GROUNDWATER MONITORING PLAN

Gibbons Creek Steam Electric Station, Grimes County, Texas

Prepared for:

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1.0 INTRODUCTION

Groundwater monitoring will be conducted at the active coal combustion residual landfill and ponds at the Texas Municipal Power Agency (TMPA) Gibbons Creek Steam Electric Station (GCSES) to comply with the requirements of the Coal Combustion Residuals (CCR) regulations found in 40 CFR parts 257 and 261. This groundwater monitoring plan includes procedures to be used to collect samples to comply with these regulations.

1.1 Monitoring Objectives

The groundwater monitoring objectives are as follows:

- Collect representative samples from the uppermost aquifer at the following designated CCR units (Figure 1.1)
    - Site F Landfill
    - Ash Ponds
    - Scrubber Sludge Pond
- Measure groundwater levels in the uppermost aquifer
- Determine groundwater flow rate and direction in the uppermost aquifer
- Determine background groundwater quality
- Evaluate whether a statistically significant increase over background levels has been detected for Appendix III to Part 257 constituents at monitoring wells at the waste boundary for CCR units

2.0 GROUNDWATER MONITORING NETWORK

Groundwater monitoring networks have been established at the three CCR units at the GCSES; the Site F Landfill, Ash Ponds, and Scrubber Sludge Pond. The monitoring networks are shown in Figures 2.1 and 2.2, respectively. Construction details for the monitoring wells that comprise the networks are summarized in Table 2-1. Borehole and well construction logs are provided in Appendix A.

2.1 SITE F LANDFILL MONITORING WELL NETWORK

2.1.2 HYDROGEOLOGIC SETTING

The Site F Landfill is underlain by stratified, heterogeneous layers of clays, silts, and sands of varying thicknesses. Sandstone was observed at some boring locations as well. The elevation of screened intervals in monitoring wells ranges from approximately 250 feet to 220 feet above mean sea level (amsl). The screened intervals are generally completed in silty sands (SM) with intervals of clayey sands and silts.

Groundwater investigations by others (ERM, 2013, 2014) indicated that groundwater flow direction beneath the Site F Landfill was generally northwest to southeast. Groundwater level monitoring

completed by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), using an expanded monitoring network confirmed the general groundwater flow gradient from northwest to southeast, but influence from the Gibbons Creek Reservoir on groundwater flow direction was observed.

2.1.3 MONITORING WELL LOCATIONS AND DESIGNATED USE

The Site F Landfill monitoring well network is shown on Figure 2.1 and consists of wells installed by Amec Foster Wheeler in 2016 and 2017, and wells installed by Black and Veatch in 1988.

The Site F Landfill monitoring network consists of the following wells:

- Background Well: MNW-18
- Boundary Wells: SFL MW-2, SFL MW-3, SFL MW-4, SFL MW-5, SFL MW-6, SFL MW-7, and MNW-15
- Water Level Only Wells: MNW-11, MNW-17, MNW-16

2.2 SCRUBBER SLUDGE POND/ASH PONDS MONITORING WELL NETWORK

2.2.1 HYDROGEOLOGIC SETTING

The Ash Ponds and Scrubber Sludge Pond are underlain by interbedded silty and sandy clays, clay, clayey sands and silty sand. Hard sandstone intervals are intermittently present, as are thin lenses of lignite or lignitic silts. Groundwater is considered confined to semi-confined, and generally encountered at depths of 30 to 40 feet below ground surface. The elevation of monitoring well screened intervals ranges from approximately 240 ft amsl to 220 ft amsl.

Groundwater investigations by others (ERM, 2013, 2014) indicated that groundwater flow directions are controlled by the local topography and a groundwater divide exists between the Ash Ponds and the Scrubber Sludge Pond. Groundwater level monitoring completed by Amec Foster Wheeler using an expanded monitoring network confirms the presence of the groundwater divide and flow direction to the east beneath the Ash Ponds. Groundwater flows to the southwest beneath the Scrubber Sludge Pond. The background groundwater quality monitoring well is located on the groundwater divide and provides background data for both networks.

Water level measurements in the most recently-installed monitoring well, AP MW-6, may be anomalously lower than the rest of the monitoring well network. Consequently, temporal trends in the well will be evaluated moving forward to assess whether the conceptual flow model should be revised.

2.2.3 MONITORING WELL LOCATIONS AND DESIGNATED USE

The Ash Ponds and Scrubber Sludge Pond monitoring well networks are shown on Figure 2-2, and consist of both monitoring wells and piezometers. The piezometers are used for water level data collection only, groundwater quality samples are only collected from monitoring wells.

The monitoring well network includes:

- Background Well: SSP/AP MW-1 (used as background for both The Ash Ponds and Scrubber Sludge Pond networks)
- Scrubber Sludge Pond Boundary Wells: SSP MW-2, SSP MW-3, SSP MW-4
- Ash Ponds Boundary Wells: AP MW-1D, AP MW-3, AP MW-4, AP MW-5
- Ash Ponds Piezometers: AP PZ-1, AP PZ-2, AP PZ-3, AP PZ-4

2.3 MONITORING FREQUENCY

The CCR regulations require the collection and analysis of a minimum of eight independent samples from each background and downgradient well for the constituents listed in Appendix III and IV of Part 257 by no later than October 17, 2017. In order to meet this requirement, monitoring was conducted and a bimonthly (every two months) schedule. Groundwater monitoring events have occurred in June 2016, August 2016, October 2016, December 2016, February 2017, April 2017, June 2017, and August 2017. Additional groundwater monitoring events were scheduled, as wells were added to the monitoring network.

Semiannual monitoring frequency for *detection monitoring* will be implemented after October 2017. The CCR rules allow for reducing the monitoring frequency to annually, based on the availability of groundwater. If annual monitoring is justified by the site-specific conditions, the sampling frequency will be adjusted.

2.4 ANALYTICAL PARAMETERS

As noted above, eight independent groundwater samples were collected prior to October 17, 2017, and analyzed for the Appendix III and IV constituents designated in Part 257, which are listed in Table 2-2.

Table 2-2
Constituents for Detection and Assessment
Monitoring under the CCR Rule

Constituent	MCL (mg/L)	Analytical Method	Reporting Limit
Appendix III to Part 257 - Constituents for Detection Monitoring			
Boron	--	E200.7	0.05
Calcium	--	E200.7	1
Chloride	--	E300.0	1
Fluoride	4	A4500-F C	0.1
Sulfate	--	E300.0	1
pH (std)	--	A4500-H B	0.1
Total Dissolved Solids	--	A2540 C	40
Appendix IV to Part 257 - Constituents for Assessment Monitoring			
Antimony	0.006	E200.7	0.05
Arsenic	0.01	E200.8	0.01
Barium	2	E200.7	0.01
Beryllium	0.004	E200.7	0.001
Cadmium	0.005	E200.7	0.01
Chromium (Total)	0.1	E200.7	0.01
Cobalt	--	E200.7	0.02
Fluoride	4		0.1
Lead	0.015	E200.8	0.01
Lithium	--	E200.7	
Mercury	0.002	E245.1	0.001
Molybdenum	--	E200.7	0.05
Radium 226		E903.0	
Radium 228		RA-05	
Radium 226 and 228 combined	5 pCi/L	A7500-RA	
Selenium	0.05	E200.8	0.01
Thallium	0.002	E200.8	0.01

When semiannual *detection monitoring* begins after October 2017, groundwater samples will be analyzed for Appendix III constituents only. In the event that a statistically significant increase over background levels has been detected for one or more of the constituents listed in Appendix III, the Site will enter *assessment monitoring*. During *assessment monitoring*, groundwater samples will be analyzed for all constituents in Appendix IV within the first 90 days of triggering the assessment monitoring program, and semi-annually thereafter. After two consecutive sampling events that demonstrate all constituents to be at or below background values, the Site monitoring program may return to *detection monitoring*.

3.0 FIELD SAMPLING PROCEDURES

The groundwater monitoring program involves collecting groundwater level measurements from the designated wells and piezometers and collecting groundwater samples from the designated wells. This section presents the specific procedures for performing these activities, including:

- groundwater monitoring locations,
- field measurement procedures and criteria,
- sampling methods,
- quality control sample protocols,
- sample container requirements,
- sample preservation methods,
- decontamination procedures, and
- documentation of sampling activities.

This section is intended to be a field manual, and provides field personnel with easy-to-use procedures and methods for consistently collecting quality, representative groundwater samples and measurements. Field personnel must understand and use these field sampling procedures (FSPs) during groundwater sampling events, consistently follow the specified procedures and protocols, and clearly document deviations from the FSPs, along with reasons for deviations.

Monitoring wells are listed in Table 2-1 along with their respective construction details. Borehole and well construction logs are provided in Appendix A. Appendix B contains field form templates for each monitoring event.

3.1 GROUNDWATER LEVEL MONITORING

Groundwater level measurements are collected from all monitoring wells and piezometers at the beginning of each monitoring event, and prior to sampling. Groundwater levels are measured to the nearest 0.01 foot, from their respective well reference points (i.e., the top of the inner casing).

Groundwater level measurements are compared to the most recent measurements obtained for that well or piezometer. If the measurements differ by more than 0.5-foot, a second groundwater level measurement is collected for verification purposes.

Groundwater levels are measured using a decontaminated water level indicator. If multiple meters are used, the calibration of each meter is checked for accuracy. The following procedures are followed each time water levels are measured in a monitoring well:

1. Turn on water level meter. Depending on the condition of the water level meter, the sensitivity may have to be adjusted by turning the power switch dial to the desired sensitivity level. Typically, the water level meter works best adjusted to a low sensitivity.
2. Press the appropriate button to test the meter.
3. Clean the meter and/or confirm that the meter has been properly decontaminated.
4. Open/unlock well head.
5. Don a new pair of nitrile gloves.
6. Water level readings are measured relative to the surveyed mark on the top of the well's inner casing. If a mark is not present, measure from the northernmost top of well casing.
7. Lower the water level meter probe into the well. When the buzzer sounds and/or the light turns on, stop the probe's descent. Gently raise the probe until the buzzing stops. Gently lower the probe until the buzzing starts again and stop. The cable should be immediately next to the measuring mark from now until the final reading is measured. If the buzzer stays on, or is very weak, adjust the sensitivity.
8. Without changing the hold on the cable, raise the probe out of the water and retest the measurement.
9. Keep adjusting the hand location until two identical readings are noted. Identical readings will be the same to 0.01 of a foot.
10. If the numbers on the cable can be observed, read the measurement at the mark to the nearest 0.01 foot.
11. If the numbers on the cable cannot be observed, place fingers around the cable at the location where the buzzer sounds relative to the reference point, pull the cable out without moving your hand with respect to its location on the cable, and record the reading.
12. If the two readings are within 0.01 foot, record the depth to water reading on the appropriate form.
13. Remove the probe from the well. Take note where the cable becomes wet. The cable and probe below this point needs to be decontaminated.
14. Decontaminate the probe and two feet (or the appropriate length if more than two feet immersed in water column) of cable by immersing in an Alconox® solution followed by immersing in tap water and deionized water rinses, respectively.
15. Spool the remaining cable.
16. Secure the probe in the holder.

17. Turn off water level meter.
18. Commence sample collection procedures or close and lock the well.

3.2 GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring includes field and laboratory analyses. Only meters that were calibrated at the beginning of the work day are used to measure field water quality parameters, which include temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), turbidity, and specific conductance (SC). Field water quality parameters are measured in a flow-through cell at regular intervals (typically every five minutes) during the low-flow process.

Samples analyzed by the contract laboratories are collected in new sample containers that are provided by the laboratory. Energy Laboratories, is the laboratory contracted by TMPA to provide analytical services.

3.2.1 Groundwater Sample Collection Procedures

The goal of groundwater sampling is to collect samples that are representative of in-situ groundwater conditions and to minimize changes in groundwater chemistry that would adversely affect analyte concentrations during sample collection and handling. To achieve this goal, groundwater samples are collected from the monitoring wells using U.S. Environmental Protection Agency's (EPA's) *Low Stress (low-flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* guidance (EQASOP-GW4), and summarized below.

Beginning with upgradient wells first, and progressing sequentially through wells with the lowest to highest contaminant concentrations, groundwater conditions are stabilized and samples collected in a consistent manner for each well. A variable speed electrical submersible pump or peristaltic pump is used to purge and collect groundwater samples from well.

The following procedures will be used when groundwater from monitoring wells, using the low-flow, minimal drawdown method:

1. Arrive at well location and start to fill out Well Sampling Record. Fill out: Date, Time, Well ID, and Sampler.
2. Put on new nitrile gloves.
3. Using a decontaminated water level meter, measure and record the depth to water from the measuring point to an accuracy of 0.01 foot. The measuring point is marked on the top of the inner casing.
4. If using a submersible pump, decontaminate the pump and connect and tighten the dedicated tubing to the submersible pump. Verify that safety lead and electrical connections to the submersible are tight and secure.

5. Lower the submersible pump to the sampling depth. If using a peristaltic pump, feed the dedicated tubing down to the sampling depth, then connect the tubing to the peristaltic pump.
6. Verify that the control box is at the lowest setting and start the pump..
7. Adjust the setting on the control box to the point where water is produced from the well.
8. Measure and record the pumping rate in milliliters per minute (ml/min) by collecting the discharged water in a beaker or graduated cylinder. Adjust the controller setting as needed so that the flow rate is between 100 and 500 ml/min.
9. Once maximum discharge rate is achieved without lowering water level more than 0.3 feet, record the final purge settings on the Well Sampling Record for use in future sampling events. The purge time starts when the settings are adjusted.
10. Collect purge water into five-gallon plastic containers as needed.
11. Connect the discharge line to the flow-through cell.
12. After the flow-through cell is connected and air bubbles evacuated to the extent possible, water quality parameters (pH, DO, ORP, SC, temperature, and turbidity) and depth to water (DTW) are measured and recorded at approximate five-minute intervals. The relative percent difference (RPD) and delta calculations are conducted and recorded between the readings.
13. When the well has been purged for 60 minutes or field water quality readings have stabilized, the well is ready to be sampled. The field parameters are considered stable when three consecutive field measurements meet the criteria listed in Table 3-1. If the well has been purged for 60 minutes and the field parameters have not stabilized, it is noted on the sampling log, and samples are collected from the well.
14. Collect a groundwater sample following the sample collection procedures in Section 3.2.
15. Stop the pump. Disconnect the pump from the power source. If a generator is used, turn off the generator.
16. Place the sample bottles into a plastic bag and into a cooler with ice.
17. Disconnect the tubing from the submersible/peristaltic pump, secure the dedicated tubing in a clean, clearly labeled storage bag and secure the well cover. (The storage bag is placed in the on-site storeroom at the end of the day).
18. Decontaminate the water level meter and submersible pump (if used) following the procedures indicated in Section 3.8.
19. Pack up the equipment and mobilize to the next well.
20. The purge and decontamination waters can be discharged to the ground near the well or Ash Ponds or Scrubber Sludge Pond.

The submersible pump (if used) and dedicated tubing are positioned at the same depth (approximately halfway through the screened interval) in each well for each sampling event. The purge rates for each well typically are similar during successive sampling events. The purge rate

for the low-flow method wells initially can be set to the rate used in previous events and adjusted as needed based on current groundwater conditions.

3.2.2 Field Parameter Measurements and Stabilization

Field water quality data are recorded during well purging to determine when groundwater conditions in the well have stabilized, and representative formation water is being sampled. As stated above, field parameters are measured in a flow-through cell at regular intervals (typically every five minutes) during the low-flow purging process, and purging continues until the field parameters have stabilized based on the criteria summarized in Table 3-1, or until the maximum purge volume/time is met.

Table 3-1. Field Parameter Stabilization Criteria for Monitor Well Purging and Sampling

Parameter	Low-Flow Method
pH	+/- 0.1 S.U.
Conductivity	+/- 3%
Temperature	+/- 3%
Dissolved Oxygen	+/- 10% or +/- 0.1 mg/l if <2.0
ORP	+/- 10% or +/- 10 mV if < 100
Turbidity	<10 NTU or +/- 10%
Drawdown	<0.3’
Pumping rate	100-500 ml/min
Volume	No Criteria
Time	Maximum of 60 min

Notes: All percentages are relative percent difference.

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The stabilization criteria are also listed on the well sampling forms in Appendix B.

3.2.3 Sample Collection

When the stabilization criteria are met, a groundwater sample is collected. Groundwater samples are collected from the pump discharge line directly into laboratory-supplied containers appropriate for the specific analysis being conducted. Specific procedures for collecting groundwater samples include the following:

1. Fill out the sample bottle labels using a pen with black waterproof ink. Place the preservative provided by the lab in the appropriate bottle(s).
2. Don new nitrile gloves.
3. Disconnect the pump’s discharge line from the flow-through cell.

4. Fill the sample bottles being careful not to overfill bottles with preservative.
5. Stop the pump.
6. Place the bottles into a cooler with ice.

Other general procedures that are followed during sampling include:

- Avoid rinsing the sample bottles before filling.
- Collect water sample from the pump's discharge line directly into laboratory-supplied containers appropriate for the specific analysis being conducted.
- Open only one sample container at a time. Immediately replace the container's cap and make sure the label is completed before starting to fill the next bottle.
- Minimize the potential for contamination to sample containers and equipment by sampling up wind and/or removing contaminants before opening containers. Common contaminants may include dust or other particulate matter.
- Immediately put the cap on each bottle after filling it.
- Place filled sample bottle into an iced cooler (except for radiochemical analysis) and enter sample information onto the appropriate chain of custody (COC) forms.

3.2.4 Sample Containers, Preservation, and Holding Times

Table 3-2 lists the number of sample bottles, the laboratory analyte(s), the type and size of the sample containers, the preservatives, and holding times. All samples are collected into new bottles supplied by the laboratory. If preservatives are added into the sample containers by the laboratory, that information is clearly marked on the container.

Table 3-2 Sample Parameter Groups, Container Sizes, Preservation Methods, Holding Times

Qty.(1)	Analyte(s)	Type-Size	Preservative	Method	Holding Time
1	Appendix III Constituents(2)	Polyethylene-1 L	None	No filter	28 days
1	Appendix IV Metals(3)	Polyethylene-500 ml (alternate - 16 oz.)	Nitric Acid to pH < 2	No filter	28 days for mercury, 6 months for others
1	Appendix IV Radium 226 and 228	Polyethylene-2L (alternate - 0.5 gal.)	Hydrochloric Acid to pH < 2	No filter	28 days

Notes: (1) Number of sample bottles filled for analyte(s).
(2) pH, total dissolved solids, boron, cadmium, chloride, sulfate, fluoride,
(3) Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, molybdenum, selenium, thallium.

"L"=liter
"ml"=milliliters

3.3 DOCUMENTATION OF FIELD ACTIVITIES

All field activities, including daily activities, sample locations and identification numbers, and significant observations or events, are documented by field staff on the appropriate forms. Specific forms for water level monitoring, equipment calibration, and groundwater sampling are included in Appendix B. The data are intended to record events in sufficient detail to allow personnel, at a later date, to reconstruct events that transpired during the life of the project. Entries are written in black indelible ink to allow preservation of information. The general documentation requirements are summarized as follows:

1. Entries will be legible.
2. Entries will be written in indelible black ink.
3. Mistakes will be corrected by drawing a single line though the error. Corrections will be initialed. No entries will be obliterated for any reason.
4. The tops of pages will be numbered sequentially and dated. The sampler will initial and date the bottom of each page and sign the last page for each day.
5. There will be no pages left blank.
6. Opinion or subjective material will not be entered into the logbook.

Each day, the following data are recorded in the logbook:

1. Project name and date.
2. Daily objectives and task progress throughout the day.
3. Weather (temperature, cloudiness, barometric pressure, wind).
4. Water quality and turbidity meters used (type, model).
5. Person calibrating meter(s).
6. Calibration results (buffers used with manufacturer, lot numbers, and expiration dates).
7. Problems calibrating meters.
8. Objective status at the end of the say, and issues encountered.

At each well, the following data is recorded in the logbook:

1. Well name and arrival time.
2. Person(s) sampling.
3. Purging method (low-flow or well volume).
4. QA/QC samples collected and the sample designation.
5. Samples preservation (ice, acid preservative).
6. Equipment decontamination procedures.
7. Decontamination/purge water disposal.
8. Comments (difficulties, questionable data, deviations from this plan, etc.).
9. Problems with field meters.
10. Visitors (name, title, organization).

3.4 SAMPLE IDENTIFICATION, DOCUMENTATION, AND CUSTODY

Collected samples are labeled in water-proof ink with the following information:

- sample name,
- date and time of collection,
- name or initials of person collecting the sample, and
- analyte list.

Similar information is also entered on the COC form, which remains with the respective collected sample through delivery to the analytical laboratory. Samplers maintain proper custody of their respective samples until delivery to the laboratory, or the samples are relinquished to another party. A sample is considered to be under a person's custody if:

- the sample is in the person's physical possession;
- the sample is in view of the person after that person has taken possession of the sample;
- the sample is secured by that person so that no individual can tamper with the sample; or
- the sample is secured by that person in an area that is restricted to authorized personnel.

Completed COC forms are delivered with the samples to the analytical laboratory. Each COC form must match the samples included in the associated cooler. The COC forms include the following information:

- Project name.
- Unique sample identification number.
- Unique COC number.
- Sample collection date and time.
- Sample matrix.
- Number and type of containers submitted.

- Preservation method, if applicable.
- Analyses requested for each sample.
- Special handling or analysis requirements.
- Courier shipment tracking number.
- Dated signature of the person collecting the samples.
- Dated signature(s) of persons, other than the sampler, involved in the delivery of the samples to the laboratory.
- Dated signature of the laboratory acknowledging receipt of the collected samples.

The COC form is filled out and signed in black indelible ink. The COC number and the date and time of delivery to the laboratory are noted in the field logbook. A copy of the COC form is delivered to and retained by the Project Manager.

3.5 SAMPLE PACKING AND TRANSPORT

Once collected, groundwater samples are packed for transport to the analytical laboratory. Care should be taken in packing the groundwater samples so that there is no damage to sample containers during transport to the contract laboratory. Samples are delivered to:

Energy Laboratories
1120 South 27th Street
Billings, Montana 59101

(406) 252-6325

Custody seals will not be required on the coolers if they are turned over directly to laboratory personnel at the time of delivery. Coolers delivered to the laboratory after hours will be placed in the designated receiving storage locker and custody seals placed on the right and left front and back sides across the gap between the lid and the cooler. The storage locker will be locked and the laboratory notified that coolers have been placed in the after-hours storage locker.

3.6 FIELD EQUIPMENT CALIBRATION

The field water quality meters are calibrated following the manufacturer's instructions. Except for temperature, pH, SC, DO, ORP, and turbidity are calibrated at the start of each day, and checked immediately after calibration, and at any time the meter is believed to be operating poorly. Calibration readings are recorded on the field calibration form, included in Appendix B. A meter is recalibrated when the reading is not within +/-10% of the standard solution or +/-0.20 pH units of the buffer solution. If the meter cannot be recalibrated, it is not used, and is sent to the rental supplier for repair.

At the end of each day of sampling, potential drift in parameter readings is evaluated by measuring standards for each parameter. The drift readings also are recorded on the field calibration form. Acceptable performance of the meter(s) is indicated by a drift of +/- 0.20 standard units for pH and +/- 10% for the remaining calibrated parameters.

3.7 SAMPLE DOCUMENTATION AND RECORDS

Field activities, including daily activities, sample locations and identification numbers, and any significant observations or events, are described in detail on the appropriate forms and/or in a field notebook. The activities and details, complete with time tags, are also written in the bound field logbook. There are individual forms for water level monitoring, equipment calibration, and groundwater sampling. Copies of these forms are included in Appendix B. The data are intended to record events in sufficient detail to allow personnel, at a later date, to reconstruct events that transpired during the life of the project. Entries are written in black indelible ink to allow preservation of data. Mistakes are corrected by drawing a single line though the error and the author initialing next to the deleted error. No entries will be obliterated for any reason.

3.8 EQUIPMENT DECONTAMINATION

Water level monitoring and non-dedicated groundwater sampling equipment that come in contact with groundwater are cleaned prior to use and between sampling locations. The non-dedicated submersible pump is decontaminated by pumping a series of solutions through the pump. The solutions are pumped in the following order: non-phosphate detergent (Alconox®), tap water, and deionized water. The last two feet of the water level meter cable is decontaminated by immersion in a non-phosphate detergent solution followed by immersion in tap water and deionized water rinses, respectively. After decontamination, equipment is stored and/or transported under clean conditions. Typically, equipment is stored in a clean plastic bag until reuse.

3.9 HANDLING AND DISPOSITION OF INVESTIGATION-DERIVED WASTES

Due to the low levels of target parameters, purge water can be discharged to the ground in the vicinity of the well. Alternately, purge water can be placed in the Ash Pond or Scrubber Sludge Pond.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 STANDARD OPERATING PROCEDURES

The groundwater sampling procedures in Section 3.0 will be followed when collecting groundwater samples and measuring water levels and field parameters. The use of these standard operating procedures is meant to ensure consistency across multiple sampling events and possibly different personnel.

4.2 SAMPLE ANALYSIS VALIDATION

The type and reliability of methods used to analyze samples is important to ensure data quality. This section describes the collection of Quality Assurance/Quality Control (QA/QC) samples and the data review procedures that will be followed to ensure acceptable data.

4.2.1 Quality Assurance and Quality Control Samples

Samples are collected at regular intervals for QA/QC purposes. These samples include duplicate, field blank, and/or equipment rinse samples. The designations given to QA/QC samples and the associated original samples are documented on the sampling logs and in the logbook.

Duplicate samples are used to compare results from two separate samples taken from the same location at a rate of one duplicate per ten samples (or less). For each duplicate, a second set of bottles is filled following the same procedures as used for the original sample. The duplicate and original sample bottles are filled by alternating the discharge between the bottles after each one-third of the bottle is filled. Duplicate samples are designated by adding the suffix "-FD" to the well name from which the duplicate was collected (e.g., a duplicate sample from SFL MW-3 is designated as SFL MW-3 -FD). Wells selected for duplicate analysis change with each sampling event and are identified on the sampling log.

Field blanks and equipment rinsate blanks are collected during each sampling event. Blank samples are used to evaluate cross-contamination Each blank sample is a full bottle set with a unique sample designation. Field blanks are designated as "FB", whereas equipment rinse blanks are designated as "EQ". Each blank is sequentially numbered in the order collected starting with "01". The sample bottles are filled with deionized (DI) water in the same manner as the original sample. Field blanks are collected at a rate of one blank for every 20 samples (or less). Equipment rinsate blanks are collected when non-dedicated sampling equipment is used, at a rate of one sample per workday. Once sampling equipment has been decontaminated, DI water is pumped through the equipment into the appropriate sample bottles. The well locations from where field and equipment rinse blanks are collected are documented on the Well Sampling Record and the field logbook.

4.2.2 Data Review Procedures

To ensure quality data collection and compliance with CCR data quality regulations, a data review will be conducted for each sampling event. The contract laboratory will complete a review of the data in accordance with its internal laboratory guidelines and the applicable analytical methods used during sample analysis. Each data package from the laboratory will include a QC summary report.

A data usability review will be completed by Amec Foster Wheeler for each sampling event. A Data Usability Summary (DUS) will be prepared in accordance with TCEQ RG-366/TRRP-13. The DUS procedures were developed by the TCEQ for use in its Texas Risk Reduction Program but provide a common, known methodology for evaluating data usability. A DUS report will be prepared and included in the project file.

Table 2-1
Well Construction Details
TMPA Gibbons Creek Steam Electric Station

10/10/2017

Well ID	Northing[1]	Easting[1]	Land Surface Elevation (ft. amsl)	Measuring Point Elevation (ft. amsl)	Total Well Depth (ft. below TOC)	Total Well Depth (ft. bgs)	Total Borehole Depth (ft. bgs)	Total Depth (elevation)	Screen Interval (ft. bgs)		Screen Interval (elevation)	
									Top	Bottom	Top	Bottom
AP MW-1D	10213589.808	3635630.942	269.02	272.04	43.0	40.0	40.0	229.0	34.5	39.5	234.5	229.5
AP MW-3	10213665.476	3635026.590	271.46	274.68	43.4	40.2	40.0	231.3	34.5	39.5	237.0	232.0
AP MW-4	10212415.597	3635562.990	270.93	274.16	52.8	49.6	50.0	221.4	44.5	49.5	226.4	221.4
AP MW-5	10212901.968	3635577.940	271.16	274.13	43.1	40.1	40.0	231.0	30.5	35.5	240.7	235.7
AP MW-6	10212689.394	3634726.766	274.74	277.95	48.1	44.9	50.0	229.9	41.0	46.0	233.7	228.7
AP PZ-1[2]	10214173.721	3634278.958	262.70	265.67	29.4	26.4	35.0	236.3	21.0	26.0	241.7	236.7
AP PZ-2[2]	10214308.029	3634847.514	271.71	274.91	43.2	40.0	40.0	231.7	34.5	39.5	237.2	232.2
AP PZ-3[2]	10213822.938	3635414.358	255.76	259.11	43.1	39.7	40.0	216.0	34.5	39.5	221.3	216.3
AP PZ-4[2]	10211826.931	3634752.131	271.39	273.65	45.3	43.0	45.0	228.4	38.5	43.5	232.9	227.9
SSP MW-2	10212007.735	3633835.274	280.62	283.66	46.9	43.9	45.0	236.8	38.5	43.5	242.1	237.1
SSP MW-3	10211581.588	3633889.744	280.95	283.97	48.2	45.2	45.0	235.8	39.5	44.5	241.5	236.5
SSP MW-4	10211577.225	3634198.516	280.86	283.86	51.5	48.5	50.0	232.3	43.0	48.0	237.9	232.9
SSP/AP MW-1	10212432.016	3634290.363	269.33	272.53	43.2	40.0	40.0	229.3	29.5	39.5	239.8	229.8
SFL MW-2	10220908.018	3636738.712	265.69	268.31	23.6	21.0	50.0	244.7	16.0	21.0	249.7	244.7
SFL MW-3	10220174.555	3637846.961	271.65	275.00	28.2	24.9	25.0	246.8	19.5	24.5	252.2	247.2
SFL MW-4	10220291.840	3637261.610	266.46	269.53	42.7	39.6	40.0	226.8	34.5	39.5	232.0	227.0
SFL MW-5	10221191.234	3636721.834	273.33	276.25	24.3	21.4	25.0	251.9	16.0	21.0	257.3	252.3
SFL MW-6	10221819.634	3636700.033	283.49	286.66	23.1	19.9	20.0	263.6	14.5	19.5	269.0	264.0
SFL MW-7	10220517.925	3638408.836	264.83	264.63	58.1	58.3	55.0	206.5	50.0	55.0	214.8	209.8
MNW-11[2]	10220909.018	3635624.897	268.12	267.95	47.3	47.5	48.0	220.7	42.5	47.5	225.7	220.7
MNW-15	10220778.128	3638974.095	257.536	257.331	27.0	27.2	27.7	230.3	22.2	27.2	235.3	230.3
MNW-16[2]	10222188.729	3635593.380	263.333	263.191	40.4	40.5	41.0	222.8	35.5	40.5	227.8	222.8
MNW-17[2]	10223663.517	3637468.447	293.864	293.724	50.2	50.4	50.9	243.5	45.4	50.4	248.5	243.5
MNW-18	10224118.439	3639397.902	270.912	270.755	51.0	51.2	51.7	219.7	46.2	51.2	224.7	219.7

[1]Datum - NAD 83 (Conus)
[2]Water levels only, not used in groundwater quality monitoring

FIGURES

Amec Foster Wheeler
Environment & Infrastructure
3755 S. Capital of Texas Highway, Ste. 375
Phone: (512) 795-0360 Fax: (512) 795-8423

N

0 1 mi

Approximate Scale in Miles

Source: Google Earth

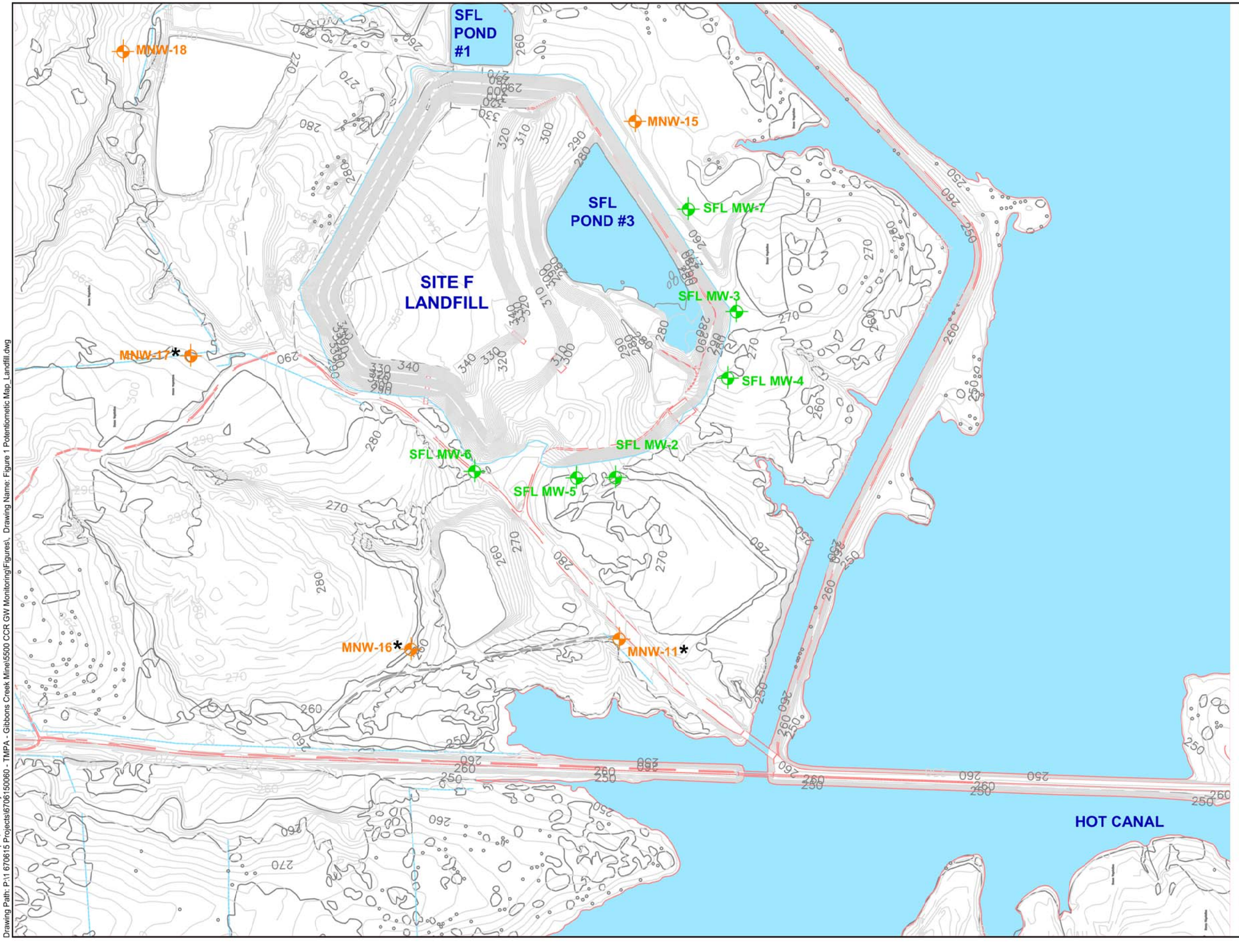
amec foster wheeler

TX Engineering Firm #F-0012

CCR UNITS
Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
Grimes County, Texas

Project No. 6706150060
Date: 10/12//2017

Figure 1.1



LEGEND

- Amec Foster Wheeler Monitoring Well
- Black and Veatch Monitoring Wells
- * Welll Used for Groundwater Level Monitoring Only

0 250 500

APPROXIMATE SCALE IN FEET

SOURCE:
POTENTIOMETRIC SURFACE ELEVATION AND BASE MAP, EPM
GOOGLE EARTH PRO

amec foster wheeler

SITE F LANDFILL
Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
Grimes County, Texas

Project No. 6706150060	**Figure 2-1**
Date 10/2/2017	

Plot Date: 10/10/17 - 5:30pm, Plotted by: susan.l.brown
Drawing Path: P:\1 670615 Projects\6706150060 - TMPA - Gibbons Creek Mine\5500 CCR GW Monitoring\Figures\, Drawing Name: Figure 1 Potentiometric Map_Landfill.dwg

FACILITIES ADMIN/TECHNICAL OFFICES

PRODUCTION AREA

MAINT. AREA

SWMU 010: WATER STORAGE AND REMEDIATION TANK

AP PZ-1*

AP PZ-2*

FLYASH LOADING AREA

GIBBONS CREEK RESERVOIR

AP PZ-3*

DOMESTIC SWEAGE TREATMENT FACILITY

AP MW-3

AP MW-1D

COAL PILE STORAGE AREA

AP MW-5

ASH PONDS

RAIL CAR UNLOADING AREA

AP MW-6 *

AP MW-4

SSP/AP MW-1

SSP MW-2

SCRUBBER SLUDGE POND

AP PZ-4*

SSP MW-3

SSP MW-4

LEGEND

- Monitoring Well
- Piezometer
- * Well Used for Groundwater Level Monitoring Only

0 200 400

Approximate Scale in Feet

Basemap modified from Potentiometric Surface Elevation and Base Map, ERM, Google Earth Pro

amec foster wheeler

SCRUBBER SLUDGE POND AND ASH PONDS

Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
Grimes County, Texas

Project No.: 6706150060

Date: 10/10/2017

Figure 2.2

Plot Date: 10/10/17 - 5:14pm, Plotted by: susan.l.brown
Drawing Path: P:\1 670615 Projects\6706150060 - TMPA - Gibbons Creek Mine\5500 CCR GW Monitoring\Figures\, Drawing Name: Figure 2 Potentiometic Map_Ponds_.DWG

APPENDIX A

Borehole Logs and Well Installation Diagrams

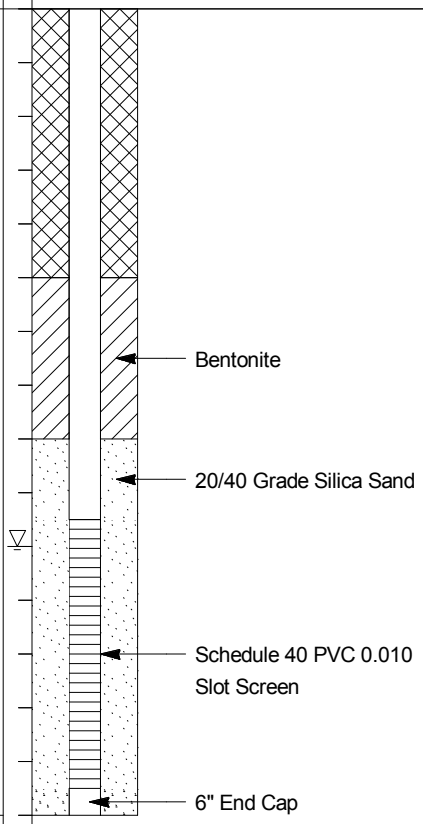
PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. AP MW-1D**	
BORING LOCATION: Northeast Corner of Ash Ponds		GROUND SURFACE ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Best Drilling		DATE STARTED: 5/24/16	DATE FINISHED: 5/24/16
DRILLING METHOD: HSA		TOTAL DEPTH (ft.): 40.0	SCREEN INTERVAL (ft.): 34.5'-39.5
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig		DEPTH TO WATER ATD: 35	CASING:
SAMPLING METHOD: 5' x 4" Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Sandy clay fill to 4.5'	2" Diameter PVC
5					Slightly SANDY CLAY (CH): light yellowish-brown, dry, hard, trace calcium carbonate nodules, fine-grained sand to 5' SANDY CLAY (CH): light yellowish-brown, slightly moist, hard, fine-grained sand, trace pebbles	
					Lignite, dark brown, slighly moist, firm 7'-8.5'	
10					SANDY CLAY (CL): light olive brown, moist, very stiff, fine-grained sand, trace of small gravel size nodules, minor ferrous staining SANDY CLAY (CL): light olive brown, brown lenses, dry, fine-grained sand, stiff	
					SILTY SAND (SM): dark gray, very moist	
15					CLAYEY SAND (SC): light olive brown, moist, very stiff, fine-grained sand CLAYEY SAND (SC): light olive brown, moist, firm, fine-grained sand SILTY SAND (SM): light olive brown, wet, loose, fine-grained at 16'	Grout
20					SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP MW-1D (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
30					1" hard shaley sand lenses at 25.5' SILTY SAND (SM): light olive brown, wet, loose, fine-grained, one ferrsous stained sand lense at 16' SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand 2" sandstone lense, hard at 31.5'	
35					4" sandstone lense, hard at 33' 3" sandstone lense, ferrous staining, hard, blocky at 34.25' SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand SILTY SAND (SM): light olive brown with very thin lignite lenses 2" hard sandstone layer at 40'	
40					Total Depth = 40'	
45						
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. AP-MW-3**	
BORING LOCATION: Northeast Corner of Ash Ponds		GROUND SURFACE ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Best Drilling		DATE STARTED: 5/25/16	DATE FINISHED: 5/25/16
DRILLING METHOD: HSA		TOTAL DEPTH (ft.): 40.0	SCREEN INTERVAL (ft.): 34.5'-39.5
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig		DEPTH TO WATER ATD: 20	CASING:
SAMPLING METHOD: 5' x 4" Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

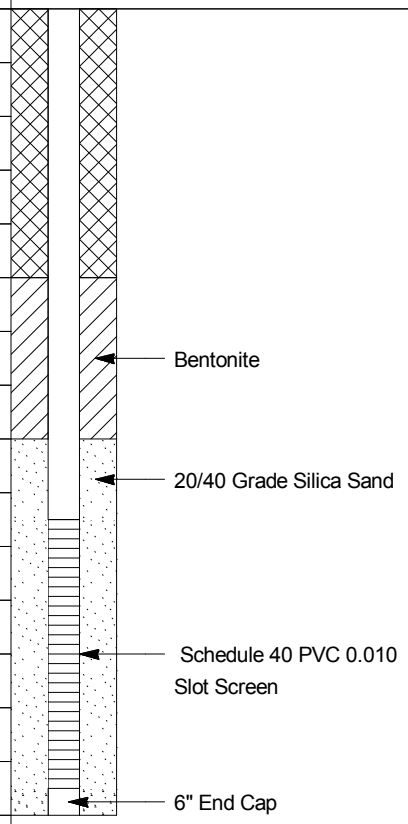
DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					SANDY CLAY with gravel (CH): brown, moist, firm, fine-grained sand, few small gravel, (fill)	2" Diameter PVC
5					SANDY CLAY with gravel (CL): brown and reddish-brown, moist, very stiff, fine-grained sand, few small gravel, few clay clasts, 3-4' layers (fill)	
10					SANDY CLAY with gravel (CL): brown mottled, moist, very stiff, fine-grained sand, trace of small gravel (fill)	
					SILTY SAND (SM): light olive brown, moist, firm, fine-grained sand	
15					SILTY SAND (SM): light olive brown, moist, fine-grained sand	Grout
20					SILTY SAND (SM): light olive brown, wet, fine-grained sand	▽
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP-MW-3 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): light olive brown, wet, fine-grained sand	
					- siltsone interbedded with loose sand 27.5'-28.75'	
					Siltstone, light olive gray, dry, hard at 28.75' and 29.5'	
30					SILTY SAND (SM): light olive brown, moist, fine-grained sand SITLY SAND (SM): light olive brown, wet, fine-grained sand	
35					SILTY SAND (SM): light olive brown, wet, fine-grained sand	
40					Total Depth = 40'	
45						
50						
55						



WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. AP MW-4**
BORING LOCATION: East of Ash Ponds	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 6/1/16 / DATE FINISHED: 6/1/16
DRILLING METHOD: CME 75 HSA	TOTAL DEPTH (ft.): 50.0 / SCREEN INTERVAL (ft.): 44.5'-49.5'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA	DEPTH TO WATER ATD: 48 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY (CL): dark yellowish-brown, brown, moist, stiff, fine-grained sand, sand fill to 3.5'	
					SANDY CLAY (CH): brown, moist, stiff, fine-grained sand	2" Diameter PVC
5					SANDY CLAY (CH): brown, mottled, moist, firm, clay clasts, fine-grained sand	
10					SANDY CLAY (CL): yellowish-brown, moist, firm, fine-grained sand, few pebbles	
15					SANDY CLAY (CL): olive brown and yellowish-brown, moist, stiff, 3" lignite lense at 14.75' SANDY CLAY (CL): yellowish-brown, moist, stiff, fine-grained sand, bedding planes, yellow and black streaks	Grout
20					SANDY CLAY (CL): yellowish-brown, moist, stiff, fine-grained sand, bedding planes	
					Lignite, black, moist, firm 23.5'-25'	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP MW-4 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY (CH): yellowish-brown, moist, soft, fine-grained sand, discontinous lignite lenses	
					Lignite, black, moist, firm 26.5'-30'	
30					SANDY CLAY (CH): olive-brown, moist, fine-grained sand, stiff	
					Perched water at 32'	
					Lignite, black, dry, stiff 34'-37.5'	
35					Interbedded silty sand and sandy clay, thin bedded (1/4" - 1/2"), olive brown, sandy clay, gray silty sand, dry, stiff, fine-grained sand	
					Lignite, black, dry, hard, 6"	Bentonite
40					CLAY (CL): black, dry, hard, blocky, some interbedded black lignite	
						20/40 Grade Silica Sand
45					SANDY CLAY (CL): black, dry, hard, fine-grained sand, platty	
						Schedule 40 PVC 0.010 Slot Screen
					SILTY SAND (SM): dark olive brown, wet, loose, bedding planes, fine-grained sand	
50					Total Depth =50'	6" End Cap
55						

WELL3

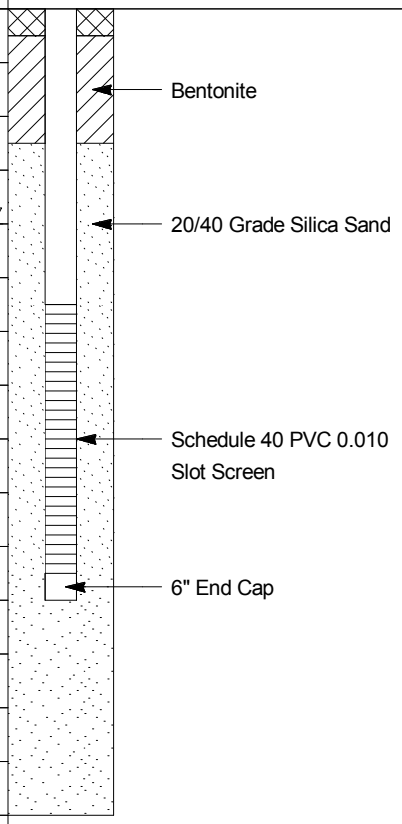
PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. AP MW-5**	
BORING LOCATION: East Center of Ash Ponds		GROUND SURFACE ELEVATION AND DATUM: NA	
DRILLING CONTRACTOR: Best Drilling		DATE STARTED: 6/1/16	DATE FINISHED: 6/1/16
DRILLING METHOD: CME 75 HSA		TOTAL DEPTH (ft.): 40.0	SCREEN INTERVAL (ft.): 30.5'-35.5'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA		DEPTH TO WATER ATD: 29	CASING:
SAMPLING METHOD: 5' x 4" Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: NA	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Sand and clay fill to 2.5'	
					SANDY CLAY (CH): yellowish-brown, moist, firm to hard, fine-grained sand, some mottling	2" Diameter PVC
5					SANDY CLAY (CH): light yellowish-brown, moist, stiff, trace of small gravel, fine-grained sand	
10					SANDY CLAY (CL): reddish-brown then light yellowish-brown, (14'-15'), moist, stiff, sand lense at 14.5', fine-grained sand	Grout
15					SANDY CLAY (CH): yellowish-brown, moist, firm, fine-grained sand CLAYEY SAND (SC): yellowish-brown, wet, firm, fine-grained sand, few gravel	
20					SANDY CLAY (CL): yellowish-brown, moist, firm, fine-grained sand, clay clasts SANDY CLAY (CH): reddish-brown mottled with grayish-brown, moist, firm, fine-grained sand	
25					SANDY CLAY (CH): brown mottled with few reddish-brown streaks, moist, fine-grained sand, few pebbles	

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP MW-5 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY (CH): brown, moist, fine-grained sand to small gravel	
					CLAYEY SAND (SC): brown, wet, firm, fine- to coarse-grained sand	
					SANDY CLAY (CL): light yellowish-brown, moist, stiff, fine-grained sand, ferrous staining	
					SANDY CLAY (CL): light yellowish-brown, very moist to wet, medium-grained sand	
					CLAYEY SILTY SAND (SC-SM): dark greenish gray, slightly moist, fine-grained sand	
					Total Depth = 40'	

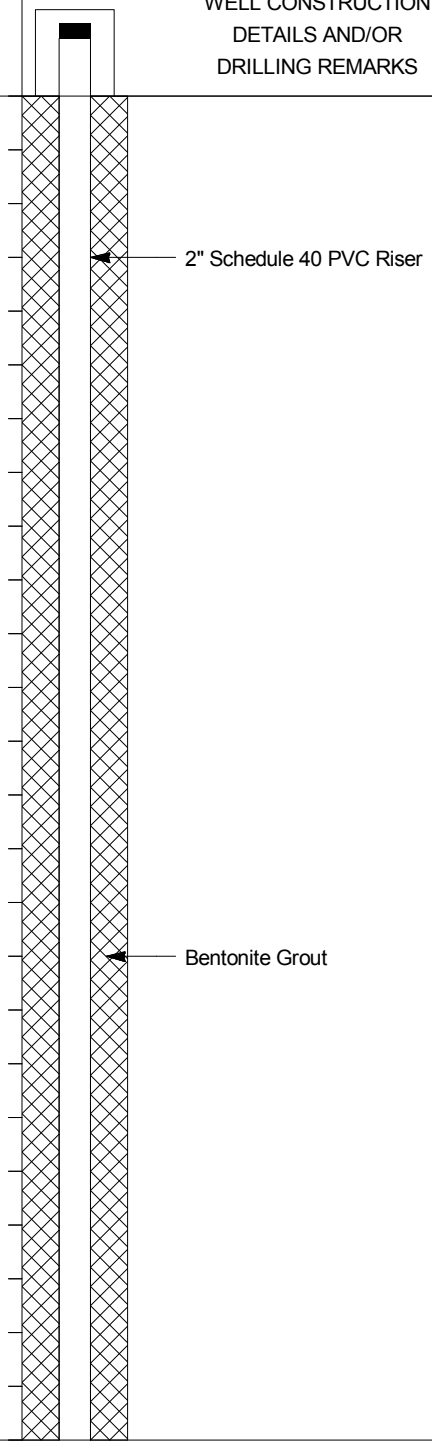


30
35
40
45
50
55

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. AP MW-6**
BORING LOCATION: West Side of Ash Ponds	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Tolunay-Wong	DATE STARTED: 5/3/17 / DATE FINISHED: 5/5/17
DRILLING METHOD: HSA with Continous Core Barell	TOTAL DEPTH (ft.): 50.0 / SCREEN INTERVAL (ft.): 41'-46'
DRILLING EQUIPMENT: CME 75	DEPTH TO WATER ATD: / CASING:
SAMPLING METHOD: 5' x 4.25" OD Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:
				0.3	Grass at the surface, gravel, sand and clay material to 4.25' (probable fill)
5					SANDY CLAY (CL): yellowish-brown, moist, stiff, ferrous nodules, trace of caliche, fine-grained sand
				0.1	SILT (ML) with lignite: reddish-brown, dry, firm, very little recovery
10					CLAY (CL): reddish-brown, slightly moist, firm Lignite with clay, dark red, slightly moist, firm
				0.1	SANDY CLAY (CL): yellowish-brown, dry, firm, very fine-grained sand
15				1.8	2" lignite seam, dark reddish-brown, slightly moist, soft CLAY (CH): yellowish-brown, slightly moist to moist, stiff, ferrous staining Interbedded CLAY and LIGNITE (0-CL): black to reddish-brown, dry, frim to hard 1" cemented lenses with gypsum
20				2.1	LIGNITE (0) with hard lenses of cemented clay and silt with organics: dark brown, dry, hard
25					SANDY CLAY (CL): dark brown, dry, stiff, very fine-grained sand, numerous thin very fine-grained sand partings, laminated



WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP MW-6 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Interbedded SAND and LIGNITE (SP-0): sand - olive gray, lignite - black, very moist to wet, mostly sand, fine-grained sand	
				2.5	LIGNITE (0): black, dry, hard - Lignite to 30.25'	
30					CLAY (CL): light gray, slighltly moist, hard	Bentonite Grout
				4.3	CLAYEY SAND (SC): very dark grayish-brown, dry, dense, very fine-grained sand, lignite fragments	
35					CLAYEY SAND (SC): olive gray, slightly moist to moist, dense, fine-grained sand, weakly cemented, laminated	Bentonite Chips
				4.9		16/30 Grade Silica Sand
40					Slightly CLAYEY SAND (SC): olive gray, moist to very moist, 42.5'-43' wet, moist below 43' and silty, medium dense, very fine- to fine grained sand	
				4.4		2" Schedule 40 PVC Screen 0.010 Slot
45					Very slightly CLAYEY SILTY SAND (SM): olive gray, moist, dense, fine-grained sand, trace of lignite lenses	5.5" End Cap
				0.6		
					- Sulfur smell	
50					Total Depth = 50"	
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. AP PZ-1**
BORING LOCATION: West of Limestone Storage Building	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/24/16 / DATE FINISHED: 5/24/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 35.0 / SCREEN INTERVAL (ft.): 21'-26'
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig	DEPTH TO WATER ATD: 21 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Surface Elevation:	
					6" ash	
					Sandy clay with few small gravel fill to 2"	
					SANDY CLAY (CH): yellowish-brown, moist, stiff, fine- to coarse-grained sand	2" Diameter PVC
5					CLAYEY SAND (SC): light yellowish-brown, moist, stiff, fine-grained sand	Grout
					0.5" sandstone lense at 9.25'	
10					CLAYEY SAND (SC): light yellowish-brown, slightly moist, stiff, fine-grained sand	
					sandstone nodules and 0.5" sand lense at 12'-12.5'	
					- trace of ferrous staining	
15					- interbedded sand and sandy clay	
					CLAYEY SAND and SAND (SP, SC) olive-gray, dry to moist, loose to firm	
					CLAY (CL): brown, dry, hard, with interbedded sand and clay	Bentonite
					SILTY SAND (SM): brown, dry, loose to firm, fine-grained sand, clay lenses	
20					CLAY (CL): yellowish-brown, dry, hard, thin fine-grained sand lenses, trace of pebbles	20/40 Grade Silica Sand
					CLAYEY SAND with sandstone lenses, brown, wet, dense, fine-grained to small gravels size	
					SANDY CLAY (CL): brown, dry, hard, fine-grained sand lamina	
					SILTY SAND (SM): olive gray, moist, loose to firm, fine-grained sand	Schedule 40 PVC 0.010 Slot Screen
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP PZ-1 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): light olive gray, wet, hard, fine-grained sand, very thin lignite seams	6" End Cap
					CLAY (CH): olive, dry, hard, blocky	
30					CLAY (CH): olive, dry, hard, blocky	20/40 Grade Silica Sand
35					Total Depth = 35'	
40						
45						
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. AP PZ-2**
BORING LOCATION: North of Fly Ash Silos	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/23/16 / DATE FINISHED: 5/24/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 40.0 / SCREEN INTERVAL (ft.): 34'-39'
DRILLING EQUIPMENT: 8 5/8" OD HSA 2" Rods	DEPTH TO WATER ATD: 39 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					SILTY SAND (SM): dark gray, slightly moist, loose, fine- to coarse-grained sand, roots, fly ash	
					SILTY SANDY CLAY (CH): brown, moist, firm, fine- to coarse-grained sand	
					SILTY SANDY CLAY (CL): brown, moist, firm, fine- to coarse-grained sand, increasing sand content	2" Diameter PVC
5					SANDY CLAY (CH): yellowish-brown, moist, soft, fine- to coarse-grained	
					SILTY SANDY CLAY (CH): yellowish-brown, moist, hard, fine-grained sand, ferrous staining - lignite seam 9'-9.5'	
10					CLAYEY SAND (SC): light olive brown, dry, dense, fine- to medium-grained sand, wood fragments	
					SILTY CLAYEY SAND (SC): light yellowish-brown, moist, firm, fine-grained sand	
					SANDY CLAY (CH): yellowish-brown, dry, hard, fine-grained sand, lignite seam (thin)	
15					CLAYEY SILTY SAND (SM): gray, wet, firm, fine-grained sand	Grout
					SANDY CLAY (CH): light yellowish-brown, dry, hard, layered, fine-grained sand	
20					SILTY SANDY CLAY (CL): light olive brown, dry with few moist intervals, hard to very stiff, fine-grained sand, drier after 22'	
25						

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP PZ-2 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): light olive brown, very moist, fine-grained sand, soft	
					Sligthly SANDY CLAY (CH): brown, dry, hard, fine-grained sand lenses - increased sand content with depth	
30					SILTY SAND (SM): light olive brown, moist, fine-grained sand, firm CLAYEY SILTY SAND (SM): light olive gray, very moist, firm, 1/4" lignite seams, fine-grained sand	Bentonite
					SANDY CLAY (CL): light olive brown, moist to dry, hard, fine-grained sand, very hard lenses, organics (wood) in sandstone	20/40 Grade Silica Sand
35					SILTY SAND (SM): light olive brown, wet to 39', tan lignite lenses (1/4"), fine-grained sand	Schedule 40 PVC 0.010 Slot Screen
					CLAY (CH): brown, moist, hard	6" End Cap
40					Total Depth = 40'	
45						
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. AP PZ-3**
BORING LOCATION: North of Ash Ponds	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/25/16 / DATE FINISHED: 5/25/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 40.0 / SCREEN INTERVAL (ft.): 34.5'-39.5
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig	DEPTH TO WATER ATD: 25 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY with Gravel (CH): yellowish-brown, moist, very stiff, fine-grained sand, few small gravel, probably fill	
					SANDY CLAY (CL): olive brown, moist, very stiff, fine-grained sand	2" Diameter PVC
5					SANDY CLAY (CL): light olive brown, slightly moist to moist at 9', firm, layered, fine-grained sand	
10					SANDY CLAY (CL): light olive brown, moist to wet above underlying clay, fine-grained sand, loose CLAY (CH): light olive brown, dry, blocky, hard, layered SILTY SAND (SM): light olive brown, wet, fine-grained sand	
15						Grout
20					SILTY SAND (SM): light olive brown, wet, fine-grained sand, layered	
25					- interbedded sand and siltstone	

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. AP PZ-3 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): light olive brown, wet, fine-grained sand, hard siltstone at 28.75' to 29' and 1" lense at 27.5' ferrous staining around siltstone lenses	
30					SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand Sandstone, light to olive brown, wet, hard, platy 32.5'-33'	Bentonite
					SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand Sandstone, pale yellow, wet, hard, platy 34'-34.5	20/40 Grade Silica Sand
35					SILTY SAND (SM): light olive brown, wet, loose, fine-grained sand	
					Siltstone, olive brown, wet, hard, platy 36.5'-36.75' SILTY SAND (SM): light olive brown, wet, loose to firm, fine-grained sand SILTY SAND (SM): olive gray, wet, firm, fine-grained sand, layered	Schedule 40 PVC 0.010 Slot Screen
40					CLAY (CH): olive gray, dry, hard, blocky Total Depth = 40'	6" End Cap
45						
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. AP PZ-4**	
BORING LOCATION: Southwest Corner of Ash Ponds		GROUND SURFACE ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Best Drilling		DATE STARTED: 6/2/2016	DATE FINISHED: 6/2/2016
DRILLING METHOD: HSA		TOTAL DEPTH (ft.): 45.0	SCREEN INTERVAL (ft.): 38.5'-43.5'
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig		DEPTH TO WATER ATD: 40	CASING:
SAMPLING METHOD: 5' x 4" Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Clay and gravel fill to 3'	
					SANDY CLAY (CL): light yellowish-brown, moist, stiff, fine-grained sand	2" Diameter PVC
5					Interbedded sandstone and SANDY CLAY (CL): light yellowish-brown, moist, hard, fine-grained sand	
					SANDY CLAY (CL): light yellowish-brown, moist, stiff, fine-grained sand, ferrous partings	
10					SANDY CLAY (CL): light yellowish-brown, moist, stiff to 14.5', hard to 15', fine-grained sand, ferrous staining, reddish-brown with increased clay content at 14.5-15'	
15					SANDY CLAY (CL): olive brown, dry, hard, very fine-grained sand, discontinous silt and sand partings	Grout
20					SANDY CLAY (CL): olive brown, dry, very stiff, fine-grained sand	
					Lignite, black, dry, hard 23.5'-25' - 2" sand and clay lenses	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

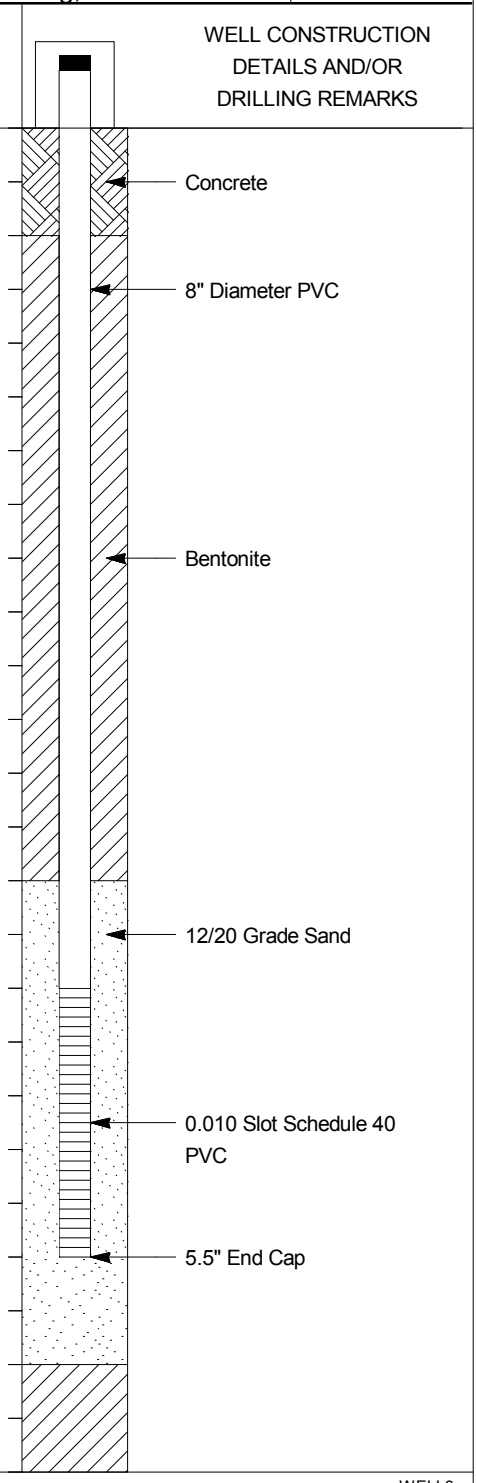
Log of Well No. AP PZ-4 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Lignite, dark brown and black, dry, stiff, few interbedded ironstone, sand, clay (thin beds-large majority lignite 25'-30')	
30					Sandstone: olive brown, moist, hard	
					Lignite, brown to dark brown, dry, stiff 31'-32.75' Interbedded olive brown sand, brown clay and lignite Lignite, brown to dark brown, dry, stiff, platy 33'-35' Lignite, brown to dark brown, dry, stiff, blocky 35'-36'	Bentonite
35					Interbedded sandy clay, lignite (thin beds), medium gray sand, fine-grained sand, dark brown clay and lignite	20/40 Grade Silica Sand
					Lignite, brown to dark brown, dry, stiff, blocky 39'-40'	
40					Sand interbedded with lighnite, black, wet, loose, fine- to medium-grained Lignite, black dry, very stiff 41'-41.75 SANDY SILT (ML): olive gray, slightly moist, stiff, very fine-grained sand	Schedule 40 PVC 0.010 Slot Screen 6" End Cap
45					Total Depth = 45'	
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SFL MW-2**
BORING LOCATION: South Side of Landfill F, West of Outfall	GROUND SURFACE ELEVATION AND DATUM: 269'
DRILLING CONTRACTOR: Vortex Drilling	DATE STARTED: 3/16/16 / DATE FINISHED: 3/16/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 50.0 / SCREEN INTERVAL (ft.): 16'-21'
DRILLING EQUIPMENT: 4 1/4 ID HSA (8" Borehole)	DEPTH TO WATER ATD: 17.5' / CASING:
SAMPLING METHOD: Split Spoon	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: NA
0			1/1/4	0.0	CLAY CH): dark gray, moist, soft, grading to yellowish-brown at 2'
			3/7		CLAYEY SILTY SAND (SM-SC): light yellowish-brown, dry, hard, platy, fine-grained sand
			50/1"	0.0	
5			50/1"		SANDY SILT (ML): pale yellow, moist, hard, very fine-grained sand
				3.0	SILT (ML): pale yellow, moist, hard, very fine-grained sand
			50/5"	3.0	
10			21/35	0.8	SILT (ML): pale yellow, moist to wet, hard, very fine-grained sand
					SANDY SILT (ML): pale yellow, moist to wet, hard, wet to 13', then very moist, siltier-a trace of clay (unconsolidated)
			11/ 24/ 30	5.0	
15			30/ 50/2"	4.3	SILTY SAND (SM): light yellowish-brown, moist, hard, unconsolidated, very fine- to fine-grained sand, trace iron oxide staining
					SILTY SAND (SM): light yellowish-brown, moist to wet, hard, unconsolidated, very fine- to fine-grained sand, iron oxide staining 19-20'
			19/ 31/ 32	3.8	
20			20/ 50/4"	3.9	SANDY SILTY (SM): light yellowish-brown, wet, unconsolidated, hard, iron oxide staining
					SILTY CLAY (CL): brown, dry, hard at 22.25 SANDY SILTY CLAY (CL): dark gray, dry, hard, bedding planes
			41/ 60/6"	2.3	SANDY SILTY CLAY (CL): dark gray, dry, hard, bedding
25					



WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SFL MW-2 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
			20/ 50/5"	3.7	CLAY (CH): dark gray, dry, hard, lenses of sandy clay, fine-grained sand SANDY CLAY (CL): olive gray, moist (clayey interval, dry), hard, fine-grained sand	
			15/ 21/ 37	3.2	SANDY CLAY (CL): olive gray, dry, hard, fine-grained sand	
30			15/ 21/ 21	2.0	Slightly SANDY CLAY (CL): dark gray, dry, hard, fine-grained sand	
			12/ 29/ 40	2.5	SILTY CLAY (CH): dark gray, dry, hard, thin linear structures in the clay	
35			20/20 60/6"	2.0	SILTY CLAY (CH): olive gray, dry, hard, silt lenses at 35.5', moist	Bentonite
			10/ 17/ 17	1.1	SILTY CLAY (CH): olive gray, dry, hard, silt lenses <1/4, thin, dry	
40			10/ 11/ 15	1.9	SILTY CLAY (CH): olive gray, moist, firm to hard, few silt partings	
			8/ 12/ 15	2.1	SILTY CLAY (CH): olive gray, moist, firm to hard, few silt partings, one pyrite nodule	
45			12/ 12/ 17	2.2	CLAY (CH): olive gray, moist, firm to hard, silt partings	
			10/ 12/ 31	2.2	CLAY (CH): olive gray, moist, firm to hard, few silt partings	
50					Total Depth = 50'	
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SFL MW-3**
BORING LOCATION: Southeast of Landfill F	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/31/16 / DATE FINISHED: 5/31/16
DRILLING METHOD: CME 75 HSA (Buggy Rig)	TOTAL DEPTH (ft.): 25.0 / SCREEN INTERVAL (ft.): 19.5'-24.5'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA	DEPTH TO WATER ATD: 22 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): light yellowish-brown, moist, loose, fine-grained sand, trace ferrous staining	2" Diameter PVC
5					SANDY CLAY (CH): brown mottled with blackish-brown, moist, firm, fine-grained sand, minor ferrous staining SANDY CLAY (CH): brown, mottled, moist, firm, fine-grained sand	Grout
10					SANDY CLAY (CL): yellowish-brown, slightly moist, fine-grained sand, bedding planes, stiff Slightly SANDY SILTY CLAY (CL): yellowish-brown, slightly moist, very firm, fine-grained sand	
15					SANDY SILTY CLAY (CL): yellowish-brown, slightly moist, stiff, very fine-grained sand, few bedding planes	Bentonite 20/40 Grade Silica Sand
20					Interbedded sandy clay and sandstone, reddish-brown, hard to very stiff, fine-grained sand SILTY SAND (SM): light olive brown, wet, loose to firm, fine-grained sand	Schedule 40 PVC 0.010 Slot Screen
25					CLAY (CL): light to olive green, dry, hard Total Depth = 25'	6" End Cap

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SFL MW-4**
BORING LOCATION: South of Landfill F	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/31/16 / DATE FINISHED: 5/31/16
DRILLING METHOD: CME 75 HSA	TOTAL DEPTH (ft.): 40.0 / SCREEN INTERVAL (ft.): 34.5'-39.5
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA	DEPTH TO WATER ATD: 36 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					CLAYEY SAND (SC): medium gray, moist, firm, fine-grained sand Interbedded silty sand and sandstone, medium gray, slighly moist, firm to hard, fine-grained CLAYEY SILTY SAND (SC-SM): medium gray, slighty moist, very firm, fine-grained sand	2" Diameter PVC
5					SANDY CLAY (CL): light olive brown, dry, hard, fine-grained sand, ferrous staining SANDY SILTY CLAY (CL): light olive brown, slightly moist, very fine-grained sand	
10					SANDY SILTY CLAY (CL): light olive brown, slightly moist, very fine-grained sand, minor ferrous staining	
15					SANDY SILTY CLAY (CL): brown, dry, very stiff, bedding planes, fine-grained sand	Grout
20					SANDY CLAY (CL): dark olive brown, dry, hard, bedding planes, trace of gypsum, fine-grained sand Lignite lense, dark gray to balck, loose to firm SILTY SAND (SM): light olive gray, slightly moist, fine-grained sand, bedding planes, firm	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SFL MW-4 (cont'd)

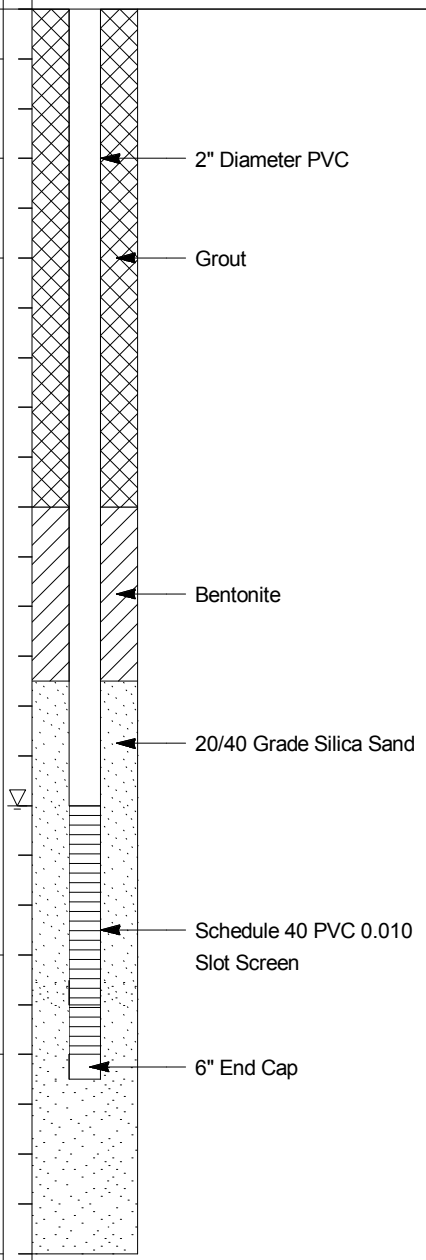
DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
30					SILTY SAND (SM): light olive gray, dry, very fine-grained sand, 25'-26' interbedded siltstone CLAYEY SANDY SILT (ML): dark gray, dry, fine-grained sand, discontinous thin sand lenses SANDY SILTY CLAY (CL): dark gray, dry, very fine-grained sand, discontinuous thin silt lenses	Grout Bentonite 20/40 Grade Silica Sand
35					Interbedded clay and sand; clay, black, dry, hard; sand, olive gray, dry, loose, very fine-grained sand SAND (SP): olive gray, wet, loose, very fine-grained sand SILTY SAND (SM): olive gray, dry, firm, fine-grained sand	▽ Schedule 40 PVC 0.010 Slot Screen 6" End Cap
40					Total Depth = 40'	
45						
50						
55						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SFL MW-5**
BORING LOCATION: Landfill F	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/23/16 / DATE FINISHED: 5/23/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 25.0 / SCREEN INTERVAL (ft.): 16'-21'
DRILLING EQUIPMENT: 8 5/8" OD HSA 2" Rods	DEPTH TO WATER ATD: 16 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.
					Surface Elevation:
					SILTY SAND (SM): dark grayish-brown, moist, loose, fine-grained sand, roots
					SANDY CLAY (CH): dark yellowish-brown, moist, soft, fine-grained sand, roots
					SILTY SANDY CLAY (CL): yellowish-brown, dark yellowish-brown lenses, moist, fine-grained sand, firm
5					SILTY SANDY CLAY (CL): yellowish-brown, dry, hard, very fine-grained sand, ferrous staining
					SILTY SAND (SM): light brownish-gray, mottled with brownish-yellow, soft, moist (slightly) increasing clay content to 8.5', fine-grained sand
					Slightly CLAYEY SILTY SAND (SM): light olive brown, loose, moist, fine-grained sand
10					Slightly CLAYEY SILTY SAND (SM): light olive brown, slightly firm, moist, trace of pebbles
15					SILTY SAND (SM): light olive brown, wet to very moist, firm, faint stratification, fine-grained sand
20					SANDSTONE (SS): light yellowish-brown, dry, hard, ferrous staining along fractures, layered
					Shale (SILTY CLAY) (CL): gray, dry, hard, very fine-grained sand, silt partings
25					Total Depth = 25'

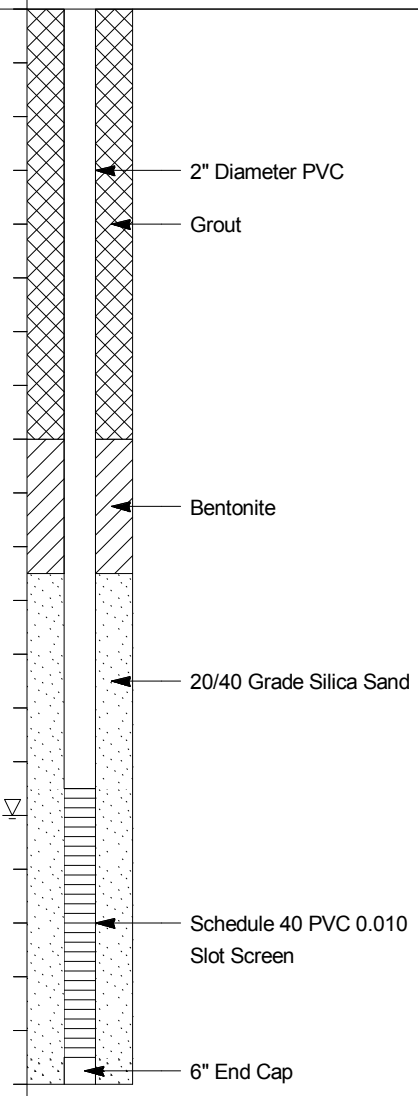
WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SFL MW-6**
BORING LOCATION: Southwest Corner of Landfill	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/23/16 / DATE FINISHED: 5/23/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 20.0 / SCREEN INTERVAL (ft.): 14.5'-19.5
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig	DEPTH TO WATER ATD: 15 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Surface Elevation:	
					Sandy Clay fill, few gravel fill to 4.5'	
5					SANDY SILTY CLAY (CL): pale brown, dry, hard, dark gray partings, very fine-grained sand	
					CLAYEY SAND SILT (ML): pale brown, dry, very stiff to hard, dark gray clay partings, fine-grained sand, increased ferrous staining after 8', few sand partings, wood fragments in a few partings	
10					SILTY SANDY CLAY (CH): pale brown, dry, hard, light brown partings to reddish-brown, fine-grained sand, ferrous staining	
15					Layered SILTY SAND (SM) and SANDY SILTY CLAY (CL): pale brown, some brown layers after 17', very moist to dry, fine-grained sand	
20					SANDY SILTY CLAY (CL): gray silt and sand, dark gray clay, layered, dry, hard, very fine sand	
					Total Depth = 20'	
25						



WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. SFL MW-7**	
BORING LOCATION: Southeast Side of Landfill F		GROUND SURFACE ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Tolunay-Wong		DATE STARTED: 5/2/17	DATE FINISHED: 5/3/17
DRILLING METHOD: HSA with Continous Core Barell		TOTAL DEPTH (ft.): 55.0	SCREEN INTERVAL (ft.): 50'-55'
DRILLING EQUIPMENT: CME 75		DEPTH TO WATER ATD:	CASING:
SAMPLING METHOD: 5' x 4.25" OD Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Grass at surface	
				2.6	SILTY SAND (SM): yellowish-brown, dry, firm, very fine-grained sand (fill)	
5						8" Diameter PVC
				1.1	SANDY CLAY (CH): gray, slightly moist, firm, very fine-grained sand	
10					SANDY CLAY (CH): brown, slightly moist to moist, firm, olive gray mottling and some ferrous staining, very fine-grained sand, fill to □ppro□i□ □t□l□12'	
				0.8	SANDY CLAY (CL): brown, slightly moist, very fine-grained sand, some lammination, couple of thin greenish-□r□□sand lenses	
15					CLAY (CL): dark brown, slightly moist, very fine-grained sand intervals (thin)	
				0.4	SANDY CLAY (CL) with lignite fragments: very dark brown, hard, very fine-grained sand, slightly moist to dry	
20					- Layered sand and clay with lignite 19.5'-20', very dark brown to light gray, hard, slightly moist, pyrite nodules	Bentonite Grout
				0.8	CLAY (CH): very dark gray, dry, hard, very thin sand lenses, greenish-gray, lignite fragments along bedding planes, platy	
25					CLAY (CH) with interbedded thin sand lenses: very dark gray, dry, hard, very fine-grained sand, lignite fragments along bedding planes in the clay, clay breaks along horizontal laminae, platy	
				0.4		
30						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SFL MW-7 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
35				0.3	CLAY (CL): with numerous thin sand lenses interbedded with clay: very dark gray clay, greenish-gray sand, dry, hard, lignite fragments along bedding planes in the clay, very fine-grained sand, platy	2" Schedule 40 PVC Riser
				0.3	CLAY (CH): with sand partings: very dark gray, dry, hard, very fine-grained sand, lignite fragments along bedding planes in the clay, platy, sand greenish-gray	
40				0.2	CLAY (CH) with SAND partings: very dark gray, dry, hard, very fine-grained sand, lignite fragmenst along bedding planes in the clay, platy, sand greenish-gray	Bentonite Chips
45					SAND (SP): olive gray, wet, loose, fine- to very fine-grained sand	
				0.2	CLAY (CH): dark greenish-gray, dry to hard at 46' CLAY (CH): very dark gray, dry, hard, platy	16/30 Grade Sand
50				0.2	SILTY SAND (SM): dark gray, wet, loose, very fine- to fine-grained sand Interbedded SAND (SP) and lignite: olive gray, wet, loost to firm 2" lignite seam SAND (SP) with thin lignite lenses, olive gray, wet, loose to firm	2" Schedule 40 PVC Screen 0.010 Slot
55					Total Depth = 55'	5.5" End Cap
60						
65						

WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SSP/AP MW-1**
BORING LOCATION: North of Sludge Pond	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 5/25/16 / DATE FINISHED: 5/26/16
DRILLING METHOD: HSA	TOTAL DEPTH (ft.): 40.0 / SCREEN INTERVAL (ft.): 29.5'-39.5'
DRILLING EQUIPMENT: 8 5/8" OD HSA Truck Mounded Rig	DEPTH TO WATER ATD: 30 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Silty sand, fly ash and sandy clay, fill to 3.5'	2" Diameter PVC
					SANDY CLAY (CL): light yellowish-brown, moist, very stiff, fine-grained sand	
5					SILT (ML): yellowish-red, moist, firm to hard, after 3" grading to clay, yellowish-red, moist, hard	
					SANDY CLAY (CL): reddish-brown, moist, very stiff, fine-grained sand	
10					Slightly SANDY CLAY (CH): reddish-brown, moist, very stiff, very fine-grained sand	Grout
					Lignite, black, dry, hard 12'-16'	
15					Slightly SANDY CLAY (CH): dark grayish-brown, dry, hard, very fine-grained sand	
20					SANDY CLAY (CL): dark grayish-brown, moist, hard, fine-grained sand, lithofied sandy lenses from 20.5' to 25', sandier and softer toward 25', platy where hard	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SSP/AP MW-1 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SILTY SAND (SM): dark olive brown, slightly moist, hard, platy when hard, fine-grained sand	Bentonite; 20/40 Grade Silica Sand
30					Slightly SILTY SAND (SM): dark olive brown, wet, loose, fine-grained sand	▽
35					CLAYEY SILTY SAND (SM-SC): dark olive brown, dry to moist, fine-grained sand, firm	Schedule 40 PVC 0.010 Slot Screen
40					Total Depth = 40'	6" End Cap
45						
50						
55						

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas		**Log of Well No. SSP MW-2**	
BORING LOCATION: West of Center of Scrubber Sludge Pone		GROUND SURFACE ELEVATION AND DATUM:	
DRILLING CONTRACTOR: Best Drilling		DATE STARTED: 6/2/06	DATE FINISHED: 6/2/06
DRILLING METHOD: CME 75 HSA		TOTAL DEPTH (ft.): 45.0	SCREEN INTERVAL (ft.): 38.5'-43.5'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA		DEPTH TO WATER ATD: 30	CASING:
SAMPLING METHOD: 5' x 4" Core Barrel		LOGGED BY: Daniel B. Haug, P.G.	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G.	REG. NO. 1773

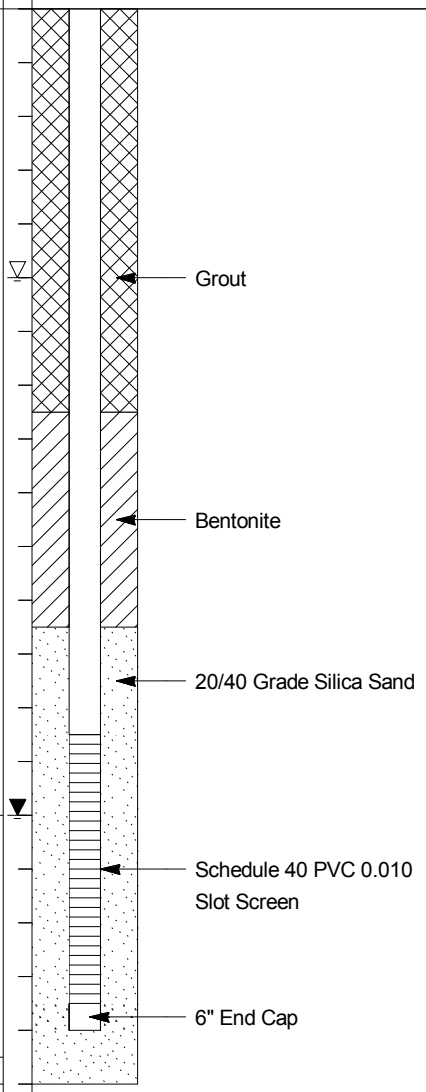
DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					9" ash, black, loose SANDY CLAY (CL): yellowish-brown, moist, firm, fine-grained sand, few pebbles	2" Diameter PVC
5					SANDY CLAY (CL): medium gray, moist, firm, fine-grained sand, few pebbles SANDY CLAY (CL): brown, moist, firm, fine-grained sand, few small gravel	
10					SANDY CLAY (CH) with small gravel: brown, moist, firm to stiff, fine-grained sand with pebbles and small gravel, clay clasts, some red and greenish-gray streaking, trace yellow nodules	
15					SANDY SILTY CLAY (CL): brown, moist, stiff, fine-grained sand, trace roots, few bedding planes	Grout
20					SILTY SAND (SM): light olive brown, moist, firm, fine-grained sand, bedding planes, brown organic lenses, very thin	
25						

WELL3

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SSP MW-2 (cont'd)

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
30					CLAYEY SILTY SAND (SC-SM): light olive brown, moist, firm, fine-grained sand SILTY SAND (SM): light olive brown, wet, 30'-33', sandstone at 33', fine-grained sand Slightly SILTY SAND (SM): light olive brown, slightly moist, firm, fine-grained sand	Grout Bentonite 20/40 Grade Silica Sand
40					SANDY CLAY (CH) with few gravel: reddish-brown, wet, firm SANDY CLAY (CH): dark olive brown, moist, stiff, fine-grained sand	Schedule 40 PVC 0.010 Slot Screen 6" End Cap
45					CLAYEY SILTY SAND (SM-SC): dark olive brown, dry, dense, fine-grained sand Total Depth = 45'	
50						
55						



WELL3

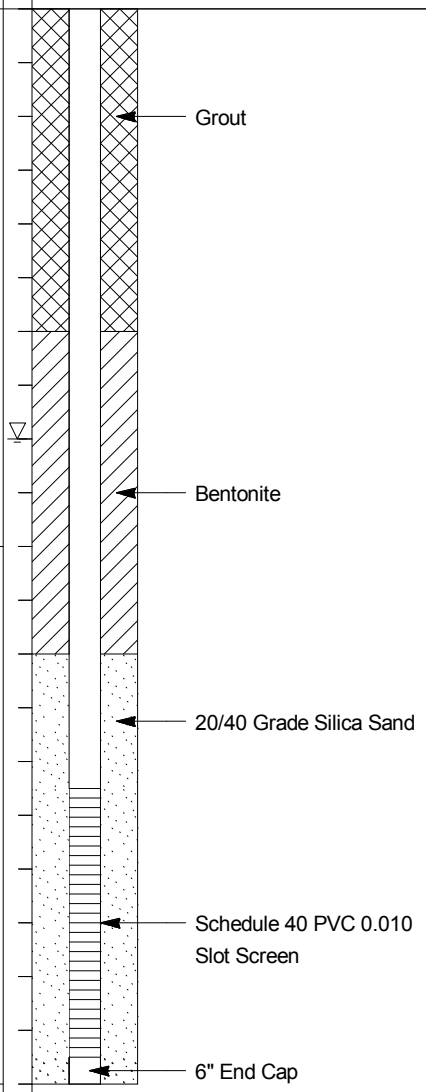
PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SSP MW-3**
BORING LOCATION: Southwest Corner of Scrubber Sludge Pond	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 6/3/16 / DATE FINISHED: 6/3/16
DRILLING METHOD: CME 75 HSA	TOTAL DEPTH (ft.): 45.0 / SCREEN INTERVAL (ft.): 39.5'-44.5'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA	DEPTH TO WATER ATD: 33 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Gravelly sandy clay at surface to 1.5'	
					SANDY CLAY (CL): yellowish-brown, moist, stiff, fine-grained sand	2" Diameter PVC
5					SANDY CLAY (CL) with gravel: yellowish-brown, moist, stiff, fine-grained sand	
10					CLAY and SANDY CLAY (CL-CH): yellowish-brown, reddish-brown, reddish-gray layers (fill), moist, stiff, fine-grained sand	
					Probably fill above 14'	
15					Slightly SANDY CLAY (CH): olive gray to 17.5', moist, stiff, fine-grained sand	Grout
					SANDY CLAY (CL): reddish-yellow, moist, stiff, fine-grained sand	
20					SANDY CLAY (CL): light reddish-brown, dry, stiff, fine-grained sand	
25						

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SSP MW-3 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY (CL): light brown, dry, hard	
					Sandstone, light brown, dry, hard 29.5'-30'	
30					1" of sandstone in core barrel, loose, fine-grained wet sand washed out of core barrel	
35					SILTY SAND (SM): light olive brown, wet, soft, fine-grained sand	
40					SILTY SAND (SM): light olive brown, wet, soft, fine-grained sand 1" lignite seam, brown, wet, soft at 41.75, very thin lignite lenses at 42' and 43.5'	
45					SILTY SAND (SM): light olive brown, wet, stiff, fine-grained sand Total Depth = 45'	
50						
55						



WELL3

PROJECT: TMPA Gibbons Creek Plant Carlos, Texas	**Log of Well No. SSP MW-4**
BORING LOCATION: Southeast Corner of Scrubber Sludge Pond	GROUND SURFACE ELEVATION AND DATUM:
DRILLING CONTRACTOR: Best Drilling	DATE STARTED: 6/3/16 / DATE FINISHED: 6/3/16
DRILLING METHOD: CME 75 HSA	TOTAL DEPTH (ft.): 50.0 / SCREEN INTERVAL (ft.): 43'-48'
DRILLING EQUIPMENT: CME 75 8 5/8" OD HSA	DEPTH TO WATER ATD: 44.75 / CASING:
SAMPLING METHOD: 5' x 4" Core Barrel	LOGGED BY: Daniel B. Haug, P.G.
HAMMER WEIGHT: NA / DROP: NA	RESPONSIBLE PROFESSIONAL: Daniel B. Haug, P.G. / REG. NO. 1773

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					Surface Elevation:	
					Sand, gravel, clay fill	
					SANDY CLAY (CH): layered yellowish-brown, moist, stiff, fine-grained sand, probable fill	2" Diameter PVC
5					SANDY CLAY - CLAYEY SAND (CH-SC): brown, moist, firm, fine-grained sand, probable fill	
10					SANDY CLAY (CH): brown and olive brown layered (fill); moist, stiff, fine-grained sand	
					Probably fill above 14'	
15					SANDY CLAY (CL): yellowish-brown, moist, firm, fine-grained sand, black organic streaks	Grout
20					SANDY CLAY (CH): yellowish-red, very moist, fine-grained sand, soft CLAY (CH): dark reddish-brown, moist, firm	
					Lignite, black, moist, firm 22.5'-23'	
25					SANDY CLAY (CL): light yellowish-brown, moist, stiff, fine-grained sand	

PROJECT: TMPA Gibbons Creek Plant
Carlos, Texas

Log of Well No. SSP MW-4 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
					SANDY CLAY (CL): light yellowish-brown, moist, very stiff, fine-grained sand, ferrous streaks	
30					SANDY CLAY (CL): light yellowish-brown, moist, vey stiff, fine-grained sand, ferrous streaks	Grout
35					Lignite, black, moist, firm 34.75'-35.25' SANDY CLAY (CL): dark grayish-brown, dry, hard, fine-grained sand	
					Lignite, dark brown, dry, hard 38.25'-38.75	
40					SANDY CLAY (CL): dark grayish-brown, dry, hard, fine-grained sand, interbedded black clay lenses Interbedded sand and clay to 44.75'; CLAY (CH): black, dry, hard and; SAND (SP): olive gray, dry, dense	Bentonite 20/40 Grade Silica Sand
45					SAND (SP): olive gray, moist, dense, fine-grained sand, wet	▽ Schedule 40 PVC 0.010 Slot Screen
					SANDY CLAY (CL): dark gray, moist, wet at 45'-46' (sandier interval), moist to dry below 46', hard, fine-grained sand	6" End Cap
50					Total Depth = 50'	
55						

WELL3

BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

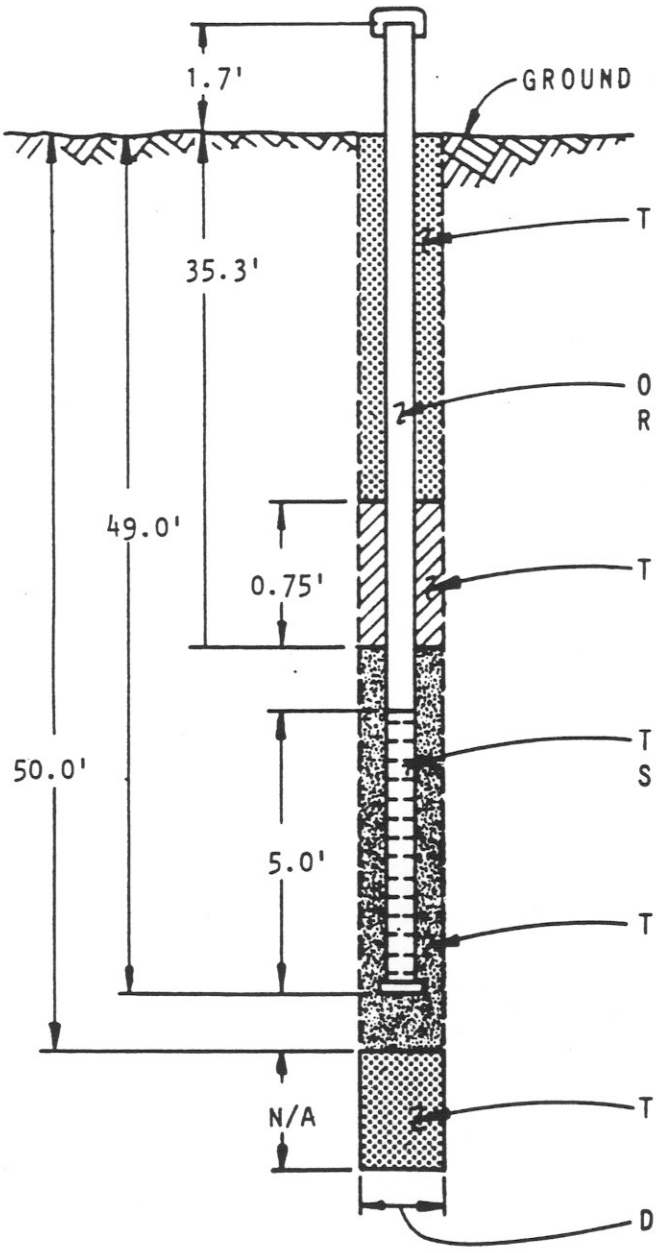
PIEZOMETER NO. B-11

CLIENT	PROJECT	PROJECT NO
Texas Municipal Power Agency	Gibbons Creek	14578

PROJECT LOCATION	COORDINATES	GROUND ELEVATION	DATE
Carlos, Texas	N378330 E3339148	266.8'	2-26-88

STRATUM MONITORED	INSPECTOR
Sandstone and clay	K. M. Blevins-McCosh

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh



TYPE OF SEAL	Volclay Grout and Initiator Cement/Bentonite
O.D. & TYPE OF RISER PIPE	2" PVC glued joints Schedule 40
TYPE OF SEAL	Bentonite Pellets 1/2"
TYPE AND SIZE OF SCREEN OR OPENINGS	.01" Slots
TYPE OF FILTER	Pea gravel
TYPE OF SEAL	N/A
DIAMETER OF BOREHOLE	4 1/2"

METHOD OF INSTALLATION: Boring drilled to completion; set riser pipe and screen; placed filter and seal; grouted to surface; poured surface pad

REMARKS: Installed piezometer in fluid-filled hole; added approximately 2 gallons of bentonite pellets for seal but only 9" arrived at 35'- rest hung up- didn't have any more bentonite developed well on 2-27-88 by flushing w/clean water for 3 minutes and blowing it out w/air

P-ST-021

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-11
SHEET 1 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N378329 E3339148	266.7'	50'	2-26-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Clearing in woods	K. M. Blevins-McCosh	2-26-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING						
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV

CORING						
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD
TW	1					1.6
TW	2					0.8
TW	3					1.1
TW	4					1.2
TW	5					1.4
TW	6					1.2
TW	7					1.5
TW	8					1.3
TW	9					1.5
TW	10					1.5
TW	11					1.8
TW	12					1.9
TW	13					1.9
TW	14					1.7
TW	15					2.0

DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
1		Silty CLAY; reddish-brown; stiff; high plasticity; moist; organics; roots; iron staining (Top soil)	Advanced boring w/4 1/2" rotary wash
2		Grading brown w/some sand; trace gravel below 2'	pp. 2.75
3		Grading w/some sandstone seams and some gravel w/trace roots below 4'	
4			
5			
6		Sandy CLAY; tan to buff; stiff; low plasticity; moist; iron stained; w/trace gravel and some silt	
7			
8		Clayey SILT; tan to buff; hard; high plasticity; moist; some sand; iron staining especially on joints; joints spaced 2-6" horizontal	
9			
10		Interbedded with silty sand below 10'	
1		Grading tan to brown with iron nodules and few cemented sand fragments; platy below 12'	
2			
3		Blocky structure below 14'	
4		Cemented sand grades out below 14';	
15			
6			
7			
8		Cemented sand layer at 18'	
9		CLAY; greenish-grey; hard; high plasticity; moist w/silt filled joints and some silt; trace sand; trace lignite 22'-24'	
20			
1			
2			
3		Grading greenish-grey and dark grey banded below 23'	
4			
25			
6		Slickensided below 26'	
7			
8			
9			
30			

P-STI-0000

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-11
SHEET 2 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N378329 E3339148	266.7'	50'	2-26-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Clearing in woods	K. M. Blevins-McCosh	2-26-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING							CORING							DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD				
TW	16					1.8								1			pp. 4+
TW	17					1.9								2		Trace pyrite below 32'	
TW	18					1.9								3			
TW	19					2.0								4		Bands grading out below 34'	
TW	20					1.7								35			pp. 4+
TW	21					1.9								6			
TW	22					2.0								7			
TW	23					1.1								8			
TW	24					0								9			
										48'				40		Trace lignite below 41'	
3"	1	2				17				1.3	0.3	65		1		Grading dark grey below 42'; 1/2" silt seam at 42.3'	
														2			
														3			
														4			pp. 4+
														45		Silty CLAY; dark grey; hard; high plasticity; dry; some iron staining	
														6			
														7			TW 24 no sample cored w/2' core barrel
														8			
														9		SANDSTONE; argillaceous; grey; fine grained; slightly weathered; w/trace lignite; horizontal joints	
										50'				50			Bottom of boring 49.8'. Groundwater level unknown. Reamed 0-3' w/6 7/8" bit Reamed 3-50' w/4 1/2" bit. Installed 2-20' sections of 2" PVC pipe; 1-7.2' section of 2" PVC and 1-5' screen.
														1			
														2			
														3			
														4			
														55			
														6			
														7			
														8			
														9			
														60			

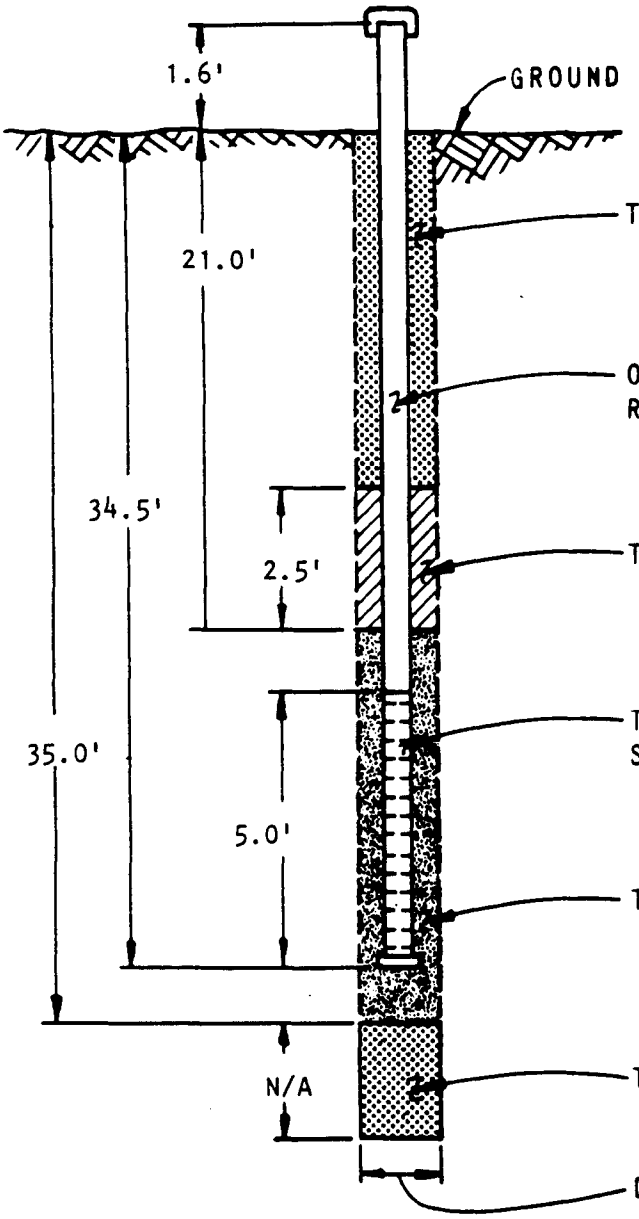
P-STD

BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. B-15

CLIENT: Texas Municipal Power Agency	PROJECT: Gibbons Creek		PROJECT NO: 14578
PROJECT LOCATION: Carlos, Texas	COORDINATES: N378200 E3342496	GROUND ELEVATION: 261.5'	DATE: 2-23-88
STRATUM MONITORED: Sandstone		INSPECTOR: K. M. Blevins-McCosh	
CHECKED BY: M. C. Schluter		APPROVED BY: L. J. Almaleh	



TYPE OF SEAL	Volclay grout and Initiator / Cement-Bentonite
O.D. & TYPE OF RISER PIPE	2" PVC-glued joints / Schedule 40
TYPE OF SEAL	Bentonite / 1/2" Tablets
TYPE AND SIZE OF SCREEN OR OPENINGS	.01" Slots
TYPE OF FILTER	Pea gravel
TYPE OF SEAL	N/A
DIAMETER OF BOREHOLE	4 1/2"

METHOD OF INSTALLATION: Boring drilled to completion; set riser pipe and screen; placed filter and seal; grouted to surface; poured surface pad.

REMARKS: Flushed cuttings from hole; hole remained fluid filled during installation. Developed well on 2-27-88 by flushing well with clean water for 6 min. blew out water from well with air compressor water level recorded at 23'-10" from TOC

P-ST-021B

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-15
SHEET 1 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N378200 E3342496	261.5'	35.0'	2-23-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Open pasture	K. M. Blevins-McCosh	2-23-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING							CORING							DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD				
														1		Undifferentiated overburden	Advanced hole using 4 1/2" rotary wash
TW	1					1.2								2			
														3		Silty CLAY; brown; medium dense; stiff to hard; low plasticity; moist; some sand Grading to more silt at 3'-3.5'	
TW	2					0.8								4			
														5			
TW	3					0.5								6			
														7		Sandy CLAY; tan to brown; hard; low plasticity; moist; trace silt	pp. 4+
TW	4					0.8								8			
														9			Tried to push TW
														10		Clayey SAND; tan to brown; poorly graded; fine grained; some silt; iron staining	Tried SPT - cored at 10' so reamed w/rotary wash looked at cuttings
							3"	1	2	10' 0	0	0	0	1		SANDSTONE; argillaceous; yellowish-tan; fine to medium grained; iron staining; highly weathered	
							3"	2	2	12' 1.3	0	65	0	2			Sample recovery below 12' in 1-3" sections
							3"	3	2	14' 1.2	0	60	0	3		Argillaceous grading out below 14'	
														4			
														15			
							3"	4	2	16' 0	0	0	0	6			
														7		Grading grey below 16'	
							3"	5	2	18' 0	0	0	0	8			Missed sample at 18-20' rotary washed. Continued drilling with 3" diameter 5' core barrel below 20'.
														9			
														20		Iron staining on joints below 20'	
										20'				1			
														2		Lignite partings starting at 21.7'	
							3"	6	5	4.5	0.33	90	7	3		Grading greenish-grey below 23' and slightly argillaceous	
														4			
										25'				25			
							3"	7	5	4	0.83	80	12	6			
														7			
														8		Lignite partings grading out below 27.5'	
														9			
										30'				30			

P I S T O N

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-15
SHEET 2 of 2

CLIENT		PROJECT		PROJECT NO.
Texas Municipal Power Agency		Gibbons Creek SES		14578
PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N378200 E3342496	261.5'	35.0'	2-23-88
SURFACE CONDITIONS		INSPECTOR		DATE FINISH
Open pasture		K. M. Blevins-McCosh		2-23-88
	CHECKED BY	APPROVED BY		
	M. C. Schluter	L. J. Almaleh		

SAMPLING							CORING								
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
										30'				1	Horizontal fractures spaced generally from 1-3" apart; numerous lignite partings below 30'	
							3"	8	5	2.2	0	44	0	2		
														3		
														4		
														35		Bottom of boring 35'. Ground water level unknown. Reamed hole using 4 1/2" bit. Flush cuttings out of hole installed 1-20' section and 1-11' section of 2" PVC and 5' section of screen.
										35'				6		
														7		
														8		
														9		
														40		
														1		
														2		
														3		
														4		
														45		
														6		
														7		
														8		
														9		
														50		
														1		
														2		
														3		
														4		
														55		
														6		
														7		
														8		
														9		
														60		

P I S T O D

BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

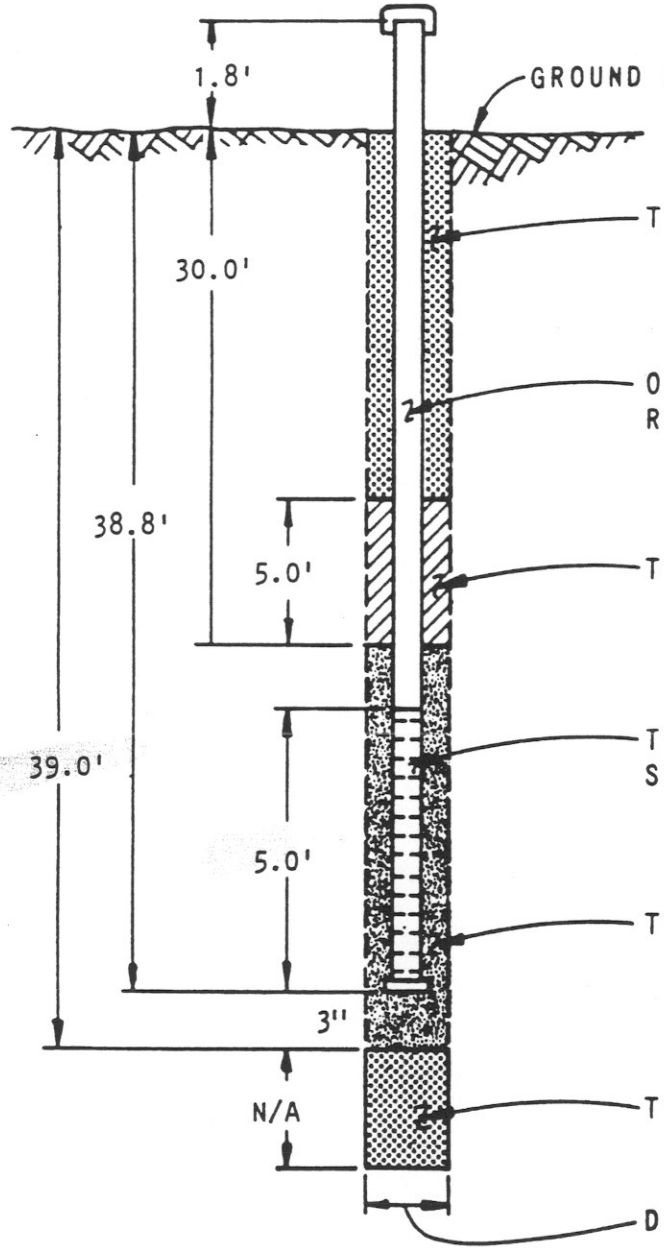
PIEZOMETER NO. B-16

CLIENT	PROJECT	PROJECT NO
Texas Municipal Power Agency	Gibbons Creek	14578

PROJECT LOCATION	COORDINATES	GROUND ELEVATION	DATE
Carlos, Texas	N379581 E3339416	261.7'	2-25-88

STRATUM MONITORED	INSPECTOR
Sandstone	K. M. Blevins-McCosh

CHECKED BY	APPROVED BY
M. C. Schluter	I. J. Almaleh



TYPE OF SEAL	Volclay grout Cement/Bentonite
O.D. & TYPE OF RISER PIPE	4" PVC flush jointed Schedule 40
TYPE OF SEAL	Bentonite Pellets 1/2"
TYPE AND SIZE OF SCREEN OR OPENINGS	.01" Slots
TYPE OF FILTER	Pea Gravel
TYPE OF SEAL	N/A
DIAMETER OF BOREHOLE	7"

METHOD OF INSTALLATION: Boring drilled to completion; set riser pipe and screen; placed filter and seal; grouted to surface; poured surface pad

REMARKS: Cuttings washed from hole; piezometer installed in fluid-filled hole; well developed on 2-27-88 by flushing hole w/clean water for 8 min. and pumping until dry. Water level recorded at 38.2' from TOC.

P-ST-02

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-16
SHEET 1 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N379581 E3339416	261.7'	39.0'	2-25-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Clearing in woods	K. M. Blevins-McCosh	2-25-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING							CORING							DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD				
TW	1					0.7								1		Silty CLAY; dark brown; medium dense; high plasticity; moist; organics; roots (Top soil)	Boring advanced using 6 7/8" rotary wash
TW	2					1.5								2		CLAY; dark brown; stiff; high plasticity; moist; some silt	
TW	3					1.1								3		Trace gravel and iron staining below 4'	pp. 1.25
TW	4					1.8								4			pp. 1.5
TW	5					1.7								5			pp. 2.0
TW	6					1.8								6		Silty CLAY; brown; stiff; high plasticity; moist; iron staining; jointed Gypsum seam at 7.5' and 9'; slickensided below 7'	
TW	7					1.5								7			
TW	8					1.7								8			
TW	9					1.7								9			
TW	10					1.7								10		Horizontal and 45° to vertical joints below 10' filled w/gypsum crystals and iron staining	pp. 2.5
TW	11					1.6								1			pp. 2.75
TW	12					1.3								2			
TW	13					1.3								3		Gypsum filled vertical joint at 14'- joint is 4" long; banded brown and dark brown below 14'. Gypsum filled joint spacing generally 8"-1.5'	
TW	14					1.2								4			
TW	15					0.4								15			pp. 2.75 pp. 3.5
														6			
														7			pp. 3.0
														8		CLAY; olive grey to dark grey; hard; high plasticity; moist; with silt seams on joints below 20'; trace iron staining; trace sand in joints; occasional silty sand pockets below 16'; thinly bedded	
														9			
														20			pp. 4+
														1			
														2			pp. 4+
														3			
														4			pp. 4+
														25			pp. 4+
														6			
														7			
														8			
														9		Lignitic below 29' - lignite seams up to 1"	
														30			

PISTIO3

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-16
SHEET 2 of 2

CLIENT		PROJECT		PROJECT NO.
Texas Municipal Power Agency		Gibbons Creek SES		14578
PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N379581 E3339416	261.7'	39.0'	2-25-88
SURFACE CONDITIONS		INSPECTOR		DATE FINISH
Clearing in woods		K. M. Blevins-McCosh		2-25-88
CHECKED BY		APPROVED BY		
M. C. Schluter		L. J. Almaleh		

SAMPLING							CORING								
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
3"	1	1	0.2	0	20	0								1	SANDSTONE; argillaceous; greenish-grey; fine grained; weathered	
			31'											2		
TW	16					0.5								3	Clayey SAND; greenish-grey; partially cemented; fine grained; poorly graded; some silt (maybe extremely weathered sandstone)	
														4		
			34'											35		
3"	2	5	4	1.3	80	26								6	SANDSTONE; argillaceous; greenish-grey; fine grained; weathered; w/lignite seams; horizontal and vertical joints - weathering on joints	
														7		
														8		
			39'											9		Bottom of boring at 39'. Groundwater level unknown. Reamed hole w/6 7/8" bit. Installed 3-10' sections 4" PVC and 1-5.8' section 4" PVC; set 1-5' section .01" slot screen.
														40		
														1		
														2		
														3		
														4		
														45		
														6		
														7		
														8		
														9		
														50		
														1		
														2		
														3		
														4		
														55		
														6		
														7		
														8		
														9		
														60		

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PIEZOMETER INSTALLATION LOG

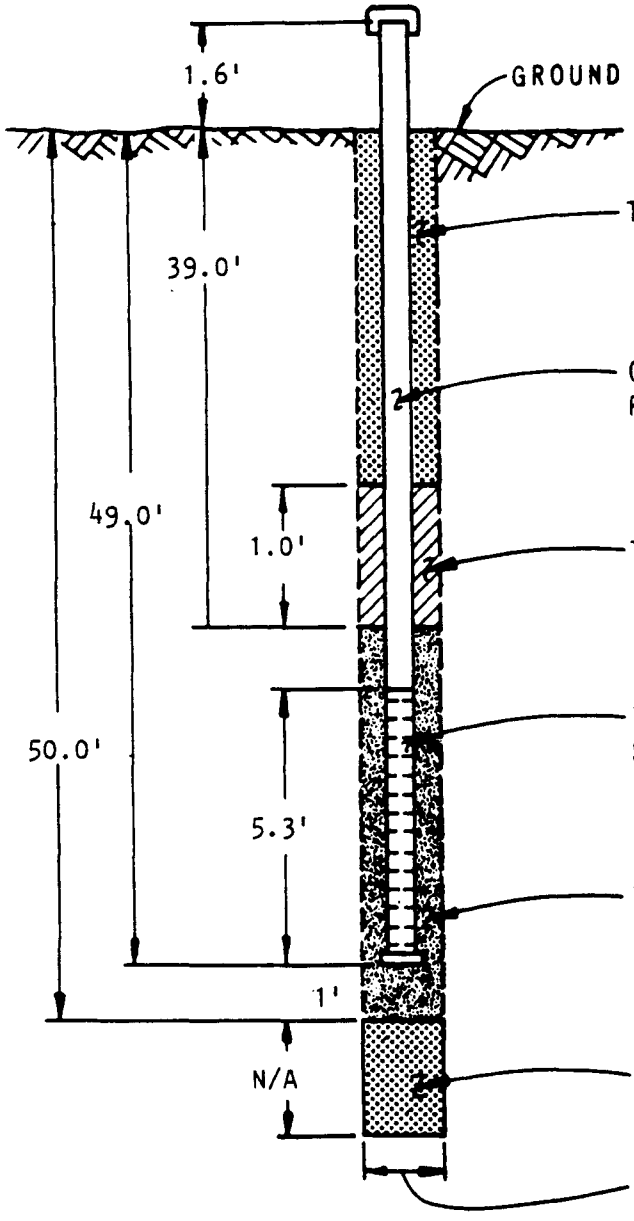
PIEZOMETER NO. B-17

CLIENT	PROJECT	PROJECT NO
Texas Municipal Power Agency	Gibbons Creek	14578

PROJECT LOCATION	COORDINATES	GROUND ELEVATION	DATE
Carlos, Texas	N381087 E3340991	292.3'	2-17-88

STRATUM MONITORED	INSPECTOR
Clay	K. M. Blevins-McCosh

CHECKED BY	APPROVED BY
M. C. Schluter	I. J. Almaleh



TYPE OF SEAL	Volclay grout & Initiator (Cement-Bentonite)
O.D. & TYPE OF RISER PIPE	4" PVC flush-jointed Schedule 40
TYPE OF SEAL	Bentonite Pellets 1/4"
TYPE AND SIZE OF SCREEN OR OPENINGS	.01" Slots
TYPE OF FILTER	Pea Gravel
TYPE OF SEAL	N/A
DIAMETER OF BOREHOLE	7"

METHOD OF INSTALLATION: Boring drilled to completion' set riser pipe and screen; placed filter and seal; grouted to within 5' of ground surface filled remaining 5' with dry grout and cuttings

REMARKS: Developed well on 2-27-88 by flushing w/clean water for 7 min.; pumped well dry; water level recorded at 48.5' from TOC.

P-ST-021B

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-17
SHEET 1 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N381083 E3340991	292.3'	50.0'	2-17-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Clearing in pasture	K. M. Blevins-McCosh	2-17-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING							CORING								
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
														1	10" Undifferentiated overburden	Advanced hole by rotary wash
TW	1					1.5								2	Silty CLAY; brown; stiff; med. plasticity; very moist; w/some roots	pp. 1.0
TW	2					1.2								3	Roots grade out below 3' Grading grey below 2.5 with trace sand	
														4	1" sand layer at 4.25'	pp. 4+
TW	3					1.1								5		pp. 4+
														6		
TW	4					0.9								7	Clayey SILT; brown to tan; hard; poorly graded; moist; with sand; trace lignite below 11'	
														8		
TW	5					1.2								9		
														10		
TW	6					0.9								1		
														2	CLAY; tan; hard; high plasticity; moist with cemented sand stringers; platy in areas with iron staining at plate faces	pp. 4+
TW	7					0.7								3		
														4		
TW	8					1.3								15	Grading silty with 2" sandy silt seam at approximately 15.7'	
														6	Clayey SILT; tan to buff; hard; low plasticity; moist; with some sand and iron staining on plates	
TW	9					1.5								7		
														8	Sandy SILT; tan to buff; poorly graded; moist with some clay; trace iron staining	
TW	10					0.9								9		
														20	Silty CLAY; brown/tan mottled; hard; high plasticity; moist; with trace sand and iron staining; platy	
TW	11					0.8								1		
														2	3" sandy silt layer at 22.5'; grading brown below 23	
TW	12					1.2								3		
														4	CLAY; brown; hard; high plasticity; moist; iron staining on plates and joints; gypsum crystals at 25.8'	
TW	13					1.8								25		
														6		pp. 4+
TW	14					1.2								7	Clayey SILT; brown; high plasticity; moist; iron staining	
														8	CLAY; greenish-grey; high plasticity; hard; moist; with trace silt; trace iron	
TW	15					1.4								9		
														30		

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BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-17
SHEET 2 of 2

CLIENT		PROJECT		PROJECT NO.
Texas Municipal Power Agency		Gibbons Creek SES		14578
PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N381083 E3340991	292.3'	50.0'	2-17-88
SURFACE CONDITIONS		INSPECTOR		DATE FINISH
Clearing in pasture		K. M. Blevins-McCosh		2-17-88
CHECKED BY		APPROVED BY		
M. C. Schluter		L. J. Almaleh		

SAMPLING							CORING								
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	CLASSIFICATION OF MATERIAL	REMARKS
TW	16					2.0								1		
TW	17					1.8								2		
TW	18					1.8								3		
TW	19					1.7								4		
TW	20					1.9								35	Grading to trace silt below 35'	
TW	21					1.9								6		
TW	22					1.8								7		
TW	23					2.0								8	Grading to laminated banded (greenish-grey and grey) below 38' with trace lignite at 39.8';	
TW	24					1.8								9		
TW	25					1.6								40		
														1		
														2		
														3		
														4	Banding grading out below 44'	
														45		
														6		pp. 4+
														7	Banded below 47'	
														8		
														9		
														50		Bottom of boring at 50'. Groundwater level unknown. Hole reamed using 6 1/2" diameter auger bit.
														1		
														2		Set 4-10' and 1-4.6' section of 4" diameter schedule 40 threaded flush-jointed PVC pipe, 5' screen.
														3		
														4		
														55		
														6		
														7		
														8		
														9		
														60		

P I S E 3 6 D

BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

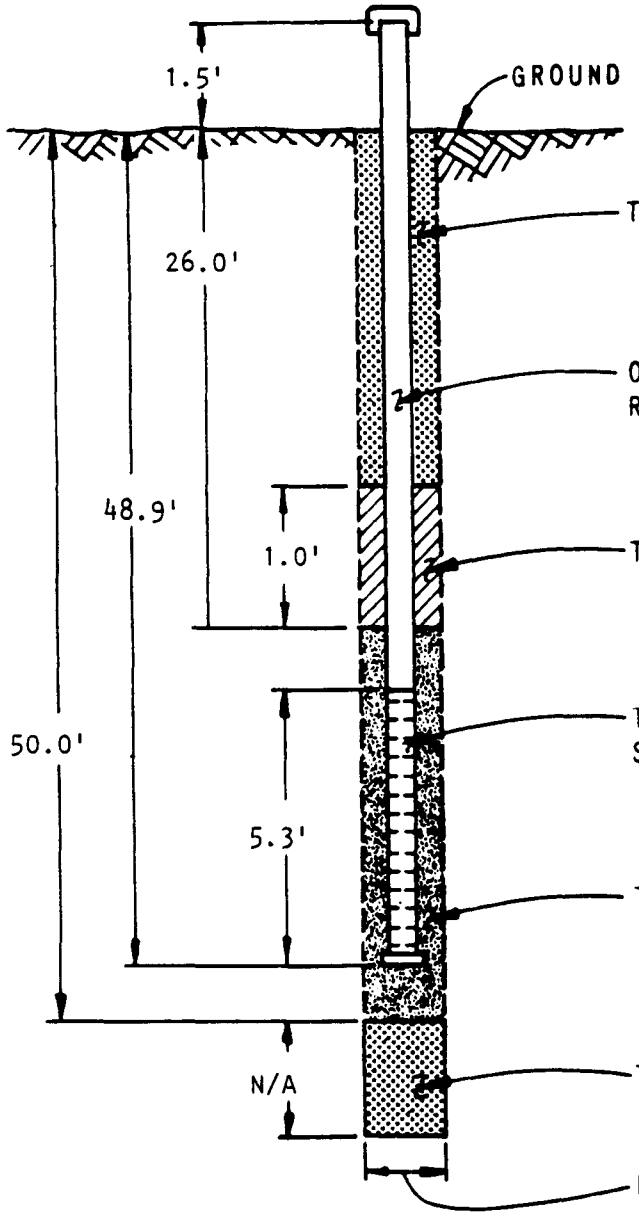
PIEZOMETER NO. B-18

CLIENT	PROJECT	PROJECT NO
Texas Municipal Power Agency	Gibbons Creek	14578

PROJECT LOCATION	COORDINATES	GROUND ELEVATION	DATE
Carlos, Texas	N381539 E3342922	269.1'	2-18-88

STRATUM MONITORED	INSPECTOR
Clay	K. M. Blevins-McCosh

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh



TYPE OF SEAL	Volclay Grout & Initiator (Cement-Bentonite)
O.D. & TYPE OF RISER PIPE	4" PVC flush-jointed Schedule 40
TYPE OF SEAL	Bentonite Pellets
TYPE AND SIZE OF SCREEN OR OPENINGS	.01" Slots
TYPE OF FILTER	Pea Gravel
TYPE OF SEAL	N/A
DIAMETER OF BOREHOLE	7"

METHOD OF INSTALLATION: Boring drilled to completion; set riser pipe and screen; placed filter and seal; grouted to surface; poured surface pad.

REMARKS: Riser pipe started to rise so had to fill with water during installations; well developed on 2-27-88 by flushing w/clean water for 7 min., and then pumping well dry. Water level 50' from TOC.

P-ST-021B

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-18
SHEET 1 of 2

CLIENT	PROJECT	PROJECT NO.
Texas Municipal Power Agency	Gibbons Creek SES	14578

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N381539 E3342922	269.1	50.0'	2-17-88

SURFACE CONDITIONS	INSPECTOR	DATE FINISH
Clearing in pasture	K. M. Blevins-McCosh	2-17-88

CHECKED BY	APPROVED BY
M. C. Schluter	L. J. Almaleh

SAMPLING SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORING CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
														1		Undifferentiated overburden	Boring advanced using 4 1/2" rotary wash
														2			
TW	1					0.6								3		Sandy SILT; tan; poorly graded; moist; with cemented sand stringers; some clay; iron staining	
														4			
TW	2					1.5								5		Clayey SILT; reddish-brown; hard; high plasticity; moist; trace sand; iron staining; grading some sand below 7'	
														6			
TW	3					1.3								7			pp. 4+
														8			
TW	4					1.7								9		Sandy SILT; reddish-brown; poorly graded; moist; with clay and iron staining; grading to silty clay; interbedding with lignitic clay below 10'; few gypsum crystals	
														10			
TW	5					1.3								1			
														2			
TW	6					1.5								3		Silty CLAY; dark brown to black; hard; highly plastic; moist; lignitic; iron staining; with trace sand below 16'	
														4			pp. 4+
TW	7					0.9								15			
														6			
TW	8					0.9								7			pp. 4+
														8		Silty SAND; tan; poorly graded; moist; trace clay; iron staining	
TW	9					0.7								9			pp. 4+
														20		Clayey SILT; greenish-grey; highly plastic; moist; with trace thin silty sand laminae; trace iron staining	
TW	10					1.4								1			
														2			
TW	11					1.8								3			
														4			
TW	12					0.8								25		Sandy SILT; greenish-grey; poorly graded; moist; with trace to some clay	
														6			
TW	13					1.2								7		Silty CLAY; greenish-grey; high plasticity; moist; with some sandy silt layers	
														8			
TW	14					1.3								9			
														30			

BLACK & VEATCH
ENGINEERS-ARCHITECTS

LOG OF BORING

BORING NO. B-18
SHEET 2 of 2

CLIENT		PROJECT		PROJECT NO.
Texas Municipal Power Agency		Gibbons Creek SES		14578
PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Carlos, Texas	N381539 E3342922	269.1	50.0'	2-17-88
SURFACE CONDITIONS		INSPECTOR		DATE FINISH
Clearing in pasture		K. M. Blevins-McCosh		2-17-88
CHECKED BY		APPROVED BY		
M. C. Schluter		L. J. Almaleh		

SAMPLING SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CORING CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET	SAMPLE TYPE / GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS
TW	15												1.4	1		2" sandy silt seam at 32.5'; grading to low plasticity; sandy silt filled fractures spacing about 4" in sample	
TW	16												1.4	2			
TW	17												1.5	3			
TW	18												0.9	4		Grading to interbedded green and greenish grey silty clay below 34'; trace cemented sand	
TW	19												2.0	35			
TW	20												2.1	6			
TW	21												2.0	7		2" sandy silt seam at 37.8' Grading greenish-grey below 38'	
TW	22												1.7	8			
TW	23												1.9	9			
TW	24												1.6	40		Grading to high plasticity below 40'; sandy silt seam grading out; becoming greenish grey and grey banded clay	
														1			
														2			
														3		Slickensides at 44.5'	
														4			
														45			
														6			
														7			
														8			
														9			
														50			Bottom of boring at 50'. Groundwater level unknown. Reamed hole twice using 6 3/4" auger bit. Installed 4-10' and 1-5.5' section of 4" PVC, 1-5' section of screen.
														1			
														2			
														3			
														4			
														55			
														6			
														7			
														8			
														9			
														60			

P I S F I L E D

APPENDIX B

Field Sampling Forms

DAILY FIELD RECORD

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

amec foster wheeler

Project and Task Number:	Date:

TIME	DESCRIPTION OF WORK PERFORMED

Water Level Monitoring Record

Project Name: _____ **Project and Task Number:** _____

Date: _____ Measured by: _____ Instrument Used: _____

Note: For your convenience, the following abbreviations may be used.

P = Pumping I = Inaccessible D = Dedicated Pump

ST = Steel Tape ES = Electric Sounder MP = Measuring Point WL = Water Level

Well No.	Time	MP Elevation (feet)	Water Level Below MP (feet)	Water Level Elevation (feet)	Previous Water Level Below MP	Remarks

WELL SAMPLING AND/OR DEVELOPMENT RECORD

amec foster wheeler

Well ID: _____

Sample ID: _____ **Duplicate ID:** _____

Sample Depth: _____

Project and Task No.: _____

Project Name: _____

Date: _____

Sampled By: _____

Method of Purging: _____

Method of Sampling: _____

Initial Depth to Water: _____

Depth to Water after Sampling: _____

Total Depth to Well: _____

Well Diameter: _____

1 Casing/Borehole Volume: (Circle one) _____

4 Casing/Borehole Volumes: (Circle one) _____

Total Casing/Borehole Volumes Removed: _____

Time	Intake Depth	Rate (ml/min)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Remarks (color, turbidity, and sediment)
Low Flow Stabilization Criteria				**+/- 3%**	**+/- 0.1**	**+/- 3%**	**+/- 10%**	**+/- 10%**	

pH CALIBRATION (choose two)					Model or Unit No.:
Buffer Solution	pH 4.0	pH 7.0	pH 10.0		
Field Temperature °C					
Instrument Reading					

SPECIFIC ELECTRICAL CONDUCTANCE (SEC) – CALIBRATION				Model or Unit No.:
KCl Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C		
Field Temperature °C				
Instrument Reading				

ORP/REDOX CALIBRATION		DISSOLVED OXYGEN CALIBRATION		Notes:
Standard Solution (mV)		Altitude / Salinity %		
Field Temperature °C		Field Temperature °C		
Instrument Reading (mV)		Instrument Reading (mg/L)		
Model or Unit No.:		Model or Unit No.:		

FIELD INSTRUMENT CALIBRATION SHEET

Project Name: _____ Project Number: _____

_____ Date: _____

_____

_____

Equipment Type: Water Quality Meter

Manufacturer: Horiba

Model Number: U-52 Serial Number: _____

Calibration (as necessary, minimum twice per day):

Calibration #1	pH	Cond.	Turb.	DO	ORP	Time: _____
Calibration Standard:	4.0	4.49	0.0	--	200-300	
Instrument Reading:						

Calibration (as necessary, minimum twice per day):

Calibration #2	pH	Cond.	Turb.	DO	ORP	Time: _____
Calibration Standard:	4.0	4.49	0.0	--	200-300	
Instrument Reading:						

Calibration (as necessary, minimum twice per day):

Calibration #3	pH	Cond.	Turb.	DO	ORP	Time: _____
Calibration Standard:	4.0	4.49	0.0	--	200-300	
Instrument Reading:						

Calibration (as necessary, minimum twice per day):

Calibration #4	pH	Cond.	Turb.	DO	ORP	Time: _____
Calibration Standard:	4.0	4.49	0.0	--	200-300	
Instrument Reading:						

Date of Last Calibration: _____ Date(s) Instrument Used: _____

Name of person(s) who calibrated instruments: _____

Calibration Standards Used:

(1) _____

(2) _____

(3) _____

(4) _____

Source of Calibration Standards: _____

Miscellaneous Comments:

_____

_____

Calibrated by: _____