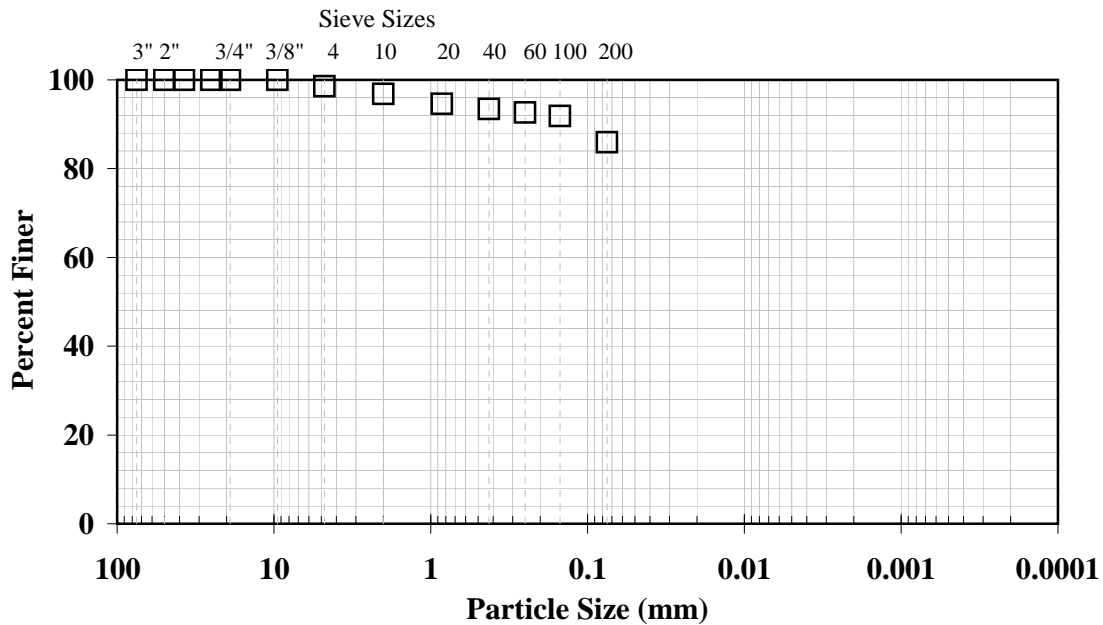
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-5 (2-5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/13/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	98.6
No. 10 (2.00 mm)	96.8
No. 20 (850 µm)	94.6
No. 40 (425 µm)	93.4
No. 60 (250 µm)	92.6
No. 100 (150 µm)	91.8
No. 200 (75 µm)	85.9

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	62
Plastic Limit	21
Plastic Index	41
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/20/10

Quality Review/Date  
Tested by: Adam Lewis & Olga Vasquez

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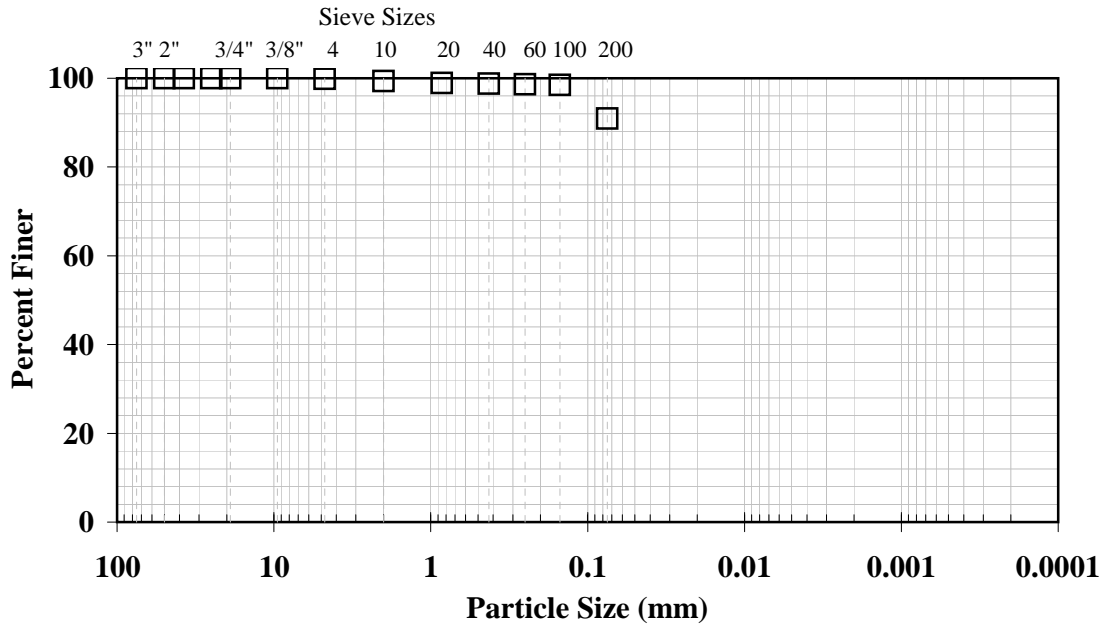
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-5 (5-6.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/23/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	99.8
No. 10 (2.00 mm)	99.4
No. 20 (850 µm)	98.9
No. 40 (425 µm)	98.8
No. 60 (250 µm)	98.7
No. 100 (150 µm)	98.5
No. 200 (75 µm)	90.9

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	55
Plastic Limit	28
Plastic Index	27
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/26/10

Quality Review/Date

Tested by: Roderick Thomas & Olga Vasquez

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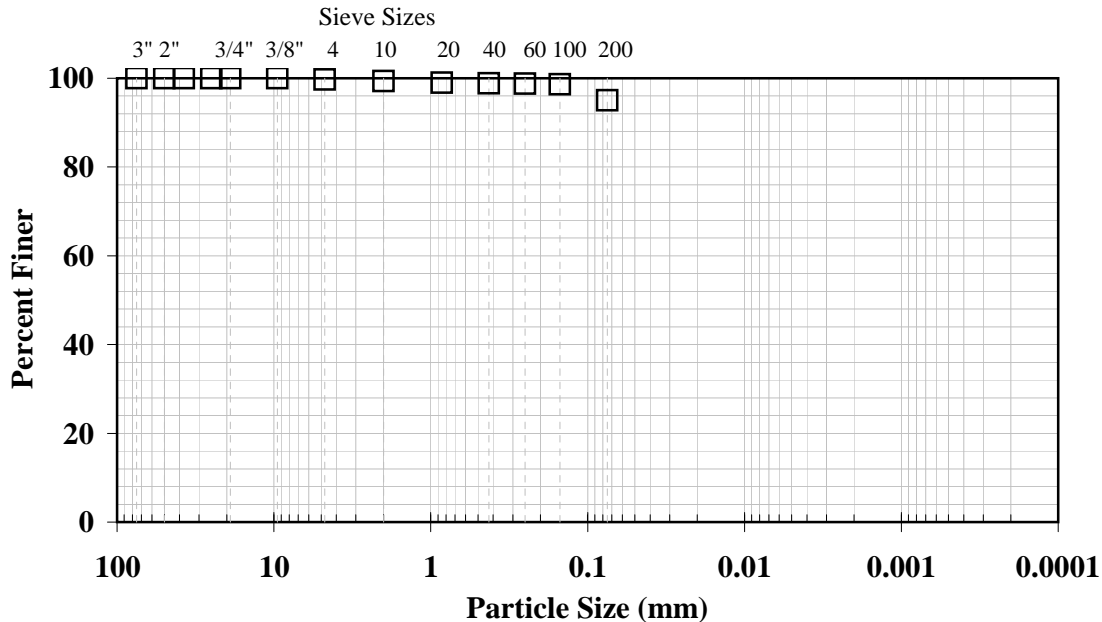
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-5 (10-11.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/23/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	100.0
No. 4 (4.75 mm)	99.7
No. 10 (2.00 mm)	99.4
No. 20 (850 µm)	99.0
No. 40 (425 µm)	98.9
No. 60 (250 µm)	98.8
No. 100 (150 µm)	98.6
No. 200 (75 µm)	95.0

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	58
Plastic Limit	26
Plastic Index	32
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/26/10

Quality Review/Date

Tested by: Roderick Thomas & Olga Vasquez

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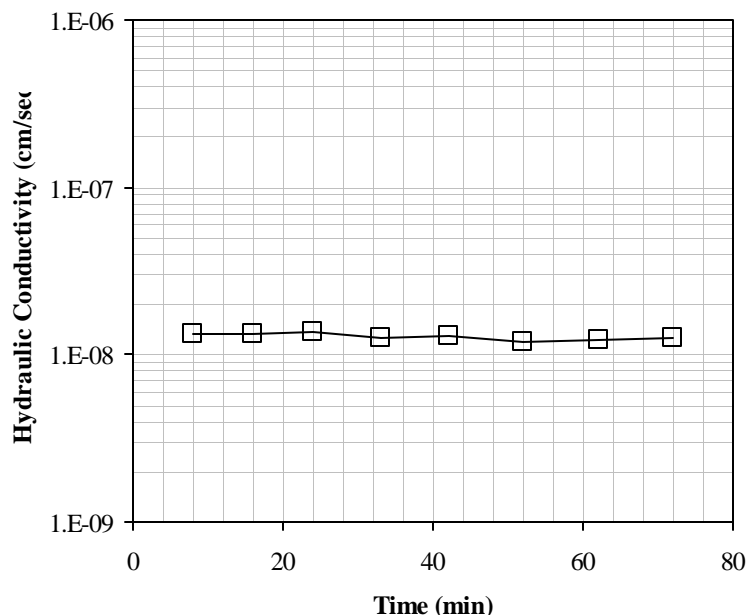


## Hydraulic Conductivity

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS)  
Leachate Evaporation Pond Design  
Sample: GB-5 (10-11.5 ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 5084, Method F  
Test Date: 09/22/10

Hydraulic Conductivity vs. Time



Note: A B-value of 0.95 was achieved for the undisturbed specimen. Permeation measurements were made with a mercury U-tube. The effective confining pressure was 5 psi per test request.

INITIAL VALUES	
Avg. Sample Height (in)	2.04
Avg. Sample Diameter (in)	2.93
Wet Weight (g)	420.2
Area (in <sup>2</sup> )	6.72
Volume (cc)	224.8
Initial Water Content (%)	21.1
Total Density (pcf)	116.7
Dry Density (pcf)	96.3
G <sub>s</sub> (assumed)	2.65
Degree of Saturation (%)	78.2
Void Ratio	0.72
Porosity	0.42
1 Pore Volume (cc)	93.9

Hydraulic Conductivity

Time (min)	k at 20 deg C (cm/sec)
8	1.32E-08
16	1.35E-08
24	1.38E-08
33	1.25E-08
42	1.28E-08
52	1.18E-08
62	1.21E-08
72	1.24E-08

Average<sup>1</sup>: **1.2E-08**

1: Average corrected hydraulic conductivity ( $k_{20}$ ) is obtained from the last 4 average readings.

Cheng-Wei Chen, 09/27/10  
Analysis & Quality Review/Date  
Tested by: David Gonzales

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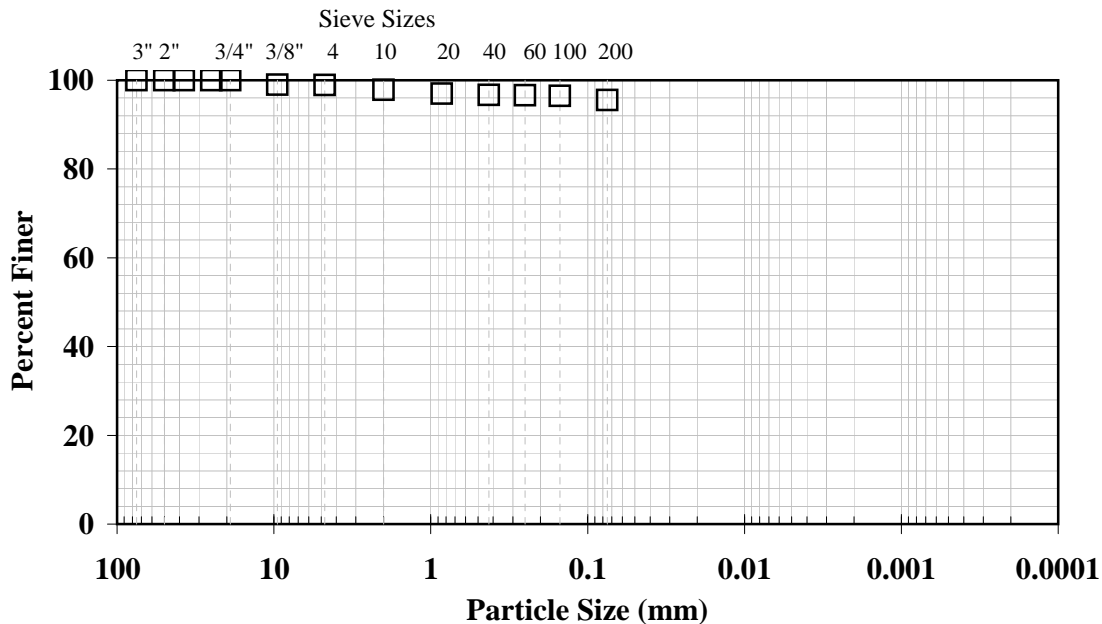
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## Particle Size Analysis for Soils

Client: Geosyntec Consultants  
Project: TXL0084-03 Sandy Creek Services (SCS) Leachate  
Evaporation Pond Design  
Sample: GB-5 (15-16ft)

TRI Log#: E2347-08-03  
Test Method: ASTM D 422  
Test Date: 09/23/10



Sieve Analysis	
Sieve Size	Percentage Passing (%)
3 in.	100.0
2 in.	100.0
1.5 in.	100.0
1 in.	100.0
3/4 in.	100.0
3/8 in.	99.0
No. 4 (4.75 mm)	98.9
No. 10 (2.00 mm)	97.9
No. 20 (850 µm)	97.0
No. 40 (425 µm)	96.7
No. 60 (250 µm)	96.6
No. 100 (150 µm)	96.5
No. 200 (75 µm)	95.5

Notes: Soil classifies as a fat clay (CH) in accordance with ASTM D 2487.

Plastic Index (ASTM D 4318) Results	
Liquid Limit	57
Plastic Limit	28
Plastic Index	29
Notes: Specimen was air dried, 3 point Liquid Limit procedure was used.	

Cheng-Wei Chen, 09/26/10

Quality Review/Date

Tested by: Roderick Thomas & Olga Vasquez

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