Report 1 - Groundwater Monitoring Network for CCR Compliance

SWEPCO - Flint Creek Class 3N Landfill
Permit No. 0273-S3N-R2
AFIN: 04-00107

August 2016
Project No. 35157124

Prepared for:
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1.0 Objective

The purpose of this Groundwater Monitoring Network Report (GWMNR) is to demonstrate adequacy and compliance of the existing monitoring well network with EPA Coal Combustion Residuals (CCR) regulations at the Southwestern Electric Power Company (SWEPCO) – Flint Creek Class 3N Landfill (Permit No. 0273-S3N-R2).

2.0 Background Information

2.1 Facility Location Description

The SWEPCO facility consists of an approximately 40-acre permitted Class 3N Landfill and various support facilities including entrance roads, leachate and contact water storage ponds, bottom ash ponds, vehicle/equipment facilities, groundwater monitoring facilities, and storm water control systems. The site is located in portions of Section 8, Township 18 North, and Range 33 West in Benton County, Arkansas (**FIGURE 1 & 2**).

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

The landfill location is shown on **FIGURE 3**. The underlying limestone was described as light gray, hard with weathered/fractured zones. The facility is currently performing improvements to the landfill. The landfill embankments are being constructed with 3:1 interior slopes. The outside embankment slopes vary from approximately 4:1 to 2:1. A geosynthetic intermediate liner and collection system are currently being installed above existing wastes in the landfill. The remaining portions of the landfill are receiving final cover which includes a flexible membrane liner. After completion of the improvements the entire landfill will be covered with a flexible membrane liner (**SWEPCO, "Ash Landfill Major Modification – Construction Drawings", Flint Creek, Dated April 2011**)[1].

2.2.2 Area/Volume

SWEPCO currently own, operate, and maintain a Class 3N landfill facility located in Gentry, Arkansas. The Class 3N landfill is operated under the authority of the ADEQ Permit No. 0273-S3N-R2 issued on December 20, 2014. The landfill is permitted for approximately 2,854,000 Cubic Yards on 40 Acres of disposal area.

2.2.3 Construction and Operational History

The Flint Creek Power Plant was constructed from 1974 to 1978, and power production and fly ash disposal began in 1978. Ash was first disposed of in the east half on the landfill. The fly ash is removed from the fly ash storage silo and transported to the landfill in trucks. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 12**)[2]

As part of the permitting process, several soil borings were advanced to characterize the soil beneath the landfill. Five of the borings were converted to monitoring wells (B-01B to B-05). Monitoring wells B-01B, B-02, B-04, and B-05 are located at approximately the midpoint on each side of the landfill. Well B-05 is on the southern side and is an up gradient well. Monitoring well B-03, located in the center of the landfill was used during the initial hydrogeological site characterization and subsequently plugged and abandoned in February, 1993. The well's location in the middle of the active fill area necessitated its closure.

An additional monitoring well, B-06, was added in 2001. Well B-06 is located just north of the northwest corner of the landfill.

Three additional wells, B-07A, B-07C, and B-08, were added in May 2007. B-07A and B-07C were added north of the northern edge of the landfill. Monitoring well B-07A is set in competent bedrock at 100 feet below ground surface (bgs). Monitoring well B-07C is set on top of bedrock at 35.5 feet bgs and does not contain a sufficient amount of groundwater for the collection of a sample. Usually there is less than 0.5 feet of water in the well. Monitoring well B-07C was decommissioned and plugged in February 2016 and is not used for the preparation of the potentiometric surface map. Monitoring well B-08 was sited to the west of the southwest corner of the landfill. B-08 was set at 50 feet bgs which is above the bedrock. Monitoring well B-08 was inadvertently damaged on October 20, 2012, by a D-10 bulldozer and therefore plugged in December 2012.

An additional monitoring well, NE-8, was added in June 2011 as part of Nature and Extent Well installations. In November 2015 the well was renamed B-09 and added to the groundwater monitoring network wells.

Two additional wells, B-10 and B-11, were added on the west side of the landfill in November 2015. B-10 was installed adjacent to previously plugged well B-08 to serve as a replacement.

Two additional wells, B-12 and B-13, were added in February 2016. B-12 is located just north of the northeast corner of the landfill and B-13 is at the southeast corner. The 2 wells were added to bring the groundwater monitoring network into compliance with CCR requirements.

Leachate has been collected since April, 2010, using a leachate collection system located inside the landfill berm in the southeast corner of the landfill. The leachate is sampled for laboratory analysis at the same time as the groundwater monitoring wells and its sample identification is SW-1.

2.2.4 Surface Water Control

The drainage channels (perimeter ditches, letdowns, and terrace ditches) and culverts are designed to collect and convey stormwater run-off from the 10-year/24-hour storm event (design storm event), in accordance with the requirements of Reg.22.517(b), Reg.22.518, and Reg.22.527 from the Arkansas Department of Environmental Quality Solid Waste Management Rules.

Surface Water will be controlled by stormwater diversion berms, reinforced letdowns, perimeter ditches (with permanent erosion control matting where necessary), and culverts. The majority of the flow from the Landfill flows to two dedicated sediment ponds (the North Sediment Pond and the West Sediment Pond). The discharge points from the North and West Sediment ponds are shown on **FIGURE 2**. A small portion of run-off from a southeast portion of the Landfill will flow to the Primary Ash Pond (**Major Modification, Appendix N-I, March 2014 – Rev. 2, Page PN-26, ADEQ Doc ID #65699**)[3].

Discharge

SWEPCO is authorized to discharge once-through condenser cooling water through Outfall 401 and combined wastewater through Outfall 101 from ash ponds (bottom ash discharge, low volume wastewater, and stormwater runoff, including coal pile runoff from a facility, treated municipal wastewater from the City of Gentry, and spring water/stormwater) from facility located as follows: approximately 3 miles southwest of Gentry in Benton County, Arkansas to receiving waters named:

Outfall 001: Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.
Outfalls 101 and 401: SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.

The outfalls are located at the following coordinates (NAD 27):

Outfall 001: Latitude: 36° 14' 0.366"; **Longitude:** 94° 33' 05.944"
Outfall 101: Latitude: 36° 14' 59.38"; **Longitude:** 94°31' 34.90"
Outfall 401: Latitude: 36° 15' 29.17"; **Longitude:** 94°31' 33.80"

Discharge shall be in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

2.3 Previous Investigations

Geotechnical

- Hull & Associates Inc., Permit Modification Application, March 2014, Section 3, Page PN-7
- Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Section 2, pg. 2-1

Groundwater and Other Environmental

- Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Section 4. Page 4-1

2.4 Hydrogeologic Setting

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

Perched groundwater is occasionally present within the upper unconsolidated soils; however, this perched zone appears discontinuous across the site. Groundwater can occur in both the unconsolidated soils and within the limestone. (**Terracon Well Installation Report, August 2011, pg. 7**)[4]

In the area of the Flint Creek Power Plant, water wells supply rural domestic households. According to state water well records, water wells are typically drilled through the Boone Formation and Chattanooga Shale into the underlying Ordovician age dolomites, due to the low yield of the upper Boone Formation. In general, the total depth of the water wells is approximately 500 feet below ground surface. The water wells are usually cased to allow water production from both the Boone Formation and the Ordovician dolomites. Yields generally range from 2 to 30 gallons per minute (gpm). Some wells within the area have been completed only within the Boone Formation at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. (**Burns & McDonnel Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[5]

2.4.1 Climate

The Arkansas River Basin lies in a semi-humid region characterized by long summers, relatively short winters, and a wide range of temperatures. Extremes in air temperatures may vary from winter lows around 0°F, usually caused by Canadian air masses to summer highs above 100°F.

Extreme temperatures may occur for short periods of time at any location within the study area. The growing season averages 244 days per year.

The average pan evaporation is about 54.9 inches for the Arkansas River Basin. Lake evaporation averages about 69 percent of the class A pan evaporation.

Precipitation is well distributed throughout the year with the driest periods occurring during the late summer and early fall. Mean annual precipitation in the study area ranges from less than 40 inches per year to greater than 52 inches per year (**Arkansas State Water Plan, Arkansas River Basin, pg. 3**)[6].

2.4.2 Regional and Local Geologic Setting

The Site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateau's Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains. Elevations typically range from 1200 to 1400 feet above mean sea level. Extensive relatively flat areas occur in Benton County (**USCS, Soil Survey of Benton County, Arkansas, January 1977**)[7]. The Site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[5]

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered. (**FIGURES 4 & 5**)

In the vicinity of the study area, the stratigraphy consists of a weathered residuum of the Boone Formation, overlying the cherty limestone of the Boone Formation (Mississippian). The Boone Formation lies conformably atop the St. Joe Member (Mississippian) and together comprise one hydrostatic unit known as the Boone-St. Joe Aquifer. Unconformably underlying the Boone-St. Joe is the Chattanooga Shale (Devonian), which acts as the upper confining layer of the Sylamore, Clifty, and Everton Aquifers.

In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as residual soil overburden. The Boone residuum is characterized by red (iron-rich) clay, weathered limestone and chert. The thickness of residuum varies from 30 to 50 feet, and the limestone and chert content also varies in lateral extent. The chert is typically the remnant of weathering after the limestone is removed by dissolution in surface and groundwater.

The Boone Formation is a gray, crinoidal limestone abundantly interbedded with gray, black and blue chert. It is massive, well cemented and has a thickness of approximately 280 feet in northwest Arkansas. It is nearly pure calcium carbonate which is soluble, and therefore underground drainage channels, sinkholes, caves and fissures can occur.

The underlying St. Joe Member is typically a light-gray, mud-supported Crinozoan-Bryozoan crystalline limestone, and is easily recognized by its lack of chert. In Northern Arkansas, the formation exhibits a thickness of between 6 to 84 feet, with an average of thickness of 45 feet.

The underlying Chattanooga Shale is a black, fissile and carbonaceous rock with abundant pyrite. It thickens (up to 70 feet) westward and acts as a barrier to vertical groundwater flow (**Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011**)[8].

2.4.3 Surface Water/Groundwater Interactions

Based on water level elevations, groundwater flow across the Landfill is to the west. Currently there is not enough data to determine if there is surface water to groundwater communication near the Landfill.

2.4.4 Water Users

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells.

The closest water well was located approximately 1457 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[9]

3.0 Certified Groundwater Monitoring Network

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Flint Creek is monitored by up-gradient wells B-4, B-12 and B-13 side-gradient wells B-1B, B-7C, and B-5, and down-gradient wells B-2, B-6, B-9, B-10, and B-11. The wells monitor the upper part of the Boone Formation. Horizontal monitoring well locations relative to the CCR Unit are provided in **FIGURE 3**. Vertical positioning of monitoring wells is shown in **TABLE 2 – WELL CONSTRUCTION DETAILS**.

3.1.2 Overall Flow Conditions

Based on water level elevations from the March 2016 Sampling Event, groundwater flow is to the west across the landfill (**FIGURE 6**).

3.2 Uppermost Useable Aquifer

3.2.1 CCR Rule Definition

"Aquifer" means a geologic formation, group of formations or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

"Uppermost Aquifer" means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Common Definition

"Aquifer" is a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses. (USGS, Water Science Glossary of Terms)

3.2.2 Identified Onsite Hydrostratigraphic Unit

3.2.2.1 Relative Position to CCR Unit

Based on water level elevations from the March 2016 Sampling Event, groundwater flow is to the west across the landfill (**FIGURE 6**). The groundwater monitoring network consist of up

gradient wells, B-4, B-12 and B-13 side gradient wells B1-B, B5, B7-A, and down gradient wells B2, B6, B-9, B10, and B11.

3.2.3.2 Water Quality

Rural domestic household water wells installed in the upper Boone-St. Joe Formation typically do not yield large quantities of water. Wells within the area completed only within the Boone Formation are installed at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. The underlying Roubidoux Formation and Gunter Sandstone are the most regionally significant water bearing units in this area, and the units are typically encountered at depths of greater than 1,200 feet below land surface.

Wells in the Roubidoux Formation yield an average of less than 150 gal/min, but can yield up to 450 gal/min. Well yields from the Gunter average more than 200 gal/min, with local yields up to 500 gal/min. The depth to water in the Gunter Sandstone ranges from approximately 27 to 465 feet below land surface in the study area, and the depth to water in the Roubidoux Formation ranges from approximately 90 to 200 feet below land surface. Year-to-year water-level fluctuations are due primarily to temporal variations in pumpage and do not represent long-term trends.

Analyses of samples from wells tapping subsurface rock units show that water in these units is a moderately hard to very hard, calcium and magnesium carbonate water. The quality of water from these units is well within the established drinking water standards with the exception of high iron and nitrate concentrations in a few isolated Benton County wells. The subsurface rock units will yield fresh water in Benton and Washington Counties, but the water becomes mineralized and is unusable to the south (**Arkansas State Water Plan, Arkansas River Basin, pg. 121**)[10]

3.2.3.3 Users/Receptors

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells.

The closest water well was located approximately 1457 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[9]

3.3 Review of Existing Monitoring Network

3.3.1 Overview

The current groundwater monitoring system at the Flint Creek Class 3N Landfill consists of 11 groundwater monitoring wells (B-1B, B-2, B-4, B-5, B-6, B-7A, B-9, B-10, B-11, B-12 and B-13). The groundwater monitoring network was evaluated to determine compliance with the new CCR requirements. In February 2016 AEP installed up gradient monitoring wells B-12 and B-13 to comply with the new CCR requirements. The groundwater monitoring network complies with the CCR requirments.

3.3.1.1 Well Construction Summary Table

Please refer to **TABLE 2** for construction details of the groundwater monitoring wells.

3.3.1.2 Depth Ranges and Hydrostratigraphic units monitored

Please refer to **TABLE 1** for groundwater elevation data taken from the groundwater monitoring system.

3.3.1.3 Position in Terms of Flow Directions and Distance from Waste Boundary

Based on water level elevations, groundwater flow is to the west across the landfill (March 2016 Sampling Event). (**FIGURE 6**) The groundwater monitoring network consist of up gradient wells, B-4, B-12 and B-13 side gradient wells B1-B, B5, B7-A, and down gradient wells B2, B6, B-9, B10, and B11.

3.3.1.4 Uppermost Useable Aquifer

The groundwater monitoring network at the Flint Creek Class 3N Landfill is installed to monitor the uppermost aquifer at the facility. The uppermost usable aquifer at the site is the Mississippian age Boone Formation. Groundwater flow is to the west and north.

3.3.1.5 Insufficient Definition of Background Water Quality

Background water quality data will need to be reestablished according to the new requirements set by 40 CFR 257 using Appendix III and IV Constituents for groundwater monitoring at CCR units. Background concentrations need to be established by October 17, 2017 in accordance with §257.90.

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name[1]
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name[1]
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

3.3.1.6 Key Downgradient Directions

Groundwater flow at the facility is to the west and is currently monitored by 5 groundwater monitoring wells located down-gradient of the landfill: B-2, B-6, B-9, B-10, and B-11. (**See FIGURE 6**).

3.3.1.7 Key Users/Receptors Not Protected

Key users/receptors are protected with the recently installed monitoring wells that reduce the spacing between the down-gradient wells.

4.0 Certification

The monitoring wells currently installed are adequate to monitor the uppermost aquifer as required by §257.91.

4.1 Limitations

The findings and conclusions resulting from this investigation are based upon information derived from the on-site activities and other services performed under the scope of work as described in this report; such information is subject to change over time if additional information is obtained. Please note that Terracon does not warrant the work of laboratories, regulatory agencies or other third parties supplying information used in the preparation of the report.

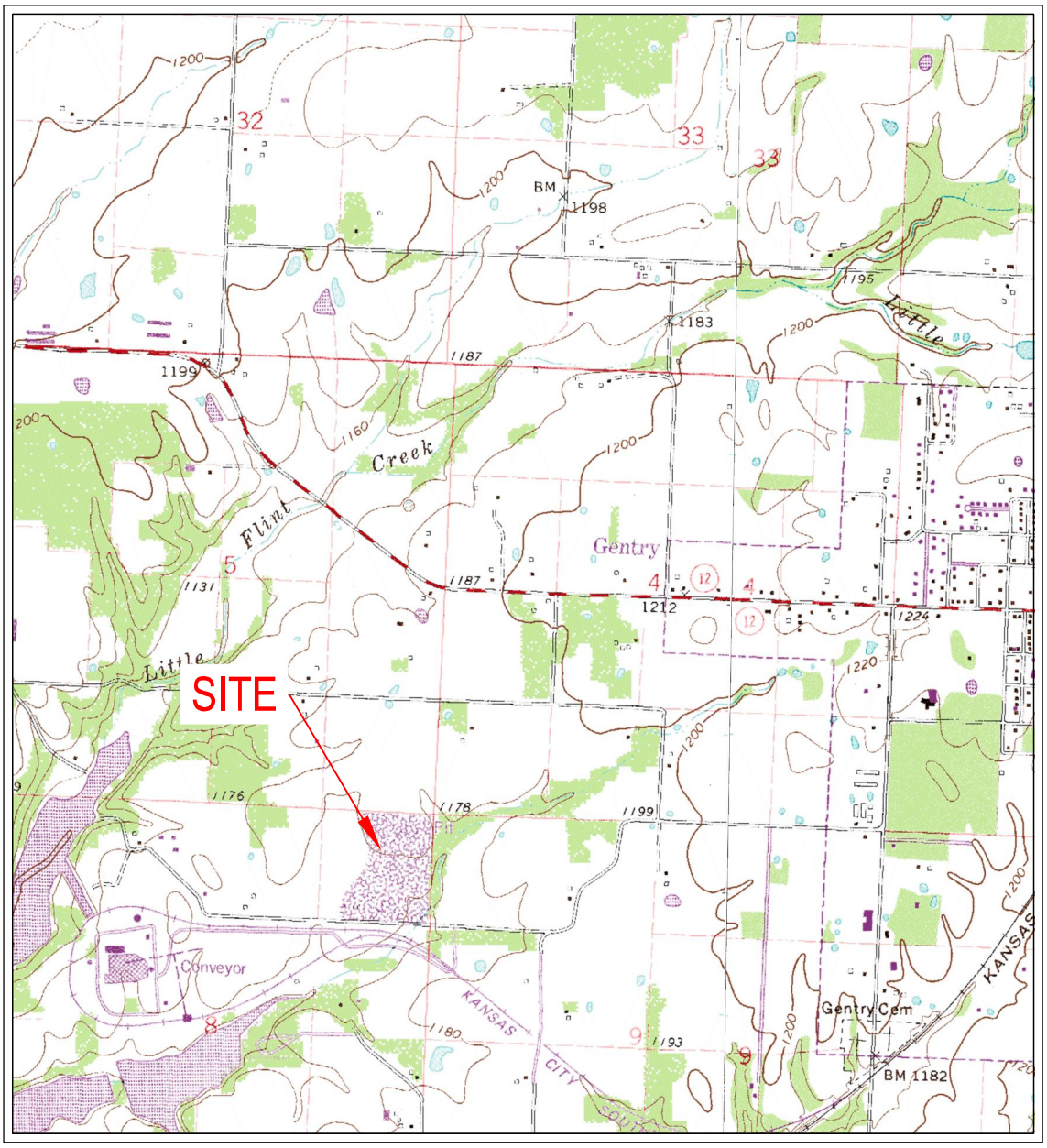
4.2 PE Certification

Name: D. C. McCormick	Date: 8/5/16	STATE OF ARKANSAS ★★★ REGISTERED PROFESSIONAL ENGINEER ★★★ No. 9199 DAVID C. McCORMICK
Company: Terracon COA #223	Expiration Date: 12/31/17	Stamp

Bibliography

1 SWEPCO, “Ash Landfill Major Modification – Construction Drawings”, Flint Creek, Dated April 2011
2 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 12
3 Major Modification, Appendix N-I, March 2014, page PN-26, ADEQ Doc ID# 65699
4 Terracon Well Installation Report, August 2011, pg.7
5 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20
6 Arkansas State Water Plan, Arkansas River Basin, pg. 3
7 USCS, Soil Survey of Benton County, Arkansas, January 1977
8 Nature and Extent Groundwater Monitoring Well Installation Report, Terracon, August 2011
9 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21
10 Arkansas State Water Plan, Arkansas River Basin, pg. 121

UNITED STATES – DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY



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1000 0 METERS 1000 2000

1 .5 0 1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

N

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CHEROKEE CITY
QUADRANGLE
1982
7.5 MINUTE SERIES (TOPOGRAPHIC)

Project Mngr: DCM	Project No. 216-001-35157124	Terracon Consulting Engineers and Scientists 25809 I-30 SOUTH BRYANT, AR 72022 PH. (501) 847-9292 FAX. (501) 847-9210	SITE LOCATION MAP GROUNDWATER MONITORING NETWORK EVALUATION AMERICAN ELECTRIC POWER SWEPCO FLINT CREEK POWER PLANT LANDFILL GENTRY ARKANSAS	FIG. No. 1
Drawn By: JDW	Scale: AS SHOWN			
Checked By: DCM	File No. LF/001			
Approved By: DCM	Date: 10-15-15			

JERALD SHEA RD.

N

0 150 300 600

SCALE IN FEET

NORTH SEDIMENT POND

NORTH SEDIMENT POND DISCHARGE TO BOTTOM ASH POND

WEST SEDIMENT POND

WEST SEDIMENT POND DISCHARGE TO BOTTOM ASH POND

LANDFILL

OUTFALL 401

SWEPCO RESERVOIR

POWER PLANT

SWEPCO PLANT RD.

COAL STORAGE AREA

BOTTOM ASH POND PRIMARY

COUNTY RD. 486

TAYLOR ORCHARD RD.

SWEPCO RESERVOIR

OUTFALL 101

CLEAR WATER POND (NON-CCR)

OUTFALL 001*

* - OUTFALL 001 LOCATED APPROX. 9,525 FT SOUTHWEST

FIGURE 2

DESIGNED BY:	JDW
DRAWN BY:	JDW
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-38157124
ACAD NO.	LF1002
SHEET NO.:	2 OF 7

PLANT AND CCR UNIT LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEL POWER PLANT LANDFILL

GENTRY ARKANSAS

Terracon

Consulting Engineers and Scientists

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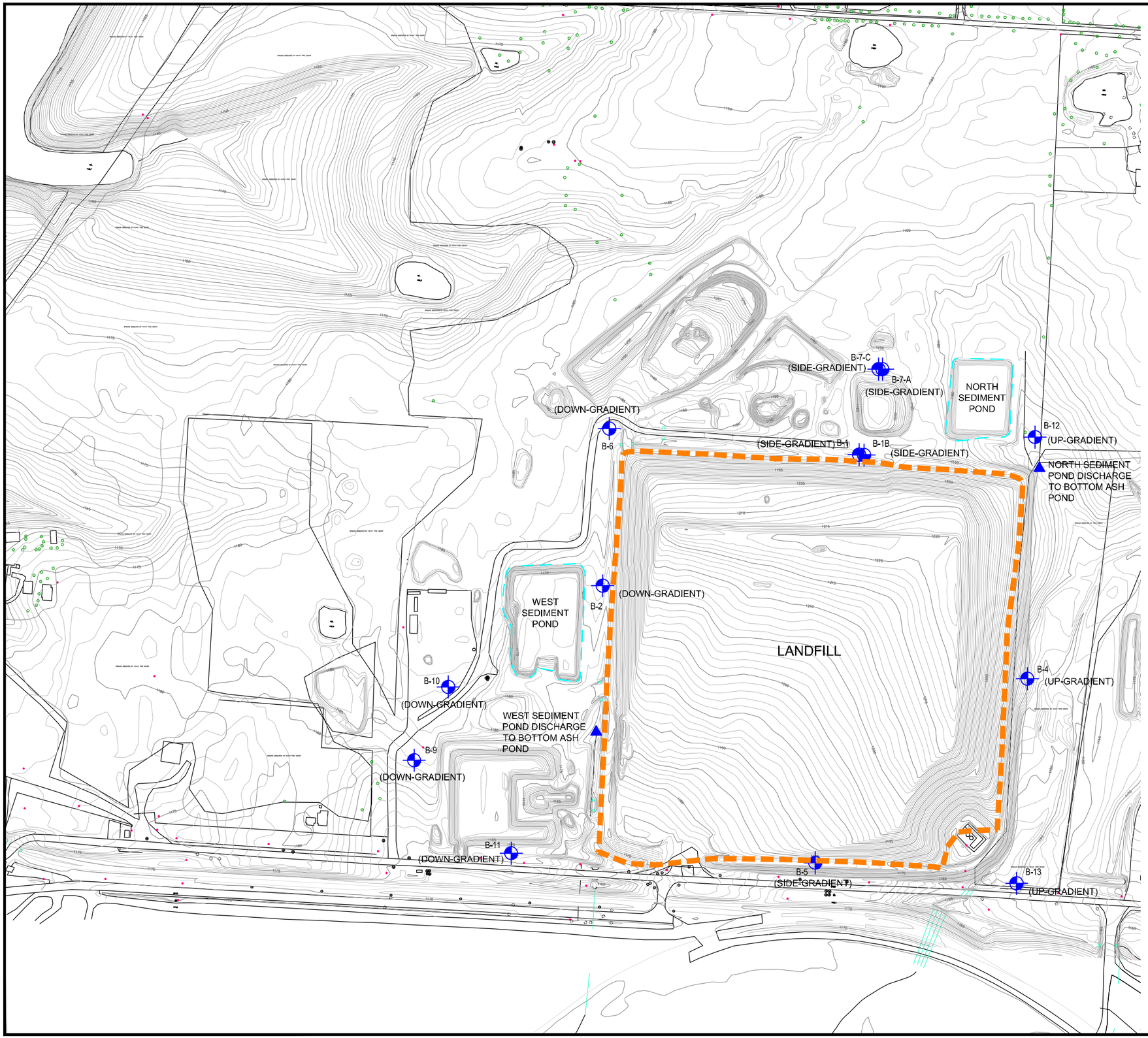
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION



N

0 75 150 300

SCALE IN FEET

LEGEND:

LANDFILL WASTE BOUNDARY

MONITORING WELL

NOTE:

WELL B-9 WAS PREVIOUSLY WELL NE-8.

FIGURE 3

DESIGNED BY:	JDW
DRAWN BY:	JDW
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-38157124
ACAD NO.	LF1003
SHEET NO.:	3 OF 7

CCR UNIT AND WELL LOCATIONS

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT LANDFILL

GENTRY ARKANSAS

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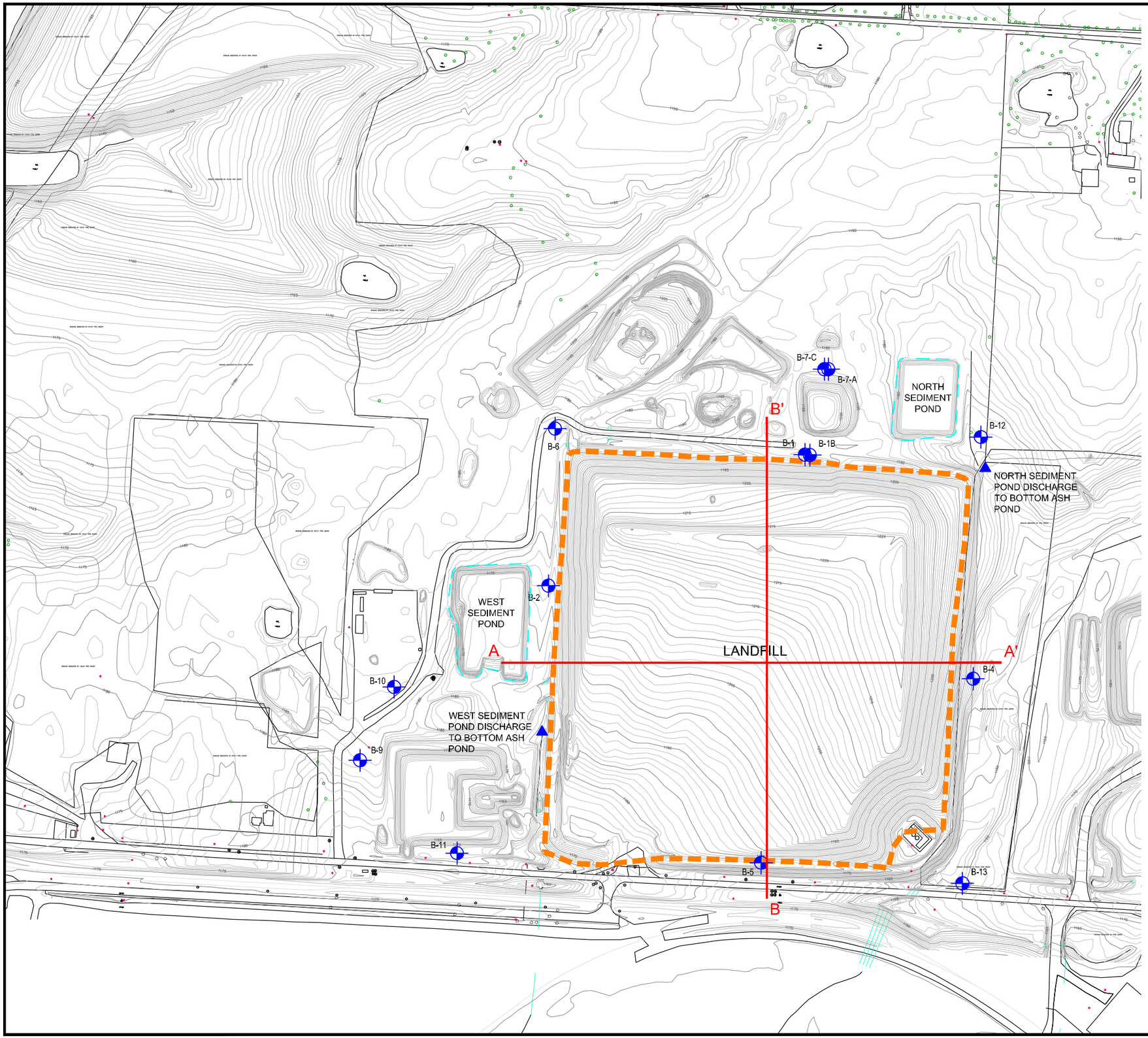
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION



N

0 75 150 300

SCALE IN FEET

NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015.

BOTTOM GRADING INFORMATION:
B-1B - B-5 WELL INSTALLATION LOGS PERFORMED BY BURNS & McDONNELL, DATING NOVEMBER 25, 1991 THROUGH MARCH 1, 1993.
B-6 WELL INSTALLATION LOG PERFORMED BY ANDERSON ENGINEERING, DATED OCTOBER 8, 2001.
B-7A & B-8 WELL INSTALLATION LOG PERFORMED BY TERRACON CONSULTANTS, INC., DATING MAY 16, 2007 & MAY 17, 2007.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM NOVEMBER 1, 1994 THROUGH MARCH 15, 2016.

LEGEND:

- LANDFILL WASTE BOUNDARY
- CROSS SECTION LOCATION
- MONITORING WELL

FIGURE 4

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-38157124
ACAD NO.	LF1004
SHEET NO.:	4 OF 7

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

Terracon
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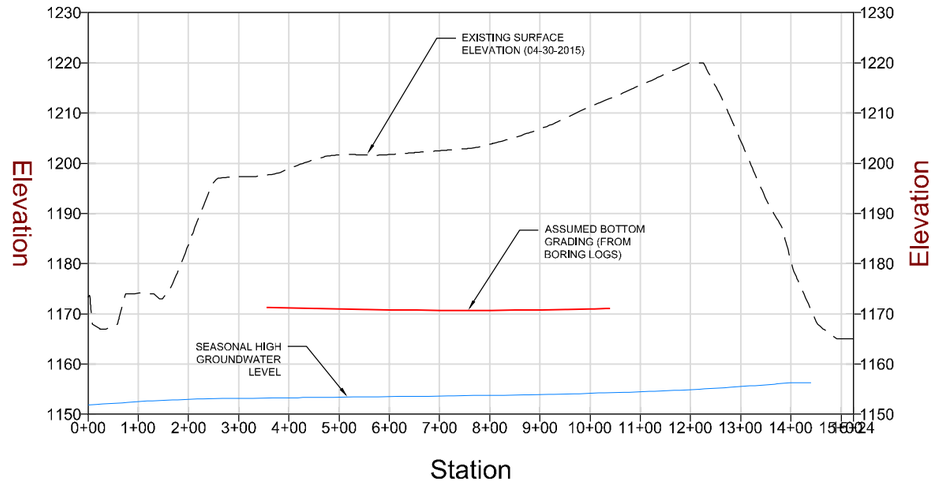
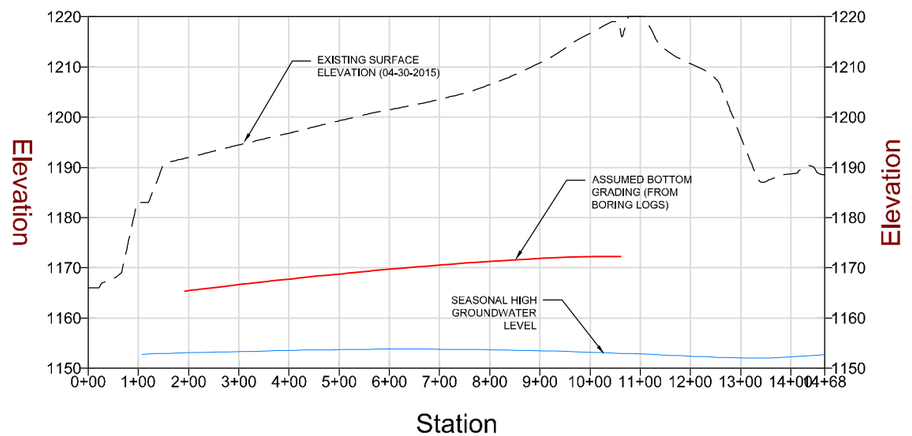
REV.	DATE	BY	DESCRIPTION

SECTION A-A'



SECTION B-B'



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015.

BOTTOM GRADING INFORMATION:
B-1B - B-5 WELL INSTALLATION LOGS PERFORMED BY BURNS & McDONNELL, DATING NOVEMBER 25, 1991 THROUGH MARCH 1, 1993.
B-6 WELL INSTALLATION LOG PERFORMED BY ANDERSON ENGINEERING, DATED OCTOBER 8, 2001.
B-7A & B-8 WELL INSTALLATION LOG PERFORMED BY TERRACON CONSULTANTS, INC., DATING MAY 16, 2007 & MAY 17, 2007.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM NOVEMBER 1, 1994 THROUGH MARCH 15, 2016.

FIGURE 5

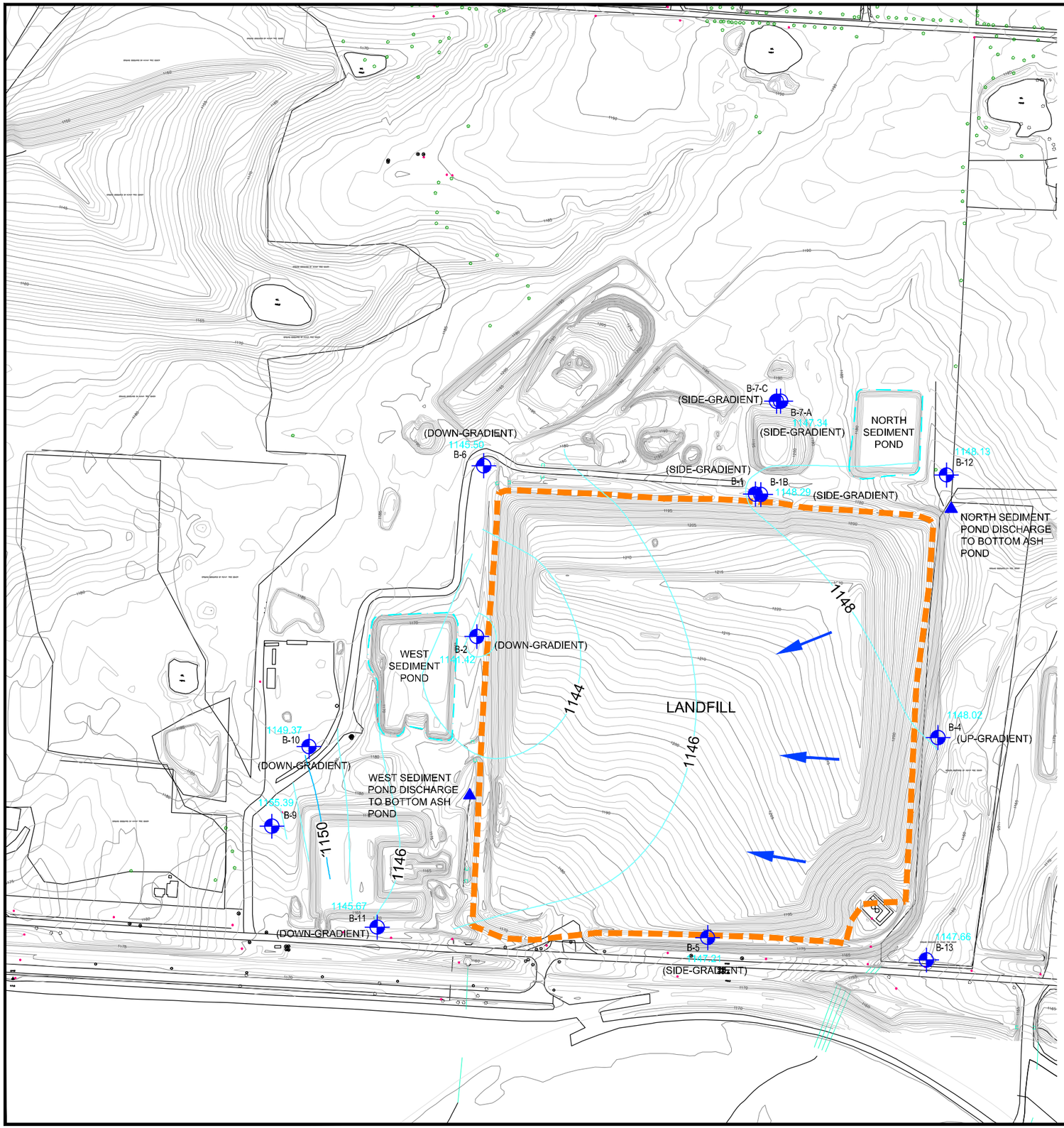
DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-38157124
ACAD NO.	LF1005
SHEET NO.:	5 OF 7

CROSS SECTIONS

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION



LEGEND:

- LANDFILL WASTE BOUNDARY
- GROUNDWATER CONTOUR (IDX.)
- GROUNDWATER CONTOUR (INT.)
- GROUNDWATER FLOW DIRECTION
- 1147.66 GROUNDWATER LEVEL
- MONITORING WELL

NOTE:

1. GROUNDWATER ELEVATIONS TAKEN FROM SAMPLING EVENT ON MARCH 15, 2016.

FIGURE 6

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	04/14/2016
JOB NO.	216-001-35157124
ACAD NO.	LF0006
SHEET NO.:	6 OF 7

POTENTIOMETRIC SURFACE MAP - UPPERMOST AQUIFER

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEL POWER PLANT LANDFILL

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
PH. (501) 847-9292
BRYANT, AR 72022
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
DOMESTIC WELL
JERALD SHEA RD.
1457±
NORTH SEDIMENT POND
NORTH SEDIMENT POND DISCHARGE TO BOTTOM ASH POND
WEST SEDIMENT POND
WEST SEDIMENT POND DISCHARGE TO BOTTOM ASH POND
LANDFILL
SWEPCO PLANT RD.
POWER PLANT
SWEPCO RESERVOIR
COAL STORAGE AREA
BOTTOM ASH POND PRIMARY
SWEPCO RESERVOIR
COUNTY RD. 486
RD RD.
N
0 150 300 600
SCALE IN FEET

FIGURE 7

DESIGNED BY:	JDW
DRAWN BY:	JDW
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	215-001-38157124
ACAD NO.	LF1008
SHEET NO.:	7 OF 7

NEAREST DOMESTIC WELL LOCATION

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEL POWER PLANT LANDFILL

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
2808 I-30 SOUTH
PH. (501) 847-9292
BRYANT, AR 72022
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

TABLE 1 - Landfill Wells
AEP – Flint Creek
Class 3N Landfill
Groundwater Elevations (FMSL)

Well	B-1B	B-2	B-4	B-5	B-6	B-7A	B-8	B-9	B-10	B-11	B-12	B-13
Date												
11/1/1994	1136.36	1135.22	1136.70	1137.53								
4/27/1995	1144.40	1147.24	1148.62	1147.29								
11/3/1995	1138.12	1137.71	1137.11	1138.79								
5/7/1996	1137.94	1137.77	1138.21	1138.96								
11/7/1996	1135.72	1142.14	1147.28	1141.58								
5/1/1997	1145.86	1144.76	1145.45	1146.15								
12/9/1997	1140.96	1142.40	1144.41	1142.58								
5/28/1998												
11/18/1998	1141.95	1142.93	1143.55	1144.45								
5/12/1999	1147.91	1149.13	1150.53	1150.36								
11/10/1999	1138.18	1138.39	1138.70	1139.39								
5/10/2000	1138.54	1139.74	1142.03	1139.98								
11/21/2000	1141.76	1142.67	1143.30	1144.04								
5/16/2001	1142.22	1141.77	1142.18	1142.90								
11/14/2001	1138.94	1138.90	1139.18	1140.36	1137.73							
5/22/2002	1145.47	1146.60	1147.79	1147.34	1145.38							
11/19/2002	1139.02	1140.34	1140.60	1140.41	1139.34							
5/20/2003	1141.98	1144.86	1147.27	1143.72	1144.09							
11/19/2003	1137.35	1138.21	1139.16	1138.84	1137.47							
5/11/2004	1151.26	1152.99	1154.03	1152.90	1151.85							
11/16/2004	1142.87	1143.88	1144.25	1144.84	1142.72							
5/25/2005	1142.22	1142.28	1143.00	1143.02	1141.16							
8/17/2005	1140.84	1141.69	1142.28	1142.19	1140.71							
11/30/2005	1139.00	1139.52	1139.68	1140.17	1134.49							
2/15/2006	1137.43	1137.87	1138.02	1138.58	1136.87							
5/17/2006	1141.19	1142.77	1143.23	1143.27	1141.55							
8/24/2006	1139.80	1141.15	1141.71	1141.19	1140.24							
12/7/2006	1141.49	1143.74	1144.50	1143.70	1142.62							
2/20/2007	1147.28	1148.15	1149.01	1149.09	1146.98							
5/23/2007	1143.35	1144.34	1144.76	1145.15	1143.15	1143.24	1144.28					
8/22/2007	1141.04	1141.88	1142.08	1142.40	1140.82	1141.32	1141.93					
1/23/2008				1147.28								
5/14/2008	1150.64	1150.15	1150.61	1151.00	1148.90	1151.29	1149.62					
10/8/2008	1148.33	1148.48	1148.94	1149.35	1147.28	1148.51	1148.19					
1/7/2009		1144.64										
4/14/2009	1148.31	1150.36	1152.18	1150.22	1149.59	1148.18	1149.85					
7/29/2009	1145.69	1145.77	1146.07	1146.63	1144.66	1146.21						
8/21/2009												
10/28/2009	1149.07	1152.29	1154.20	1152.35	1151.21	1148.65	1151.74					
1/27/2010	1144.64	1145.90	1146.69	1145.75	1144.93	1145.10	1145.68					
5/18/2010	1146.76	1147.76	1149.38	1148.24	1146.93	1147.24	1147.45					
8/25/2010	1144.18	1144.80	1145.00	1144.91	1143.74	1144.60	1144.80					
11/30/2010	1141.62	1142.27	1142.57	1143.04	1141.33	1142.21	1142.30					
2/24/2011	1142.81	1144.86	1145.00	1145.12	1143.81	1153.48	1144.98					
5/25/2011	1149.84	1154.68	1156.89	1152.07	1154.14	1150.77	1151.07					
7/20/2011	1145.83	1145.85	1146.10	1146.59	1144.78	1146.46	1145.91	1152.77				
10/26/2011	1144.35	1145.40	1145.49	1146.03	1144.23	1144.54	1145.59	1153.02				
1/24/2012	1145.75	1146.02	1146.30	1146.72	1144.90	1146.07	1146.03	1158.63				
4/25/2012	1146.88	1146.67	1147.08	1147.66	1145.47	1147.56	1146.71	1153.85				
7/31/2012	1143.69	1144.37	1144.49	1144.79	1143.36	1144.11	1144.44	1151.94				
10/24/2012	1142.76	1143.57	1143.67	1144.12	1142.58	1143.19	plugged	1151.94				
1/29/2013	1141	1141.52	1141.58	1142.16	1140.53	1141.93		1151.5				
4/23/2013	1148.99	1151.21	1152.51	1150.86	1150.37	1148.4		1156.7				
8/8/2013	1145.09	1146.17	1146.3	1146.95	1144.18	1145.68		1154.32				
10/21/2013	1143.89	1144.73	1144.86	1145.51	1143.83	1144.38		1152.69				
1/29/2014	1145.83	1146.16	1146.69	1146.93	1145.04	1146.28		1154.99				
4/30/2014	1143.02	1143.97	1144.35	1144.71	1142.45	1143.53		1155.35				
7/23/2014	1145.35	1146.31	1147.16	1146.54	1144.89	1146.45		1154.91				
10/16/2014	1145.83	1148.97	1151.46	1149.61	1148.8	1145.6		1156.49				
1/20/2015	1145.75	1147.13	1147.51	1147.66	1145.92	1146.62		1155.21				
4/28/2015	1147.25	1147.75	1151.24	1148.49	1148.19	1146.07		1155.9				
7/22/2015	1151.29	1152.61	1153.59	1151.97	1151.4	1152.14		1156.14				
10/20/2015	1143.53	1144.05	1151.31	1143.66	1142.97	1144.16		1152.49				
3/15/2016	1148.29	1141.42	1148.02	1147.21	1145.5	1147.34		1155.39	1149.37	1145.67	1148.13	1147.66
Seasonal High	1151.29	1154.68	1156.89	1152.90	1154.14	1153.48	1151.74	1158.63	1149.37	1145.67	1148.13	1147.66

B-3 is not in use as a monitoring well.

B-9 was renamed from well NE-8, groundwater elevation data previous to 3/15/2016 was taken from NE-8.

TABLE 2

AEP - FLINT CREEK

CLASS 3N LANDFILL

MONITORING WELL/PIEZOMETER CONSTRUCTION DETAILS

Well Number	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft.bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen Depth ft. bls	Top of Screen Elevation ft. msl	Bottom of Screen Depth ft. bls	Bottom of Screen Elevation ft. msl
B-1B	36° 15' 38.508"	94° 30' 48.390"	1189.04	1191.64	72.2	3/1/1993	PVC	2	59.6	1129.44	69.6	1122.04
B-2	36º 15' 34.367"	94º 30' 57.987"	1176.60	1179.36	45	11/25/1991	PVC	2	35	1141.60	45	1134.36
B-4	36º 15' 31.890"	94º 30' 42.096"	1166.80	1169.09	34	11/26/1991	PVC	2	24	1142.80	34	1135.09
B-5	36º 15' 26.182"	94º 30' 49.814"	1183.40	1185.54	60	12/6/1991	PVC	2	50	1133.40	60	1125.54
B-6	36º 15' 39.110"	94º 30' 57.890"	1181.20	1184.19	59.75	11/13/1991	PVC	2	48.2	1133.00	59.75	1124.44
B-7A	36º 15' 41.108"	94º 30' 47.780"	1194.89	1191.89	100	5/17/2007	PVC	2	80	1114.89	100.5	1091.39
B-9	36° 15' 29.95958"	94° 31' 04.83356"	1179.10	1182.13	38.5	6/8/2011	PVC	2	22.85	1156.25	38.25	1143.88
B-10	36° 15' 31.4844"	94° 31' 04.4162"	1181.78	1184.98	51	11/12/2015	PVC	2	40.85	1140.93	51.15	1133.83
B-11	36º 15' 26.5230"	94º 31' 01.9179"	1171.59	1174.53	32.5	11/12/2015	PVC	2	22.02	1149.57	32.32	1142.21
B-12	36° 15' 39.4681"	94° 30' 42.8205"	1177.48	1180.26	49	2/10/2016	PVC	2	38.27	1139.21	48.67	1131.59
B-13	36º 15' 26.0006"	94º 30' 43.0819"	1159.54	1162.61	38	2/9/2016	PVC	2	27.16	1132.38	37.56	1125.05

APPENDIX 1

Boring & Monitoring Well Installation Logs

Boring Logs

Drilling Log

Project Name: SWEPCO						Boring Number: B-1B	
Project No.: 92-388-1						Page: 1 of 5	
Ground Elevation		Location				Total Footage: 75 ft.	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water	Date Measured
AIR ROTARY	5 5/8"	35	40	0	0	See Remarks	See Remarks

Drilling Co.: LOUNE WESTERN	Driller (s): FLOYD CHILCOAT / JAMES MUTTE
Drilling Rig: K-30 SPEEDSTAR	Type of Penetration Test: NONE
Date: 2/26/93 To 3/2/93	Field Observer (s): C. Wood

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
1	SILT, CLAYEY, TRACE FINE GRAVEL, DAMP, TRACE PLASTICITY, 10R4/6	CL					START @ 0805 2/26/93
2	CLAY, SILTY, SOME MEDIUM SAND, TRACE FINE TO MEDIUM GRAVEL, TRACE PLASTICITY, STIFF DAMP, 10R4/6	CL					LOGGED FROM CUTTINGS
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Drilling Log, continued

Project Name	SWEPCO
Project No.	92-388-1
Boring No.	B-1B
Page	2 of 5
Date	2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
15	CLAY, SILTY, WITH GRAVEL AND COBBLES, POORLY GRADED, CLAY TRACE PLASTICITY, STIFF, 2.5YR, 4/6, DAMP	CL					
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Drilling Log, continued

Boring No. B-1B
Project Name SWEPCO
Page 3 of 5
Project No. 92-388-1
Date 7/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
32	CLAY, SILTY, WITH GRAVEL & COBBLES, POORLY GRADED, CLAY: TRACE PLASTICITY, STIFF, DAMP, 2.5YR 4/6	CL					
33							
34							
35	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, WEATHERED MOD. STRONG, MED. DK GREY N4	LS					
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							

Drilling Log, continued

Boring No. B-1B
Page 4 of 5
Project Name SWEPCO
Project No. 92-388-1
Date 2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
49	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, FRESH MED. DK GREY N4, STRONG	LS					
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							1253 - WATER OBSERVED 3/1/93
60							
61							
62							
63							
64							
65							

Drilling Log, continued

Boring No. B-1B
Page 5 of 5
Project Name SWEPCO
Project No. 92-388-1
Date 2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
66	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, FRESH STRONG, MED. DK. GREY N4	LS					
67							
68							
69							
70							
71							
72							
73							
74							
75							NO WATER OBSERVED 2/26/93
	T.D. 75'						T.D. @ 1225 2/26/93
76							1327 3/1/93 BEGIN WELL CONSTRUCTION. SET 9.98' SCH 40 0.10 SLOTTED SCREEN @ 72.20', AND 64.70 SCH 40 RISER PIPE. FILTER PACK TO 56.2 Ft BGS. BENTONITE SEAL TO 51.03 Ft BGS. BENTONITE ENVIROPLUG GROUT TO 3.2 Ft BGS. SURFACE COMPLETION 3/2/93
77							
78							
79							
80							
81							
82							

Drilling Log

Project Name: SWEPCO						Boring No.: B-2	
Project No.: 91-339-4						Page: 1 of 3	
Ground Elevation: 1176.6'	Location: N710591.2 E258212.0					Total Footage: 45'	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA	8"	45'	-0-	2	-0-	SEE REMARKS	
Drilling Co.: LAYNE WESTERN						Driller (s): T. ATHERTON, BUDDY	
Drilling Rig: CME-75						Type of Penetration Test: STANDARD PENETRATION TEST	
Date: 11-24-91	To: 11-25-91					Field Observer (s): GLENN SCHERER	

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
1	SILTY CLAY, MODERATE BROWN 5YR 3/4, DAMP, MEDIUM PLASTIC, MEDIUM	CL				BEGAN AT 4:15 pm
2	CLAY, GRAVEL, MODERATE BROWN 5YR 3/4, MOIST, LOW PLASTIC, STIFF		12/13/23	18"/18"		
3		CL			SS-1	4:25 pm TPS = 4.5
4						
5	CLAYEY GRAVEL, SILT, MODERATE BROWN 5YR 3/4, DAMP, NON PLASTIC, SOFT					
6		GC				
7						
8	LIMESTONE GRAVEL, DARK YELLOWISH ORANGE, clayey		11/46/36	18"/18"	SS-2	4:42 pm TPS = 2.4
9		GC				
10						
11						
12	CLAYEY GRAVEL; MODERATE BROWN 5YR 3/4 DAMP, NON PLASTIC, FIRM	GC				
13	CLAY, DARK YELLOWISH ORANGE, DAMP MEDIUM PLASTIC, FIRM	CL	5/11/13	18"/18"	SS-3	5:00 pm TPS = 3.2
14						

Drilling Log, continued

Boring No. B-2
Project Name SWECO
Page 2 of 3
Project No. 91-339-4
Date 4/5/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
15	CLAY, DARK YELLOWISH ORANGE, DAMP MEDIUM PLASTIC, FIRM	CL				
16						
17						
18			4/11/5C	6"/18"	SS-4	5:15 PM TFS = 1.5
19	LIMESTONE GRAVEL, CLAY, SILT, LIGHT BROWN 5YR 5/6, DRY, LOOSE, NONPLASTIC	GC				QUIT FOR THE DAY RESTART 4/5/91 AT 7:25 AM
20						
21	LIMESTONE, GRAY, SEAMS OF CLAY, RED, MOIST, MEDIUM PLASTIC, SOFT	BG				
22						
23			25/50/50 @.25'	6"/18"	SS-5	7:30 AM
24						
25						
26						
27						
28			6/14/9	14"/18"	SS-6	BECOMING MOIST
29						
30						
31						

Drilling Log, continued

Boring No. B-2

Project Name SWEPCO

Page 3 of 3

Project No. 91-339-4

Date 11-25-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
32	LIMESTONE, GRAY, SEAMS of CLAY, RED MOIST, MEDIUM PLASTIC, SOFT, LIMESTONE HIGHLY WEATHERED AND WEAK					
33		LS	12/35/19	14"/18"	S5-7	8:30 AM
34						
35						
36						
37						
38			11/15/4	12"/18"	S5-8	8:45 AM TPS = 0.25 — BECOMES WET
39						
40						
41	SAME AS ABOVE					
42						
43			21/16/18	12"/18"	S5-9	
44						
45						TD = 45' AT 9:35 AM AUGER REFUSAL Place monitoring well 11/25/91 @ 1:20P

Drilling Log

Project Name	Boring No.
SWEPCO	B-3
Project No.	**Page** 1 of 4
91-339-4	

Ground Elevation	Location	Total Footage
1191.5	N 710416.6 E 259114.4	59 1/2'

Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
SSA/HSA	12"/8"	59 1/2	-0-	5	-0-	SEE REMARKS	

Drilling Co. LAYNE-WESTERN	Driller (s) T. ATHERTON, BUDDY
Drilling Rig. CME-75	Type of Penetration Test NONE
Date 12-23-91 To 12-5-91	Field Observer (s) G. SCHERER

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
0	FLY ASH					BEGAN AT 8:15 AM using 12" SSA
1						
2						
3						
4						
5						RIG BROKE DOWN RESTART AT 10:30 AM
6						
7						
8						
9						
10						
11						
12						
13						
14						

Drilling Log, continued

Boring No. B-3

Project Name SWEPCO

Page 2 of 4

Project No. 91-339-4

Date 11-23-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
15						11:20 AM
16						
17						
18						
19						
20						11:40 AM
21	CLAY, GRAVEL, RED, MOIST, HIGH PLASTIC, MEDIUM	CH				
22						
23						FINISH 12" BOPING BEGAN AUGERING 8" 12-5-91 AT 10:30 AM
24						
25	CLAY, YELLOWISH BROWN, MOIST, MEDIUM PLASTIC, MEDIUM	CL				
26						11:00 AM ATTEMPTED SHELBY TUBE FAILED
27						
28					SHELBY	11:15 AM GOOD SHELBY TUBE
29				1.5/2.0'	TUBE	
30						
31						BEGAN HITTING ROCK

Drilling Log, continued

Boring No. B-3
Project Name SWEPCO
Page 3 of 4
Project No. 91-339-4
Date 12-5-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
32	CLAY, SANDY, SOME FINE GRAVEL, MODERATE REDDISH BROWN, MOIST, LOW PLASTIC, LOOSE	CL				
33			20/17/50@.3"	10"/18"	SS-1	1:30 pm TOOK SAMPLE B-3/SS-1
34						
35	GRAVEL WITH CLAY LAYERS, REDDISH BROWN	GC				
36						
37						
38						
39	LIMESTONE, HIGHLY WEATHERED, FRAGMENTED WITH SOME CLAY, REDDISH BROWN, MOIST, FIRM	LS	50@.25"	.25"/1.5"	SS-2	
40						
41						
42						
43						
44			50@.2"	0/18"	SS-3	
45						
46						
47	CLAY WITH LIMESTONE, MODERATE REDDISH BROWN, WET, FIRM	CL				
48						

Drilling Log, continued

Boring No. B-3

Project Name SWEPCO

Page 4 of 4

Project No. 91-339-4

Date 12-5-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
48	LIMESTONE, HIGHLY WEATHERED, FRAGMENTED WITH CLAY, MOIST, BECOMING WET, FIRM, NON-PLASTIC	LS	18/50 for .2'	6"/18"	S5-4	3:30pm
49						
50						
51						
52						
53	CHERTY LIMESTONE, GREY, HIGHLY WEATHERED, CLAYEY, CLAY IS MODERATE REDDISH BROWN, MOIST TO WET, FIRM, MEDIUM PLASTIC	LS	38/60/18	12"/18"		3:50pm
54					S5-5	
55						
56						▼ 56.5' BGS MEASURED THROUGH AUGERS 4:05pm
57						
58						
59						
60						4:10 pm AUGER REFUSAL, TOTAL DEPTH = 59.5'
						12/6/91 9:10A Monitoring Well Set.

Drilling Log

Project Name: SWEPCO						Boring No.: B-4	
Project No.: 91-339-4						Page: 1 of 3	
Ground Elevation: 1166.8'	Location: N710307.6 E259506.3					Total Footage: 34.0'	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA	8"	34.0'	-0-	2	—	SEE REMARKS	
Drilling Co.: LAYNE-WESTERN						Driller (s): T. ATHERTON/BUDDY	
Drilling Rig.: CME-75						Type of Penetration Test: STANDARD PENETRATION	
Date: 11-26-91	To: 11-26-91					Field Observer (s): GLENN SCHEPER	

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
1	CLAY, GRAVEL, DARK MODERATE BROWN 5YR 3/4 DAMP, MEDIUM, MEDIUM PLASTIC	CL				BEGAN DRILLING AT 7:15AM
2						
3					SS-1	7:30AM TSF = 1.5
4	GRAVEL, SOME CLAY, GRAVELS ARE CHERT LIMESTONE GRAY, CLAYEY DARK MODERATE BROWN 5YR 3/4 DAMP, MEDIUM, MEDIUM PLASTIC	GC				
5						
6						
7						
8			50 for .2'	0"/18"	SS-2	
9						
10						
11	CLAY, BROWN 5YR 3/4, DAMP, MEDIUM, MEDIUM PLASTIC	CL				
12						
13					SS-3	9:15AM
14						

Drilling Log, continued

Boring No. B-4

Project Name SWEPCO

Page 2 of 3

Project No. 91-339-4

Date 11-26-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
14	CLAY, SOME GRAVEL, SAND, LIGHT YELLOWISH BROWN, MOIST, MEDIUM, LOW PLASTIC	CL				
18			3/20/36	12"/18"	SS-4	9:45 AM
20	ALTERNATING LAYERS of LIMESTONE AND CLAY — LIMESTONE IS CHERTY, GRAY, - CLAY IS SANDY, LIGHT BROWN, WET, LOW PLASTICITY	LS/CL				
23				19"/18"	SS-5	9:58 AM TSF = 0.1
26	LIMESTONE, GREY; EXTREMELY WEATHERED, WEAK, WET / CLAYEY, CLAY IS LIGHT BROWN, LOW PLASTICITY	LS				
28			4/22/50	6"/18"	SS-6	10:10 AM TSF = 0 ▼ MEASURED INSIDE AUGERS 28.0'
31						

Drilling Log, continued

Boring No. B-4

Project Name SWEPCO

Page 3 of 3

Project No. 91-339-4

Date 11-26-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
31	LIMESTONE, BUFF, EXTREMELY WEATHERED; WEAK, FRAGMENTED, CLAYEY, CLAY IS LIGHT BROWN, WET, LOW PLASTICITY.	LS				
32						10:20 AM
33			50 for .4'	2"/18"	S5-7	
34						AUGER REFUSAL AT 10:30 AM 34.0' place monitoring well - 11/26/91.

Drilling Log

Project Name						Boring No.	
SWEPCO						B-5	
Project No.						Page	of
91-339-4						1	5
Ground Elevation		Location				Total Footage	
1183.4'		N709746.8 E 258859.7'				70	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA & Rotary Wash	8"	24'	46'	5	0	See Remarks	—
Drilling Co.	Layne-Western Co. - Kansas City, KS			Driller (s)	Tom Atherton, Buddy		
Drilling Rig.	CME 75			Type of Penetration Test	Standard Split Spoon		
Date	11/16/91	To	11/20/91	Field Observer (s)	Martha Hildebrandt		

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
0	FLY ASH					start at 7:40A
	CLAY, silty, grey-brown, moist, medium plasticity, soft	CH				
1	CLAY, silty, red-brown, moist, medium-to high-plasticity, stiff with GRAVEL, chert, white, rounded, poorly sorted. (Fill for berm)	CH				
2						
3			12/7/18	15"/18"	SS-1	7:55P 4.0 tsf (?)
4						
5						
6						dark organic layer at 6.4'
7	CLAY, silty, brownish grey, gravelly, moist, trace plasticity, medium consistency (fill for berm).	CL				
8			9/9/14	14"/18"	SS-2	8:10A 3.25 tsf
9						
10						
11						
12						
13	CLAY, silty, red intermixed with brownish-grey medium plasticity, stiff with GRAVEL (20%) chert, angular, poorly sorted (fill for berm)	CL	6/9/20	11"/18"	SS-3	8:20A 2.75 tsf
14						

Drilling Log, continued

Boring No. B-5

Project Name SNEPCO

Page 2 of 5

Project No. 91-339-4

Date 11/16/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
17	CLAY, silty, yellow-brown, moist, medium- to high-plasticity, stiff with GRAVEL (40%) chert, white, angular, poorly sorted.	CL	59/50 @ 4"	10"/10"	55-4	← "Undisturbed" soil augering hardend with more gravel. 8:30A
23	CLAY, silty, gravelly, reddish yellow-brown, moist, high plasticity, tough, very stiff	CH	4/2/50 @ 1"	12"/13"	55-5	8:55A
24	Auger Refusal @ 24.0'					
25	LIMESTONE, grey, moderately to highly weathered, moderately strong with Chert occurring in sporatic 3" layers. CLAY	LS				1:00 P - Begin Rotary Wash. Broke off bit at ~25'. Had to abandon hole. 11/18/91 - Offset 6 feet West. Rotary Wash to 25'. 11/19/91 - Rotary Wash down ward

Drilling Log, continued

Boring No. B-5

Project Name SWEPCO

Page 3 of 5

Project No. 91-339-4

Date 11/19/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
31						
32						
33						
34						
35	As above but with more clay.	CL				
36						
37						
38						
39						
40						1:00 P Remove rods & bail well down. Wait 30 minutes. WL does not change.
41	LIMESTONE, buff, moderately weathered, moderately strong, micro crystalline, clay & Chert beds but fewer than above.	LS				
42						
43						
44						
45						
46						
47						
48						

Drilling Log, continued

Boring No. B-5
Project Name SWEPCO
Page 4 of 5
Project No. 91-339-4
Date 11/19/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
48						
49						
50						← 1:45P Boring advanced to 50', Pull rods. Bail well down. 2:15P TD 50' WL 47.0' 3:00P WL-47.1'
51						
52	As above with more clay. Little chert.	LS				
53						
54						
55						
56						
57						
58						
59						
60	CLAY, red, high plasticity with LIMESTONE buff, weathered	CH/LS				← 4:00P Boring at 60' 5:00P Well bailed down WL 55.5' TD 56' 11/20/91 7:00A WL 55.8' TD 56' 10:35 Begin Rotary Wash at 60'
61						
62						
63						
64						
65						← 11:10A

Burns & McDonnell
ENGINEERS · ARCHITECTS · CONSULTANTS

Drilling Log, continued

Boring No. B-5

Project Name SWEPCO

Page 5 of 5

Project No. 91-339-4

Date 11/20/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
65						
66	LIMESTONE, light grey, slightly weathered, strong, massive, cherty.	LS				11:20A Drilling harder advancing slowly
67						Advancing 1"/5 minutes
68						← 1:45P
69						
70	Total 70.0					Finish at 4:00 12/6/91 Place monitoring well
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						

1/7

ELC 10/8/01 1:27 pm B-6

Gary Moyer & Rodney Phillips - Anderson

Lat. 36 15 40 N } B-6

Long. 094 30 58 W }

MW B-6

8¼" HSA

CL 0-5' tan sl cl

GC 5-10' 7½ hilly rock bring up nodules reddish sl cl w/ chert pebbles

GC 10-15' more of same until 12½ thin less chert

GC 15'-20' changed color to light brown at 15' (more clay content) more chert

CL 20-25' tan slightly moist clay w silt

CL 25 to 30' 22 ft changed to yellow sl clay no chert

GC 30 to 35' more of same to 33' - 33 to 35' light brown w chert sl clay

35 to 40' same as above

40 to 45' Same as above Chg with get

next page

FLC
10/8/01

GC 45'-50' same as above
LS 50-55' same a above but more silty
?50' LS 55-60' same as above
LS 60' TD
drill stem wet at 55' @ 2:45pm
D to W 45' (approx 1" above g.s. measuring pt.
4 1/2 50lbs bag of sand to 2'
above screen Unimin Corp. (see bag)
1/4" bentonite pellets 3' all in water
3/4 of a bucket (5gal) PDS Co
Polymer Drilling Systems
El Dorado Ark.
Note: Water level measurements made with
a tape base on sound & feel
pulled casing @ 4:40pm
moved to B7 @ 4:47pm
B7 - 36°15'40"N ; 094°31'02"W (@4:48pm)
0-5' reddish brown silty w chert
5-10' 7 1/2' turns more red and
sl clay w chert

LOG OF WELL NO. B-7-A

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

Boring Location: N = 711249.14 E = 1259063.79
T.O.C. Elevation = 1191.89
Drilling Method: 8.25 O.D. HOLLOW STEM AUGER
6" Air Rotary

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	2								
	8								
	12								
	15								
	20								
	26								
	32								
	36								

SILTY LEAN CLAY
dark brown

LEAN TO FAT CLAY, gravely
orangish brown with chert and limestone gravel, limestone is subangular and heavily weathered

LEAN TO FAT CLAY, gravely
medium brown chert and limestone gravel, limestone is subangular and heavily weathered

LEAN TO FAT CLAY
medium to dark brown with angular chert gravel

LEAN TO FAT CLAY
light brown to tan with angular chert gravel

SILTY LEAN CLAY
orangish brown, moist with intermittent chert and limestone beds

LEAN TO FAT CLAY
orange, silty

LEAN TO FAT CLAY
orangish brown with intermittent chert beds, moist
-Auger refusal-started drilling at 36 feet with air rotary (6"dia.)

LIMESTONE
gray, unweathered, dry

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 48.13 bgs	▼
WL	▼	▼
WL	Logged by drill cuttings	

Terracon

BORING STARTED	5-15-07		
BORING COMPLETED	5-16-07		
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

LOG OF WELL NO. B-7-A

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	LIMESTONE gray, unweathered, dry - Stabilized groundwater level at 48.13' ▽	50 55 60 65 70 75 80 85 90								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 48.13 bgs	▼	
WL	▼	▼	
WL	Logged by drill cuttings		

Terracon

BORING STARTED			5-15-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

BOREHOLE_99 35077067.GPJ TERRACON.GDT 8/30/07

LOG OF WELL NO. B-7-A

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	LIMESTONE gray, unweathered, dry	95								
100		100								
	BOTTOM OF BORING AT 100 FEET									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 48.13 bgs	▼
WL	▼	▼
WL	Logged by drill cuttings	

Terracon

BORING STARTED	5-15-07		
BORING COMPLETED	5-16-07		
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

LOG OF WELL NO. B-8

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

Boring Location: N = 709769.92 E = 1257934.80
T.O.C. Elevation = 1174.19
Drilling Method: 8.25 O.D. HOLLOW STEM AUGER

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	1 **LEAN CLAY** brown									
	3 **LEAN TO FAT CLAY**, gravelly brown clay with subangular weathered limestone gravel									
	LEAN CLAY, gravelly red, silty with subangular limestone and angular chert gravel	5								
		10								
	13									
	14 **FAT CLAY** medium brown	15								
	16 **LEAN TO FAT CLAY**									
	17 medium brown									
	BEDDED CHERT									
	20 **FAT CLAY**, gravelly	20								
	BEDDED CHERT									
	22 **LEAN CLAY**, gravelly red with chert and limestone gravel, moist									
	25 **LEAN TO FAT CLAY** red with chert and limestone beds	25								
	- Stabilized groundwater level at 29.49' ▽	30								
	35									
	LEAN CLAY, gravelly medium brown clay with weathered limestone gravel, wet ▼	35								
	40 **LEAN CLAY** medium brown, saturated	40								
	45	45								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 29.49 bgs	▼ 36 bgs	
WL	▼	▽	
WL	Logged by drill cuttings		

Terracon

BORING STARTED	5-16-07		
BORING COMPLETED	5-16-07		
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

BOREHOLE_99 35077067.GPJ TERRACON.GDT 8/30/07

LOG OF WELL NO. B-8

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	FAT CLAY, gravelly red with weathered limestone gravel	50								
	50 BOTTOM OF BORING AT 50 FEET									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 29.49 bgs	▼ 36 bgs	
WL	▼	▽	
WL	Logged by drill cuttings		

Terracon

BORING STARTED			5-16-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

BOREHOLE_99 35077067.GPJ TERRACON.GDT 8/30/07

Terracon
Consulting Engineers and Scientists
25809 Interstate-30 BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: NE-8 PAGE: 1 of 1

TOTAL DEPTH: 38.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK	PROJECT: NATURE AND EXTENT WELLS
JOB NO.: 216-001-35117108-007	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS	DRILLER: GARRY MOYERS
DATE DRILLED: 6/8/11	RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY

SAMPLING METHOD: SPLIT SPOON

N: 710,056.77 E: 1,257,636.17 G.S. ELEV. 1,179.10

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 2' SILTY CLAY brown, more silt than clay					
	2' - 9' GRAVELLY CLAY reddish brown		1	8"		
5						
10	9' - 13' SILTY CLAY tan, gray and reddish brown with gravel, mottled		2	18"		
	13' - 19' SILTY CLAY tan and gray, mottled Moist at 15.5'		3			
15						
20	19' - 20' LIMESTONE weathered 20' - 38.5' LIMESTONE bedrock limestone consists of alternating hard and soft beds soft drilling from 28'-29' but still limestone					Refusal at 20' bgs (Started air rotary at 20')
25						
30	moist at 31'					Allowed boring to sit open for 30 min. at 30' & was dry.
35						Allowed boring to sit open for 1 hr. & 20 min. at 35' water is at 28' bgs
40	Total Depth of Boring at 38.5' bgs					

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FIELD BORING LOG

BORING NO.: B-10 PAGE: 1 of 1

TOTAL DEPTH: 51 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: AEP-Flint Creek Monitoring Well Installation
JOB NO.: 216-001-35157178-001	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 11/10/2015 & 11/11/2015	RIG TYPE: TRUCK MOUNTED CME 75

DRILLING METHOD: HOLLOW STEM AUGER & AIR ROTARY

SAMPLING METHOD: SPLIT SPOON & CUTTINGS

N: N/A E: N/A TOC: N/A

Depth BGS	Sample Interval	DESCRIPTION	Litho. Symbol	Comments
0		0"-8" Gravel and Fill		
		8"-13' SILTY CLAY red with chert and limestone gravel		
5				
10				
		13'-20' CLAY red and gray, mottled, fat with some chert gravel		
15				
20		20'-22' SILTY CLAY with weathered chert and limestone fragments		
		22'-51' LIMESTONE crystalline and consistent		
25				
30				
35				Dry after 14 hours at 36' bgs
40				
45				Clear water after 3 hours at 46' bgs
50				Few inches of water after 3 hours at 51' bgs Approx. 3' of water after 14 hours at 51' bgs
		Total Depth of Boring at 51' bgs		

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FIELD BORING LOG

BORING NO.: B-11 PAGE: 1 of 1

TOTAL DEPTH: 32.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: AEP-Flint Creek Monitoring Well Installation
JOB NO.: 216-001-35157178-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: MERRICK ROTENBERRY	DRILLER: GARY MOYERS
DATE DRILLED: 11/11/2015	RIG TYPE: TRUCK MOUNTED CME 75

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON AND CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY red with chert and limestone gravel		
15	15'-16.5' CLAY brown and red, fat with some chert gravel		
	16.5'-32.5' SILTY CLAY red with weathered chert and limestone fragments		Moist from 24.5'-26.5' bgs Water encountered between 28'-29' bgs
30	Total Depth of Boring at 32.5' bgs		

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FIELD BORING LOG

BORING NO.: B-12 PAGE: 1 of 2

TOTAL DEPTH: 49 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-003	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/10/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

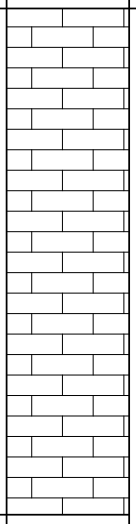
Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-8' SILTY CLAY dark brown, stiff		
5			
	8'-20' SILTY CLAY some chert and limestone gravel increasing with depth		
10			
15			
20	20'-39' LIMESTONE heavily weathered with gray clay and chert gravel		
25			
30			Wet at 32' bgs

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: B-12 PAGE: 2 of 2

TOTAL DEPTH: 49 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
40	39'-49' LIMESTONE light gray with chert		39' - 49' bgs logged by cuttings
45			
50	Total Depth of Boring at 49' bgs		
55			
60			
65			
70			
75			

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Consulting Engineers and Scientists
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PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: B-13 PAGE: 1 of 1

TOTAL DEPTH: 38 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-004	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/9/2016	RIG TYPE: CME 75 BUGGY

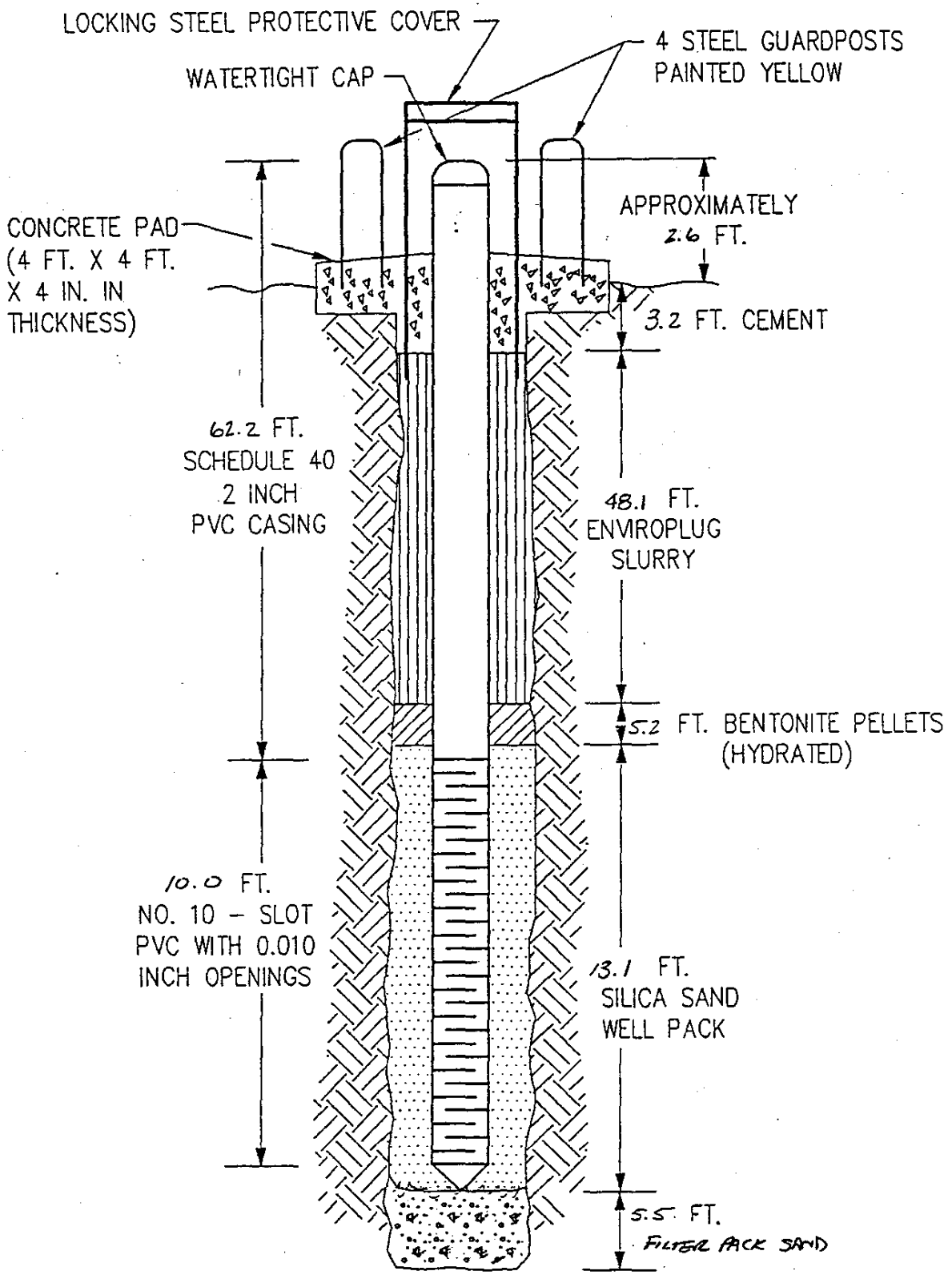
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: NA E: NA G.S. ELEV. NA

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-38' SILTY CLAY red with chert gravel		Wet at 14' bgs
35	Top of limestone bedrock		
40	Total Depth of Boring at 38' bgs		

Monitoring Well Installation Logs



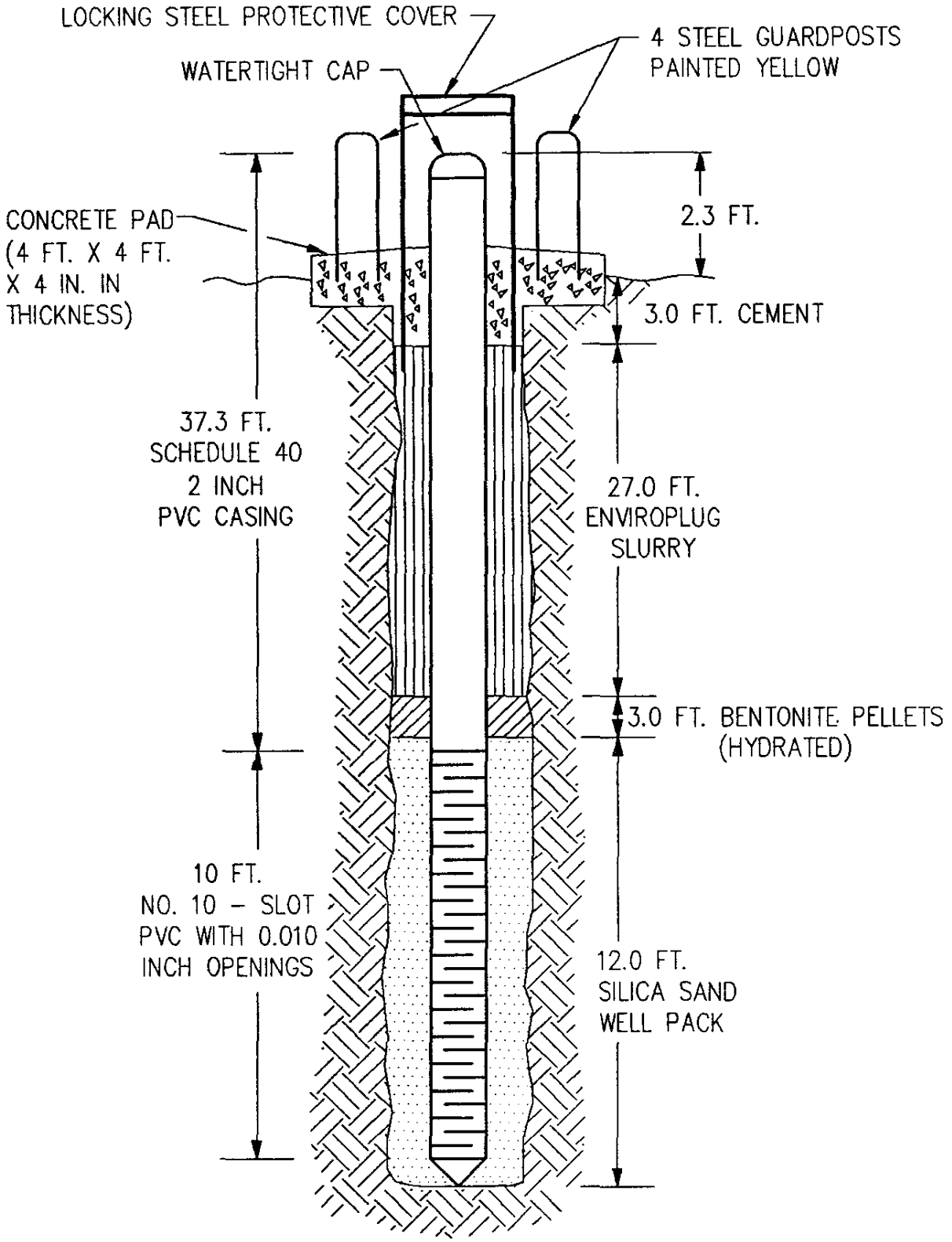
TOP OF PIPE ELEVATION
GROUND SURFACE ELEVATION
TOTAL DEPTH OF PIEZOMETER 72.20

NOT TO SCALE DATE INSTALLED 3/1/93

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-1B
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC013.DWG 01-08-1992 14:13 KBL



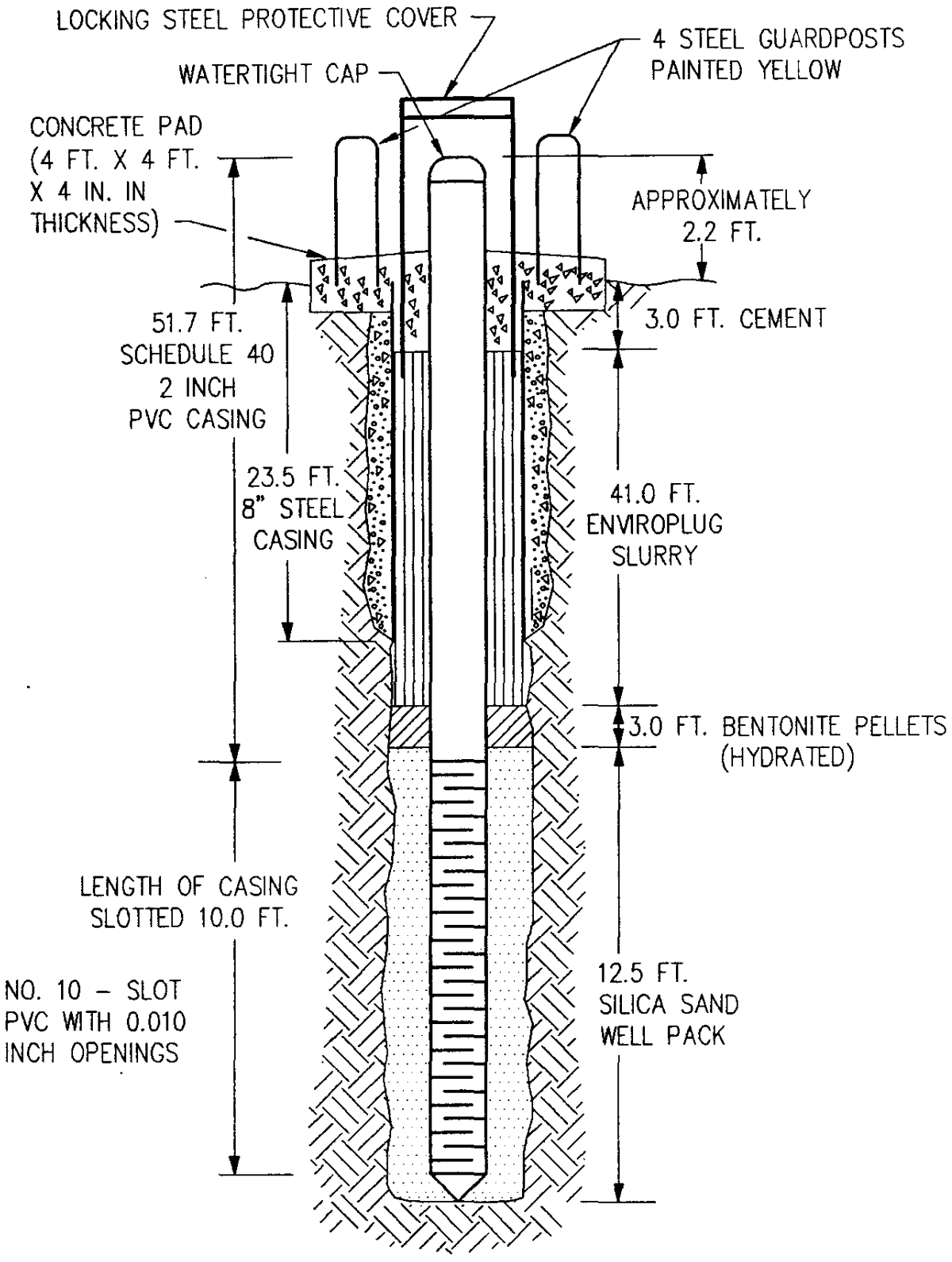
TOP OF PIPE ELEVATION 1178.93'
GROUND SURFACE ELEVATION 1176.6'
TOTAL DEPTH OF PIEZOMETER 45.0'

NOT TO SCALE DATE INSTALLED 11-25-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-2
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC010.DWG 01-08-1992 11:45 KBL



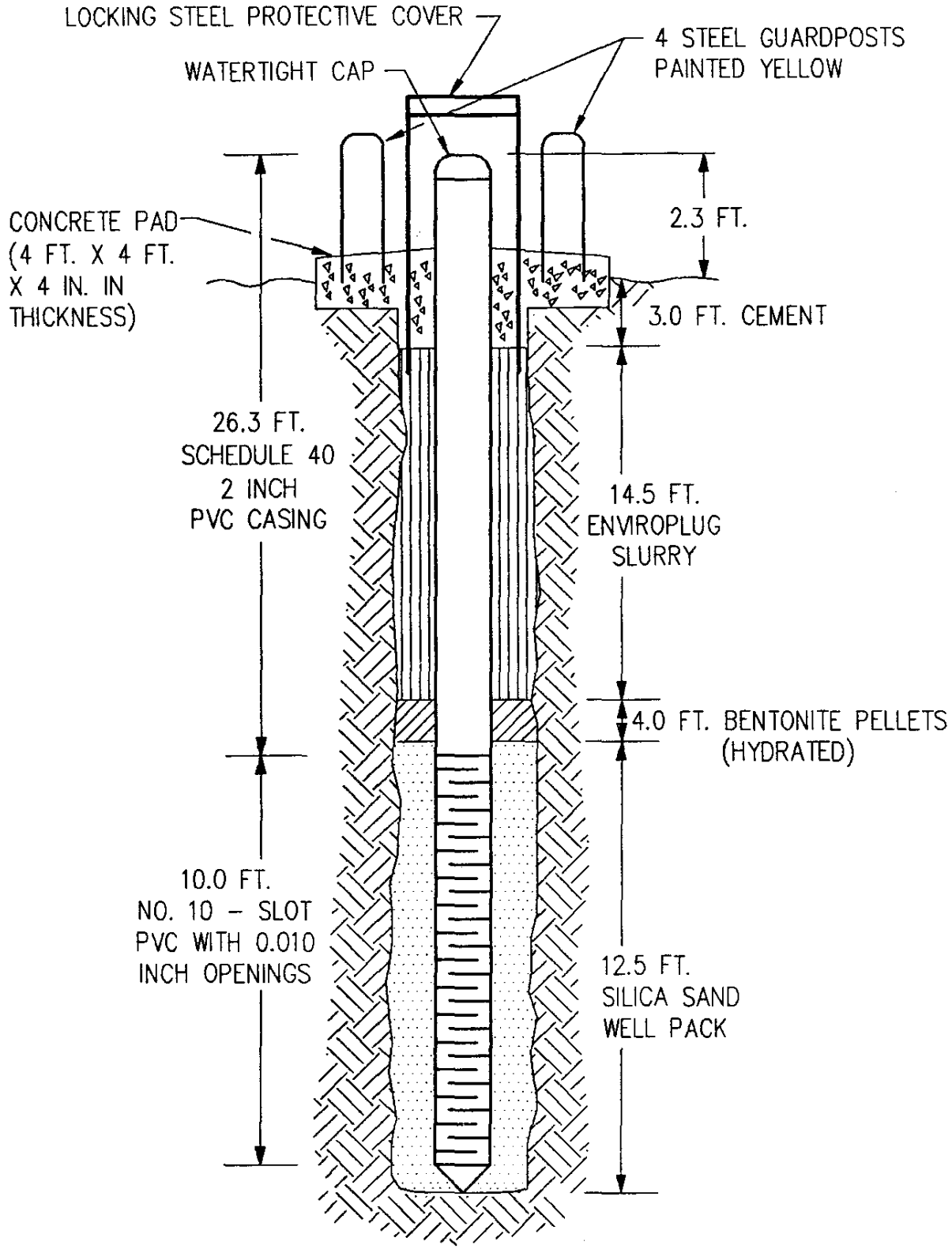
TOP OF PIPE ELEVATION 1193.72'
GROUND SURFACE ELEVATION 1191.5'
TOTAL DEPTH OF PIEZOMETER 59.5'

NOT TO SCALE DATE INSTALLED 12-6-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-3
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC011.DWG 01-27-1992 14:21 KBL



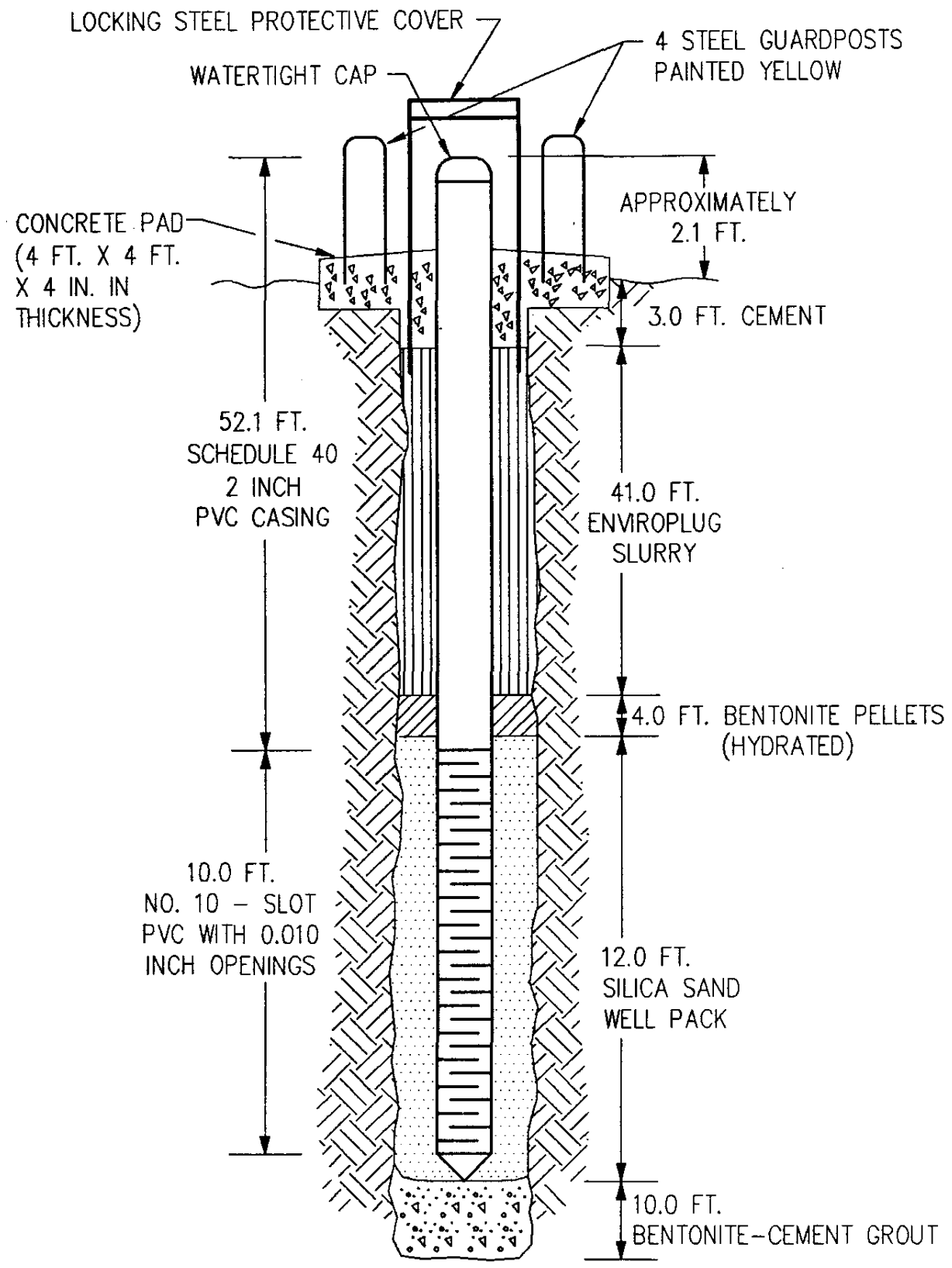
TOP OF PIPE ELEVATION 1169.09'
GROUND SURFACE ELEVATION 1166.8'
TOTAL DEPTH OF PIEZOMETER 34.0'

NOT TO SCALE DATE INSTALLED 11-26-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-4
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC012.DWG 01-08-1992 14:21 KBL



TOP OF PIPE ELEVATION 1185.54'
GROUND SURFACE ELEVATION 1183.4'
TOTAL DEPTH OF PIEZOMETER 60.0'

NOT TO SCALE DATE INSTALLED 12-6-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-5
MONITORING WELL CONSTRUCTION DIAGRAM

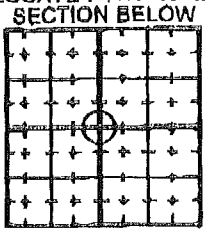
SWEPC013.DWG 01-08-1992 14:13 KBL

Date:	# of Pages: 1
To: Curtis Carter	From: Scott Anderson
Co:	Co: ANDERSON ENGINEERING CONSULTANTS, INC.
Phone:	Phone: 501/455-4545
Fax #:	Fax #: 501/455-4552

STATE OF ARKA
REPORT ON WATER WELL CONSTRUCT

A
1 Contractor Name & Number: Anderson Engr. C# 1121
2 Driller Name & Number: Garry Mayers D# 2396
3 Pump Installer Name & Number: P#
4 Date Well Completed: 10/8/01 New Well ☑ Replace or Work-over ☐

10 LOCATE WITH 'X' IN SECTION BELOW



5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
Benton	¼ of ¼ of			

LONGITUDE 11 N 36 ° 15 ' 18 "
LATITUDE 11 W 95 ° 31 ' 28 "

B 1 DESCRIPTION OF FORMATION: DEPTHS IN FEET

	FROM	TO
Red Clay w/LS Frag	0	58.5
with Grey Limestone		60
ATTACH ADDITIONAL SHEETS IF NECESSARY		

2 TOTAL DEPTH OF WELL 60 ft
3 DEPTHS TO WATER PRODUCING FORMATIONS. 50
4 STATIC WATER LEVEL 52 Ft below land surface
5 YIELD N/A gallons per ☐ min ☐ hr
6 DIAMETER OF BORE HOLE 8.25 IN

C PUMP REPORT
1 TYPE PUMP: SUBMERSIBLE ☐ TURBINE ☐ JET ☐
2 SETTING DEPTH: FEET
3 BRAND NAME AND SERIAL NUMBERS:
4 RATED CAPACITY gallons per minute
5 TYPE LUBRICATION
6 DROP PIPE OR COLUMN PIPE SIZE
7 WIRE SIZE
8 PRESSURE TANK . . . SIZE, MAKE, MODEL
9 DATE OF INSTALLATION OR REPAIR
10 Is there an abandoned water well on the property?

D 1 LAND OWNER OR OTHER CONTACT PERSON:
NAME Flint Creek Power Plant
STREET ADDRESS Hwy 12 & 59
CITY Gentry, Ark.

2 CASING FROM 0.0 TO 50.0 W/ 2" "ID
FROM TO W/ "ID
TYPE CASING: PVC 40

3 SCREEN
TYPE: PVC 40 DIA 2" SLOT/GA .010"
SET FROM 50.0 FT TO 60.0 FT
TYPE: DIA SLOT/GA
SET FROM FT TO FT

4 GRAVEL PACK FROM 48 FT TO 60 FT
5 BACK FILLED WITH: Med. Plug
FROM 3 FT TO 45 FT
6 SEALED WITH: 0.25" Pellets
FROM 45 FT TO 48 FT
FROM FT TO FT
7 DISINFECTED WITH: N/A
8 USE OF WELL:

DOMESTIC	☐	COMMERCIAL	☐
IRRIGATION	☐	MONITOR	☑
LIVESTOCK/POULTRY	☐	TEST WELL	☐
OIL/GAS SUPPLY	☐	SEMI-PUBLIC	☐
PUBLIC SUPPLY	☐	OTHER	

(A/C HEATPUMP TYPE WELLS)

SOURCE	☐	RETURN	☐
CLOSED LOOP	☐		

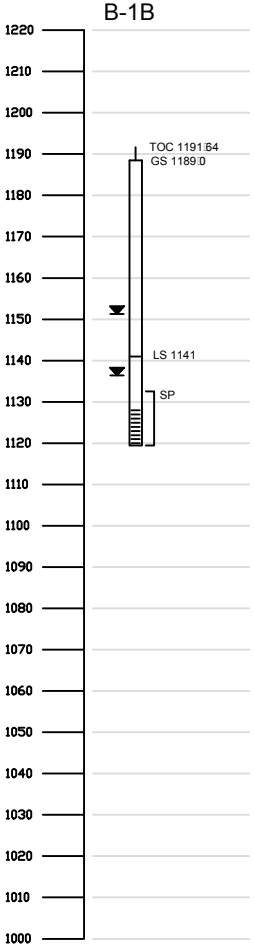
9 (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?
If yes, name use: yes ☐ no ☐
10 (For A/C open-loop only) Into what medium is water returned?
11 REMARKS
Well No. W-56
12 SIGNED Garry Mayers DATE 10/16/01

AWD 7 JAN 88 ACI 5946
Arkansas Water Well Construction Commission, 101 East Capitol, Suite 350, Little Rock, AR 72201

COMMISSION COPY

H□draulic conductivit□
□ro□ slug test□
K □ 1□18□10-6 c□/sec□

B-1B

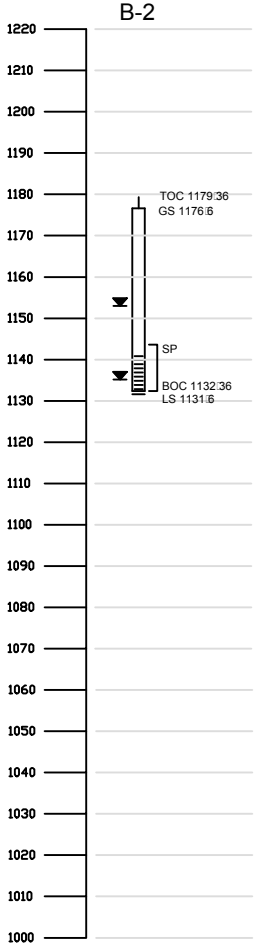


Range o□ o□served □otentio□etric ground□ater elevations in □onitoring □ell

TOC - To□ o□Casing
GS - Ground Sur□ace
LS - To□ o□Boone Li□estone
BOC - Botto□ o□Casing
SP - Sand Pac□elevations

H□draulic conductivit□
□ro□ slug test□
K □ 17□31□10-3 c□/sec□

B-2

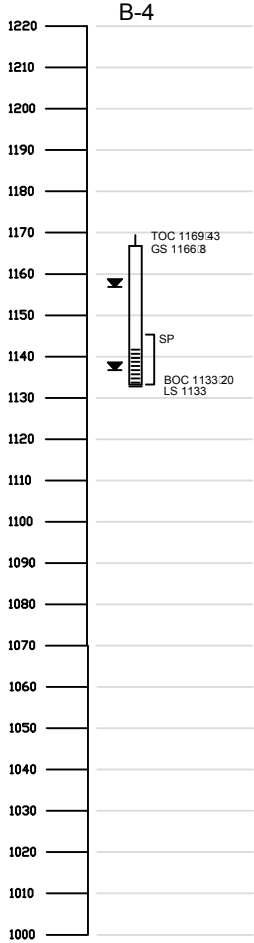


Range o□ o□served □otentio□etric ground□ater elevations in □onitoring □ell

TOC - To□ o□Casing
GS - Ground Sur□ace
LS - To□ o□Boone Li□estone
BOC - Botto□ o□Casing
SP - Sand Pac□elevations

H□draulic conductivit□
□ro□ slug test□
K □ 4□02□10-3 c□/sec□

B-4

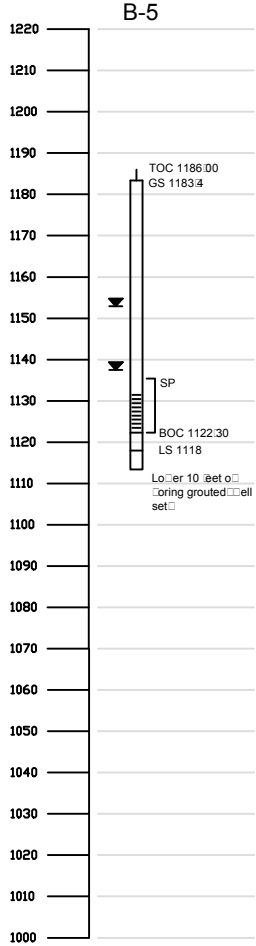


Range o□ o□served □otentio□etric ground□ater elevations in □onitoring □ell

TOC - To□ o□Casing
GS - Ground Sur□ace
LS - To□ o□Boone Li□estone
BOC - Botto□ o□Casing
SP - Sand Pac□elevations

H□draulic conductivit□
□ro□ slug test□
K □ 9□64□10-5 c□/sec□

B-5

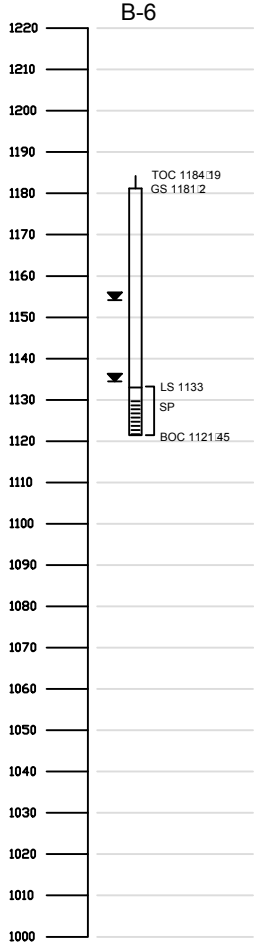


Range o□ o□served □otentio□etric ground□ater elevations in □onitoring □ell

TOC - To□ o□Casing
GS - Ground Sur□ace
LS - To□ o□Boone Li□estone
BOC - Botto□ o□Casing
SP - Sand Pac□elevations

H□draulic conductivit□
□ro□ slug test□
K □ 5□59□10-3 c□/sec□

B-6

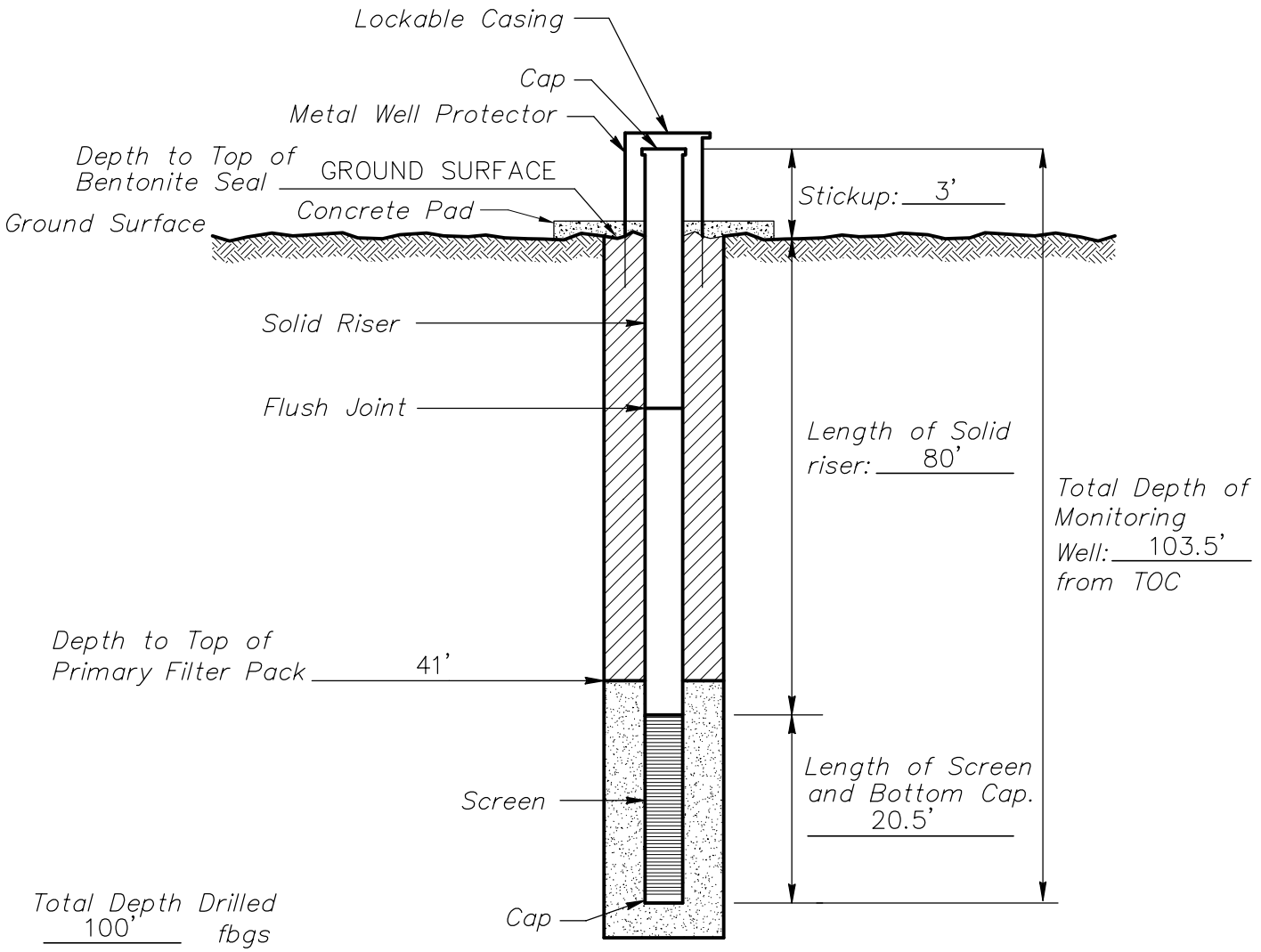


Range o□ o□served □otentio□etric ground□ater elevations in □onitoring □ell

TOC - To□ o□Casing
GS - Ground Sur□ace
LS - To□ o□Boone Li□estone
BOC - Botto□ o□Casing
SP - Sand Pac□elevations

PIEZOMETER INSTALLATION RECORD

Job Name AEP–SWEPCO FLINT CREEK Well Number B–7–A
Job Number 35077067 Installation Date 5/17/07 Location GENTRY, ARKANSAS
Datum Elevation N/A Surface Elevation N/A
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
Granular Backfill Material 10–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor MOHAWK DRILLING



Bentonite Chips

Granular Backfill

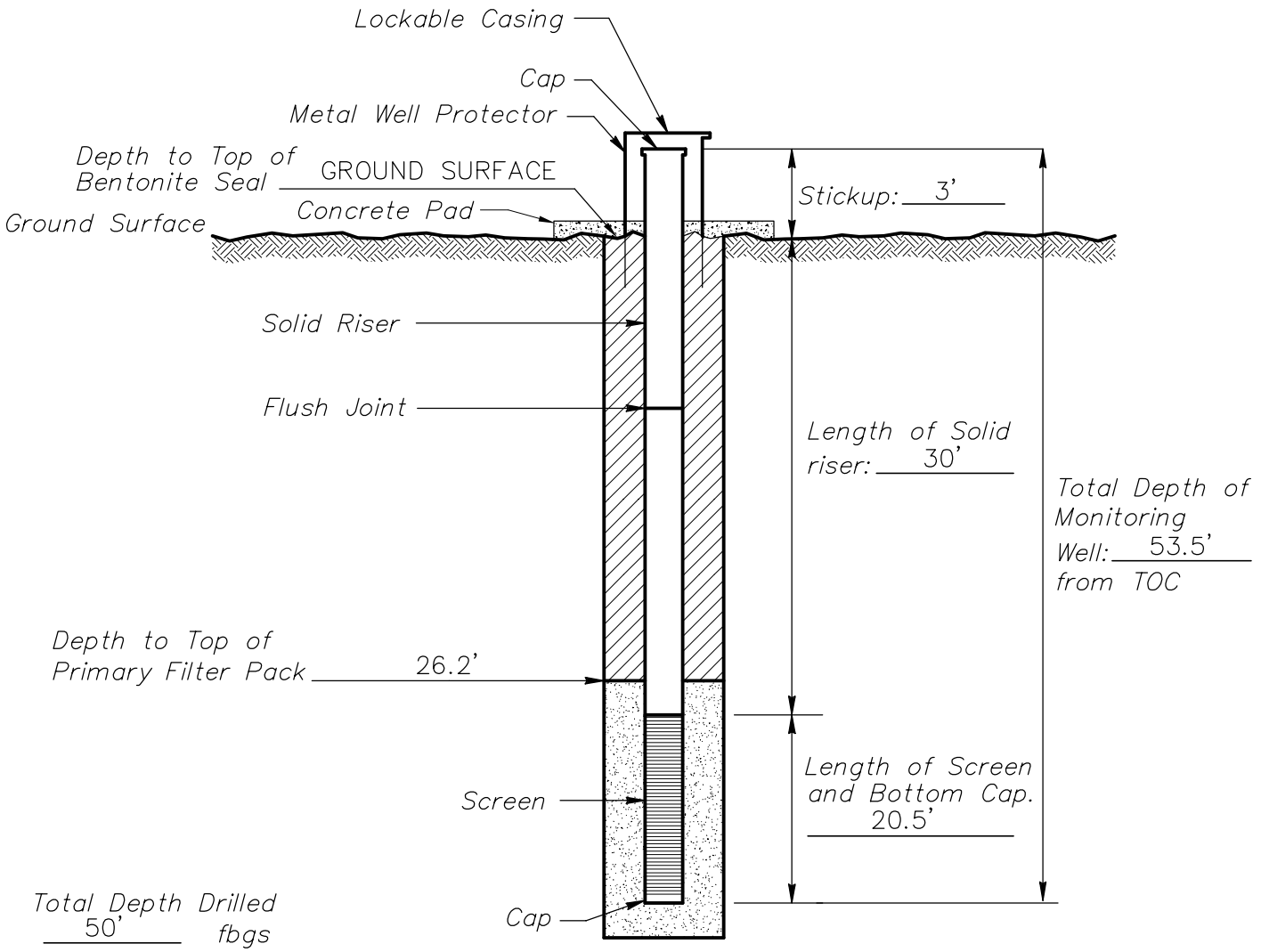
(Not to Scale)

Terracon
Consulting Engineers and Scientists
11400 WEST BASELINE ROAD LITTLE ROCK, AR. 72209
PH. (501) 455-2199 FAX. (501) 455-4547

PIEZOMETER INSTALLATION RECORD
PROJECT NUMBER: 216–001–35077067
WELL NUMBER: B–7–A
DRAWING NUMBER: 001 CHECKED BY: JBA

MONITORING WELL INSTALLATION RECORD

Job Name AEP–SWEPCO FLINT CREEK Well Number B–8
Job Number 35077067 Installation Date 5/16/07 Location GENTRY, ARKANSAS
Datum Elevation N/A Surface Elevation N/A
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
Granular Backfill Material 10–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor MOHAWK DRILLING



Bentonite Chips

Granular Backfill

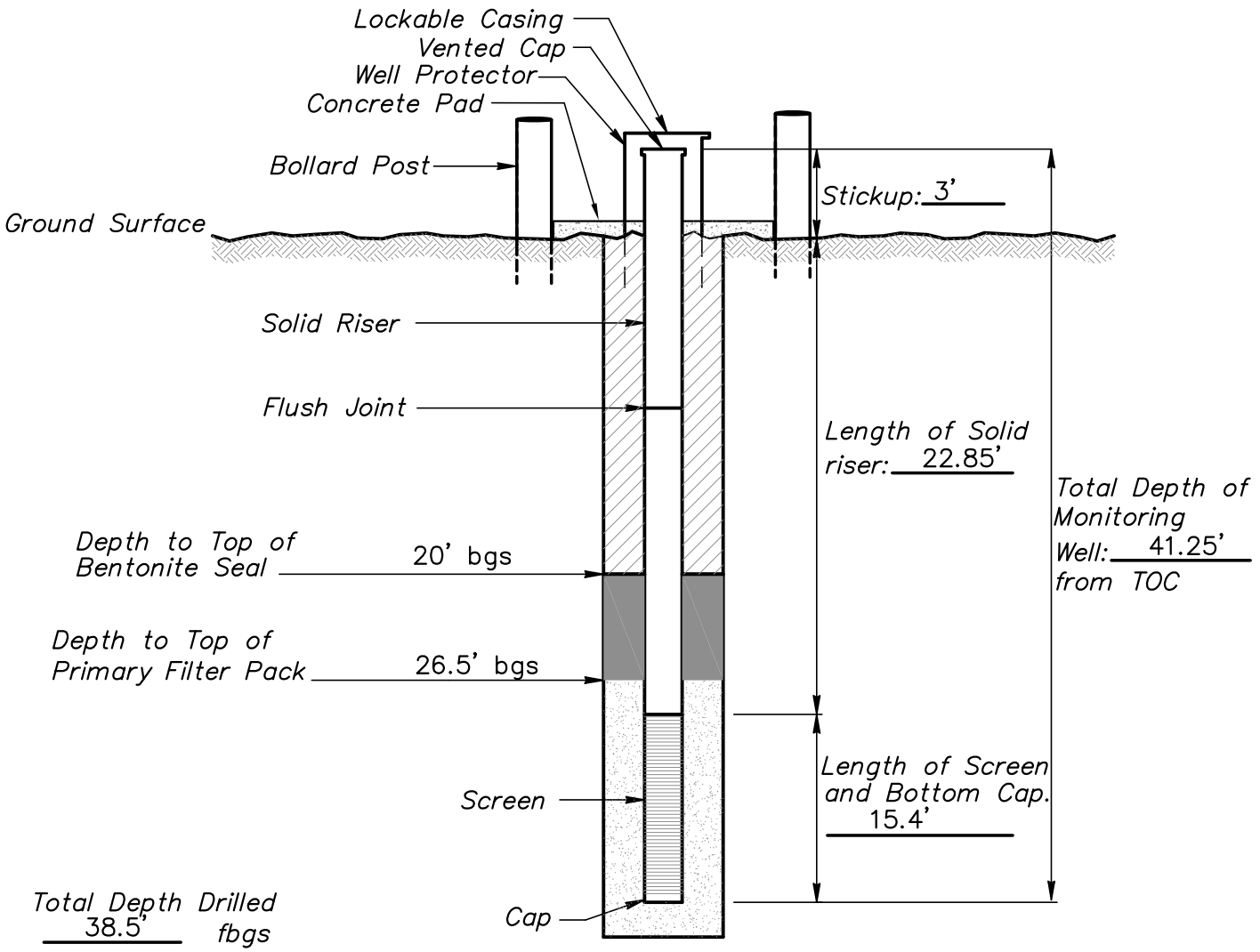
(Not to Scale)

Terracon
Consulting Engineers and Scientists
11400 WEST BASELINE ROAD LITTLE ROCK, AR. 72209
PH. (501) 455-2199 FAX. (501) 455-4547

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35077067
WELL NUMBER: B–8
DRAWING NUMBER: 003 CHECKED BY: JBA

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – NATURE AND EXTENT WELLS Well Number NE–8
Job Number 35117108 Installation Date 6/8/2011 Location GENTRY, AR.
Datum Elevation 1,182.13 Surface Elevation 1,179.10
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



Bentonite Grout

Bentonite Plug

Granular Backfill

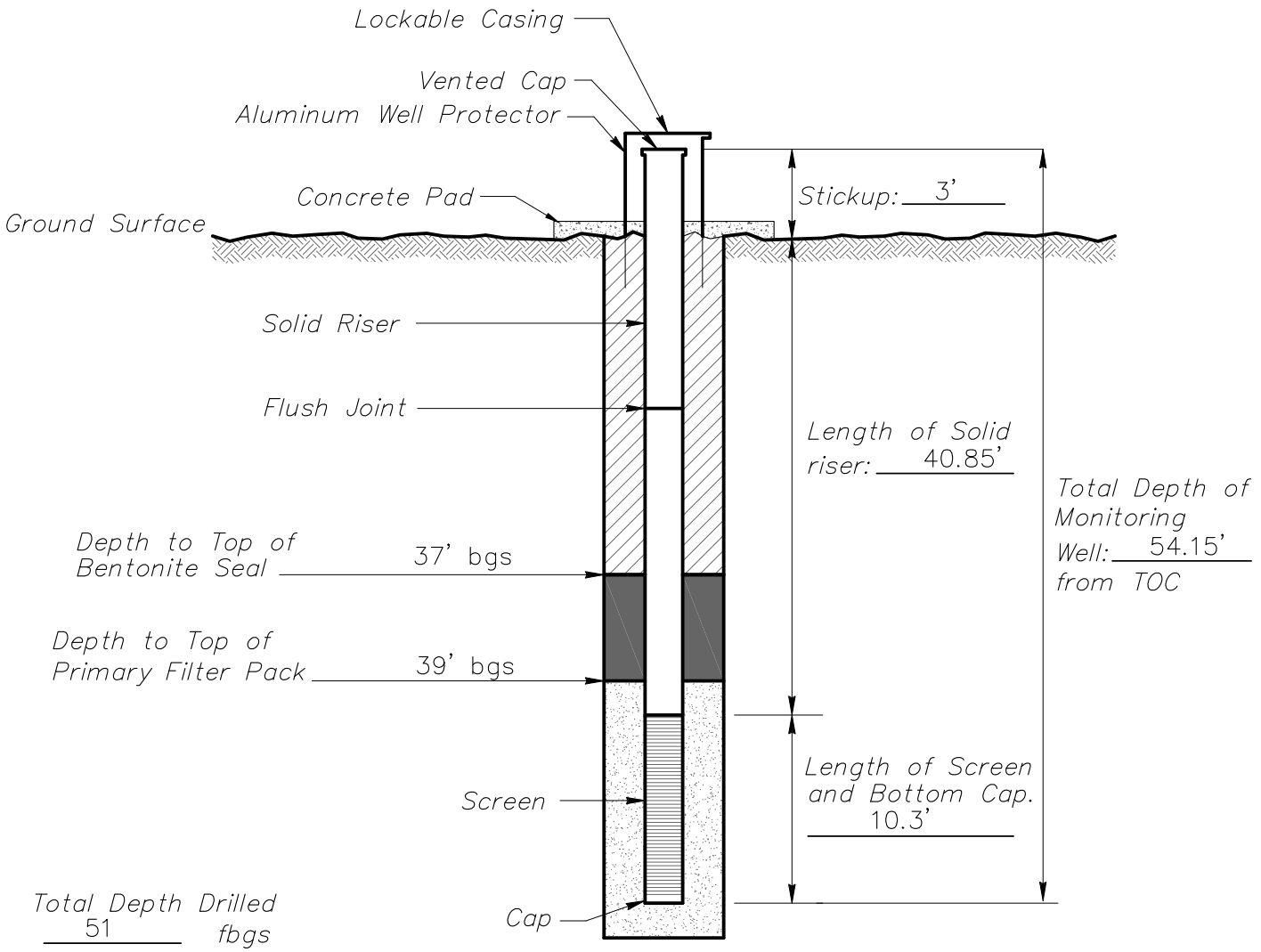
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: NE–8
DRAWING NUMBER: 020 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP–Flint Creek Monitoring Well Installation Well Number B–10
Job Number 35157178 Installation Date 11/11/15–11/12/15 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 4"–8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

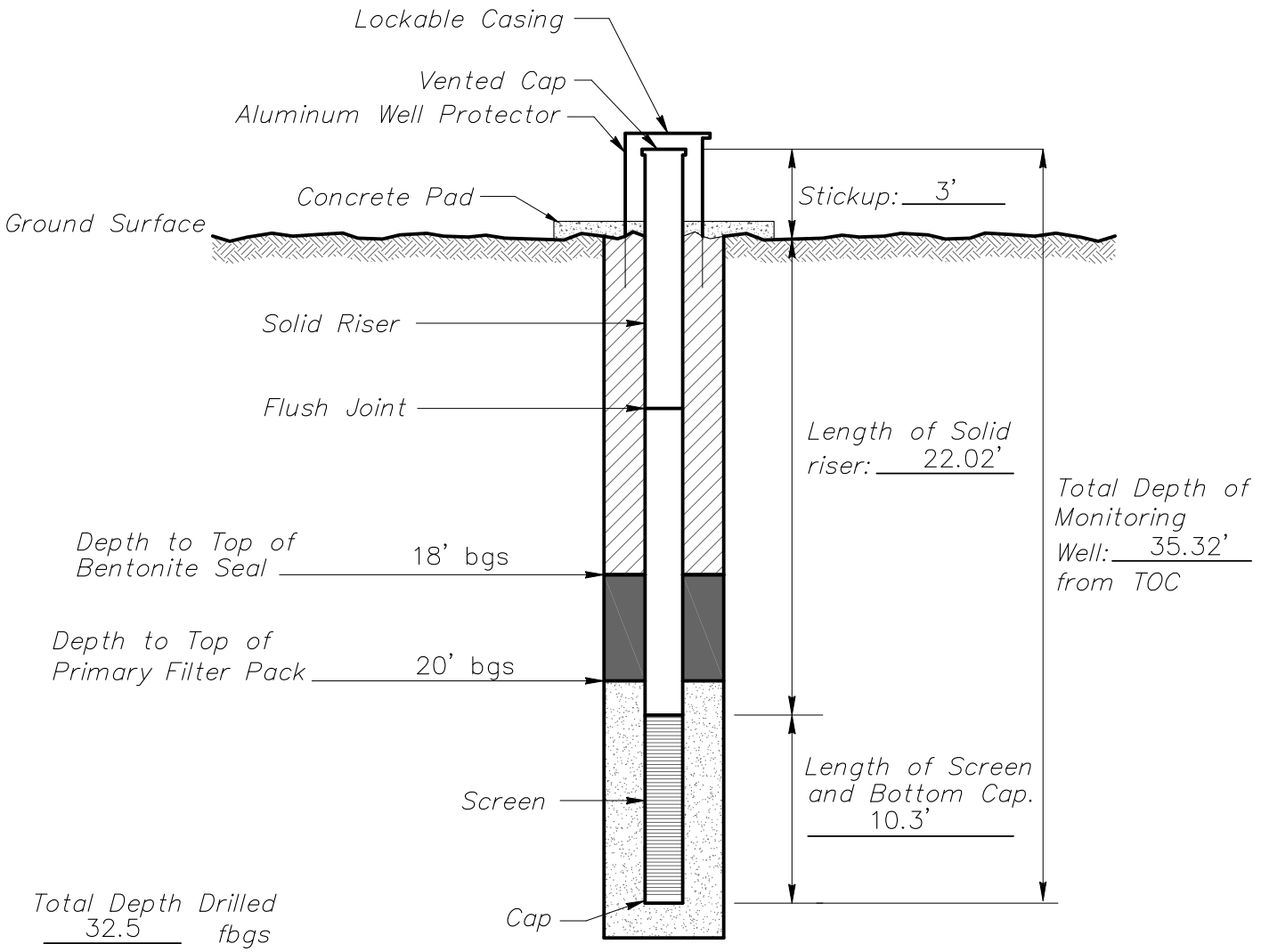
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157178
WELL NUMBER: B–10
DRAWING NUMBER: 003 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP–Flint Creek Monitoring Well Installation Well Number B–11
Job Number 35157178 Installation Date 11/10/15–11/12/15 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

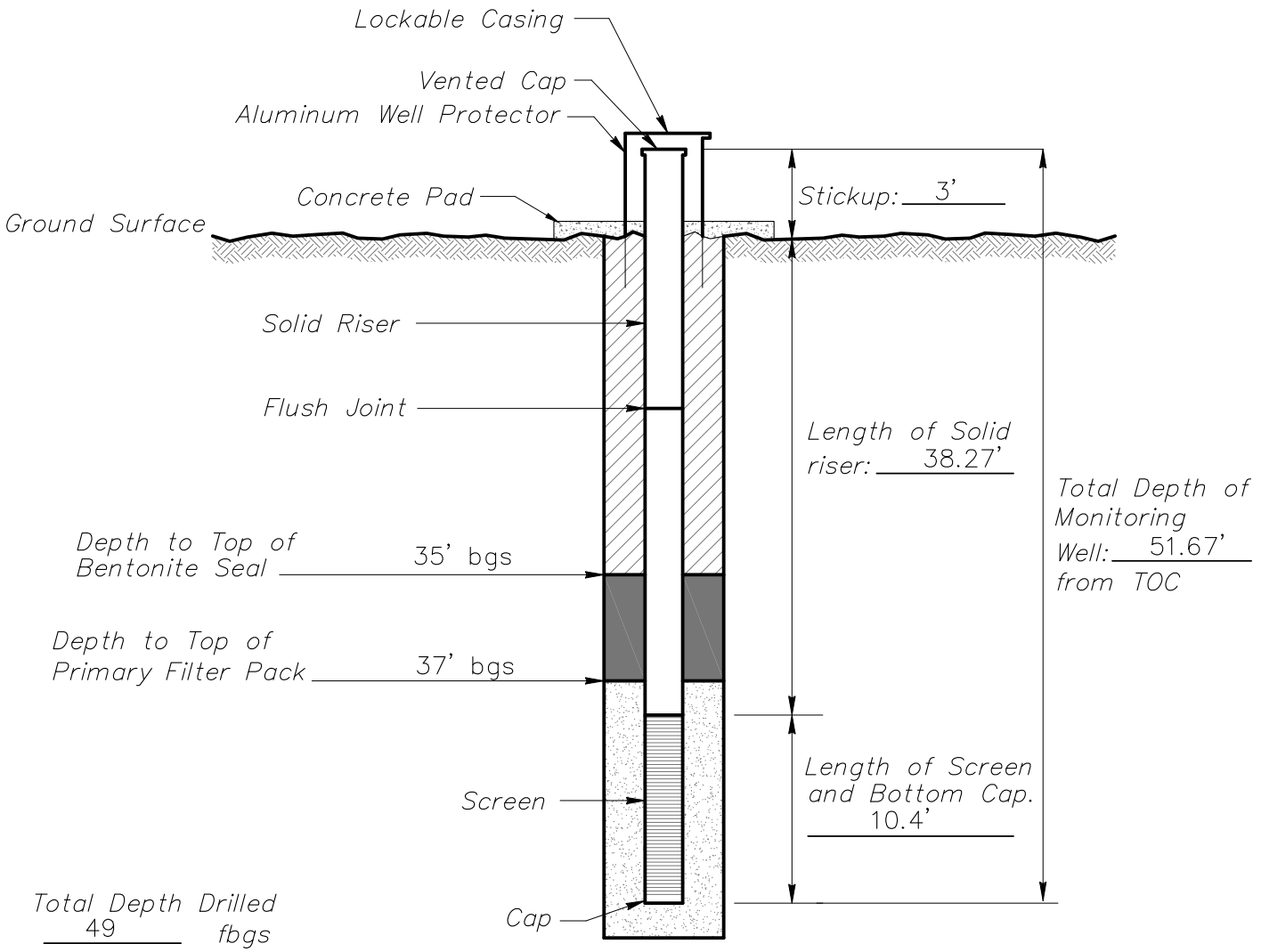
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157178
WELL NUMBER: B–11
DRAWING NUMBER: 004 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number B–12
Job Number 35157182 Installation Date 2/10/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

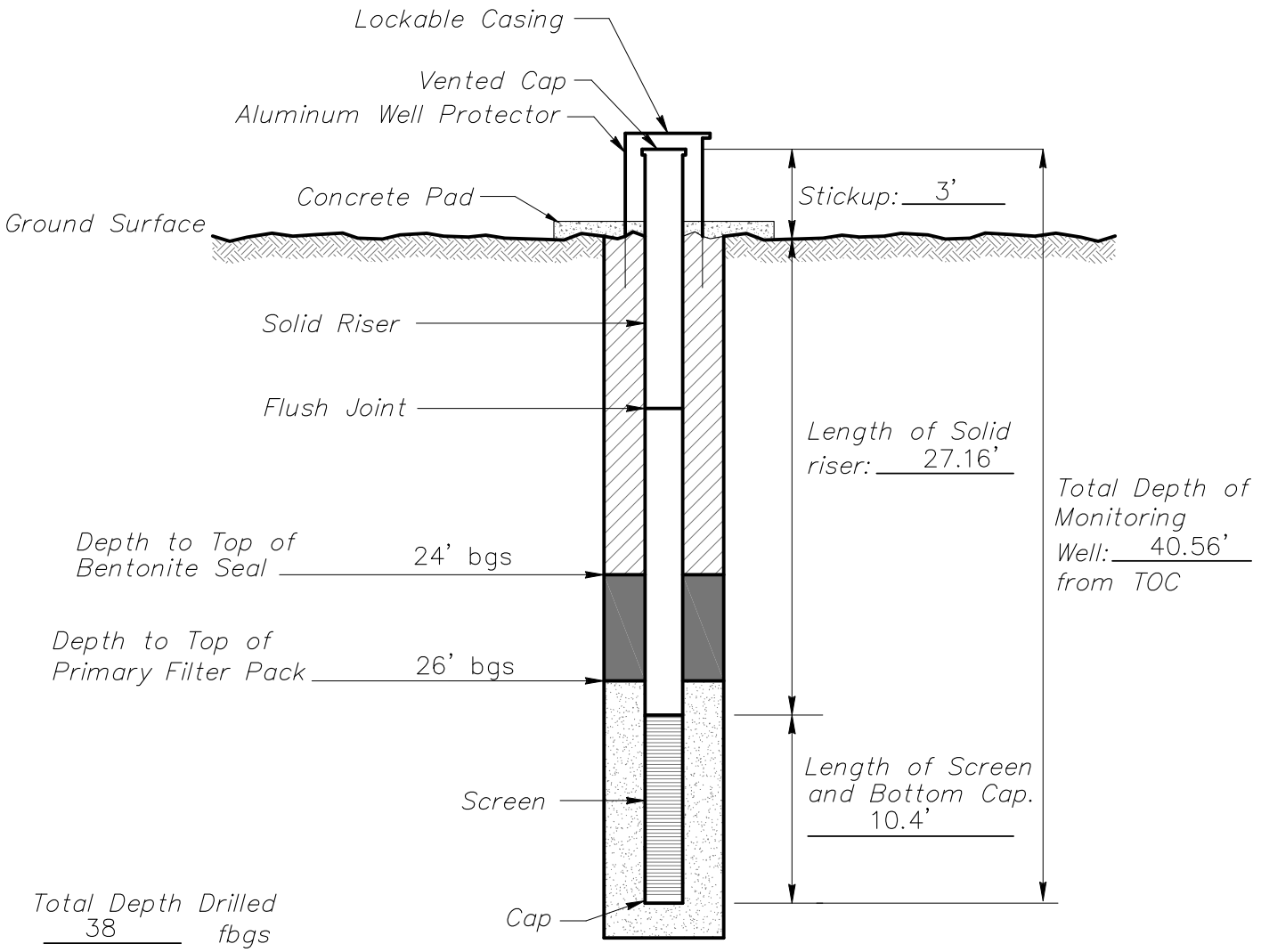
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: B–12
DRAWING NUMBER: 007 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number B–13
Job Number 35157182 Installation Date 2/9/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

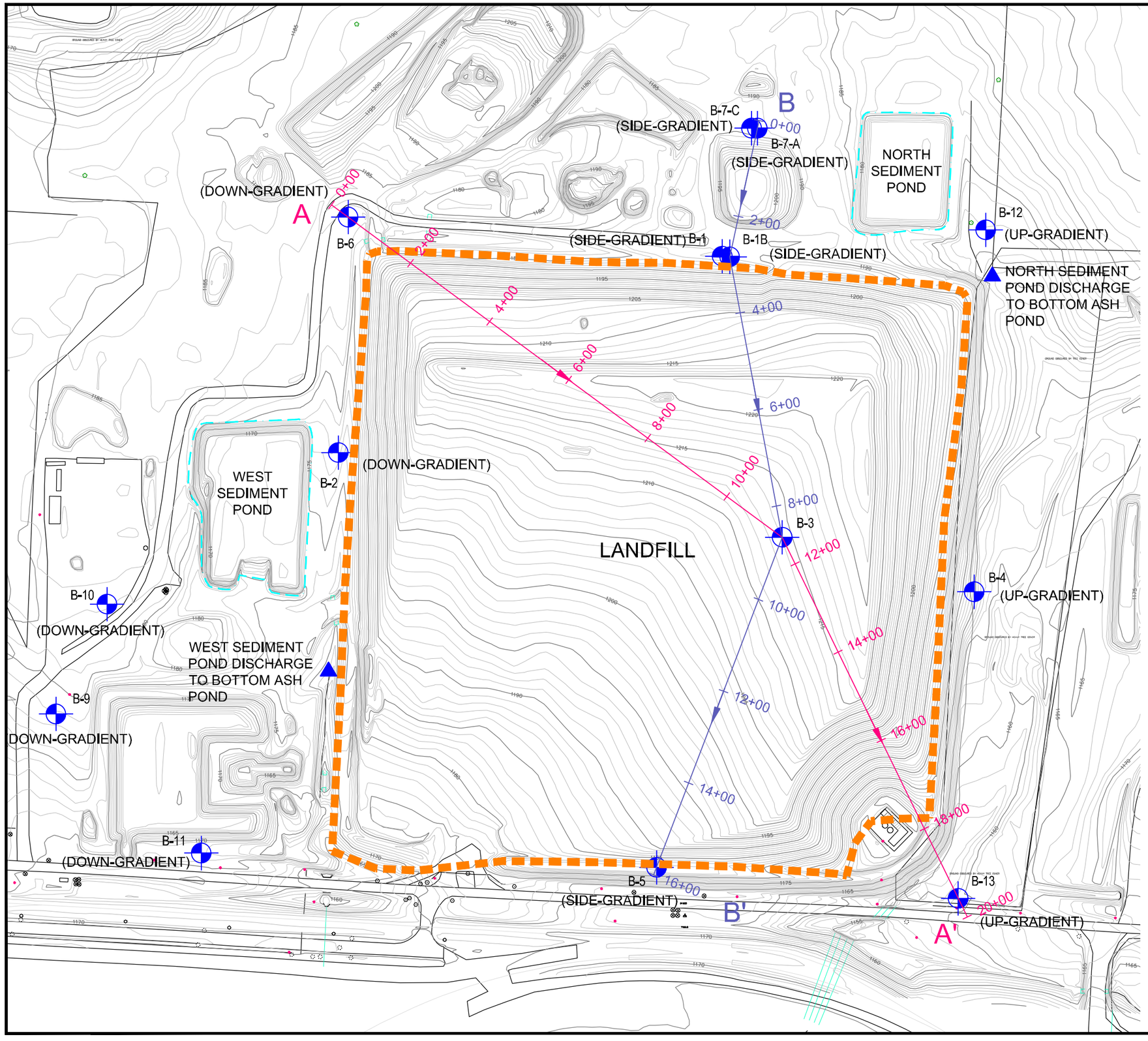
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: B–13
DRAWING NUMBER: 008 CHECKED BY: MR

APPENDIX 2

Geologic Cross Sections



N

200 0 50 100 200

SCALE IN FEET

LEGEND:

LANDFILL WASTE BOUNDARY

MONITORING WELL

NOTES:

LANDFILL BOTTOM GRADING ESTIMATED FROM BORING LOG DATA AND 1977 SURFACE TOPOGRAPHY (HULL AND ASSOC. DWG. 1-30110-B/1-30111-B, DATED 11/01/2010).

TOP OF LANDFILL ELEVATIONS FROM AERIAL SURVEY BY HENDERSON AERIAL SURVEYS INC., DATED 04/30/2015.

FIGURE 1

DESIGNED BY:	SRE
DRAWN BY:	SRE
APPVD. BY:	DOM
SCALE:	SEE BAR SCALE
DATE:	04/27/2016
JOB NO.	216-001-3515/7124
ACAD NO.	***
SHEET NO.:	1 OF 2

CROSS SECTION LOCATION MAP

LITHOLOGY CROSS SECTIONS

AMERICAN ELECTRIC POWER

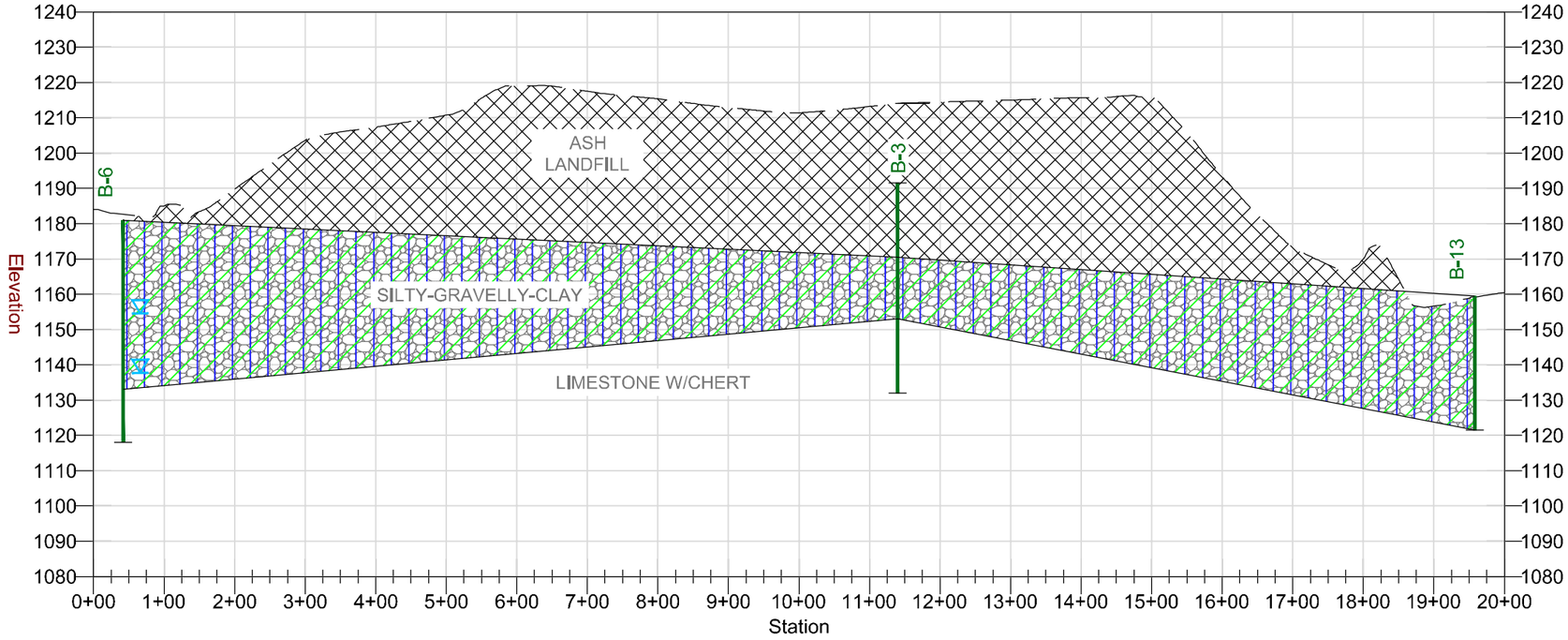
SWEPCO FLINT CREEL POWER PLANT LANDFILL

GENTRY ARKANSAS

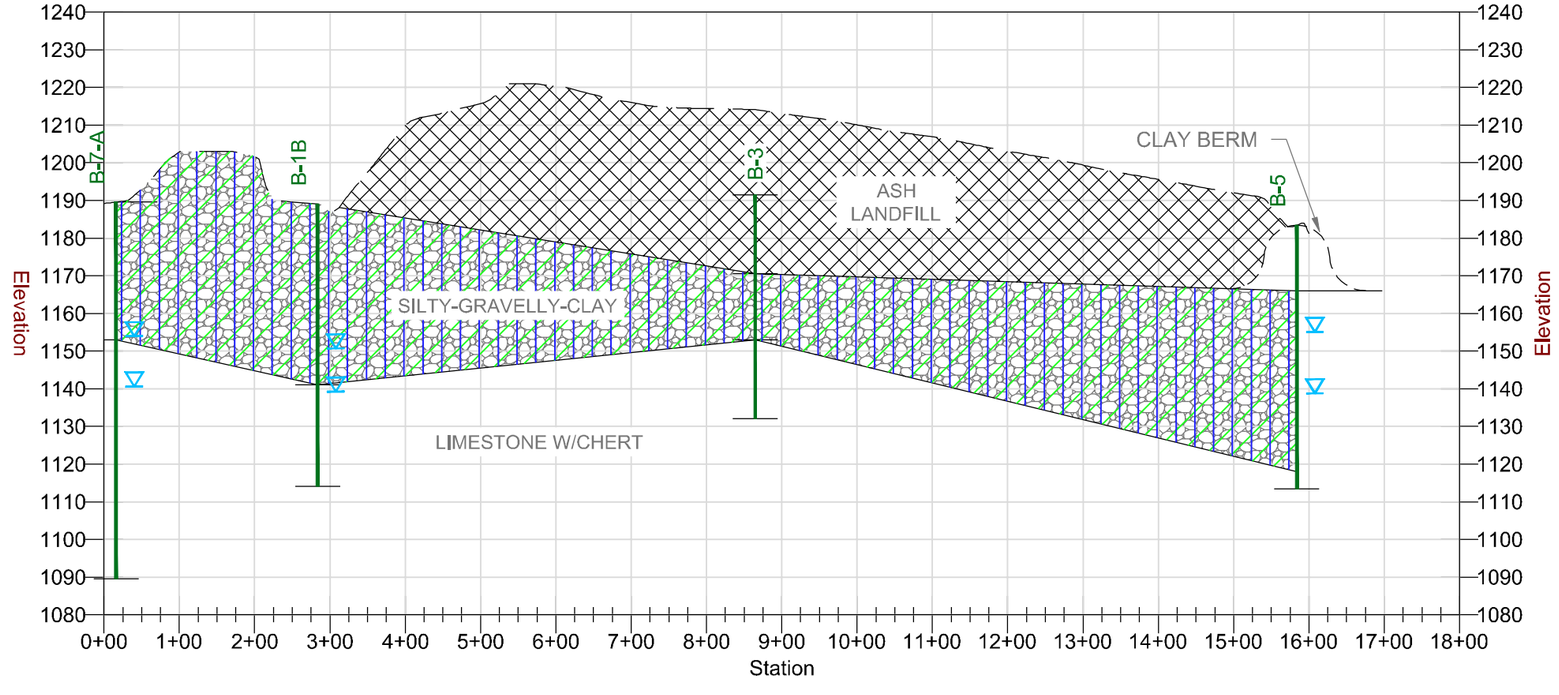
Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV	DATE	BY	DESCRIPTION

CROSS SECTION A-A'



CROSS SECTION B-B'



BASE

POND FILL

EMBANKMENT FILL (CL)
(MADE GROUND)

LEAN CLAY (CL)
(NATIVE GROUND)

SILT

SILTY CLAY (CL-ML)
(NATIVE GROUND)

SANDY LEAN CLAY (CL)
(NATIVE GROUND)

CLAYSTONE

FIGURE 2

DESIGNED BY:	SRE
DRAWN BY:	SRE
APPVD. BY:	DGM
SCALE:	1" = 200'
DATE:	04/27/2016
JOB NO.	216-001-3515/7124
ACAD NO.	***
SHEET NO.:	2 OF 2

CROSS SECTIONS - A-A' & B-B'

LITHOLOGY CROSS SECTIONS

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEL POWER PLANT LANDFILL

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
BRYANT, AR 72022
FAX. (501) 847-9210
25809 I-30 SOUTH
PH. (501) 847-9292

REV	DATE	BY	DESCRIPTION