Stantec Consulting Services Inc.
11687 Lebanon Road, Cincinnati OH 45241

November 13, 2018
File: 175534018
Revision 1

Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

RE: Groundwater Monitoring System
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

1.0 PURPOSE

This letter documents Stantec's certification of the groundwater monitoring system designed and constructed by Applied Geology and Environmental Science, Inc. (AGES) for the Indiana-Kentucky Electric Corporation (IKEC) Clifty Creek Station's CCR Landfill, West Boiler Slag Pond (WBSP), and Landfill Runoff Collection Pond (LRCP). The EPA Final CCR Rule requires owners or operators of CCR landfills and surface impoundments to install a groundwater monitoring system as per 40 CFR 257.91.

2.0 GROUNDWATER MONITORING SYSTEM - REQUIREMENTS

The performance standard listed in 40 CFR 257.91(a) requires that the groundwater monitoring system consist of sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

(1) Accurately represents the quality of background groundwater that has not been affected by leakage from a CCR unit, and

(2) Accurately represents the quality of groundwater passing the waste boundary of the CCR unit, by installing the downgradient monitoring system at the waste boundary ensuring detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

In accordance with 40 CFR 257.91(b), the number, spacing, and depths of the monitoring system shall be determined based on site-specific technical information such as:

(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow, and

(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.

40 CFR 257.91(c) states that the groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards of 40 CFR 257.91(a), based on the site-specific information in 40 CFR 257.91(b). The groundwater monitoring system must consist of a minimum of one upgradient and three downgradient monitoring wells with additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

The owner of multiple CCR units may install a single multiunit groundwater monitoring system to monitor multiple CCR units per Section 40 CFR 257.91(d). It must be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system defined in 40 CFR 257.91(a), (b), and (c) for each CCR unit based on number, spacing, and orientation of each CCR unit, hydrogeologic setting, site history, and engineering design of the CCR unit. If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by §275.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under 40 CFR 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under §257.101(a) to retrofit or close.

40 CFR 257.91(e) states that the monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. The casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

3.0 SUMMARY OF FINDINGS

Stantec personnel reviewed the *Coal Combustion Residuals Regulation, Monitoring Well Installation Report (MWIR), Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Indiana* (AGES, October 2016, Revision 1.0 October 2018). Each of the four sections of 40 CFR 257.91, as shown above in Section 2.0 of this certification letter, is detailed below to evaluate

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

compliance. The sections, tables, figures, and appendices detailed in the following paragraphs refer to the MWIR.

40 CFR 257.91(a)

Performance standard. *The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:*

(1) Accurately represents the quality of background groundwater that has not been affected by leakage from a CCR unit, and

(2) Accurately *represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.*

This standard is met if §§257.91(b) through (e) are met. §§257.91(b), (c), (d), and (e) are discussed below.

40 CFR 257.91(b)

The number, spacing, and depths of the monitoring systems shall be determined based on site-specific technical information such as:

(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow, and

(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.

The geology and hydrogeology for each CCR unit is discussed based on historical data in Section 3.0. The uppermost aquifer for each is identified using subsurface stratigraphy and the hydrogeologic study report (AGES, 2007) performed to support the landfill permit. Generalized geologic cross-sections are included as Figures 3, 5, and 7 (AGES, 2018). Tables 4 and 5 are the

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

summaries of the slug tests performed for the CCR Landfill and LRCP and the WBSP, respectively. The aquifer testing results performed in May 2016 are included in Appendix F.

Section 4.2 outlines the evaluation of the existing well and piezometer data to estimate groundwater depth in the uppermost aquifer and likely groundwater flow direction. Six additional geotechnical borings were performed in the CCR units per Section 4.3. One boring was located downgradient of the southwest end of the CCR Landfill and LRCP with three borings performed in background areas for the units. Two soil borings were performed at the WBSP. The soil borings were intended to obtain more detailed subsurface geology and to identify location, thickness, and composition, of the uppermost aquifer. Soil samples from three borings were the basis of the grain-size analyses used to design the monitoring well screens and filter packs for two background monitoring wells at the CCR Landfill and LRCP multiunit system and one monitoring well at the WBSP (Section 4.4 and Appendix A).

40 CFR 257.91(c)

> *the groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards of 40 CFR 257.91(a), based on the site-specific information in 40 CFR 257.91(b). The groundwater monitoring system must consist of a minimum of one upgradient and three downgradient monitoring wells with additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.*

Section 4.6 outlines the monitoring well networks for each CCR unit to meet this requirement.

For the CCR Landfill and LRCP multiunit system, six monitoring wells were installed in 2015. Section 3.1 describes the underlying soil stratigraphy and hydrogeologic conditions of the combined unit. A groundwater divide is located in the valley where the CCR Landfill is located with groundwater flowing to the northeast or southwest within the confined bedrock valley. At the southwestern end of the combined unit, three downgradient monitoring wells were installed. Three monitoring wells were installed outside the hydrologic influence of the combined unit and the WBSP to serve as background monitoring wells. Section 4.6.1 and Table 2 lists the eight monitoring wells in the CCR network as three downgradient and six background (or background/intermediate). Figures 1, 5, 6, and 10 show the groundwater monitoring well locations for the CCR Landfill and LRCP multiunit system.

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

The WBSP's groundwater monitoring network is described in Section 4.6.2 and Table 3. Ten monitoring wells were installed around the WBSP perimeter in late 2015 and early 2016. Three monitoring wells are noted as upgradient, while seven are listed as downgradient. Figures 7, 8, and 9 show the groundwater monitoring well locations of the WBSP.

As discussed in Section 5.0, slug testing was performed in one background well, one monitoring well at the CCR Landfill and LRCP multiunit system, and in three monitoring wells at the WBSP. The testing was performed to estimate saturated hydraulic conductivity of the uppermost aquifer. The test results are in Tables 4 and 5 with supporting data in Appendix F.

40 CFR 257.91(d)

> *The owner of multiple CCR units may install a single multiunit groundwater monitoring system to monitor multiple CCR units per Section 40 CFR 257.91(d). It must be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system defined in 40 CFR 257.91(a), (b), and (c) for each CCR unit based on number, spacing, and orientation of each CCR unit, hydrogeologic setting, site history, and engineering design of the CCR unit. If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by §275.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under 40 CFR 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under §257.101(a) to retrofit or close.*

Section 2.1 describes the site history and hydrogeologic setting of the CCR Landfill and LRCP. The two CCR units are located within an eroded bedrock channel confined as described in Section 3.1. The area initially served as a fly ash pond prior to development of a Type III CCR Landfill in 1988. Under the current Indiana Department of Environmental Management (IDEM) permit, the two CCR units are now approximately 208 acres with 109 acres designated for the CCR Landfill and 99 acres at the southwest end identified as the LRCP. The CCR Landfill and LRCP are served by a multiunit groundwater monitoring system that encompasses the historic fly ash pond footprint.

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

40 CFR 257.91(e)

> *The monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. The casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater.*

The monitoring well installation and development for the three CCR units is discussed in Section 4.5. Section 4.4 discusses the design of pre-packed well screens used for the construction of the monitoring wells. The two sections discuss the two-inch diameter slotted Schedule 40 PVC screen, 0.40-millimeter quartz sand filter pack, steel casing during well placement, and the four-foot-thick annular bentonite seal above the filter pack in each well. Monitoring well logs are detailed in Appendix B. Well construction for the monitoring networks of each CCR unit is detailed in terms of well ID, locations, elevations, and date of installation in Tables 2 and 3.

The attached MWIR demonstrates that the groundwater monitoring system was designed and constructed to meet the requirements set forth in 40 CFR 257.91(a), (b), (c), (d), and (e).

Re: **Groundwater Monitoring System**
CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the groundwater monitoring systems for the IKEC Clifty Creek Station's CCR Landfill, West Boiler Slag Pond, and Landfill Runoff Collection Pond have been designed and constructed to meet the requirements specified in 40 CFR 257.91(a), (b), (c), (d), and (e).

SIGNATURE _____ DATE 11/13/18

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

TELEPHONE: (513) 842-8200

ATTACHMENTS: Applied Geology and Environmental Science, Inc. (AGES) (2018). Coal Combustion Residuals Regulation, Monitoring Well Installation Report, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Indiana. October 2016. Revision 1.0. October.

AGES
Applied Geology And Environmental Science, Inc.

2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
www.appliedgeology.net
412. 264. 6453
412. 264. 6567

COAL COMBUSTION RESIDUALS REGULATION
MONITORING WELL INSTALLATION REPORT

INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

OCTOBER 2016

Revision 1.0 November 2018

Prepared for:

INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

By:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

COAL COMBUSTION RESIDUALS REGULATION
MONITORING WELL INSTALLATION REPORT
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

OCTOBER 2016

Revision 1.0 November 2018

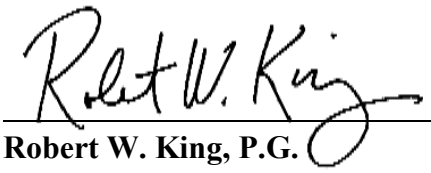
Prepared for:

INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

Prepared By:

Applied Geology and Environmental Science, Inc.

Diane E. Miller, P.G.
Senior Geologist



Robert W. King, P.G.
President/Chief Hydrogeologist

COAL COMBUSTION RESIDUALS REGULATION
MONITORING WELL INSTALLATION REPORT
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

T A B L E O F C O N T E N T S

COAL COMBUSTION RESIDUALS REGULATION
MONITORING WELL INSTALLATION REPORT
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

T A B L E O F C O N T E N T S

LIST OF TABLES

FIGURES

APPENDICES

COAL COMBUSTION RESIDUALS REGULATION
MONITORING WELL INSTALLATION REPORT
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

1.0 INTRODUCTION

On December 19, 2014, the United States Environmental Protection Agency (U.S. EPA) issued their final Coal Combustion Residuals (CCR) regulation which regulates CCR as a non-hazardous waste under Subtitle D of Resource Conservation and Recovery Act (RCRA) and became effective six (6) months from the date of its publication (April 17, 2015) in the Federal Register. The rule applies to new and existing landfills, and surface impoundments used to dispose of or otherwise manage CCR generated by electric utilities and independent power producers. Because the rule was promulgated under Subtitle D of RCRA, it does not require regulated facilities to obtain permits, does not require state adoption, and cannot be enforced by U.S. EPA. The only compliance mechanism is for a state or citizen group to bring a RCRA suit in federal district court against any facility that is alleged to be in non-compliance with the new requirements.

All CCR landfills and CCR surface impoundments (including inactive impoundments unless they close within three (3) years from the promulgation date of the rule) are subject to new, and typically more stringent than current, state requirements for groundwater monitoring and, if necessary, corrective action. Within 30 months after the date of publication (April 17, 2015) in the Federal Register, all existing CCR landfills and existing CCR surface impoundments must have installed groundwater monitoring systems, initiated a groundwater detection monitoring program, and begun assessing groundwater monitoring data to evaluate groundwater quality at each CCR unit.

In March 2015, the Indiana-Kentucky Electric Corporation (IKEC) contracted with Applied Geology and Environmental Science (AGES), Inc. to identify upgrades in the groundwater monitoring program for the Clifty Creek Station located in Madison, Indiana that would be necessary for compliance with the CCR regulation. Based on a review of available site data and the CCR regulation, AGES, IKEC and staff from Stantec worked together to develop a detailed scope of work and schedule for the groundwater monitoring system upgrades. Field work on the project (monitoring well installation and development) was conducted from November 2015 through January 2016.

Presented below are a discussion of the CCR units identified at the station, site geology and hydrogeology, and the well installation and development program.

2.0 BACKGROUND

The Clifty Creek Station, located in Madison, Indiana, is a 1,304-megawatt (MW) coal-fired generating plant operated by the IKEC, a subsidiary of the Ohio Valley Electric Company (OVEC). The Clifty Creek Station has six (6) 217.26-MW generating units and has been in operation since 1955. Beginning in 1955, ash products were sluiced to disposal ponds located in the plant site. During the course of plant operations, CCRs have been managed and disposed of in various units at the station. There are three (3) CCR units at the Clifty Creek Station (Figure 1):

- Type I Residual Waste Landfill (Type I Landfill);
- Landfill Runoff Collection Pond (LRCP); and,
- West Boiler Slag Pond (WBSP).

Information regarding the history and hydrogeology of each unit was obtained by reviewing several historic documents listed in Section 7.0 of this report.

2.1 Type I Residual Waste Landfill and Landfill Runoff Collection Pond

The active Type I Landfill occupies an approximately 200-acre area situated within an eroded bedrock channel. A total of 109 acres were approved as a Type I residual waste landfill by the Indiana Department of Environmental Management (IDEM) in 2007. The remaining 91 acres consist of the LRCP located at the southwest end of the Type I Landfill (Figures 1 and 2).

Beginning in 1955, ash products were sluiced to disposal ponds located in the bedrock channel at the plant site. To allow for more disposal capacity, an on-site fly ash pond was developed into a Type III residual landfill in 1988. All required permits for the Type III Residual Waste Landfill (Type III Landfill) were obtained from IDEM. The Type III Landfill was permitted to be constructed, and to serve as closure for the historic fly ash ponds. The Type III Landfill is located at the northeast end of the bedrock channel and went operational in 1991.

In 2013, IDEM approved IKEC's request to upgrade the Type III Landfill to a Type I residual waste landfill (Type I Landfill). As part of the process, the Type III Landfill was closed and the Type I Landfill was designed and constructed to serve as the cap for the closed Type III Landfill. The Type I Landfill is completely separated from the closed Type III Landfill by a geosynthetic liner and a compacted clay liner (Figure 3).

The LRCP is an unlined pond located at the southern edge of the station. It is bordered by the Type I Landfill to the north, natural grade to the east and west, and by a dam to the south that runs along the bank of the Ohio River. Approximately 508 acres of both landfill contact water and stormwater runoff drain to the LRCP (Stantec 2016). The base of the LRCP consists of historic hydraulically-placed fly ash. The LRCP does not receive CCR and any CCR within the

LRCP is not being actively managed. Therefore, the LRCP is identified as an inactive unit under the CCR Rule.

2.2 West Boiler Slag Pond

The WBSP currently serves as a settling facility for sluiced boiler slag produced at the plant. In addition to the process flows from the plant, approximately 510 acres drain to the WBSP. The pond is formed by natural grade to the north, east and west and a southern dike that runs along the bank of the Ohio River (Figures 1 and 2).

3.0 GEOLOGY & HYDROGEOLOGY

The site lies in the Central Lowland Physiographic Province along the western flanks of the Cincinnati Arch and within the Central Stable Region. The stratigraphic sequence in the regional area consists of widespread discontinuous layers of Quaternary deposits of alluvial and glacial origin overlying sedimentary rocks generally consisting of limestones, dolomites and interbedded shale. The exposed sedimentary rocks range in age from Mississippian to Ordovician. The Quaternary deposits are largely of glacial origin and consist of loess, till and outwash. Glacial outwash is present in nearly all of the stream valleys north of and including the Ohio River valley. The outwash is covered, in some cases, by a veneer of recent alluvial deposits from active streams.

Unconsolidated alluvial sediments deposited along the Ohio River valley, near or adjacent to the river constitute the major aquifer of the region. These deposits are normally found only within the Ohio River valley and the tributary streams north and northeast of the river. Wells installed in this aquifer typically yield 100 to 1,000 gallons per minute (gpm) depending upon their location and construction. The Ohio River valley is incised into Ordovician bedrock. The low permeability bedrock forms the lateral and underlying confinement to the aquifer.

3.1 Type I Residual Waste Landfill and Landfill Runoff Collection Pond

Based on information in the Hydrogeologic Study Report (AGES 2007), bedrock beneath the Type I Landfill & LRCP and the closed Type III Landfill consists of impermeable limestone and shale of the Ordovician Dillsboro formation, which is overlain by approximately 20 to 35 feet of gray clay. The gray clay is directly overlain by fly ash that had been historically hydraulically placed in the area. Generalized geologic cross-sections are presented in Figures 3 through 5. A limestone ridge known as the Devil's Backbone runs northeast to southwest along the length of the Type I Landfill & LRCP and the closed Type III Landfill. The Devil's Backbone acts as an impermeable barrier that forces groundwater passing beneath both of the landfills to flow either toward the northeast or toward the southwest. A detailed hydrogeologic study determined that a groundwater flow divide is present near the northeast end of the bedrock channel and that all groundwater beneath the active Type I Landfill flows toward the southwest (AGES 2007).

An aquifer does not exist beneath the Type I Landfill. Therefore, alluvial deposits located southwest of the LRCP are designated as the uppermost aquifer for the Type I Landfill & LRCP. These alluvial deposits consist of approximately 10 to 15 feet of silty clay, overlying various depths of fine to medium grained sand with gravel, silt and clay (Figure 5). The alluvial deposits overlay layers of clay and clayey gravel, which overlay limestone bedrock of the Dillsboro Formation at depths ranging from 15 to 90 feet below ground surface (bgs).

Based on historic aquifer testing conducted at the site, the upper silty clay deposits are relatively impermeable, do not yield adequate quantities of water to wells, and are considered to be an aquiclude. The lower fine to medium grained sand with gravel, silt and clay deposits are considered to be an unconfined or possibly semi-confined aquifer and are therefore designated as the uppermost aquifer at the Landfill and LRCP.

3.2 **West Boiler Slag Pond**

The WBSP is formed by natural grade to the north, east and west and a southern dike that runs along the bank of the Ohio River (Figures 1 and 2). A generalized geologic cross-section of this unit is presented in Figure 7. The Devil's Backbone borders the northern side of the WBSP.

Based on information from historical soil boring data, there appears to be a layer of fly ash, up to five (5) feet thick in the northeastern portion of the WBSP. Below the ash and extending to the south and west beneath the remainder of the pond, the WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt and silty sand ranging from approximately 16 feet bgs on the northwest side of the WBSP (closest to the Devil's Backbone) to approximately 90 feet bgs on the southeast side of the WBSP (closest to the Ohio River). These alluvial deposits sit directly on top the bedrock. Review of logs from historic soil borings indicated that a layer of silty clay extends from directly beneath the WBSP to an approximate elevation of 425 feet msl. Historic boring logs indicated that the clay is underlain by a layer of silt with fine sand that becomes more coarse-grained further to the north & northeast. This layer was determined to be the uppermost aquifer beneath the WBSP. Groundwater beneath the WBSP flows from the northwest to the southeast toward the Ohio River (Figure 8).

4.0 GROUNDWATER MONITORING SYSTEM DESIGN & INSTALLATION

4.1 Groundwater Monitoring System Design

Section §257.91 of the CCR regulation states that the groundwater monitoring system for each CCR unit must contain a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit and, accurately represent the quality of groundwater passing the waste boundary of the CCR unit.

Section §257.91(c) requires that the groundwater monitoring system for each CCR unit includes a minimum of one (1) upgradient/background monitoring well to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit, and a minimum of three (3) downgradient monitoring wells located as close as practicable to the waste boundary to accurately represent the quality of groundwater passing the waste boundary of the CCR unit.

4.2 Data Review and Evaluation of Existing Wells and Piezometers

To begin the process, AGES reviewed available data for any existing monitoring wells and piezometers that had been installed around each CCR unit. The purpose of this data review was to identify the approximate depth to the uppermost aquifer for each CCR unit and to evaluate likely groundwater flow direction to ensure that the new CCR groundwater monitoring network contained the required number of upgradient/background and downgradient monitoring wells.

4.2.1 Type I Residual Waste Landfill and Landfill Runoff Collection Pond

In June 2015, water levels were collected from all of the existing monitoring wells and piezometers around the Type I Landfill and LRCP. These water levels confirmed that groundwater beneath the Type I Landfill and LRCP flows to the southwest toward the Ohio River.

Due to the geologic setting of the Type I Landfill and LRCP, there were no suitable upgradient groundwater monitoring locations and upgradient monitoring wells were not installed. To meet the monitoring requirements of the CCR regulation IKEC opted to install one (1) background monitoring well in an area outside the influence of the Landfill (Figure 9).

The Type I Landfill is the subject of an on-going monitoring program for the Indiana Department of Environmental Management (IDEM). Several downgradient monitoring wells are included in the IDEM monitoring program but upgradient monitoring wells were not installed. To ensure consistency in monitoring well construction for all of the wells in the CCR groundwater

monitoring network for the Type I Landfill and LRCP, IKEC opted to install all new monitoring wells for the groundwater monitoring network (Figure 10).

4.2.2 West Boiler Slag Pond

In June 2015, water levels were collected from all existing monitoring wells and piezometers around the WBSP. These water levels indicated that groundwater flow beneath the WBSP was from the northwest to the south/southeast toward the adjacent Ohio River.

No previous groundwater monitoring program had been conducted at the WBSP and the existing monitoring wells and piezometers had not been properly constructed to monitor groundwater quality in the uppermost aquifer beneath the WBSP. Therefore, IKEC opted to install new monitoring wells around the WBSP to meet the requirements of the CCR regulation (Figure).

4.3 Soil Boring Installation

At the WBSP, most of the existing monitoring wells and piezometers were not screened in the uppermost aquifer. In addition, no background/upgradient wells had previously been installed for the Type I Landfill and LRCP. To obtain geologic information specific to the target areas of the aquifers to be monitored at the Type I Landfill and LRCP and to locate suitable locations in which to install background/upgradient wells for the Type I Landfill and LRCP, IKEC conducted several borings in July 2015 (Figure 1). One (1) soil boring (Downgradient SW) was conducted downgradient of the southwest end of the Type I Landfill and LRCP and three (3) soil borings (BKG-1, BKG-2 and BKG-3) were conducted in background areas. Two (2) soil borings (WAP-1 and WAP-2) were also conducted at the WBSP (Figure 1).

The purpose of these borings was to obtain a more detailed description of the subsurface geology and to identify the location, size and composition of the uppermost aquifers at the Type I Landfill and LRCP and WBSP. Representative samples of the units identified as the uppermost aquifer in borings BKG-2 and BKG-3 at the Type I Landfill and LRCP and WAP-2 at the WBSP were collected and sent to a geotechnical soil laboratory for grain-size analysis to provide data to be used to design the groundwater monitoring system. Groundwater was not encountered in Type I Landfill and LRCP boring BKG-1 or in WBSP boring WAP-1. Therefore samples were not collected from these borings for analysis.

4.4 Grain Size Analysis and Monitoring Well Design

The CCR regulation requires that unfiltered groundwater samples be submitted for laboratory analysis of Appendix III and IV constituents. According to the preamble to the rule, the unfiltered sample requirement assumes that groundwater samples with a turbidity of less than 5 NTUs can be obtained from a properly designed monitoring well. The proper design of the sand

pack and well screen in each well is therefore critical to obtaining representative groundwater samples.

To support CCR well design, representative samples were collected of material from the uppermost aquifers at the Type I Landfill and LRCP, and the WBSP. These soil samples were submitted to a geotechnical laboratory for grain-size analysis per American Society for Testing and Materials (ASTM) Methods D421 and D422. The results of the grain size analyses were used to design the well screens and filter packs for the monitoring wells. The laboratory reports for the grain size analyses are included in Appendix A.

In accordance with U.S. EPA monitoring well design guidelines (U.S. EPA, 1991), the grain size of the filter pack was chosen by multiplying the 70% retention (or 30% passing) size of the formation, as determined by the grain size analysis, by a factor of 3 (for fine uniform formations) to 6 (for coarse, non-uniform formations). Table 1 summarizes the results of the grain-size analysis and the 70% retention size for each of the samples collected from each boring.

To reduce turbidity as much as possible, pre-packed well screens were selected for use in the monitoring wells. The 2-inch diameter 0.01" slotted Schedule 40 PVC pre-packed screens are designed specifically for sampling metals in groundwater. The pre-packed well screens were constructed using an inner filter pack consisting of 0.40 mm clean quartz filter sand between two layers of food-grade plastic mesh to reduce sample turbidity by filtering out smaller particles than is possible with standard filter packed wells and prepack screens. No metal components were used in the construction of the pre-packed well screens, thus eliminating potential interference with metals analysis.

4.5 **Monitoring Well Installation and Development**

Well installation and development at the Clifty Creek Station were conducted from November 2015 through January 2016 by Bowser Morner, Inc., under the supervision of AGES. During the field work, AGES oversaw all drilling activities, prepared lithologic descriptions of all soil, and took detailed field notes for all of the work.

To comply with the CCR regulation requiring the groundwater monitoring system for each CCR unit to contain a minimum of one (1) background/upgradient and three (3) downgradient monitoring wells, six (6) wells were installed at the Type I Landfill and LRCP and 10 monitoring wells were installed at the WBSP. Details regarding monitoring well installation are presented below.

4.5.1 Monitoring Well Installation

New monitoring wells at the Type I Landfill and LRCP were installed using either rotary vibratory or hollow stem auger drilling methods. With either method, the drill bit was

simultaneously pushed down and rotated. The drill head was advanced in 10-foot runs through an 8-inch metal casing to keep the borehole open. Continuous soil samples were obtained from the entire length of each 10-foot run and were logged by the AGES geologist (Appendix B). A steel casing was installed as each boring was advanced to keep the borehole open during well installation.

When using hollow stem augers, continuous split-spoon samples were collected and were logged by the AGES geologist (Appendix B). The augers were used to advance each boring to the desired depth and the augers were kept in place to keep the borehole open during well installation. The augers were removed as well installation progressed.

Once each borehole was advanced to the desired depth, a 5-foot or 10-foot pre-packed well screen was set into the borehole depending on the geologic conditions encountered in each borehole. An outer filter pack consisting of 0.40 mm clean quartz sand was installed directly around the pre-packed well screen. The sand was placed as the metal casing was pulled back in one (1)- to two (2)- foot increments to reduce caving effects and ensure proper placement of the filter pack. The filter pack extended two (2)-feet above the top of the screen.

A four (4)-foot thick annular bentonite seal was installed above the filter pack in each well. Once in place, the bentonite seal was allowed to hydrate before the remainder of the annular space around each monitoring well was backfilled using a grout consisting of portland cement and bentonite. Each monitoring well was completed with either an above-ground protective steel casing or a flush-mount steel well cover and a locking well cap. Following installation, each monitoring well was surveyed for elevation and location by IKEC personnel.

Well construction details for all of the wells installed at the Type I Landfill and LRCP, and WBSP are presented in Tables 2 & 3, respectively. All boring and well logs are included in Appendix B.

4.5.2 Monitoring Well Development

Well development was initiated at least 48 hours after installation of each of the monitoring wells. Development consisted of alternating surging and pumping with a submersible pump or bailing in low yielding wells. During development of the monitoring wells, field parameters including temperature, specific conductance, pH and turbidity were recorded at regular intervals. Development continued until each parameter stabilized and turbidity was less than 5 NTUs. Well development data is included in Appendix C.

4.6 **Groundwater Monitoring Networks**

To comply with the CCR regulation, each monitored CCR Unit must have a groundwater monitoring network consisting of a minimum of one (1) upgradient/background monitoring well

and a minimum of three (3) downgradient monitoring wells installed as close as practicable to the waste boundary. A discussion of the CCR monitoring network for each unit is presented below.

4.6.1 Type I Residual Waste Landfill and Landfill Runoff Collection Pond

In November and December 2015, six (6) monitoring wells were installed at the Type I Landfill and LRCP (Figures 9 and 10).

Three (3) monitoring wells (CF-15-07, CF-15-08 and CF-15-09) were installed downgradient of the Type I Landfill and LRCP (Figure 10). Based on exploratory soil borings and historical data, there were no suitable upgradient locations for the Type I Landfill and LRCP. Therefore, CF-15-04 was installed outside the hydrologic influence of the Type I Landfill to serve as the required background monitoring well. In addition, CF-15-06 was installed to serve as an additional background monitoring well and CF-15-05 was installed as a background/intermediate monitoring well to ensure groundwater from the WBSP is not impacting groundwater at CF-15-06. The locations of the background wells are shown on Figure 9.

The Devils Backbone is a limestone ridge that trends northeast-southwest along the southern side of the Type I Landfill and LRCP. This ridge acts as an impermeable barrier separating groundwater flowing beneath the Type I Landfill and LRCP from groundwater flowing beneath the WBSP. Therefore, the upgradient WBSP wells WBSP-15-01 and WBSP-15-02 were also included as background wells for the Type I Landfill and LRCP groundwater monitoring network.

Table 2, and Figures 9 and 10 present the construction information and locations of the monitoring wells in the Type I Landfill and LRCP groundwater monitoring network. The review of historic data and groundwater levels measured from each well in January, March and May 2016, indicated that groundwater beneath the Type I Landfill and LRCP flows toward the southwest toward the Ohio River. Groundwater levels for January, March and May 2106 are included in Appendix D. Groundwater flow maps for January, March and May 2016 are included in Appendix E.

4.6.2 West Boiler Slag Pond

Table 2 and Figure 8 present the construction information and locations of the monitoring wells in the WBSP groundwater monitoring network. In accordance with the minimum requirements of the CCR regulation, three (3) monitoring wells were installed upgradient of the WBSP (WBSP-15-01, WBSP-15-02 and WBSP-15-03) and seven (7) monitoring wells (WBSP-15-04 through WBSP-10) were installed downgradient of the WBSP.

Based on groundwater levels measured from each well in January, March and May 2016, groundwater beneath the WBSP flows from the northwest to the southeast toward the Ohio River. Groundwater levels for January, March and May 2106 are included in Appendix D. Groundwater flow maps for January, March and May 2016 are included in Appendix E.

5.0 AQUIFER TESTING

In May 2016, aquifer testing was conducted on one (1) background well (CF-15-04), one (1) Type I Landfill and LRCP well (CF-15-08), and three (3) WBSP wells (WBSP-15-02, WBSP-15-06 and WBSP-15-07) to obtain data to calculate the saturated hydraulic conductivity (K) for the uppermost aquifer beneath each unit. Both rising and falling head slug tests were performed on each well.

The falling head tests were performed by lowering a solid slug with a known volume, into the water column of the well and recording the drop in head over time. The rising head tests were performed by removing the solid slug and recording the rise in head over time. The change of head over time was recorded using a data logger and pressure transducer. Dedicated rope was used to lower the slug into each well and the slug was decontaminated between wells using the procedures specified in the Groundwater Monitoring Program Plan (GMPP) for the Clifty Creek Station. Slug testing was performed after well development and the completion of three (3) rounds of groundwater sampling.

The slug test data were evaluated using AQTESOLV, a commercially available software package. Data from each monitoring well were analyzed using both the Bouwer-Rice and Hvorslev slug test solutions which are straight-line analytical techniques commonly used to analyze rising and falling head slug test data. The AQTESOLV results for each well are presented in Appendix E.

Slug test results for the Type I Landfill and LRCP, and WBSP are summarized on Tables 4 and 5, respectively. The K for the background well CF-15-04 is 1.51×10^{-3} centimeters per second (cm/sec). The K for well CF-15-08 at the Type I Landfill and LRCP is 2.44×10^{-3} cm/sec. The mean K for the uppermost aquifer beneath the WBSP is 9.44×10^{-3} cm/sec.

6.0 CONCLUSIONS

To meet the requirements of the CCR regulation, new groundwater monitoring networks were installed at the Type I Landfill and LRCP and the WBSP. Based on available historic data and exploratory soil borings, the following units were identified as the uppermost aquifer at each CCR unit:

- **Type I Landfill and LRCP:** Historic data identified alluvial deposits located southwest of the Type I Landfill and LRCP as the uppermost aquifer. Based on historic data and soil borings conducted during this investigation, depths to these deposits range from 15 to 40 feet bgs.

- **West Boiler Slag Pond:** The WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt and silty sand ranging from approximately 16 feet bgs on the northwest side of the WBSP (closest to the Devil's Backbone) to approximately 90 feet bgs on the southeast side of the WBSP (closest to the Ohio River). Soil and well borings indicated that a layer of gray silt with fine sand, becoming more coarse-grained further to the north & northeast, located at an elevation of approximately 425 feet msl is the uppermost aquifer beneath the WBSP.

To meet the monitoring network requirements of the CCR regulation, six (6) monitoring wells were installed at the Type I Landfill and LRCP, and 10 monitoring wells were installed around the WBSP.

Following installation, development, and three (3) rounds of groundwater sampling, slug testing was conducted on two (2) monitoring wells at the Type I Landfill and LRCP, and three (3) monitoring wells at the WBSP. Data from the slug testing was used to calculate the mean K of the uppermost aquifer at the Landfill and LRCP, and beneath the WBSP. The K for the Type I Landfill and LRCP is 2.44×10^{-3} cm/sec and the mean K for the uppermost aquifer beneath the WBSP is 9.44×10^{-3} cm/sec.

To meet the monitoring requirements of the CCR regulation, the groundwater monitoring networks at each of the two (2) CCR units at the Clifty Creek station will be sampled in accordance with the GMPP.

7.0 REFERENCES

Applied Geology and Environmental Science, Inc. (AGES), 2006. Hydrogeologic Study Report, Clifty Creek Coal Ash Landfill Modification, Clifty Creek Station, Madison, Indiana. November 2006

AGES, 2016. Coal Combustion Residuals Regulation Groundwater Monitoring Program Plan. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Indiana. September 2016.

Stantec Consulting Services, Inc. (Stantec), 2010. Reservoir Routing Analysis, Landfill Runoff Collection Pond, Clifty Creek Power Station, City of Madison, Jefferson County, Indiana. February 2010.

Stantec, 2010. Reservoir Routing Analysis, West Bottom Ash Pond, Clifty Creek Power Station, City of Madison, Jefferson County, Indiana. February 2010.

Stantec, 2010. Report of Geotechnical Exploration, AEP Clifty Creek Power Plant, West Bottom Ash Pond. May 2010.

Stantec Consulting Services, Inc. (Stantec), 2016. Coal Combustion Residuals Regulation Initial Structural Stability Assessment, Landfill Runoff Collection Pond, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. October 2016.

United States Environmental Protection Agency (U.S. EPA), 1991. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. March 1991.

TABLES

TABLE 1
GRAIN SIZE ANALYSIS RESULTS
CLIFTY CREEK STATION
MADISON, INDIANA

CCR Unit	Boring No.	Sample Depth (feet)	70% Retention Size (mm)	Filter Pack Size (mm)	Screen Mesh (inches)	Unified Soil Classification Symbol & Description	
Type I Residual Waste Landfill and Landfill Runoff Collection Pond	Downgradient	24.0 - 34.0	0.05	0.40	0.01	SM	Silty Sand
Type I Residual Waste Landfill and Landfill Runoff Collection Pond - Background	BKG-2	29.0 - 35.0	0.0085	0.40	0.01	ML	Silt with Sand
Type I Residual Waste Landfill and Landfill Runoff Collection Pond - Background	BKG-3	33.0 - 43.0	0.015	0.40	0.01	ML	Silt
West Boiler Slag Pond	WAP-2	51.0 - 61.0	0.017	0.40	0.01	CL-ML	Sandy silty Clay

TABLE 2
GROUNDWATER MONITORING NETWORK
TYPE I RESIDUAL WASTE LANDFILL AND LANDFILL RUNOFF COLLECTION POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)[2]	Top of Casing Elevation (ft)[2]	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Northing	Easting					
CF-15-04	Background	12/3/2015	451482.81	569307.19	465.55	468.03	439.55	429.55	38.48
CF-15-05	Background/Intermediate	12/1/2015	447491.91	565533.64	439.85	442.58	422.85	412.85	29.73
CF-15-06	Background	11/30/2015	447026.92	565190.31	437.49	440.40	431.49	421.49	18.91
CF-15-07	Downgradient	11/23/2015	443135.08	562259.25	438.61	441.11	432.61	422.61	18.50
CF-15-08	Downgradient	11/19/2015	443219.57	562537.29	460.33	462.79	430.33	420.33	42.46
CF-15-09	Downgradient	11/25/2015	443445.96	562871.69	456.73	459.45	447.73	442.73	16.72
WBSP-15-01	Background	11/30/2015	449072.27	566322.12	466.93	469.36	458.93	448.93	20.43
WBSP-15-02	Background	11/11/2015	449803.91	566987.30	473.83	476.76	457.83	452.83	23.93

Notes:
1. The Well locations are referenced to the North American Datum (NAD83), east zone coordinate system.
2. Elevations are referenced to the North American Vertical Datum (NAVD) 1988

TABLE 3
GROUNDWATER MONITORING NETWORK
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)[2]	Top of Casing Elevation (ft)[2]	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Northing	Easting					
WBSP-15-01	Upgradient	11/30/2015	449072.27	566322.12	466.93	469.36	458.93	448.93	20.43
WBSP-15-02	Upgradient	11/11/2015	449803.91	566987.30	473.83	476.76	457.83	452.83	23.93
WBSP-15-03	Upgradient	12/4/2015	451181.98	568093.60	484.91	488.03	476.91	471.91	16.12
WBSP-15-04	Downgradient	11/12/2015	450610.07	568637.65	471.17	473.71	416.17	406.17	67.54
WBSP-15-05	Downgradient	11/17/2015	450051.40	568495.72	471.90	474.42	410.90	400.90	73.52
WBSP-15-06	Downgradient	11/19/2015	449470.57	568402.50	471.28	473.51	395.78	385.78	87.73
WBSP-15-07	Downgradient	11/23/2015	448947.93	567946.39	468.82	471.31	426.82	416.82	54.49
WBSP-15-08	Downgradient	11/25/2015	448625.46	567343.24	468.56	471.06	415.76	405.76	65.30
WBSP-15-09	Downgradient	1/6/2016	448359.31	566711.13	471.21	470.69	421.21	410.21	59.48
WBSP-15-10	Downgradient	1/5/2016	448125.51	566225.21	471.21	470.69	425.21	435.21	55.48

Notes:
1. The Well locations are referenced to the North American Datum (NAD83), east zone coordinate system.
2. Elevations are referenced to the North American Vertical Datum (NAVD) 1988

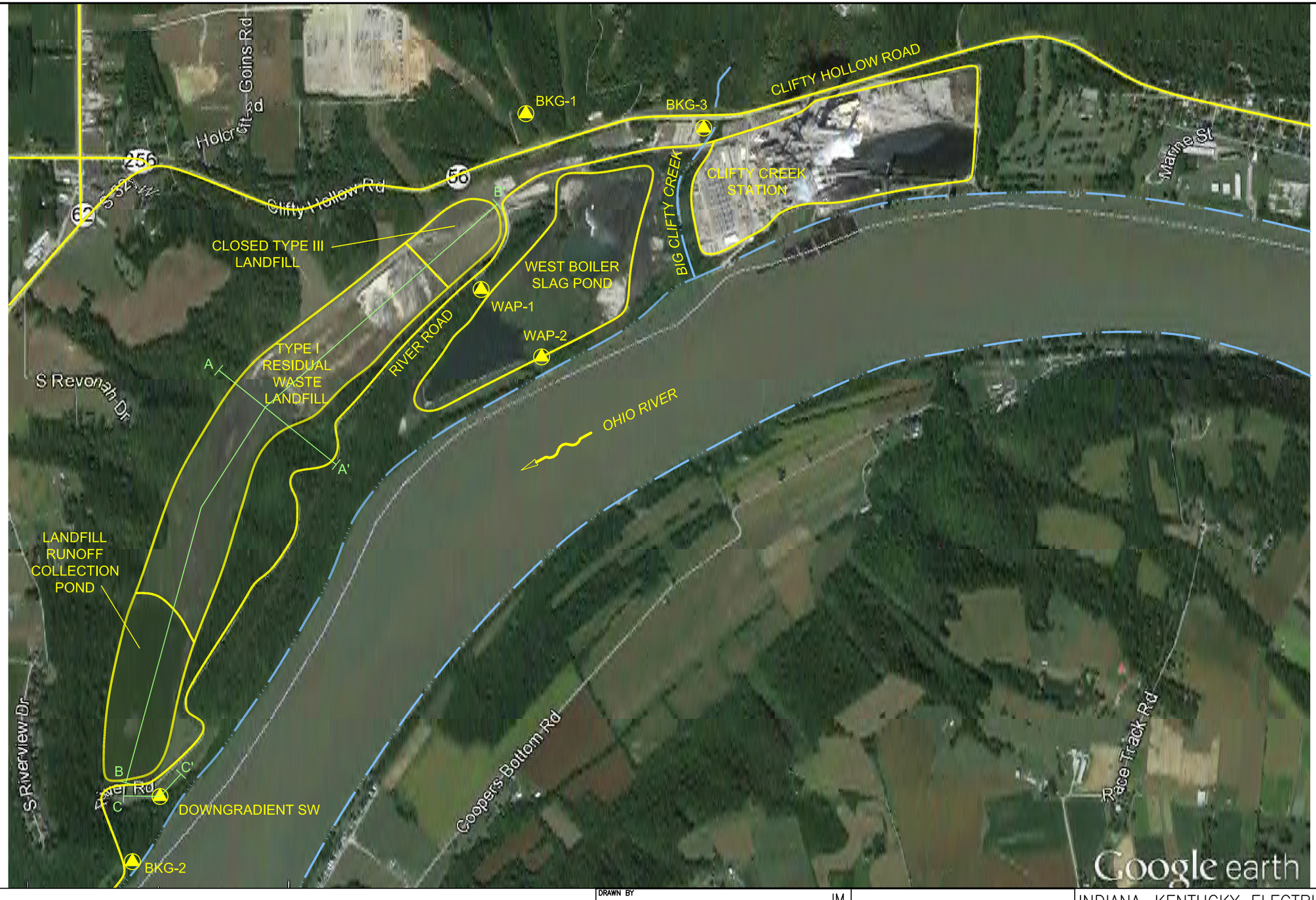
TABLE 4
SUMMARY OF AQUIFER TEST RESULTS
TYPE I RESIDUAL WASTE LANDFILL AND LANDFILL RUNOFF COLLECTION POND
CLIFTY CREEK STATION
MADISON, INDIANA
May 2016

Well	Test	Analytical Method	K (cm/sec)	Mean K (cm/sec)
CF-15-04 (Background)	Rising Head #1	Bouwer-Rice	1.82 E-2	1.51 E-2
		Hvorslev	2.21 E-2	
	Falling Head #1	Bouwer-Rice	9.26 E-3	
		Hvorslev	7.93 E-3	
	Rising Head #2	Bouwer-Rice	2.18 E-2	
		Hvorslev	2.65 E-2	
	Falling Head #2	Bouwer-Rice	5.95 E-3	
		Hvorslev	8.68 E-3	
CF-15-08 (Downgradient)	Rising Head #1	Bouwer-Rice	2.52 E-3	2.44 E-3
		Hvorslev	3.04 E-3	
	Falling Head #1	Bouwer-Rice	2.24 E-3	
		Hvorslev	2.70 E-3	
	Rising Head #2	Bouwer-Rice	1.90 E-3	
		Hvorslev	2.29 E-3	
	Falling Head #2	Bouwer-Rice	2.18 E-3	
		Hvorslev	2.62 E-3	

TABLE 5
SUMMARY OF AQUIFER TEST RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA
May 2016

Well	Test	Analytical Method	K (cm/sec)	Mean K (cm/sec)
WBSP-15-02	Rising Head #1	Bouwer-Rice	5.65 E-6	1.04 E-5
		Hvorslev	7.41 E-6	
	Falling Head #1	Bouwer-Rice	1.23 E-5	
		Hvorslev	1.63 E-5	
WBSP-15-06	Rising Head #1	Bouwer-Rice	1.61 E-2	2.83 E-2
		Hvorslev	1.66 E-2	
	Falling Head #1	Bouwer-Rice	2.27 E-2	
		Hvorslev	2.27 E-2	
	Rising Head #2	Bouwer-Rice	3.63 E-2	
		Hvorslev	3.91 E-2	
	Falling Head #2	Bouwer-Rice	3.52 E-2	
		Hvorslev	3.78 E-2	
WBSP-15-07	Rising Head #1	Bouwer-Rice	9.24 E-6	1.02 E-5
		Hvorslev	1.06 E-5	
	Falling Head #1	Bouwer-Rice	9.66 E-6	
		Hvorslev	1.11 E-5	
			Mean K (cm/sec)	**9.44 E-3**

FIGURES



LEGEND:

SOIL BORING LOCATION

1200’ 0’ 1200’ 2400’

SCALE: 1”= 1200’

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG. FILE	IKEC_Clifty MW Install_Site Loc b01.dwg
DRAWING SCALE	AS SHOWN

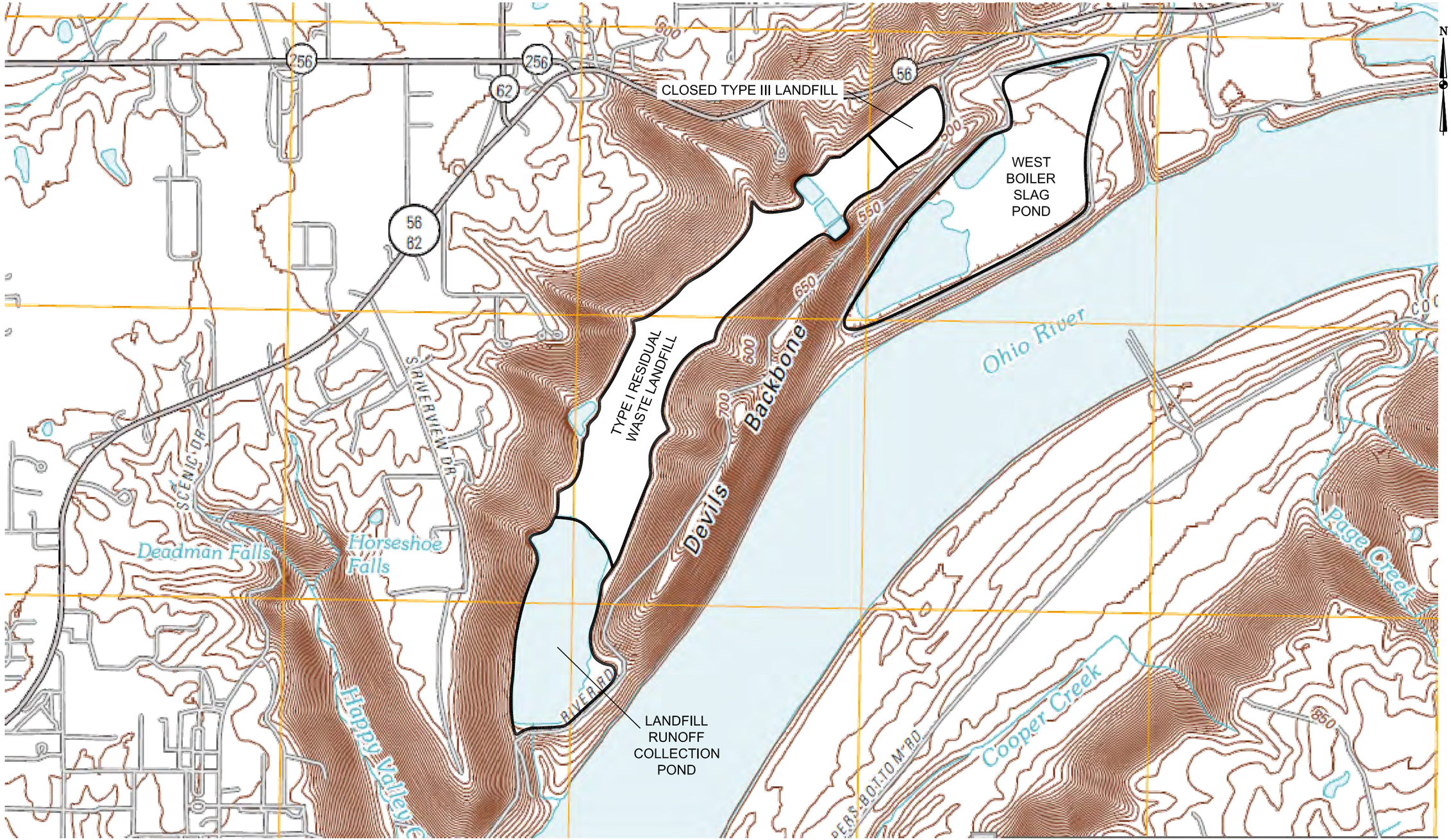
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
SITE LOCATION MAP AND SOIL BORING LOCATIONS

DRAWING NAME	REV.
FIGURE 1	0

Plot: 10/02/2018 14:17 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_Site Loc b01.dwg



SOURCE: USGS MADISON WEST 7.5 MINUTE TOPOGRAHIC QUADRANGLE, 2010.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLIF
DWG FILE	IKEC_Clifty MW Install_USGS TOPO b05.dwg
DRAWING SCALE	NOT TO SCALE

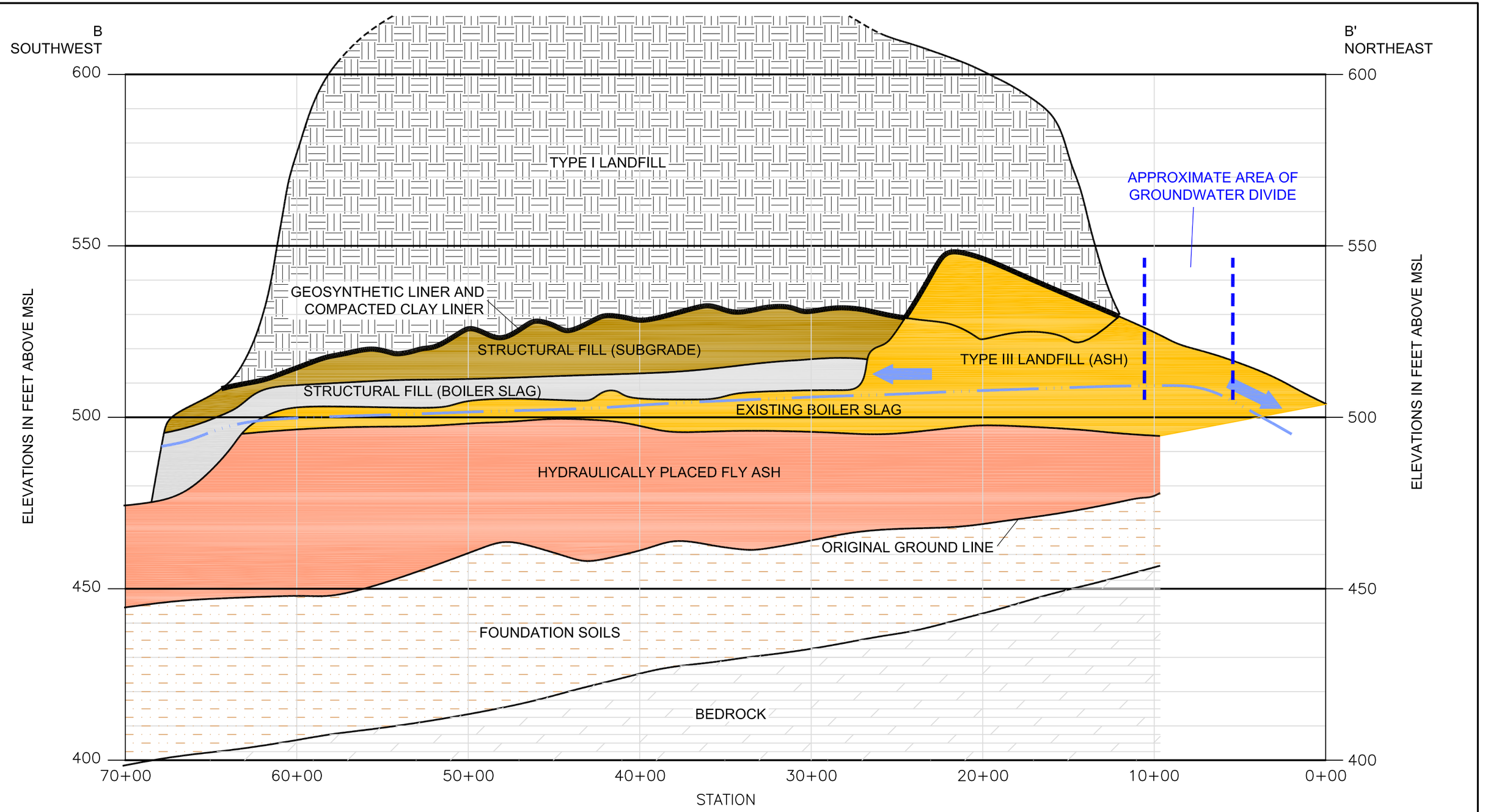
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TOPOGRAPHIC MAP

DRAWING NAME: FIGURE 2

REV.: 0



APPROXIMATE PHREATIC SURFACE

GROUNDWATER FLOW DIRECTION

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2018070-2-CLI
DWG FILE	IKEC_Clifty MW Install_Cross Sec b08.dwg
DRAWING SCALE	NOT TO SCALE

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

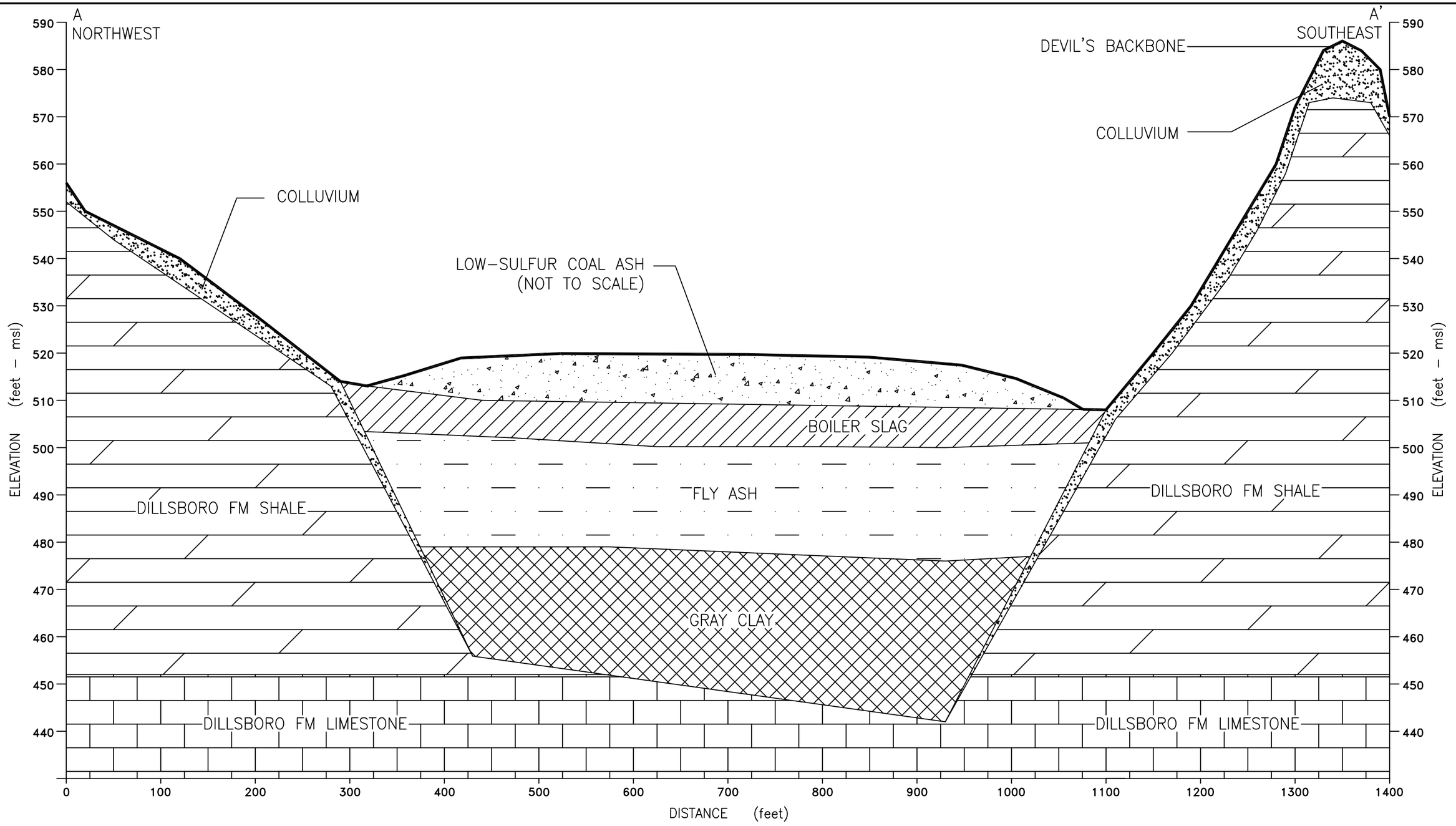
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL
GENERALIZED GEOLOGIC CROSS-SECTION
B-B' (SOUTHWEST-NORTHEAST)

DRAWING NAME: FIGURE 3

REV.: 0

Plot: 10/08/2018 14:53 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_Cross Sec b08.dwg



NOTE:
CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

SOURCE: HYDROGEOLOGIC STUDY REPORT, AGES, APRIL 2007.

100' 0' 100' 200'

HORIZONTAL SCALE: 1"=100'

VERTICAL SCALE 1" = 20'

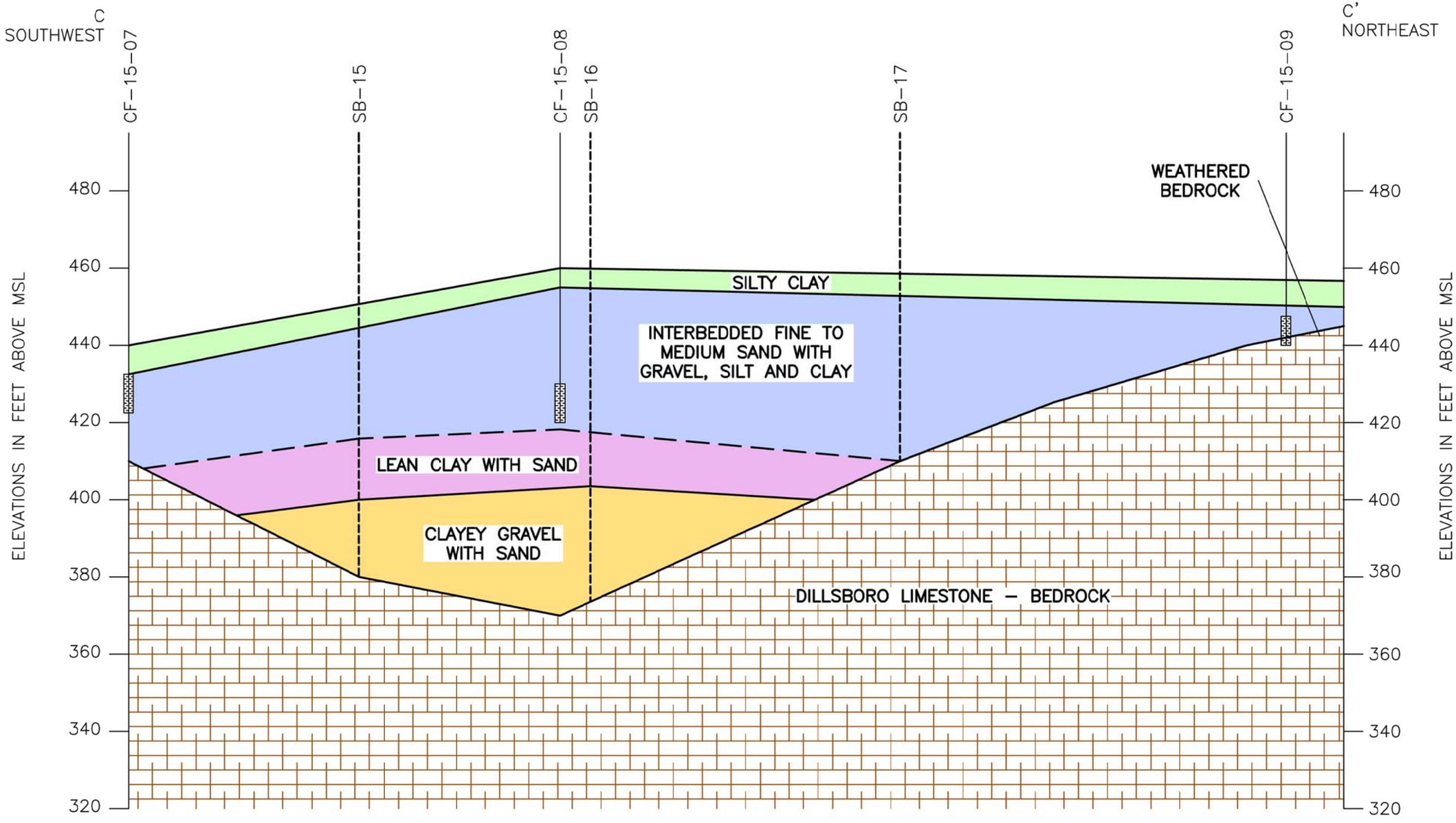
DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLIF
DWG FILE	IKEC_Clifty MW Install_Gen XSection b06.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND LANDFILL RUNOFF COLLECTION POND
GENERALIZED GEOLOGIC CROSS-SECTION
A-A' (NORTHWEST-SOUTHEAST)

DRAWING NAME: FIGURE 4
REV.: 0

Plot: 10/05/2018 13:12 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_Gen XSection b06.dwg



NOTES:

1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.
2) SOIL BORINGS SB-15, SB-16 AND SB-17 WERE DRILLED FOR THE 2006 LITIGATION REPORT TO DETERMINE DEPTH TO BEDROCK ONLY – DETAILED GEOLOGIC LOGS WERE NOT MAINTAINED (AGES 2006).
3) THE LEAN CLAY WITH SAND LAYER AND THE CLAYEY GRAVEL WITH SAND LAYER BASED ON DATA FROM THE STANTEC LRCP STABILITY ASSESSMENT REPORT (STANTEC 2016).

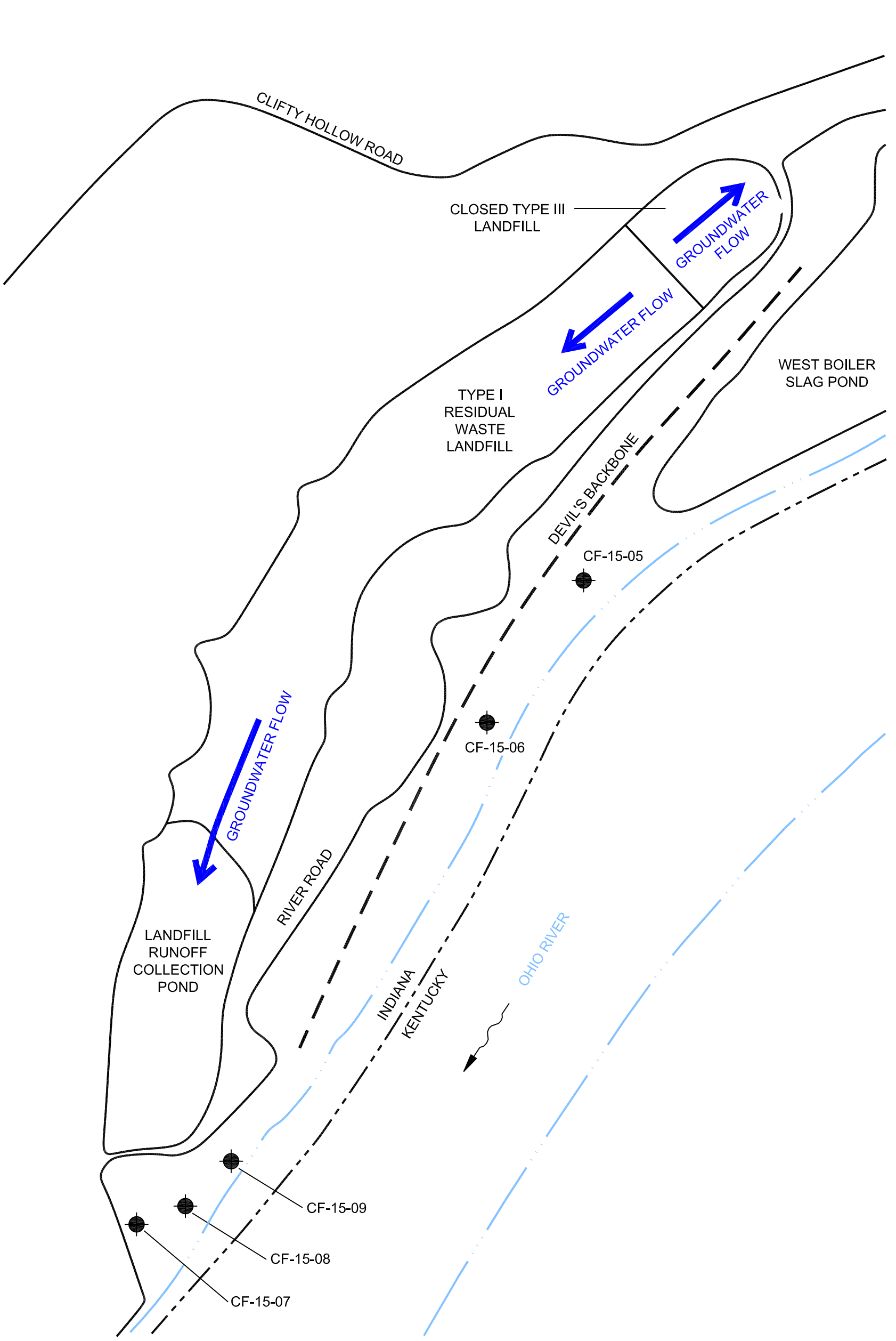
DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2018070-2-CLIF
DWG FILE	IKEC_Clifty MW Install_X-Sec C-C' b09.dwg
DRAWING SCALE	NOT TO SCALE

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND LANDFILL RUNOFF COLLECTION POND
GENERALIZED GEOLOGIC CROSS-SECTION C-C'

DRAWING NAME: FIGURE 5
REV.: 0

Plot: 10/08/2018 14:56 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_X-Sec C-C' b09.dwg



LEGEND:

MONITORING WELL LOCATION

NOTE:
SEE FIGURE 7 FOR LOCATION OF BACKGROUND WELL CF-15-04.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLIF
DWG FILE	IKEC_Clifty MWs_LANDFILL b01.dwg
DRAWING SCALE	NOT TO SCALE

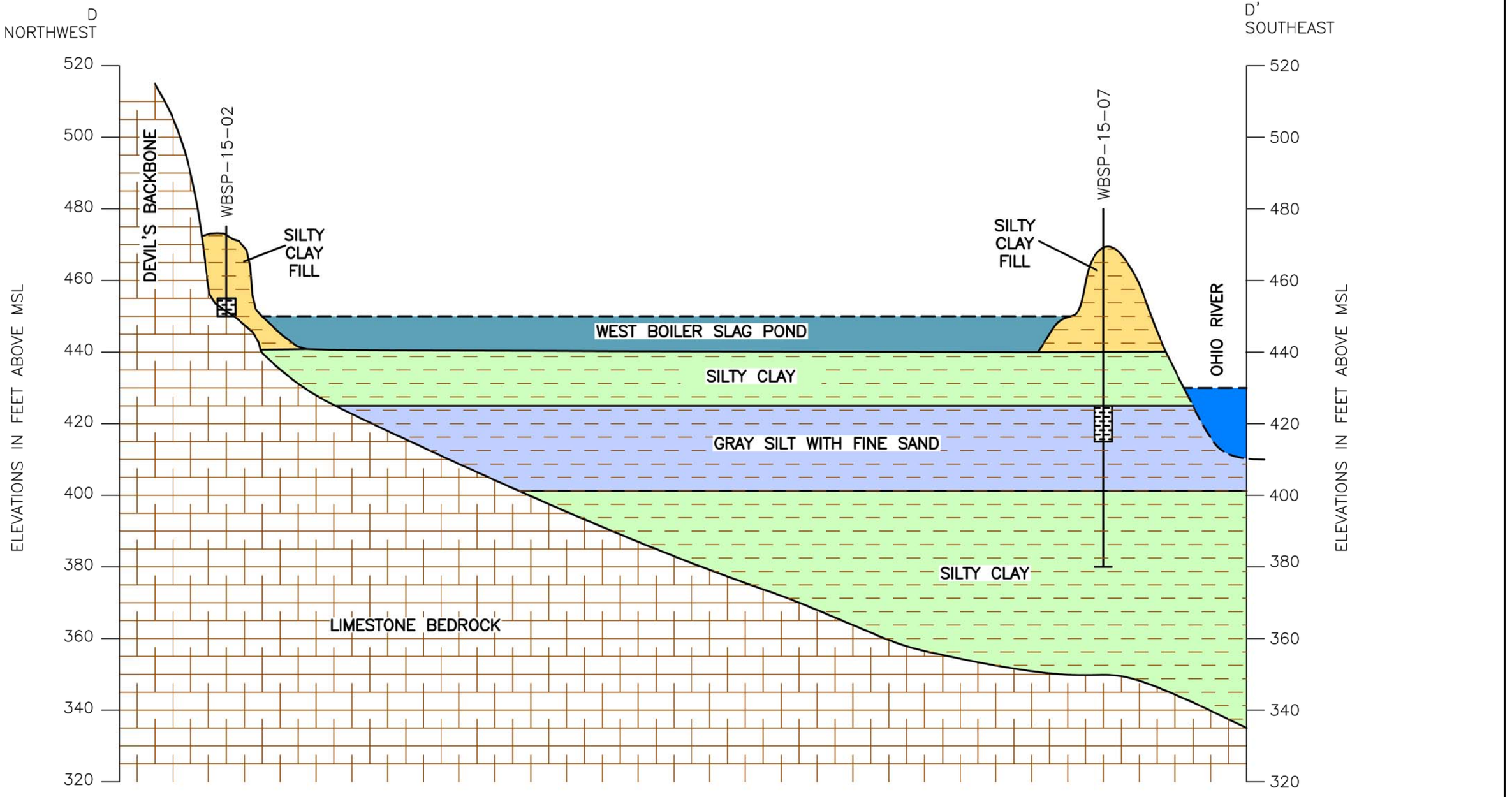
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND LANDFILL RUNOFF COLLECTION POND
MONITORING WELL LOCATIONS AND GENERALIZED GROUNDWATER FLOW

DRAWING NAME	REV.
FIGURE 6	0

Plot: 10/02/2018 14:42 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MWs_LANDFILL b01.dwg



NOTE:
CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLIF
DWG FILE	IKEC_Clifty MW Install_Slag Pond X-Sec b07.dwg
DRAWING SCALE	NOT TO SCALE

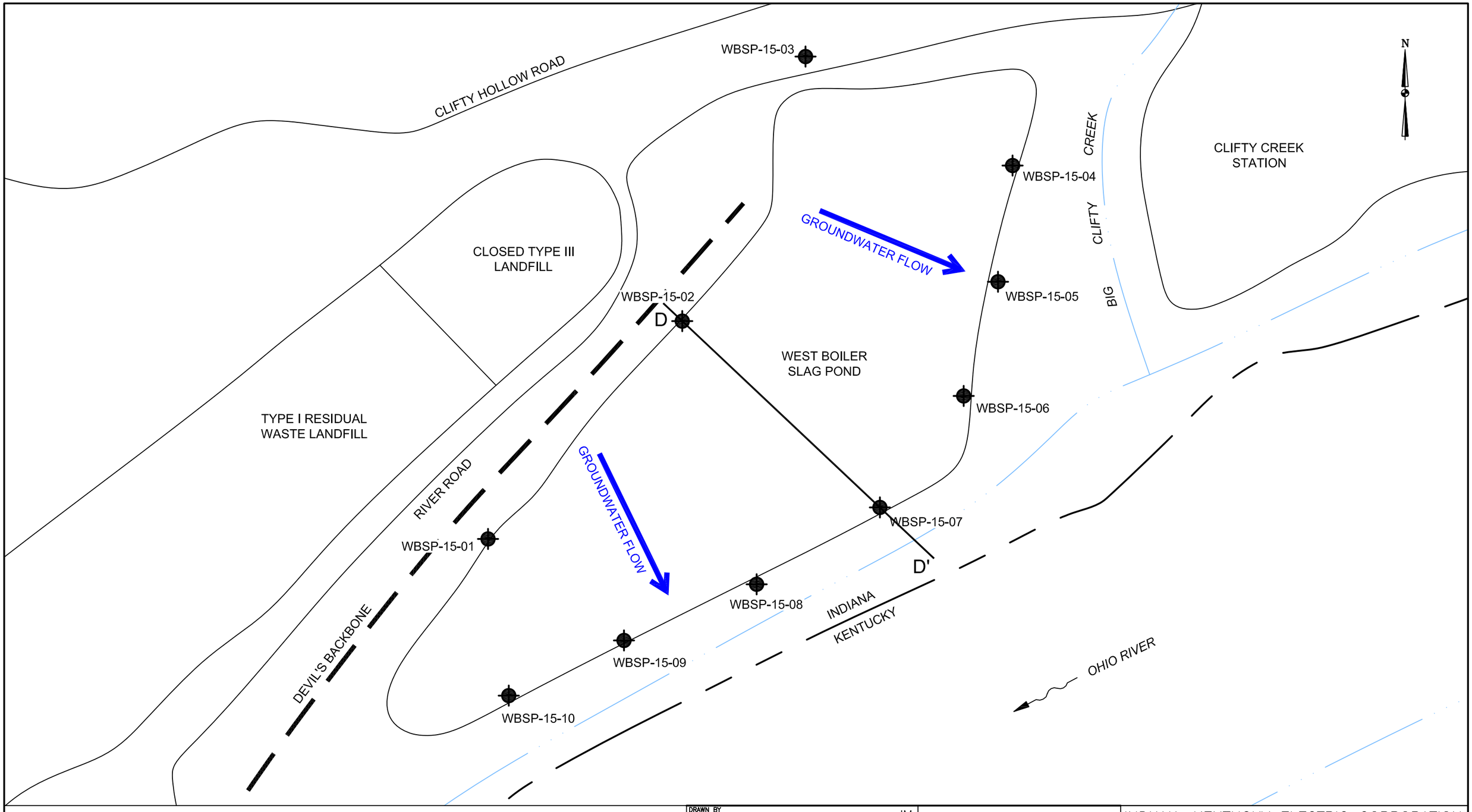
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION D-D'

DRAWING NAME	REV.
FIGURE 7	0

Plot: 10/08/2018 15:17 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_Slag Pond X-Sec b07.dwg



LEGEND:

MONITORING WELL LOCATION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

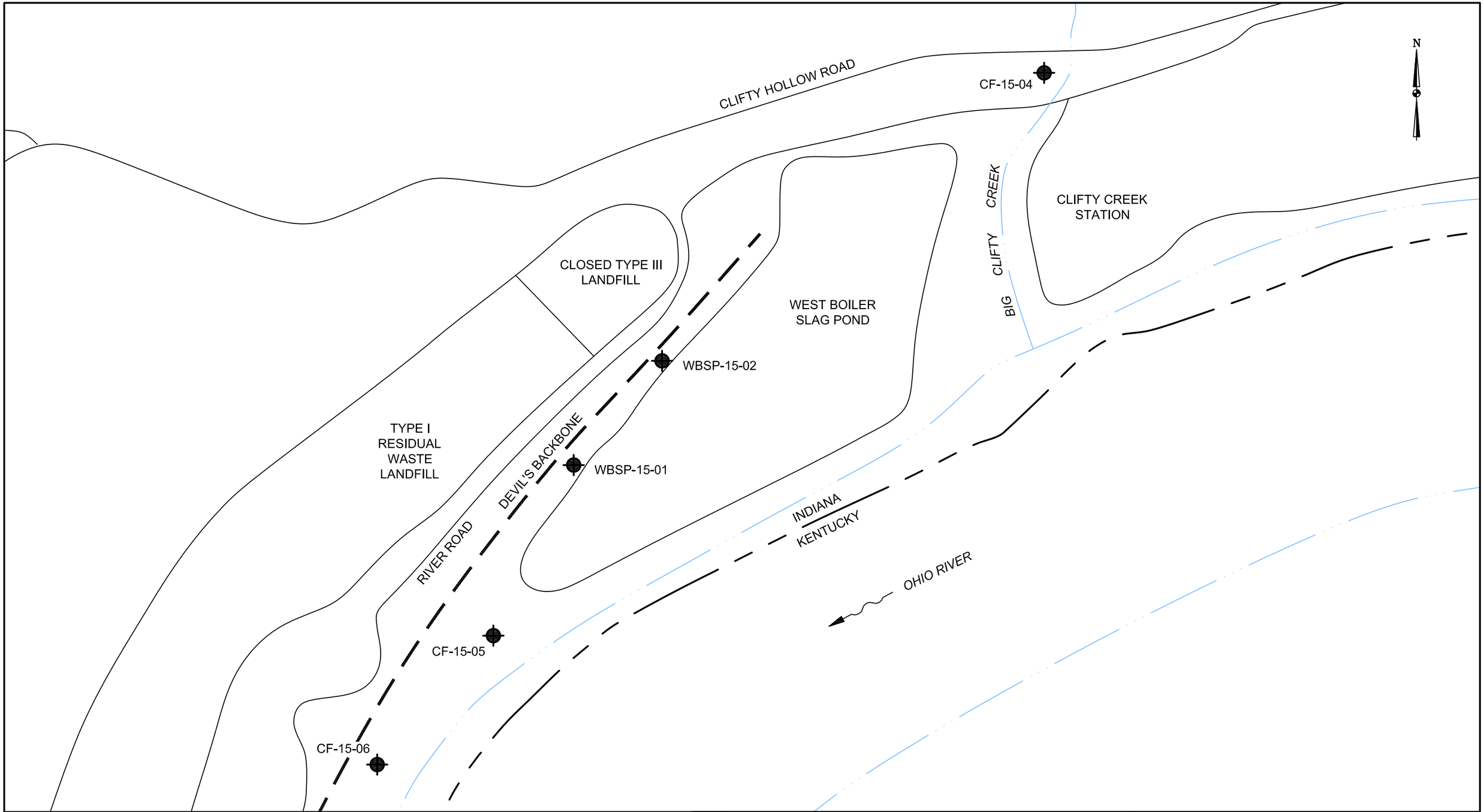
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
MONITORING WELL LOCATIONS AND
GENERALIZED GROUNDWATER FLOW

DRAWING NAME: FIGURE 8

REV.: 0

Plot: 10/02/2018 14:46 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg\b04



LEGEND:

MONITORING WELL LOCATION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

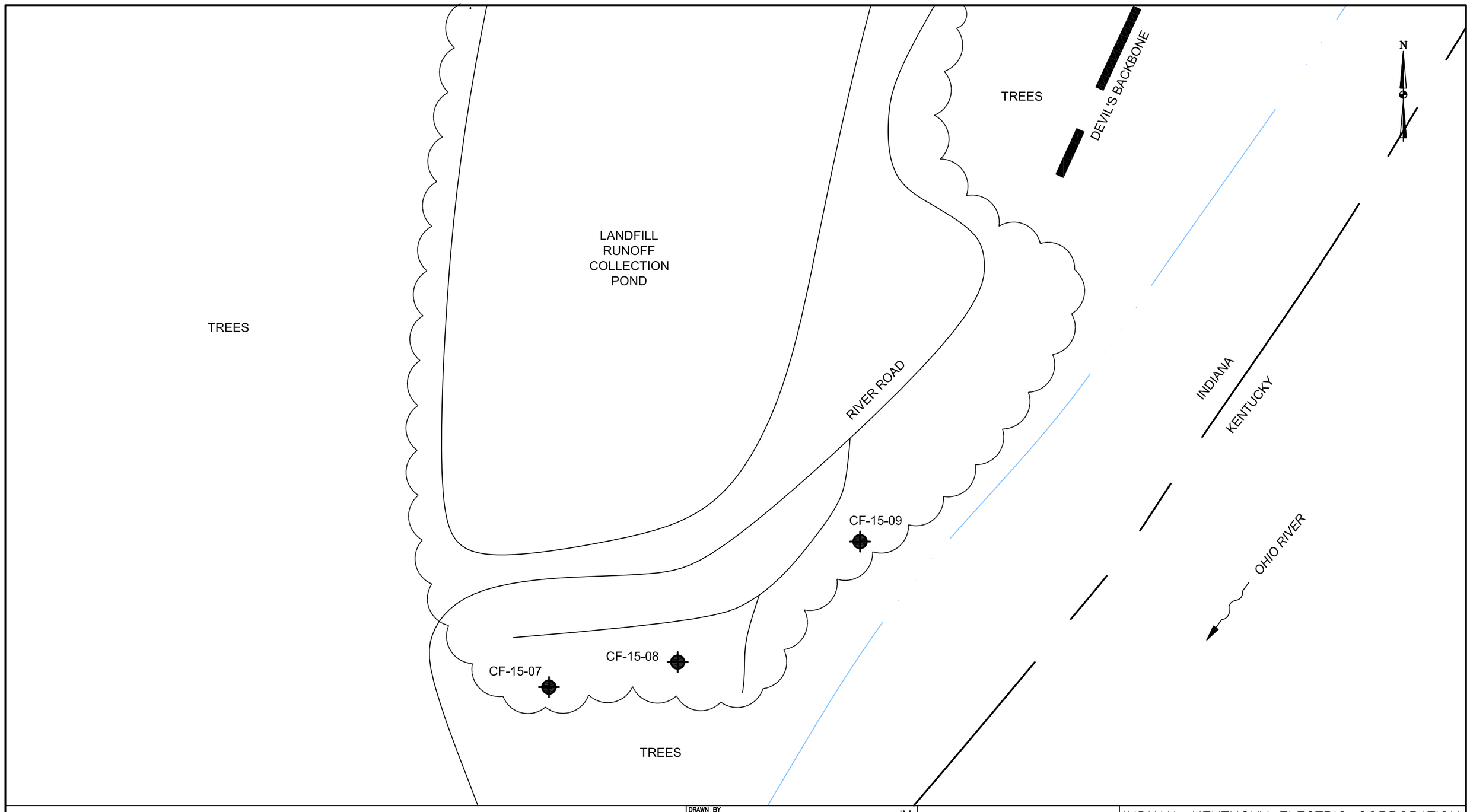
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
BACKGROUND MONITORING WELL LOCATIONS

DRAWING NAME: FIGURE 9

REV. 0

Plot: 10/02/2018 14:50 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty_MWs_b02-b03-b04.dwg\b02



LEGEND:

MONITORING WELL LOCATION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
MONITORING WELL LOCATIONS

DRAWING NAME	REV.
FIGURE 10	0

Plot: 10/02/2018 14:52 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg\b03

APPENDIX A

GRAIN SIZE ANALYSIS RESULTS

Stantec

Summary of Soil Tests

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	WAP-2-51-61, 51.0'-61.0'	Lab ID	2
Sample Type	SPT	Date Received	7-21-15
		Date Reported	7-27-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
3/8"	9.5	100.0
No. 4	4.75	99.2
No. 10	2	98.0
No. 40	0.425	96.8
No. 200	0.075	69.6
	0.02	34.7
	0.005	17.0
	0.002	11.2
estimated	0.001	7.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.8	2.0
Coarse Sand	1.2	1.2
Medium Sand	1.2	---
Fine Sand	27.2	27.2
Silt	52.6	58.4
Clay	17.0	11.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	23
Plastic Limit:	19
Plasticity Index:	4
Activity Index:	0.36

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.65

Classification

Unified Group Symbol:	CL-ML
Group Name:	Sandy silty clay
AASHTO Classification:	A-4 (1)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	WAP-2-51-61, 51.0'-61.0'	Lab ID	2

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	TA
Test Date	07-22-2015
Date Received	07-21-2015

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3/8"	100.0
No. 4	99.2
No. 10	98.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

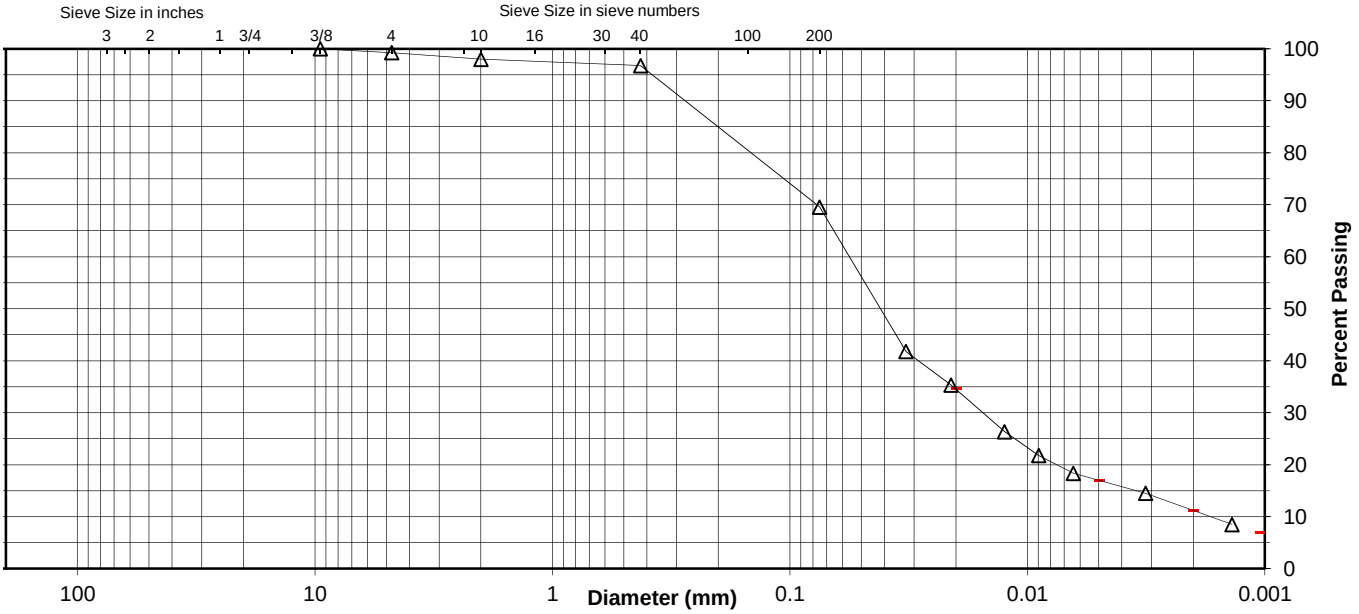
Specific Gravity 2.65

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	96.8
No. 200	69.6
0.02 mm	34.7
0.005 mm	17.0
0.002 mm	11.2
0.001 mm	7.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.8	1.2	1.2	27.2	52.6	17.0
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	2.0			1.2	27.2	58.4	11.2



Comments

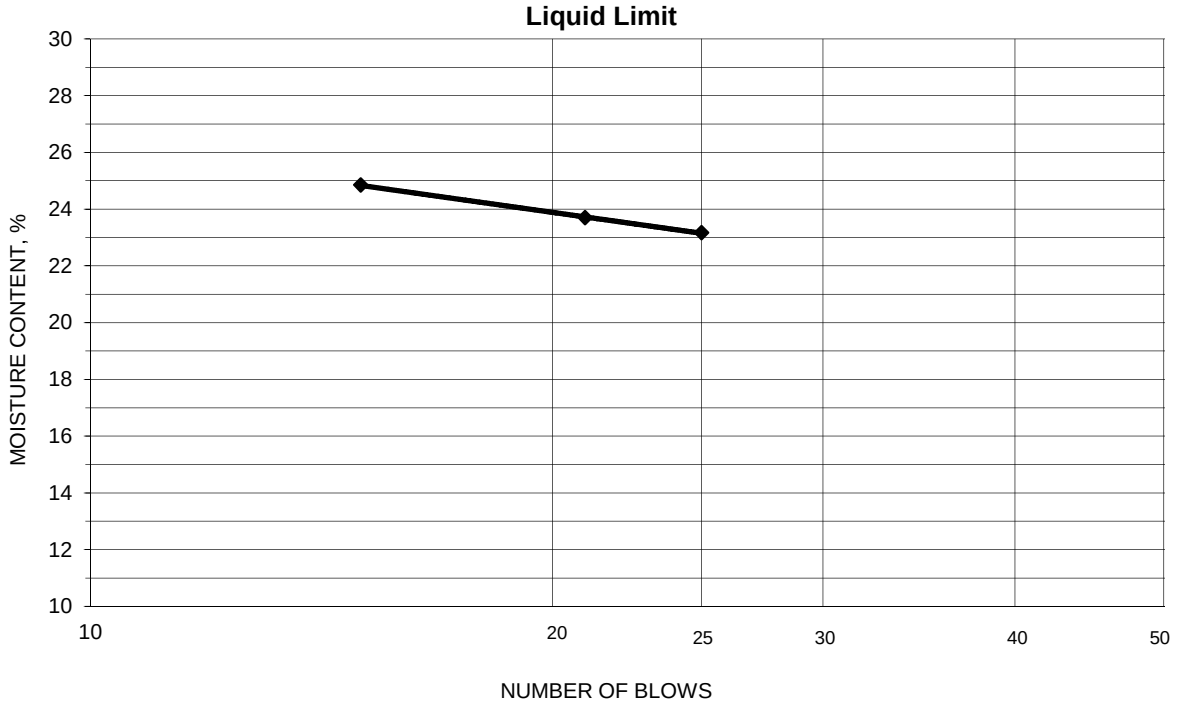
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Clifty Creek IKEC CCR Rule Eng			Project No.	175534018
Source	WAP-2-51-61, 51.0'-61.0'			Lab ID	2
				% + No. 40	3
Tested By	KG	Test Method	ASTM D 4318 Method A	Date Received	07-21-2015
Test Date	07-31-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
23.91	21.55	11.59	21	23.7	
24.82	22.29	11.37	25	23.2	
27.00	23.79	10.87	15	24.8	23



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.36	20.83	12.71	18.8	19	4
20.94	19.66	12.73	18.5		

Remarks: _____

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	SW-24-34, 24.0'-34.0'	Lab ID	1
Sample Type	SPT	Date Received	7-21-15
		Date Reported	7-27-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	99.0
No. 4	4.75	96.5
No. 10	2	93.0
No. 40	0.425	90.7
No. 200	0.075	37.8
	0.02	13.6
	0.005	5.8
	0.002	3.5
estimated	0.001	2.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.5	7.0
Coarse Sand	3.5	2.3
Medium Sand	2.3	---
Fine Sand	52.9	52.9
Silt	32.0	34.3
Clay	5.8	3.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.65

Classification

Unified Group Symbol:	SM
Group Name:	Silty sand
AASHTO Classification:	A-4 (0)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	SW-24-34, 24.0'-34.0'	Lab ID	1

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	JS
Test Date	07-22-2015
Date Received	07-21-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	99.0
No. 4	96.5
No. 10	93.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

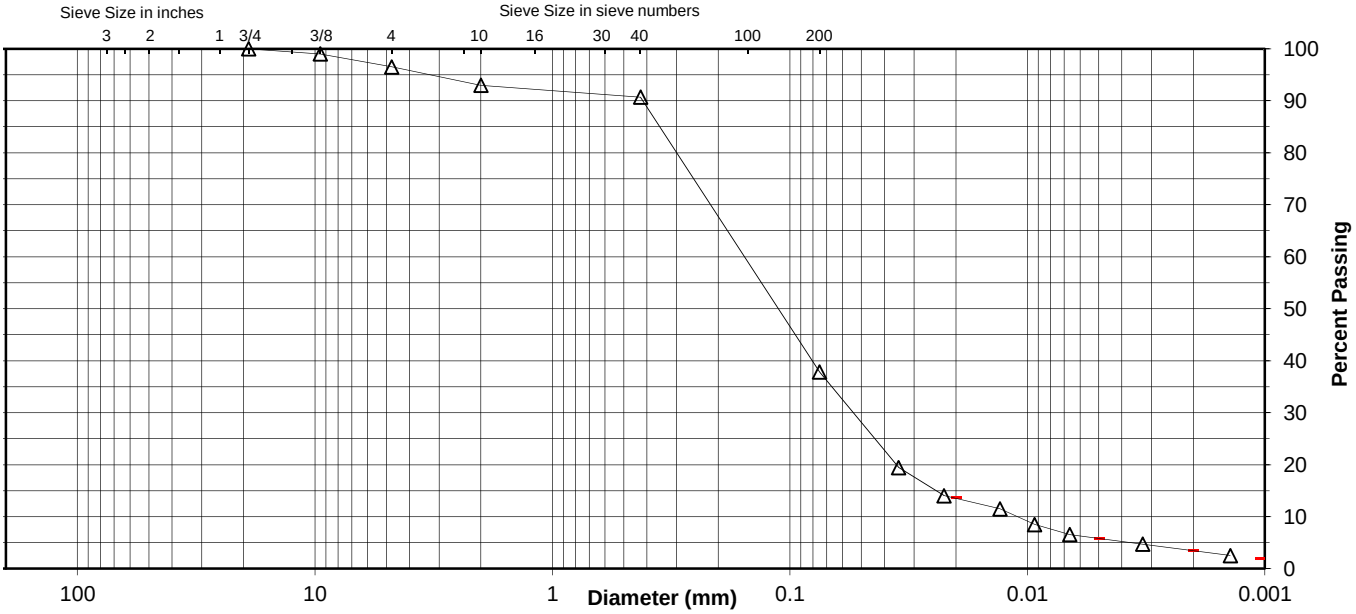
Specific Gravity 2.65

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	90.7
No. 200	37.8
0.02 mm	13.6
0.005 mm	5.8
0.002 mm	3.5
0.001 mm	2.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	3.5	3.5	2.3	52.9	32.0	5.8
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	7.0			2.3	52.9	34.3	3.5



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	BKG-3-33-43, 33.0'-43.0'	Lab ID	3
Sample Type	SPT	Date Received	7-21-15
		Date Reported	7-27-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
3/8"	9.5	100.0
No. 4	4.75	99.8
No. 10	2	99.7
No. 40	0.425	99.6
No. 200	0.075	98.4
	0.02	42.5
	0.005	10.7
	0.002	6.3
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.2	0.3
Coarse Sand	0.1	0.1
Medium Sand	0.1	---
Fine Sand	1.2	1.2
Silt	87.7	92.1
Clay	10.7	6.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.65

Classification

Unified Group Symbol:	ML
Group Name:	Silt
AASHTO Classification:	A-4 (0)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	BKG-3-33-43, 33.0'-43.0'	Lab ID	3

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	TA
Test Date	07-22-2015
Date Received	07-21-2015

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3/8"	100.0
No. 4	99.8
No. 10	99.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

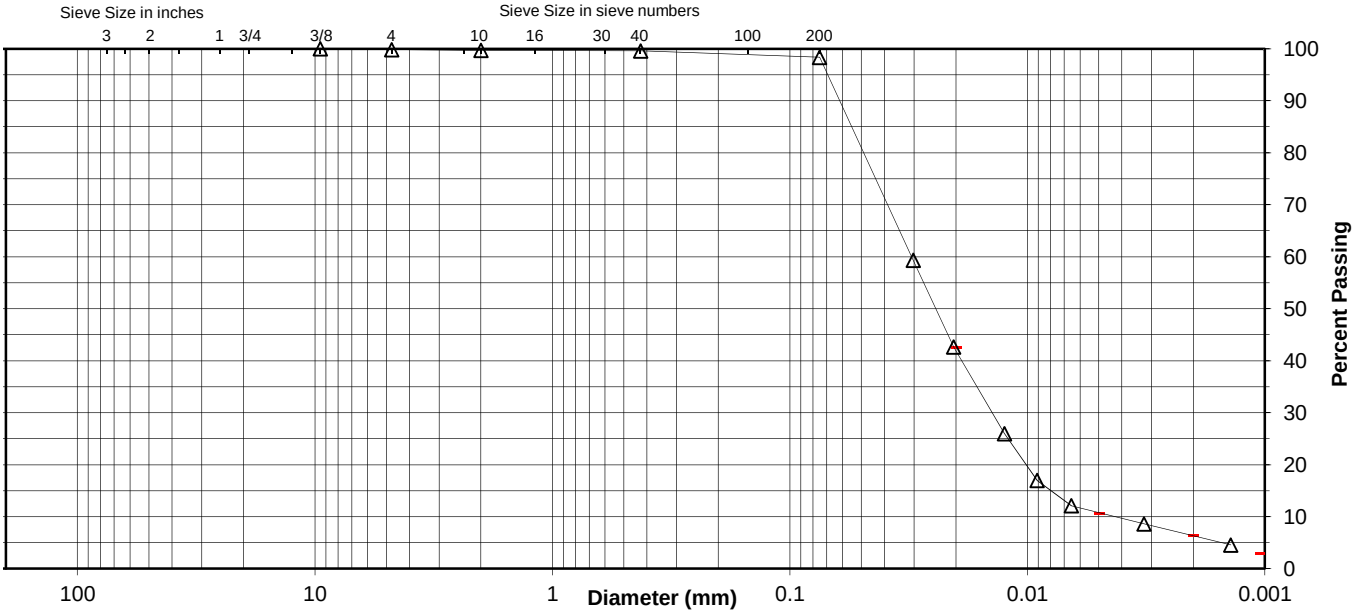
Specific Gravity 2.65

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	99.6
No. 200	98.4
0.02 mm	42.5
0.005 mm	10.7
0.002 mm	6.3
0.001 mm	3.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.2	0.1	0.1	1.2	87.7	10.7
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.3			0.1	1.2	92.1	6.3



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	BKG-2-29-35, 29.0'-35.0'	Lab ID	4
Sample Type	SPT	Date Received	7-23-15
		Date Reported	7-31-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	98.6
No. 4	4.75	98.1
No. 10	2	96.8
No. 40	0.425	94.3
No. 200	0.075	79.8
	0.02	46.9
	0.005	23.4
	0.002	16.0
estimated	0.001	12.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.9	3.2
Coarse Sand	1.3	2.5
Medium Sand	2.5	---
Fine Sand	14.5	14.5
Silt	56.4	63.8
Clay	23.4	16.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	ML
Group Name:	Silt with sand
AASHTO Classification:	A-4 (0)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Clifty Creek IKEC CCR Rule Eng	Project Number	175534018
Source	BKG-2-29-35, 29.0'-35.0'	Lab ID	4

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	TA
Test Date	07-27-2015
Date Received	07-23-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	98.6
No. 4	98.1
No. 10	96.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

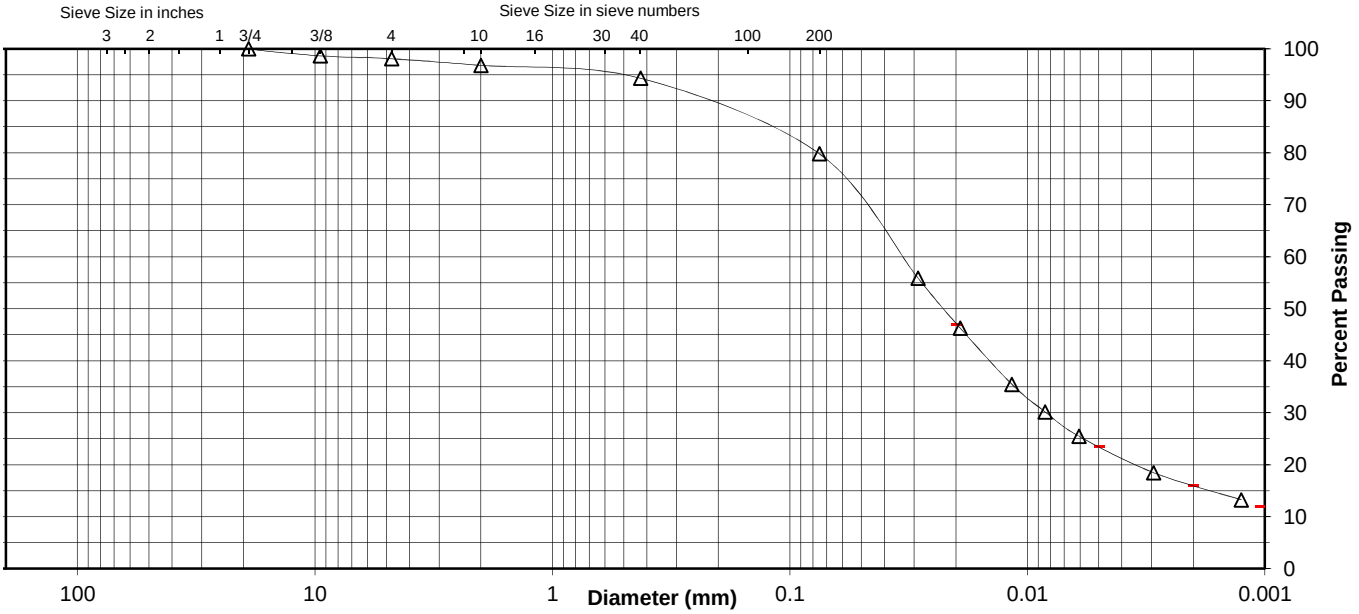
Specific Gravity 2.7

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	94.3
No. 200	79.8
0.02 mm	46.9
0.005 mm	23.4
0.002 mm	16.0
0.001 mm	12.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.9	1.3	2.5	14.5	56.4	23.4
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	3.2			2.5	14.5	63.8	16.0



Comments

Reviewed By RJ

APPENDIX B

BORING & WELL LOGS

BORING NO. CF-15-04
SAMPLE/CORE LOG

Project Number:	2015067	Log Page 1 of 1	
Project Location:	Clifty Creek Plant Landfill Northeast End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	12/3/15	AGES Geologist:	Mike Gelles

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	40’	Surface Elevation:	465.55’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	7	NA	0-4’ Boiler slag, clay, fine sand, moist, fill; 4’-7’ gray silty clay, trace gravel, stiff, plastic, moist	N/A
10-20	9	NA	Orange brown silty clay, fine sand, gray mottling, stiff, plastic, moist	N/A
20-30	10	NA	20’-24’ Orange brown silty clay, fine sand, gray mottling, stiff, plastic, moist; 24’-29’ gray brown silty clay, fine sand, stiff, plastic, wet; 29’-30’ gray brown silty clay, fine sand, stiff, plastic, moist	N/A
30-40	10	NA	30’-36’ Orange brown silty clay, fine and medium sand, gravel, stiff, plastic, wet; 36’-40’ brown gray silty clay, trace gravel, stiff, plastic, moist, till	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-04

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill Northeast End

Installation Date(s): 12/3/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 0.91 NTUs

Volume Purged: 65 gallons

Static Water-Level* 28.53'

Top of Well Casing Elevation: 468.03'

Well Purpose:
Groundawter Monitoring

Northing (Y): 451482.81

Easting (X): 569307.19

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

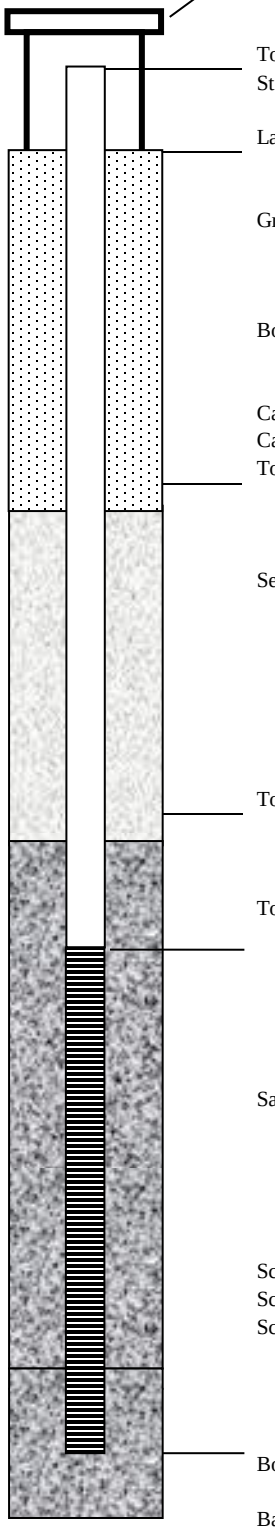
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

6 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 468.03 ft.
Stick-up: 2.48 ft.

Land Surface Elevation: 465.55 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 20 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 24 ft*

Top of Well Screen 26 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 36 ft.*

Base of Borehole: 40 ft.*

Total Depth of Well
Below Top of Casing: 38.48 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-05
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant Landfill South End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/29/15-11/30/15	AGES Geologist:	Joe Webster

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	27’	Surface Elevation:	439.85’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	2	2-2-2-2	Brown clay, little silt, very moist to wet	N/A
12-14	2	1-2-2-3	Brown clay, little silt, wet.	N/A
14-16	2	2-2-2-2	Brown clay, little silt, very moist to wet	N/A
16-18	2	2-3-2-2	Brown to olive gray clay, little silt, trace sand, very moist to wet	N/A
18-20	1.33	1-1-2-1	Olive gray clay, some silt, wet	N/A
20-22	2	2-2-3-2	Olive gray clay, some silt, wet	N/A
22-24	2	WH-WH-2-2	Gray clay, some silt, trace fine sand, moist to wet	N/A
24-26	2	1-1-2-2	Gray clay, some silt, trace fine sand, moist	N/A
26-27	0.1	10-50/1	Brown to gray weathered shale with limestone	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/29/15-12/1/15

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 11.23'

Top of Well Casing Elevation: 442.58'

Well Purpose:
Groundawter Monitoring

Northing (Y): 447491.91

Easting (X): 565533.64

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

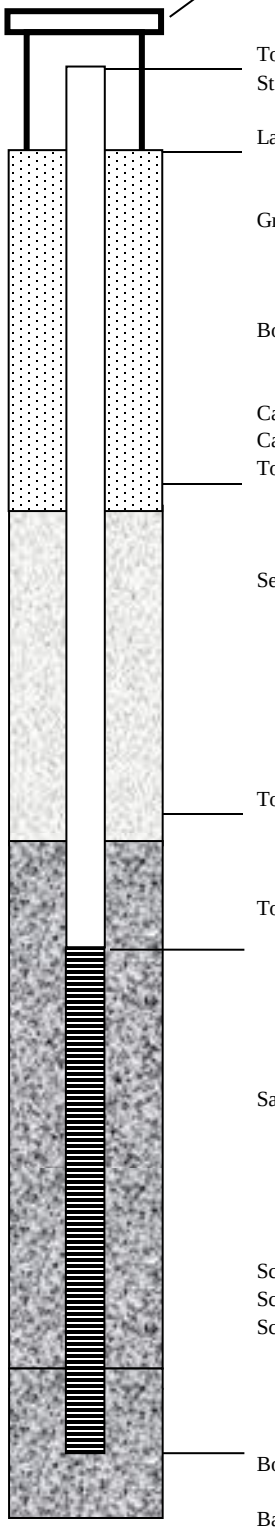
CONSTRUCTION MATERIALS USED:

_____ Bags of Sand

_____ Bags/Buckets Bentonite Pellets

_____ Bags Portland for Grout

_____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 442.58 ft.
Stick-up: 2.73 ft.

Land Surface Elevation: 439.85 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 15 ft*

Top of Well Screen 17 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 27 ft.*

Base of Borehole: 27 ft.*

Total Depth of Well
Below Top of Casing: 29.73 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-06
SAMPLE/CORE LOG

Project Number:	2015067	Log Page 1 of 1	
Project Location:	Clifty Creek Plant Landfill South End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/29/15-11/30/15	AGES Geologist:	Joe Webster

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	16’	Surface Elevation:	437.49’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1.5	3-3-3-5	Brown clay, some silt, soft, moist	N/A
12-14	1.7	3-3-4-3	Brown clay, little silt, soft, moist	N/A
14-16	0.8	4-7-46-50/4	Gray to brown, weathered shale with limestone, hard, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/29/15-11/30/15

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 5.59 NTUs

Volume Purged: 6.95 gallons

Static Water-Level* 17.65'

Top of Well Casing Elevation: 440.40'

Well Purpose:
Groundwater Monitoring

Northing (Y): 447026.92

Easting (X): 565190.31

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

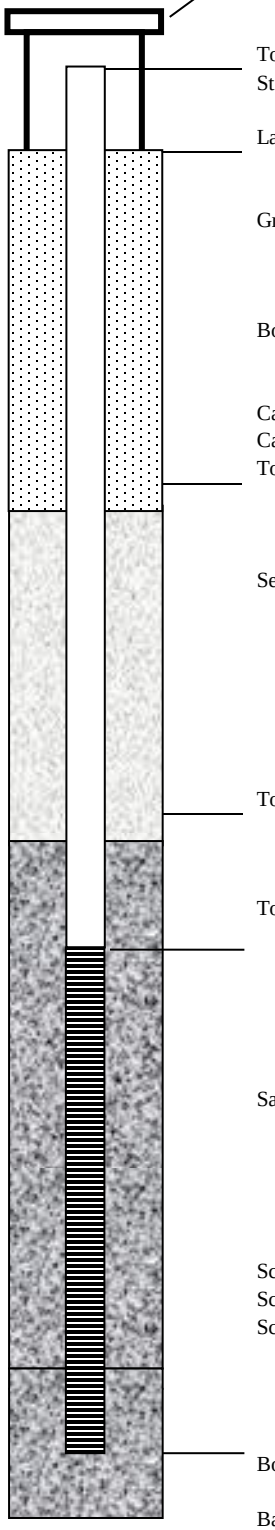
CONSTRUCTION MATERIALS USED:

_____ Bags of Sand

_____ Bags/Buckets Bentonite Pellets

_____ Bags Portland for Grout

_____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 440.40 ft.
Stick-up: 2.91 ft.

Land Surface Elevation: 437.49 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 5 ft*

Top of Well Screen 6 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 16 ft.*

Base of Borehole: 16 ft.*

Total Depth of Well
Below Top of Casing: 18.91 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-07
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant Landfill South End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/19/15-11/23/15	AGES Geologist:	Joe Webster

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb.	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	16’	Surface Elevation:	438.61’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1	1-1-3-5	Brown silty clay, stiff, plastic, wet	N/A
12-14	0	NA	No recovery	N/A
14-16	1.35	3-2-2-2	Brown gray silty clay with mottling, trace gravel, stiff, moist	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/23/15

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 4.42 NTUs

Volume Purged: 12.5 gallons

Static Water-Level* 5.92’

Top of Well Casing Elevation: 441.11’

Well Purpose:
Groundwater Monitoring

Northing (Y): 443135.08

Easting (X): 562259.25

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

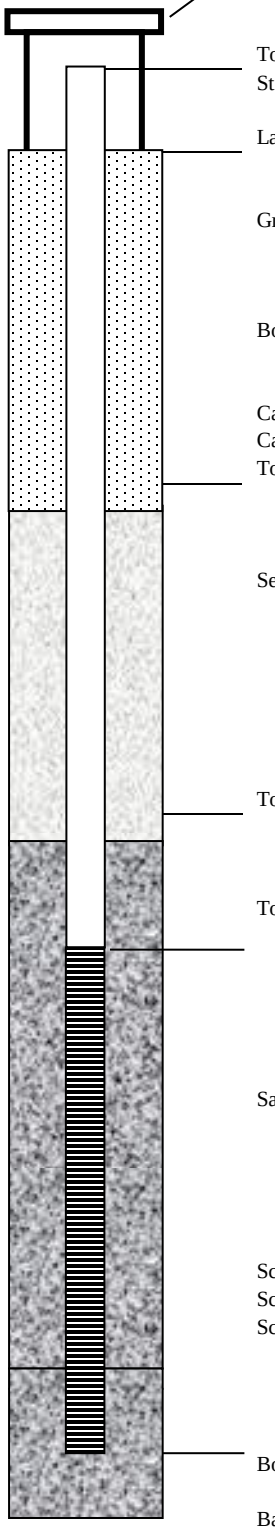
CONSTRUCTION MATERIALS USED:

_____ Bags of Sand

_____ Bags/Buckets Bentonite Pellets

_____ Bags Portland for Grout

_____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 441.11 ft.
Stick-up: 2.50 ft.

Land Surface Elevation: 438.61 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 5 ft*

Top of Well Screen 6 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 16 ft.*

Base of Borehole: 16 ft.*

Total Depth of Well
Below Top of Casing: 18.50 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-08
SAMPLE/CORE LOG

Project Number:	2015067	Log Page 1 of 1	
Project Location:	Clifty Creek Plant Landfill South End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/17/15-11/19/15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	40’	Surface Elevation:	460.33’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	2	3-6-6-7	Orange brown silty clay, fine sand, slightly plastic, moist	N/A
12-14	1.4	5-7-10-10	Light brown silt, loose, moist	N/A
14-16	1.6	4-8-12-10	Light brown silt, loose, moist	N/A
16-18	1.6	7-6-9-7	Light brown silt, loose, moist	N/A
18-20	1.6	3-6-4-4	18’-19’ Light brown silt, loose, moist; 19’20’ Light brown silt, loose, wet	N/A
20-22	1.2	2-3-6-6	Light brown silt, trace clay, wet	N/A
22-24	0.1	2-3-3-3	Brown silt, clay, wet	N/A
24-26	2	2-4-6-7	Brown silt, clay, wet	N/A
26-28	2	3-5-5-5	Brown fine and medium sand, trace silt, trace clay, wet	N/A
28-30	2	3-5-9-12	Brown fine and medium sand, trace silt, trace clay, wet	N/A
30-32	1.2	1-2-2-2	Brown fine and medium sand, medium gravel, trace silt, trace clay, wet	N/A
32-34	2	4-5-5-9	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
34-36	2	WH-3-6-8	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
36-38	2	4-5-7-8	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
38-40	2	3-5-5-11	38’-39.75’ Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet; 39.75’-40’ gray fine and medium sand, silt, trace clay, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/17/15-11/19/15

Drilling Method: Hollow stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 12/8/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 2.16 NTUs

Volume Purged: 100 gallons

Static Water-Level* 24.31'

Top of Well Casing Elevation: 462.79'

Well Purpose:
Groundwater Monitoring

Northing (Y): 443219.57

Easting (X): 562537.29

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

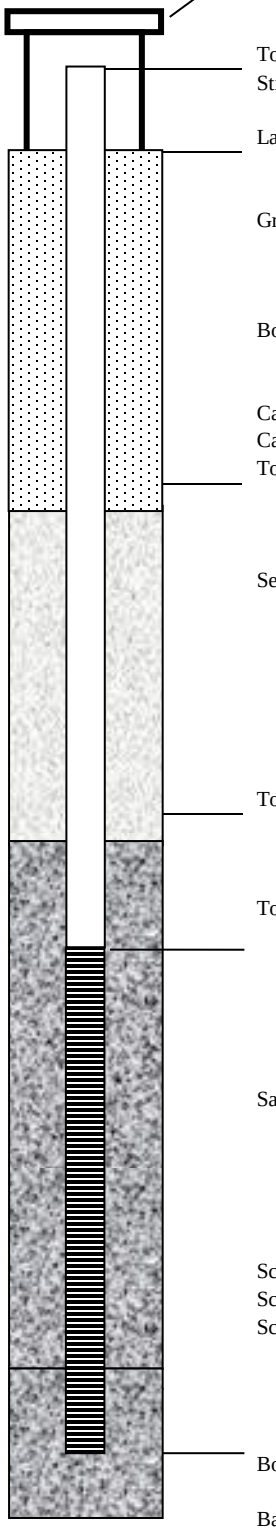
CONSTRUCTION MATERIALS USED:

4.5 Bags of Sand

0.5 Bags/Buckets Bentonite Pellets

3 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 462.79 ft.

Stick-up: 2.46 ft.

Land Surface Elevation: 460.33 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 24 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 28 ft*

Top of Well Screen 30 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 40 ft.*

Base of Borehole: 40 ft.*

Total Depth of Well
Below Top of Casing: 42.46 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-09
SAMPLE/CORE LOG

Project Number:	2015067	Log Page 1 of 1	
Project Location:	Clifty Creek Plant Landfill South End	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/24/15-11/25/15	AGES Geologist:	Joe Webster

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	14’	Surface Elevation:	456.73’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1.8	5-9-6-9	Brown weathered shale wilt limestone, hard, dry	N/A
12-14	0.2	50/4	Brown weathered shale wilt limestone, hard, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 3.21 NTUs

Volume Purged: 6 gallons

Static Water-Level* 12.18'

Top of Well Casing Elevation: 459.45'

Well Purpose:
Groundwater Monitoring

Northing (Y): 443445.96

Easting (X): 562871.69

Comments/Notes:
2 inch PVC riser and screen

5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

CONSTRUCTION MATERIALS USED:

_____ Bags of Sand

_____ Bags/Buckets Bentonite Pellets

_____ Bags Portland for Grout

_____ Bags Concrete/Sakrete

Protective Casing with Locking Cap

Top of Casing Elevation: 459.45 ft.
Stick-up: 2.72 ft.

Land Surface Elevation: 456.73 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 1 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 9 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 14 ft.*

Base of Borehole: 14 ft.*

Total Depth of Well
Below Top of Casing: 16.72 ft.

*Indicates Depth Below Land Surface

BORING NO. ____WAP -1__
SAMPLE/CORE LOG

Project Number:	P200852	Log Page 1 of 1	
Project Location:	Clifty Creek- West Boiler Slag Pond	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-8-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	1.5	4-9-16-32	Brown/black silt and fine sand, bottom ash, coal dust, moist	N/A
2-4	1.7	9-21-42-46	Brown/black silt and fine sand, coal dust, moist	N/A
4-6	1.8	12-27-28-25	Brown/black silt, sand, boiler slag, moist	N/A
6-8	1.8	2-7-3-4	Top 1.1' Brown/black boiler slag, silt, fine sand, moist, stiff Bottom 0.7' Brown gray clay, moist, stiff	N/A
8-10	1.6	2-3-6-8	Brown grey silty clay, moist	N/A
10-12	2.0	2-3-6-9	Brown grey to brown, silty clay, moist, stiff	N/A
12-14	2.0	3-4-8-11	Brown silty clay, moist, stiff	N/A
14-16	2.0	3-3-7-9	Brown silty clay moist, stiff	N/A
16-18	2.0	1-2-4-15	Top 1.7' Brown silty clay ,very moist, stiff Bottom 0.3' Rock (limestone), fragments of bedrock	N/A
18-20	1.7	20-6-13-17	Brown Silty clay, moist, stiff, layers of limestone, 20'refusal 50 blows on limestone bedrock.	N/A
20	0	50/0	Refusal – limestone bedrock	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

CONTINUED SAMPLE/CORE LOG
BORING NO. B-1

Project No: 2015078 HMI Inspector: Mike Gelles Page 2 of 2

BORING NO. BKG-2
SAMPLE/CORE LOG

Project Number:	P200852	Log Page	1 of 1
Project Location:	Clifty Creek-Background-2	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-8-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS: Sample collected for grain size analysis @ 29.0 – 35.0'

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-15	N/A	N/A	Brown silty clay, moist	N/A
15-17	100%	2-3-3-4	Brown, silty clay, moist, slightly plastic	N/A
17-19	100%	3-1-2-2	Brown, silty clay, moist, slightly plastic	N/A
19-21	100%	3-3-3-5	Brown, silty clay, moist, plastic	N/A
21-23	100%	1-2-2-5	Brown, silty clay, moist, plastic	N/A
23-25	100%	2-5-4-5	Brown, silty clay, moist, plastic	N/A
25-27	100%	3-5-8-15	Brown, silty clay, moist, plastic	N/A
27-29	100%	10-8-5-6	Brown, silty clay, moist, plastic	N/A
29-31	100%	4-6-11-9	Top 1.0' Brown fine & medium sand, silt wet Bottom 1.0' Gray clay trace silt, stiff, moist	N/A
31-33	100%	6-6-6-6	Gray silt, trace clay, wet	N/A
33-35	100%	3-5-4-6	Gray silt, trace clay, wet	N/A

BORING NO. WAP -2
SAMPLE/CORE LOG

Project Number:	P200852	Log Page 1 of 1	
Project Location:	Clifty Creek- West Boiler Slag Pond	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-9-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS: Sample collected for grain size analysis @ 51.0 – 61.0'

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	N/A	N/A	Red brown silty clay, gravel, moist	N/A
10-35	N/A	N/A	Red brown silty clay, some gravel, moist	N/A
35-37	No recovery	3-6-8-11	No description	N/A
37-39	1.9	3-6-9-10	Brown silty clay, moist, trace gravel	N/A
39-41	1.9	WOH-3-7-9	Brown gray silt clay, moist, trace sand	N/A
41-43	2.0	2-3-3-5	Brown gray silt, clay, moist	N/A
43-45	1.8	1-1-2-4	Brown gray silt, clay, moist	N/A
45-47	2.0	WOH-2-1-3	Brown gray silt, clay, moist	N/A
47-49	1.9	WOH-1-3-3	Brown gray silt, clay, moist	N/A
49-51	1.9	WOH-2-1-3	Brown gray silt, clay, moist	N/A
51-53	1.9	WOH-2-1-4	Brown gray silt, clay, wet	N/A
53-55	2.0	WOH-1-3-3	Brown gray silt, clay, wet	N/A
55-57	2.0	1-2-4-7	Brown gray silt, clay, wet	N/A
57-59	2.0	1-1-2-3	Brown gray silt, clay, wet	N/A
59-61	2.0	1-1-4-8	Brown gray silt, clay, wet	N/A
				N/A

BORING NO. BKG -1
SAMPLE/CORE LOG

Project Number:	P200852	Log Page 1 of 1	
Project Location:	Clifty Creek-Background-1	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-9-15, 7-10-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	1.6	3-6-15-15	Gravel, brown sandy clay, moist (Fill)	N/A
2-4	0.5	6-5-4-3	Gravel, brown sandy clay, moist (Fill)	N/A
4-6	1.9	3-2-2-4	Gravel, brown sandy clay and silty clay, moist (Fill)	N/A
6-8	1.2	4-2-3-8	Gravel, brown sandy clay, moist	N/A
8-10	1.6	4-5-4-5	Brown silty clay, moist and sandy clay, rock fragments.	N/A
10-12	1.6	8-5-5-8	Brown sandy clay, rock fragments, moist	N/A
12-14	1.4	8-2-6-9	Brown sandy clay gravel (fill) wet	N/A
14-16	1.0	2-2-1-3	Brown sandy clay, rock fragments, moist	N/A
16-18	0.5	1-2-5-50	Brown sand clay, rock fragments, wet, bedrock 17.5 to 17.8 Refusal on limestone.	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

BORING NO. BKG-3
SAMPLE/CORE LOG

Project Number:	P200852	Log Page 1 of 1	
Project Location:	Clifty Creek-Background-3	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-15-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS: Sample collected for grain size analysis @ 33.0 – 43.0'

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-5	N/A	N/A	Gravel, ash, silty clay brown, black, moist	N/A
5-13	N/A	N/A	Brown gray silty clay, moist	N/A
13-15	N/A	N/A	Brown gray silty clay, moist, fine sand ,wet	N/A
15-20	N/A	N/A	Brown gray silty clay, fine sand, moist	N/A
20-25	N/A	N/A	Brown gray silty clay, fine sand, moist	N/A
25-27	1.0	11-5-15-24	Brown orange silty clay, rock fragments, wet	N/A
27-29	1.0	10-20-18-13	Brown orange sand fine & medium, gravel round, moist, rock fragments	N/A
29-31	1.0	8-20-19-28	Brown tan sand fine & medium, silt, moist to wet	N/A
31-33	2.0	7-50/2	Brown tan sand fine & medium, silt, wet, weathered limestone (from above, not true interval)	N/A
33-35	0.8	10-5-5-6	Top 0.5' Brown orange silt moist Bottom 0.3' Gray brown silt, saturated	N/A
35-37	1.5	4-2-2-3	Brown gray silt, wet	N/A
37-39	1.5	2-1-3-3	Brown gray silt, clay, wet	N/A
39-41	1.8	1-3-4-4	Brown gray silt, clay, wet	N/A
41-43	1.8	1-2-3-5	Brown gray silt, clay ,wet	N/A
				N/A
				N/A
				N/A

CONTINUED SAMPLE/CORE LOG
BORING NO. B-1

Project No: 2015078 HMI Inspector: Mike Gelles Page 2 of 2

BORING NO. _Downgradient SW__
SAMPLE/CORE LOG

Project Number:	P200852	Log Page 1 of 1	
Project Location:	Clifty Creek Landfill– Downgradient SW	Drilling Contractor:	Stan Tec
Drilling Date(s):	7-8-15	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:		Drilling Fluid Used:	None		
Sampling Interval:	NA	Borehole Depth:		Surface Elevation:			

NOTES/COMMENTS: Samples collected for grain size analysis @ 24.0 – 34.0'

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-5	N/A	N/A	Very moist clay, brown with some silt	N/A
5-10	N/A	N/A	Moist-damp, brown, stiff clay, no gravel, some silt	N/A
10-15	N/A	N/A	Very moist, brown with some grey clay, trace silt, no sand or gravel	N/A
15-20	N/A	N/A	Very moist- wet, brown with some gray, clay and silt with some very fine sand no gravel	N/A
20-22	2.0	1-1-2-2	Upper 0.8' Very moist brown silty clay with sand; Lower 1.2' wet/saturated brown silt & very fine sand	N/A
22-24	1.6	WOH/12-1/12	Saturated, brown, very fine sandy silt, free water in spoon	N/A
24-26	2.0	1/12-1-1	Upper 1.8' Saturated, brown, very fine sandy silt, free water in spoon; Lower 0.2' Saturated, brown sand with silt and some fine gravel	N/A
26-28	1.0	WOH – 1/18	Saturated, brown loose silty sand with trace clay, no gravel	N/A
28-30	1.7	WHO-1-2-4	Saturated, brown fine sand with silt and few 3/8" pieces of gravel, few small clay areas	N/A
30-32	1.2	1-4-9-10	Upper 0.5' Brown silt, clay and sand, firm; Lower 0.7' Saturated, brown, fine sand, silt, with some clay and gravel, compacted	N/A
32-34	0.5	6-10-11-15	Poor recovery, large gravel in shoe, brown wet silty fine sand	N/A
34-36	1.5	4-4-5-10	Saturated brown sand all sizes and some small gravel, with 1-2" silt lense and few small clay areas; 15% silt throughout	N/A
36-38	1.6	1-4-10-12	Saturated, brown sand all sizes, mostly fine with silt and gravel; Lower 0.6' dense	N/A
38-40	1.5	3-6-7-10	Wet, brown, sand with silt and gravel and some clay, compacted	N/A
				N/A

CONTINUED SAMPLE/CORE LOG
BORING NO. B-1

Project No: 2015078 HMI Inspector: Mike Gelles Page 2 of 2

				N/A

BORING NO. WBSP-15-01
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/30/15	AGES Geologist:	Mike Gelles

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	18’	Surface Elevation:	466.93’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Yellow brown silty clay, stiff, plastic, moist	N/A
10-18	8	NA	10’-15’ Yellow brown silty clay, stiff, plastic, moist; 12’-14’ wet; 15’18’ Light gray limestone	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-01

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/30/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 3.12 NTUs

Volume Purged: 33 gallons

Static Water-Level* 16.76'

Top of Well Casing Elevation: 469.36'

Well Purpose:
Groundwater Monitoring

Northing (Y): 449072.27

Easting (X): 566322.12

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

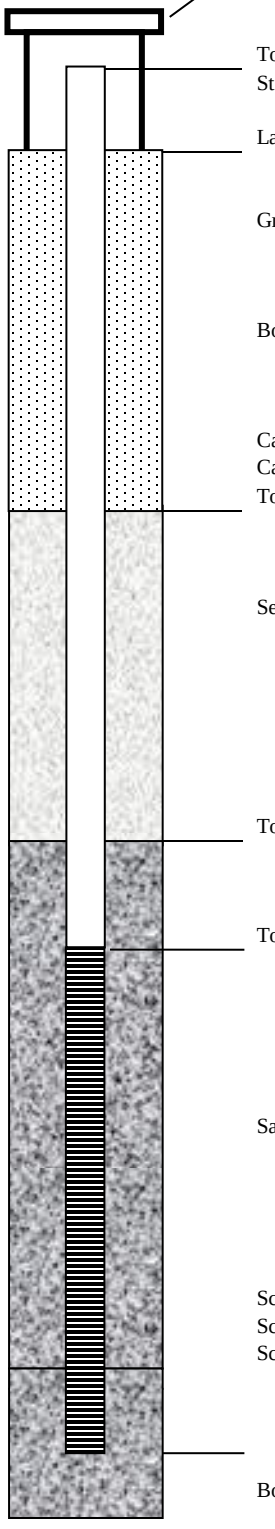
CONSTRUCTION MATERIALS USED:

4 Bags of Sand

2 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 469.36 ft.
Stick-up: 2.43 ft.

Land Surface Elevation: 466.93 ft.

Grout; Type: Potland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 18 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well
Below Top of Casing: 20.43 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-02

SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15	AGES Geologist:	Mike Gelles

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	21’	Surface Elevation:	473.83’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	5	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
10-20	8	NA	10’-11’ Red brown silt, fine sand, black boiler slag, loose, moist; 11’-19’ light brown silty clay, stiff, moist; 19’-20’ light brown silty clay, stiff, rock fragments, moist	N/A
20-21	1	NA	Gray limestone	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-02

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/7/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 3.69 NTUs

Volume Purged: 114.5 gallons

Static Water-Level* 15.40'

Top of Well Casing Elevation: 476.76'

Well Purpose:
Groundwater Monitoring

Northing (Y): 449803.91

Easting (X): 566987.30

Comments/Notes:
2 inch PVC riser and screen

5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

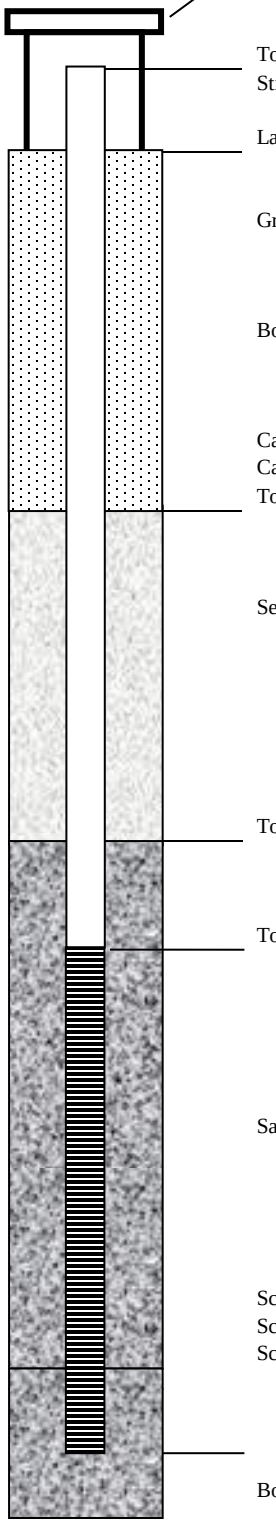
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 476.76 ft.

Stick-up: 2.93 ft.

Land Surface Elevation: 473.83 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 14 ft*

Top of Well Screen 16 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 21 ft.*

Base of Borehole: 21 ft.*

Total Depth of Well Below Top of Casing: 23.93 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-03

SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	12/4/15	AGES Geologist:	Mike Gelles

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	18’	Surface Elevation:	484.91’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	2	NA	Brown silty clay, black boiler slag, limestone fragments, stiff, plastic, moist	N/A
10-18	8	NA	10’-13’ Brown silty clay, black boiler slag, limestone fragments, stiff, plastic, moist; 13’-18’ Gray, limestone, weathered, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-03

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 12/4/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 2.42 NTUs

Volume Purged: 14.5 gallons

Static Water-Level* 11.08'

Top of Well Casing Elevation: 488.03'

Well Purpose:
Groundwater Monitoring

Northing (Y): 451181.98

Easting (X): 568093.60

Comments/Notes:
2 inch PVC riser and screen

5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

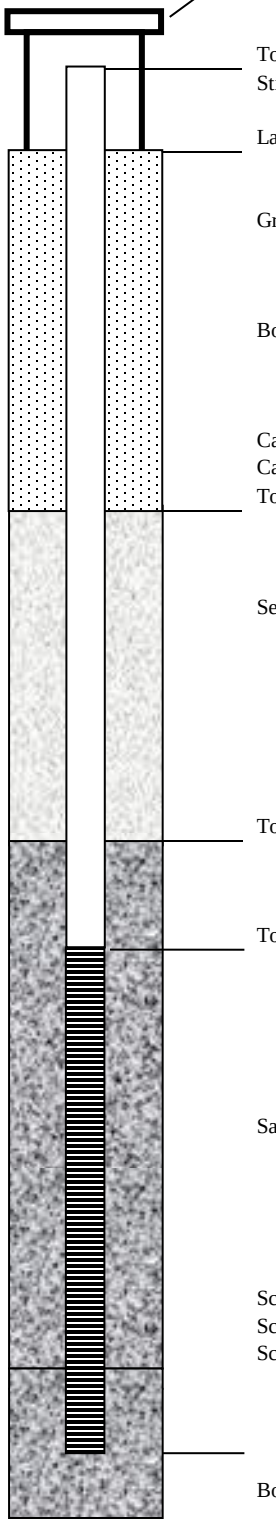
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 488.03 ft.

Stick-up: 3.12 ft.

Land Surface Elevation: 484.91 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 13 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 16.12 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-04

SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15-11/12/15	AGES Geologist:	Mike Gelles

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	70’	Surface Elevation:	471.17’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Red brown silt, fine sand, boiler slag, loose, moist	N/A
10-20	8	NA	Red brown silt, fine sand, boiler slag, loose, moist	N/A
20-30	8	NA	20’-28’ Red brown silt, fine sand, boiler slag, loose, moist; 28’-30’ wet	N/A
30-40	7	NA	Red brown silt, fine sand, boiler slag, loose, wet	N/A
40-50	10	NA	40’-45’ Red brown silt, fine sand, boiler slag, loose, wet; 45’-47’ Yellow brown clay, stiff, plastic, moist; 47’-49’ Yellow brown gravel angular, fine and medium sand, wet; 49’-50’ Orange brown sandy clay, fine, stiff, moist	N/A
50-60	9	NA	50’-53’ Orange brown sandy clay, fine, stiff, moist; 53’ – 60’ Light brown sand, fine, medium, coarse, gravel angular fine, medium, coarse, large, wet	N/A
60-70	7	NA	60’-68.5’ Light brown sand, fine, medium, coarse, gravel angular fine, medium, coarse, wet; 68.5’ -70’ light brown sand, fine, medium, coarse, black coal and peat, wet	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-04

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15-11/12/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 0.91 NTUs

Volume Purged: 65 gallons

Static Water-Level* 50.68'

Top of Well Casing Elevation: 473.71'

Well Purpose:
Groundwater Monitoring

Northing (Y): 450610.07

Easting (X): 568637.65

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

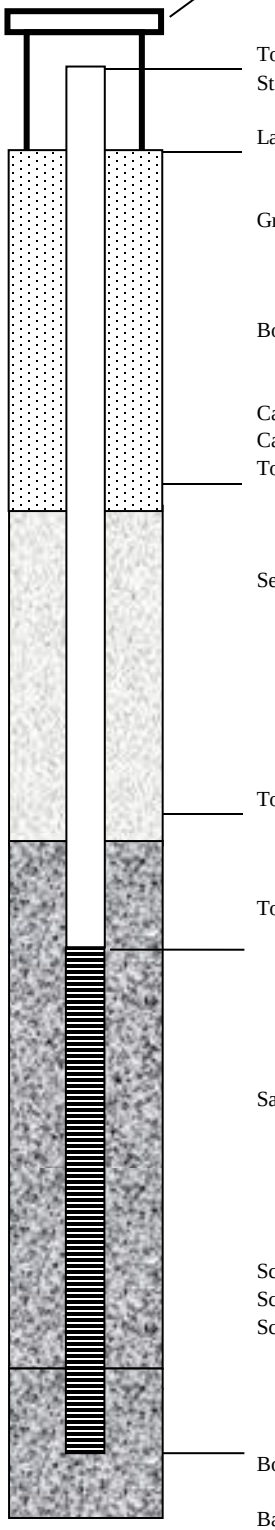
CONSTRUCTION MATERIALS USED:

5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.71 ft.

Stick-up: 2.54 ft.

Land Surface Elevation: 471.17 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 53 ft*

Top of Well Screen 55 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 65 ft.*

Base of Borehole: 70 ft.*

Total Depth of Well
Below Top of Casing: 67.54 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-05
SAMPLE/CORE LOG

Project Number:	2015067	Log Page 1 of 1	
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/13/15-11/17/15	AGES Geologist:	John Campbell

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	71’	Surface Elevation:	471.90’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
10-20	8	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
20-30	6	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
30-40	5	NA	30’-33’ Red brown silt, fine sand, black boiler slag, loose, moist; 33’-35’ brown clay, wet, loose	N/A
40-50	8	NA	40’-45’ Brown clay(till), plastic, moist; 45’-50’ gray clay(till), plastic, moist	N/A
50-60	9	NA	50’-59’ Gray silty clay(till); sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, very moist	N/A
60-70	5	NA	Gray to brown sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, wet	N/A
70-71	1	NA	Gray to brown sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, wet	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/13/15-11/17/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 52.42'

Top of Well Casing Elevation: 474.42'

Well Purpose:
Groundwater Monitoring

Northing (Y): 450051.40

Easting (X): 568495.72

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: John Campbell

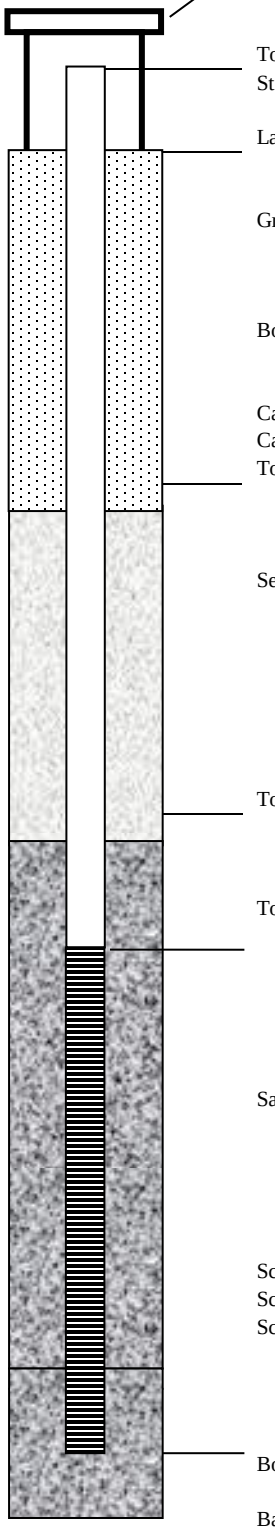
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

18 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 474.42 ft.
Stick-up: 2.52 ft.

Land Surface Elevation: 471.90 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 55 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 59 ft*

Top of Well Screen 61 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 71 ft.*

Base of Borehole: 71 ft.*

Total Depth of Well
Below Top of Casing: 73.52 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-06
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/18/15-11/19/15	AGES Geologist:	John Campbell

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	90’	Surface Elevation:	471.28’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	7	NA	Black boiler slag and ash, loose, fill	N/A
10-20	7	NA	Black boiler slag and ash, loose, fill	N/A
20-30	6	NA	Black boiler slag and ash, loose, fill; 27’-30’ wet	N/A
30-40	6	NA	Black boiler slag and ash, loose, fill, 30’-34’ wet; 34’-36’ brown clay, some silt, hard, damp	N/A
40-50	10	NA	40’-48’ Gray silty clay, soft, very moist, moist 7’-8’; brown silty clay, firm, damp	N/A
50-60	10	NA	Gray silty clay, firm to soft, moist to very moist	N/A
60-70	10	NA	60’-65’ Gray silty clay, firm, moist to very moist; 65’ – 70’ Gray silt, clay, firm, wet	N/A
70-80	4	NA	70’ - 72’ Gray silty clay, firm, moist to very moist; 72’ – 74’ Gray silt, clay, firm, wet; 74’-76’ Gray to brown sand fine, medium, coarse, large and gravel subrounded fine, medium, coarse, large, wet	N/A
80-90	9	NA	80’-88’ Gray to brown sand fine, medium, coarse, large and gravel subrounded fine, medium, coarse, large, wet; 88’- 89’ Gray to brown sand fine, medium, coarse, large to sand fine, medium, wet	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/18/15-11/19/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 3.44 NTUs

Volume Purged: 100 gallons

Static Water-Level* 51.55'

Top of Well Casing Elevation: 473.51'

Well Purpose:
Groundwater Monitoring

Northing (Y): 449470.57

Easting (X): 568402.50

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: John Campbell

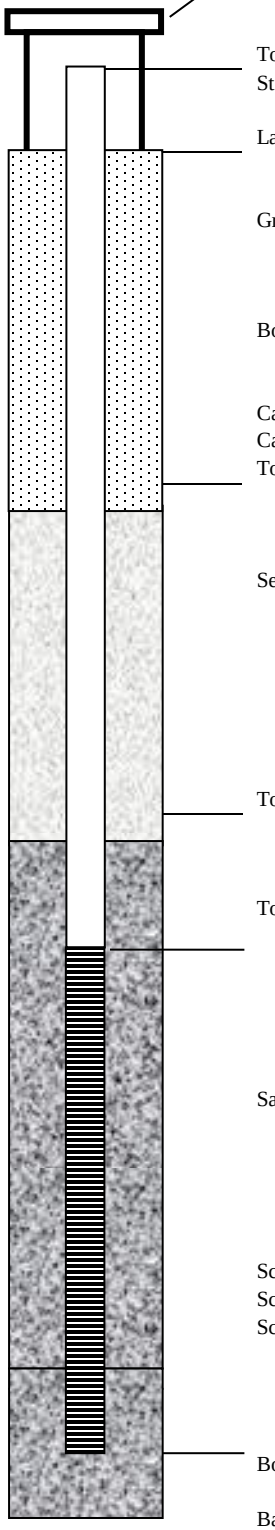
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.51 ft.
Stick-up: 2.23 ft.

Land Surface Elevation: 471.28 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 69.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 73.5 ft*

Top of Well Screen 75.5 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 85.5 ft.*

Base of Borehole: 85.5 ft.*

Total Depth of Well
Below Top of Casing: 87.73 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-07
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/20/15-11/23/15	AGES Geologist:	John Campbell

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	90’	Surface Elevation:	468.82’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	10	NA	Silty clay, some sand, some fine gravel, dense, hard, slightly moist. fill	N/A
10-20	8.5	NA	Brown silty clay, sand and gravel, gray 13’-14.5’, moist to very moist	N/A
20-30	10	NA	20’-28’ Brown with gray silty clay, moist; 28’-30’ brown silty clay, some gravel, trace sand, very moist to wet	N/A
30-40	10	NA	30’-34’ Gray silt, well compacted, damp; 34’-40’ brown silty clay, very hard, damp	N/A
40-50	10	NA	40’-48’ Gray silt, some very fine sand lenses, some clay; 48’-50’ gray silt, clay, moist	N/A
50-60	10	NA	50’-58’ Gray silt, clay, moist; 58’-60’ yellow brown silty clay, moist	N/A
60-70	10	NA	60’-64’ Gray silt, some sand lenses, some clay; 64’-70’ gray silty clay, some roots and organic matter, firm	N/A
70-80	9	NA	70’-78’ Gray silty clay, some roots and organic matter, firm; 78’-80’ Gray silt, some sand lenses, some clay, wet	N/A
80-90	9	NA	80’-83’ Gray sandy silty, clay, wet; 83’-86’ gray silty clay, hard, moist; 86’-90’ gray sand, silt, wood, wet	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/20/15-11/23/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 2.86 NTUs

Volume Purged: 35.5 gallons

Static Water-Level* 41.01'

Top of Well Casing Elevation: 471.31'

Well Purpose:
Groundwater Monitoring

Northing (Y): 448947.93

Easting (X): 567946.39

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: John Campbell

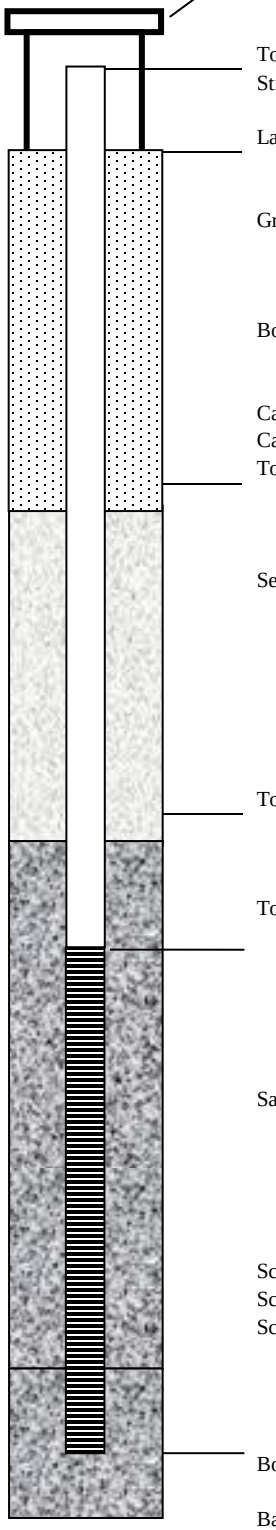
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

14 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.31 ft.
Stick-up: 2.49 ft.

Land Surface Elevation: 468.82 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 36 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 40 ft*

Top of Well Screen 42 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 52 ft.*

Base of Borehole: 90 ft.*

Total Depth of Well
Below Top of Casing: 54.49 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-08

SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/24/15-11/25/15	AGES Geologist:	John Campbell

Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	80’	Surface Elevation:	468.56’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Brown silty clay, some sand and gravel, damp, fill	N/A
10-20	9	NA	Brown silty clay, firm, damp to moist	N/A
20-30	7	NA	Brown silty clay, firm, moist	N/A
30-40	10	NA	30’-37’ Brown silty clay, firm, moist; 37’-40’ gray clay, stiff, slightly plastic, very moist	N/A
40-50	9	NA	40’-44.5’ Gray clay, stiff, slightly plastic, very moist; 44.5’-50’ Gray silt, clay, some very fine sand, wet	N/A
50-60	10	NA	50’-59’ Gray silt, clay, some very fine sand, wet; 59’-60’ gray silty clay, moist	N/A
60-70	8.5	NA	Gray silty and silty clay lenses intermittent, wet	N/A
70-80	9	NA	70’-76’ Gray silty and silty clay lenses intermittent, wet; 76’-79’ gray silty clay, firm, moist	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 4.96 NTUs

Volume Purged: 89.5 gallons

Static Water-Level* 37.02'

Top of Well Casing Elevation: 471.06'

Well Purpose:
Groundwater Monitoring

Northing (Y): 448625.46

Easting (X): 567343.24

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: John Campbell

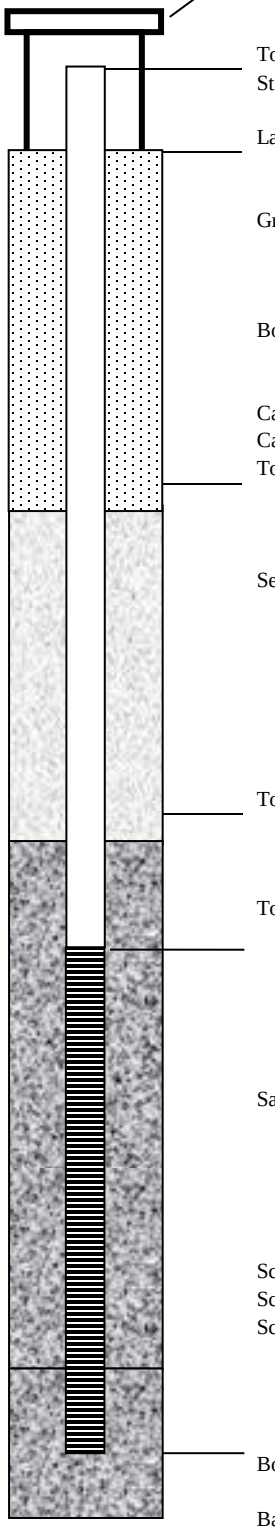
CONSTRUCTION MATERIALS USED:

8 Bags of Sand

4 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.06 ft.

Stick-up: 2.5 ft.

Land Surface Elevation: 468.56 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 46.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 50.5 ft*

Top of Well Screen 52.8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 62.8 ft.*

Base of Borehole: 80 ft.*

Total Depth of Well
Below Top of Casing: 65.3 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-09

SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/5/16-1/6/16	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb.	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	60’	Surface Elevation:	471.21’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-30			Advance augers – no samples	N/A
30-32	1	4-5-7-8	Orange brown silty clay, trace fine sand, stiff, moist	N/A
32-34	1.2	3-6-8-9	Orange brown silty clay, trace fine sand, stiff, moist	N/A
34-36	1.8	3-5-8-7	Orange brown silty clay, trace fine sand, stiff, moist	N/A
36-38	1	2-3-5-7	Orange brown silty clay, trace fine sand, stiff, moist	N/A
38-40	1.6	2-3-4-6	Orange brown silty clay, trace fine sand, stiff, moist	N/A
40-42	1.5	3-3-5-6	Orange brown silty clay, trace fine sand, stiff, moist; to gray last 8”	N/A
42-44	2	3-5-7-8	42’-43’ Orange brown silty clay, trace fine sand, stiff, moist; 43’-44’ Gray silty clay, stiff, moist	N/A
44-46	2	3-4-4-4	44’-44.5’ Gray silty clay, stiff, moist; 44.5’-46’ gray silty fine sand, moist	N/A
46-48	2	1-2-2-3	46’-46.5’ Gray silty fine sand, moist; 46.5’-48’ gray silty clay, fine sand, stiff, plastic, moist	N/A
48-50	2	3-4-4-4	48’-49’ Gray silty clay, fine sand, stiff, plastic, moist; 49’-50’ Orange brown sandy clay fine, stiff, wet	N/A
50-52	2	2-4-4-4	Gray brown sandy silt, fine sand seams, wet	N/A
52-54	2	2-2-3-5	Orange brown sandy silt, fine sand seams, wet	N/A
54-56	2	3-4-5-6	Gray brown sandy silt, fine sand seams, wet	N/A
56-58	2	2-2-2-2	Gray brown sandy silt, fine sand seams, wet	N/A
58-60	2	2-2-3-3	Gray brown sandy silt, fine sand seams, wet	N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/5/16-1/6/16

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 1/19/16

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 3.57 NTUs

Volume Purged: 74.5 gallons

Static Water-Level* 38.52'

Top of Well Casing Elevation: 470.69'

Well Purpose:
Groundwater Monitoring

Northing (Y): 448359.31

Easting (X): 566711.13

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

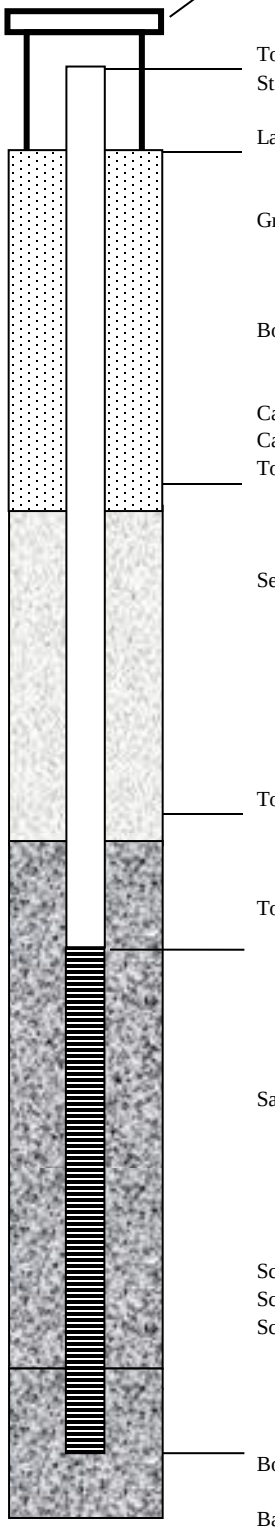
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.

Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 44 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 48 ft*

Top of Well Screen 50 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 60 ft.*

Base of Borehole: 60 ft.*

Total Depth of Well
Below Top of Casing: 59.48 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-10
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/4/16-1/5/16	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb.	and Drop	2ft
Sampling Method:	NA	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water		
Sampling Interval:	NA	Borehole Depth:	56’	Surface Elevation:	471.21’ MSL		

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-30			Advance augers – no samples	N/A
30-32	1.5	4-8-10-11	Orange brown silty clay, trace fine sand, stiff, moist	N/A
32-34	2	4-7-9-12	Orange brown silty clay, trace fine sand, stiff, moist	N/A
34-36	1.5	4-8-10-10	Orange brown silty clay, trace fine sand, stiff, moist	N/A
36-38	1.6	4-4-5-7	36’-37’ Orange brown silty clay, trace fine sand, stiff, moist; 37’-38’ brown gray sandy silt, moist	N/A
38-40	2	3-3-4-4	Brown gray silty clay, stiff, moist	N/A
40-42	2	2-2-3-3	Brown gray silty clay, stiff, moist	N/A
42-44	2	2-2-3-3	Orange brown sandy clay, stiff, plastic, moist	N/A
44-46	2	1-1-2-1	Orange brown sandy clay, stiff, plastic, moist; with 3”-4” fine and medium sand seams, wet	N/A
46-48	2	1-1-1-2	Brown gray sandy clay, stiff, plastic, moist; fine and medium sand seams, wet	N/A
48-50	1	1-2-2-3	Brown gray silty clay, fine sand, wet	N/A
50-52	1.6	2-2-3-4	Brown gray silty clay, fine sand, wet	N/A
52-54	1	1-2-2-3	Brown gray silty clay, fine sand, wet	N/A
54-56	2	1-2-2-2	Brown gray silty clay, fine sand, wet	N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-10

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/4/16-1/5/16

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 1/20/16

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 3.59 NTUs

Volume Purged: 58.5 gallons

Static Water-Level* 39.28'

Top of Well Casing Elevation: 470.69'

Well Purpose:
Groundwater Monitoring

Northing (Y): 448125.51

Easting (X): 566225.21

Comments/Notes:
2 inch PVC riser and screen

10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

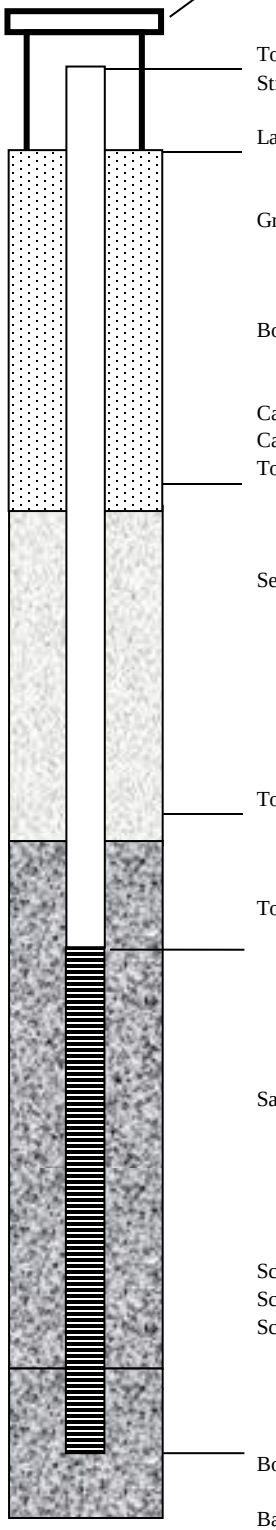
CONSTRUCTION MATERIALS USED:

8.5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.

Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 40 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 44 ft*

Top of Well Screen 46 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 56 ft.*

Base of Borehole: 56 ft.*

Total Depth of Well
Below Top of Casing: 55.48 ft.

*Indicates Depth Below Land Surface

APPENDIX C

WELL DEVELOPMENT DATA

TABLE C-1
SUMMARY OF WELL DEVELOPMENT DATA
KYGER CREEK PLANT
GALLIA COUNTY, OHIO

Well/ Piezometer	Dates	Method	Volume (gal)	Final Turbidity (NTU)
Type I Residual Waste Landfill and Landfill Runoff Collection Pond				
CF-15-04	12/9/2015	Pump	65	0.91
CF-15-05	12/09/2015 - 12/16/2015	Pump	46	4.28
CF-15-06	12/09/2015 - 12/18/2016	Pump/Bail	21	9.59
CF-15-07	12/08/2015 - 12/15/2015	Pump/Bail	13	4.42
CF-15-08	12/8/2015	Pump	100	2.16
CF-15-09	12/08/2015 - 12/16/2015	Pump/Bail	6	3.21
West Boiler Slag Pond				
WBSP-15-01	12/03/2015 - 12/17/2015	Pump/Bail	23	70.8
WBSP-15-02	12/03/2015 - 12/15/2015	Pump	31.5	3.48
WBSP-15-03	12/09/2015 - 12/15/2015	Pump/Bail	15	2.42
WBSP-15-04	12/02/2015 - 12/08/2015	Pump	110	1.37
WBSP-15-05	12/02/2015 - 12/03/2015	Pump	130	1.87
WBSP-15-06	12/03/2015 - 12/09/2015	Pump	100	3.44
WBSP-15-07	12/02/2015 -12/16/2015	Pump/Bail	36	2.86
WBSP-15-08	12/02/2015 - 12/16/2015	Pump	90	4.96
WBSP-15-09	1/08/2016 - 1/19/2016	Pump	59	3.57
WBSP-15-10	1/07/2016 - 1/20/2016	Pump	33	3.59

APPENDIX D

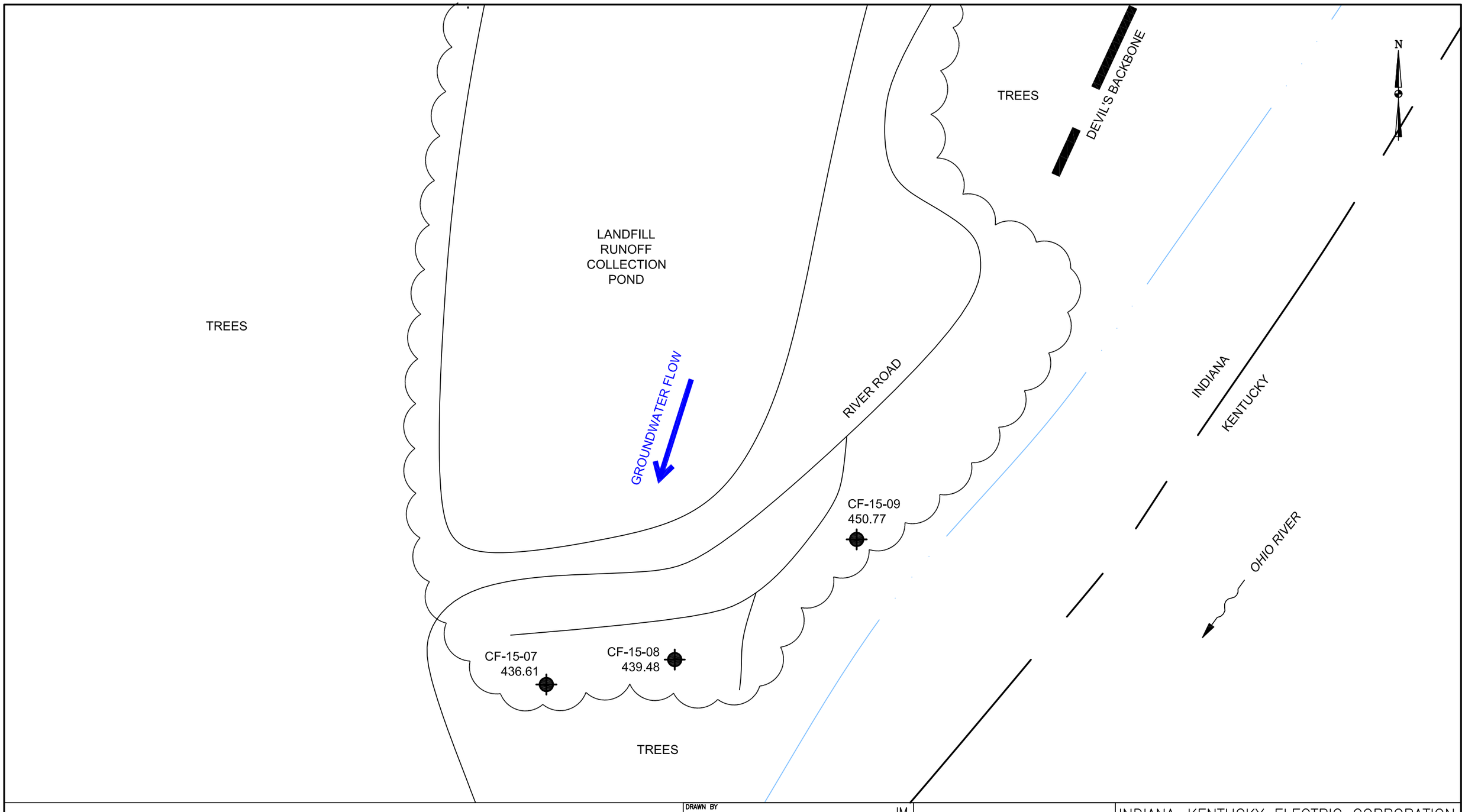
GROUNDWATER LEVELS
January 2016 through May 2016

TABLE D-1
CLIFTY CREEK CREEK PLANT
SUMMARY OF GROUNDWATER ELEVATION DATA
JANUARY 2016 - MAY 2016

Monitoring Well Designation	Jan-16 Groundwater Elevation (ft)	Mar-16 Groundwater Elevation (ft)	May-16 Groundwater Elevation (ft)
LANDFILL AND LANDFILL RUNOFF COLLECTION POND			
CF-15-04	439.83	441.19	441.27
CF-15-05	438.68	439.86	436.25
CF-15-06	432.27	437.12	429.22
CF-15-07	436.61	438.08	437.48
CF-15-08	439.48	440.54	440.88
CF-15-09	450.77	451.58	450.69
WEST BOILER SLAG POND			
WBSP-15-01	451.72	453.01	453.27
WBSP-15-02	468.31	472.52	471.52
WBSP-15-03	477.03	477.11	477.62
WBSP-15-04	429.22	436.25	424.96
WBSP-15-05	428.95	436.12	424.84
WBSP-15-06	428.82	436.06	424.77
WBSP-15-07	429.72	430.41	430.88
WBSP-15-08	434.03	434.62	434.81
WBSP-15-09	432.17	430.39	432.21
WBSP-15-10	431.41	433.28	432.58

APPENDIX E

GROUNDWATER CONTOUR MAPS
January 2016 through May 2016



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg
DRAWING SCALE	AS SHOWN

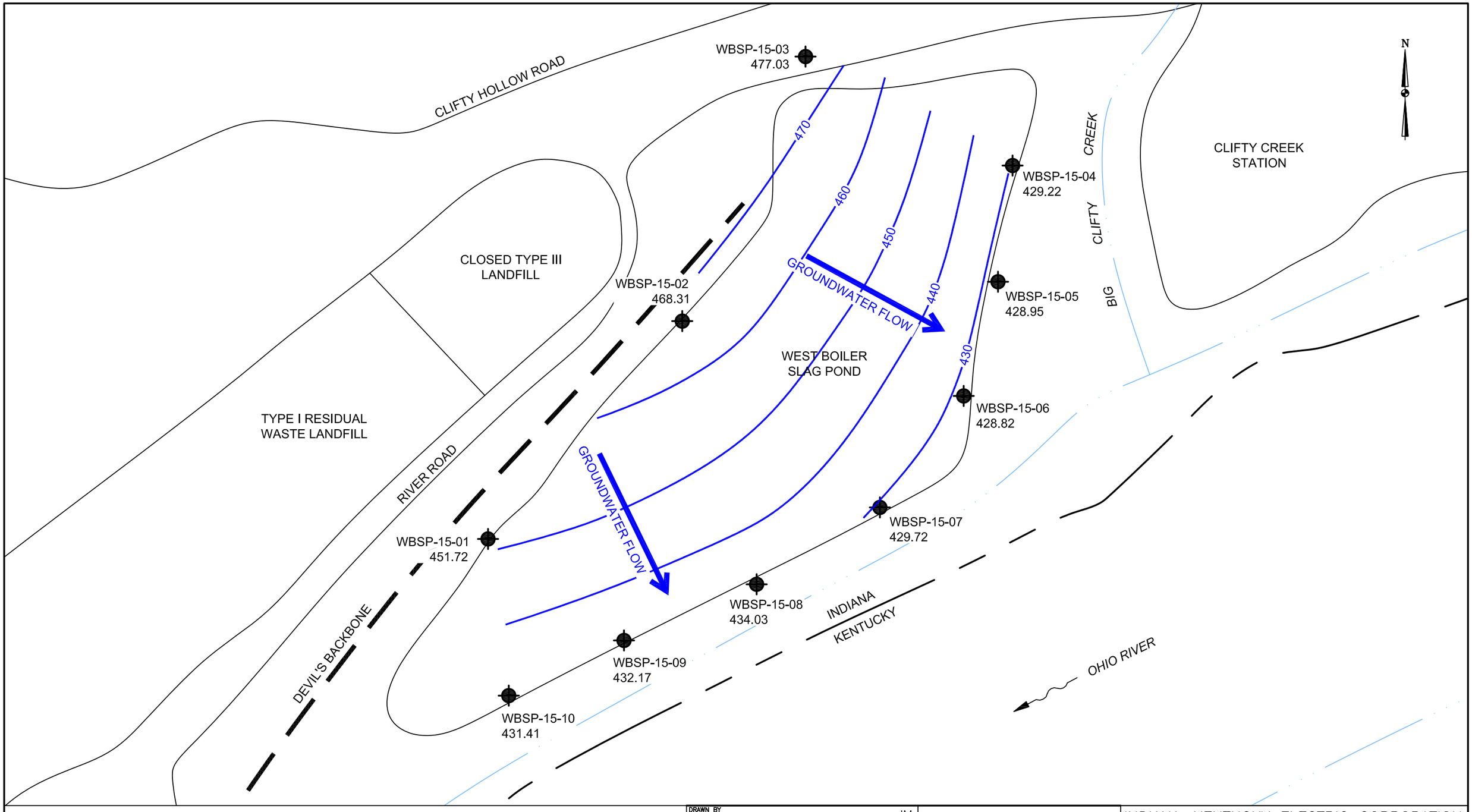
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
GROUNDWATER LEVELS & FLOW DIRECTION-JANUARY 2016

DRAWING NAME: FIGURE E-1

REV.: 0



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

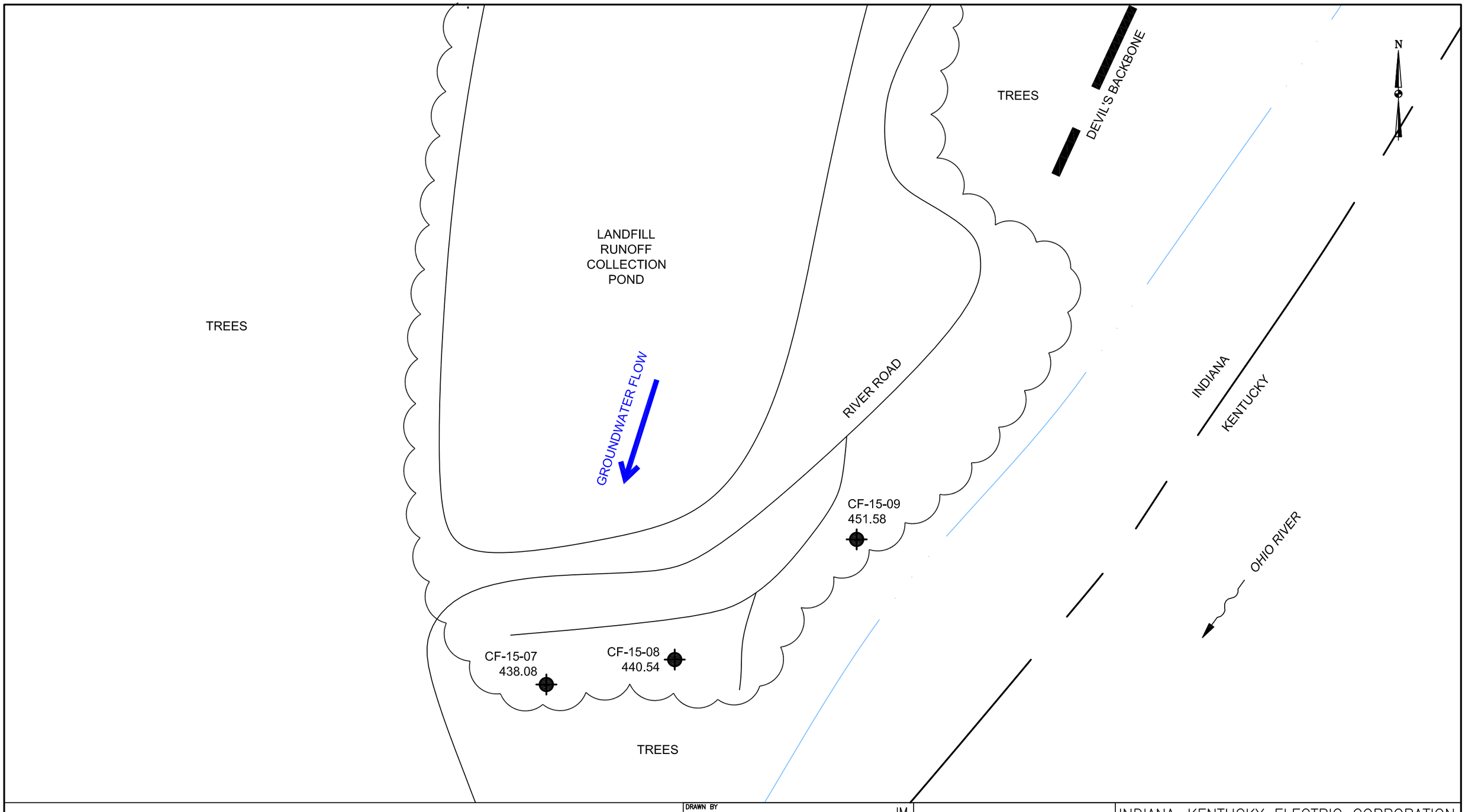
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION-JANUARY 2016

DRAWING NAME: FIGURE E-2

REV. 0

Plot: 10/02/2018 11:32 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg\E-2



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

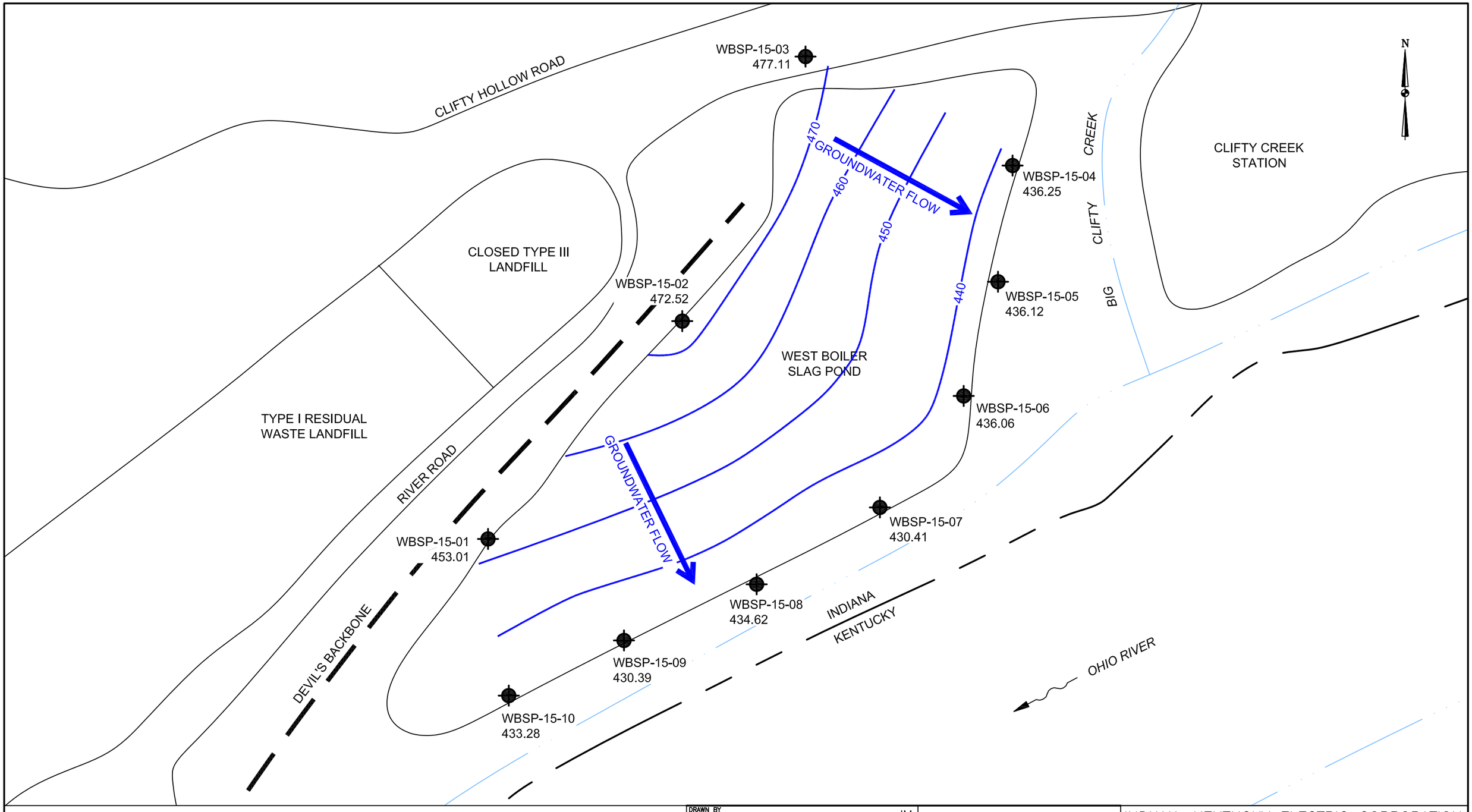
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
GROUNDWATER LEVELS & FLOW DIRECTION-MARCH 2016

DRAWING NAME: FIGURE E-3

REV.: 0



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

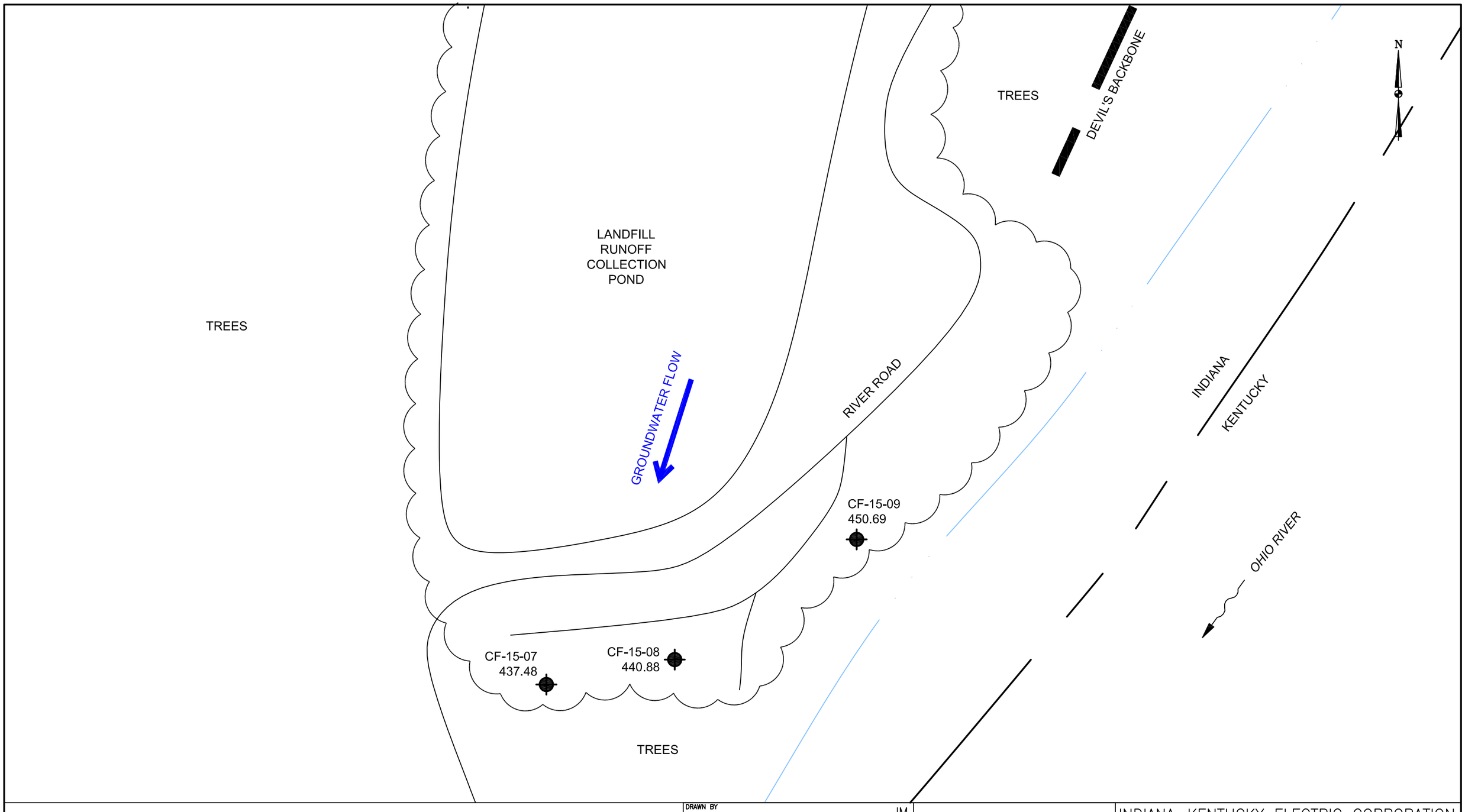
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION-MARCH 2016

DRAWING NAME: FIGURE E-4

REV. 0



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

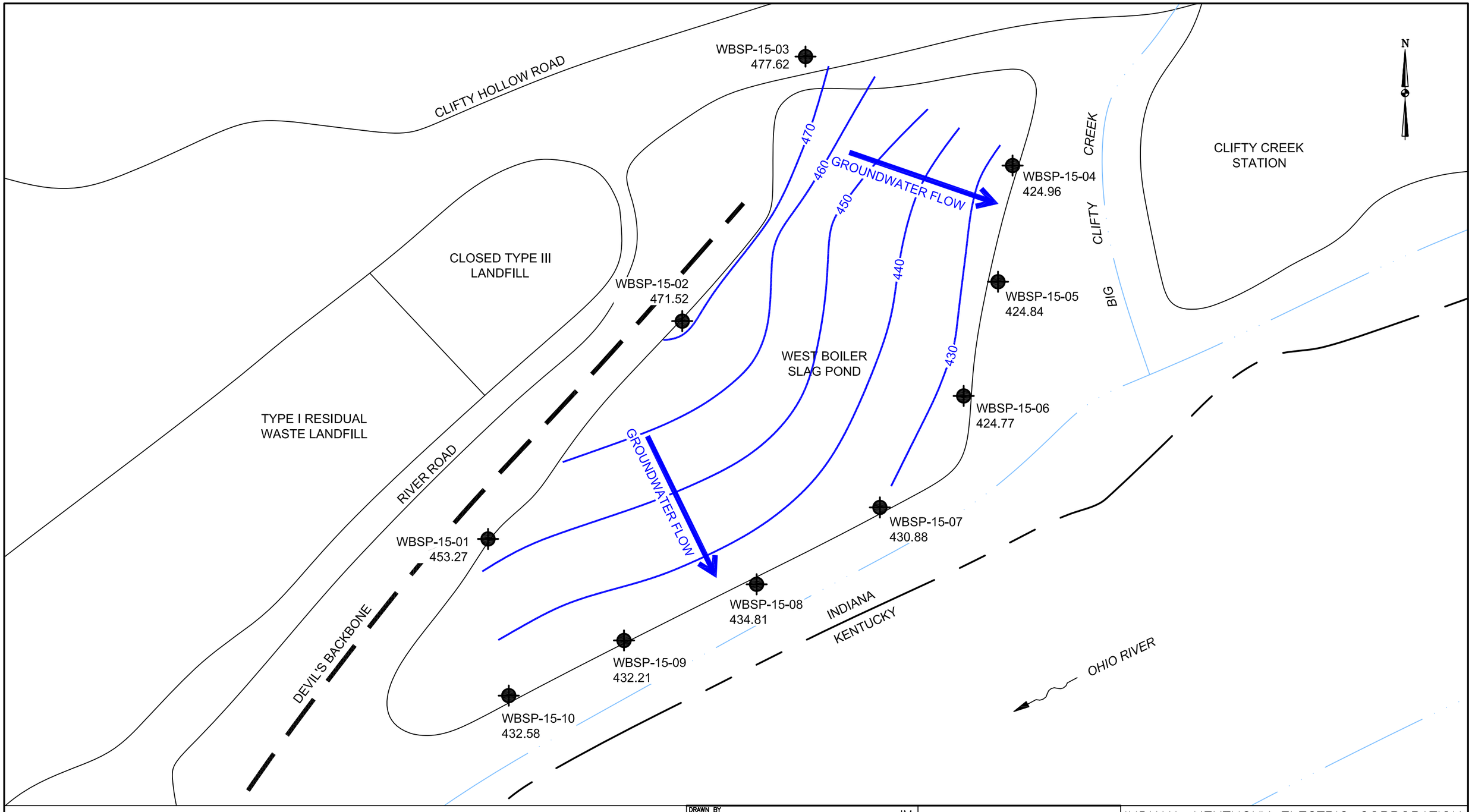
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
GROUNDWATER LEVELS & FLOW DIRECTION-MAY 2016

DRAWING NAME: FIGURE E-5

REV.: 0

Plot: 10/04/2018 10:31 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E-5



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLI
DWG. FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION-MAY 2016

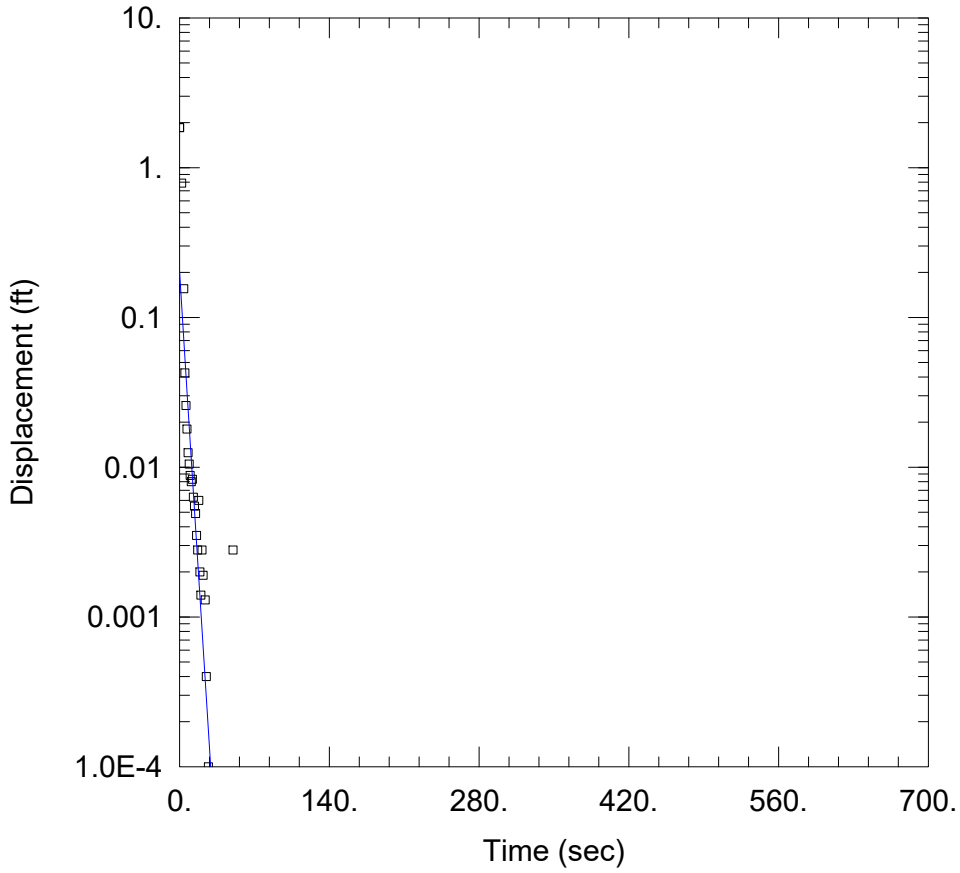
DRAWING NAME: FIGURE E-6

REV.: 0

Plot: 10/02/2018 11:52 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E-6

APPENDIX F

AQUIFER TESTING RESULTS
May 2016



IN-A

Data Set: Y:\...\CF-15-04_IN-A-BR.aqt
Date: 08/19/16 Time: 14:14:21

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

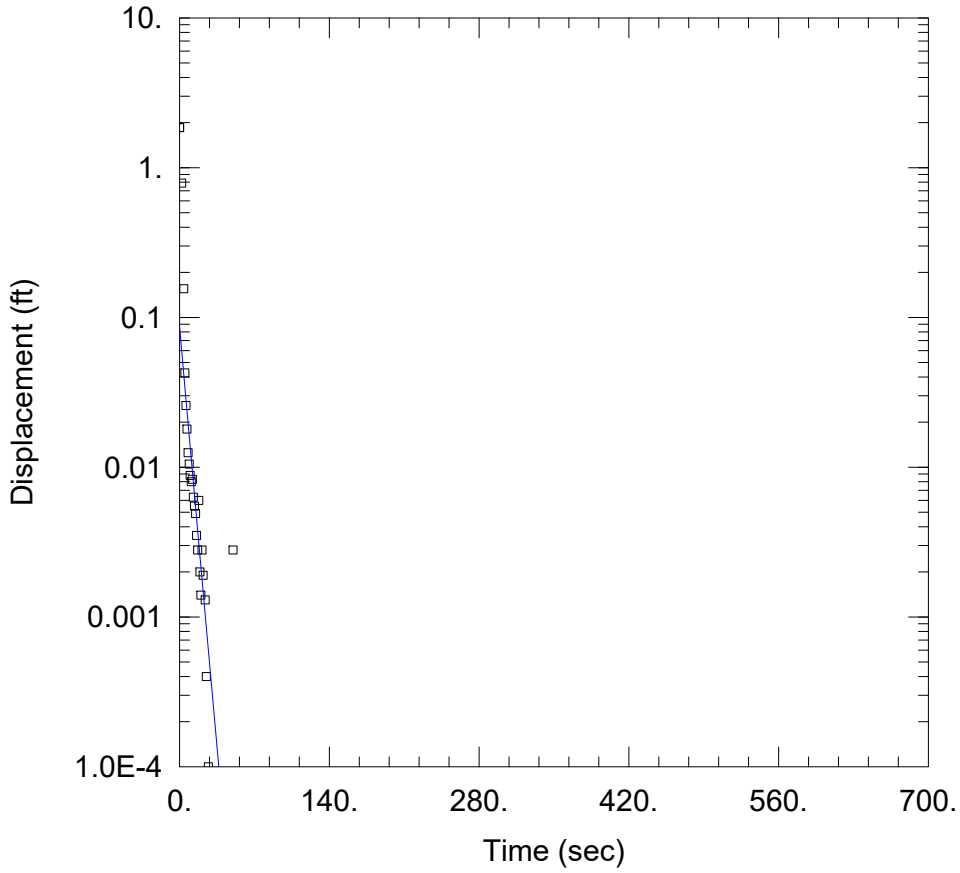
WELL DATA (CF-15-04)

Initial Displacement: 1.851 ft Static Water Column Height: 12.29 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.009257 cm/sec y0 = 0.2015 ft



IN-A

Data Set: Y:\...\CF-15-04_IN-A-H.aqt
Date: 08/19/16 Time: 14:15:09

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

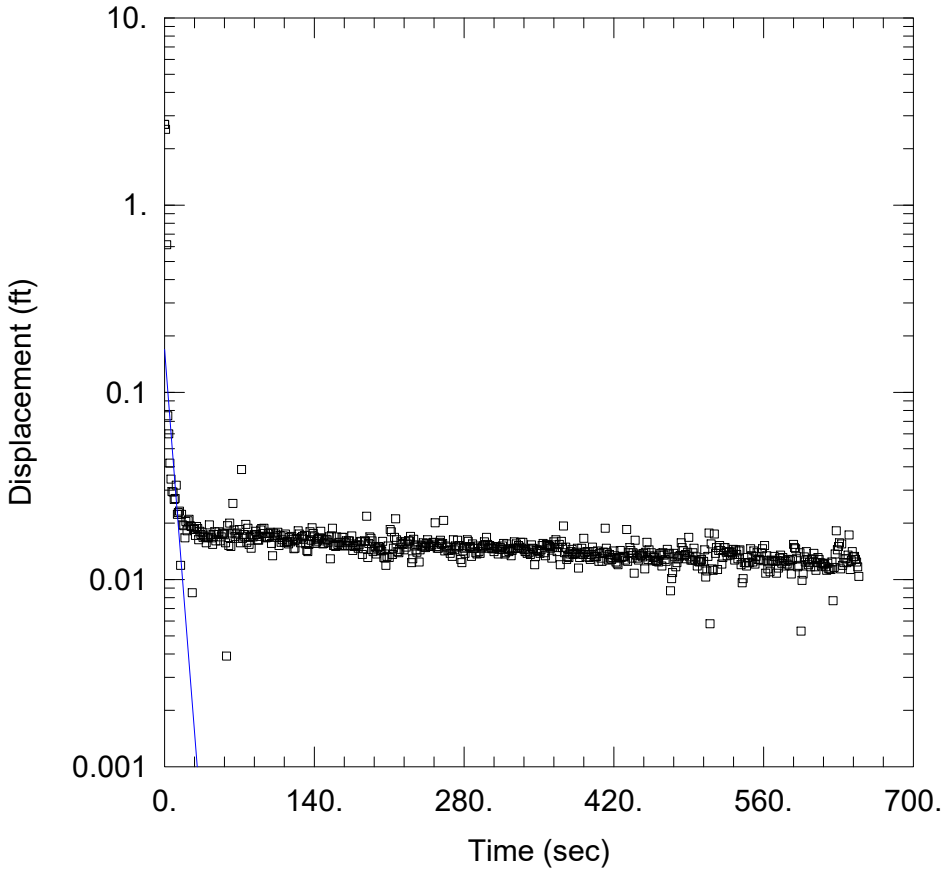
Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-04)

Initial Displacement: 1.851 ft Static Water Column Height: 12.29 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.007934 cm/sec y0 = 0.08653 ft



IN-B

Data Set: Y:\...\CF-15-04_IN-B-BR.aqt
Date: 08/19/16 Time: 14:16:29

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

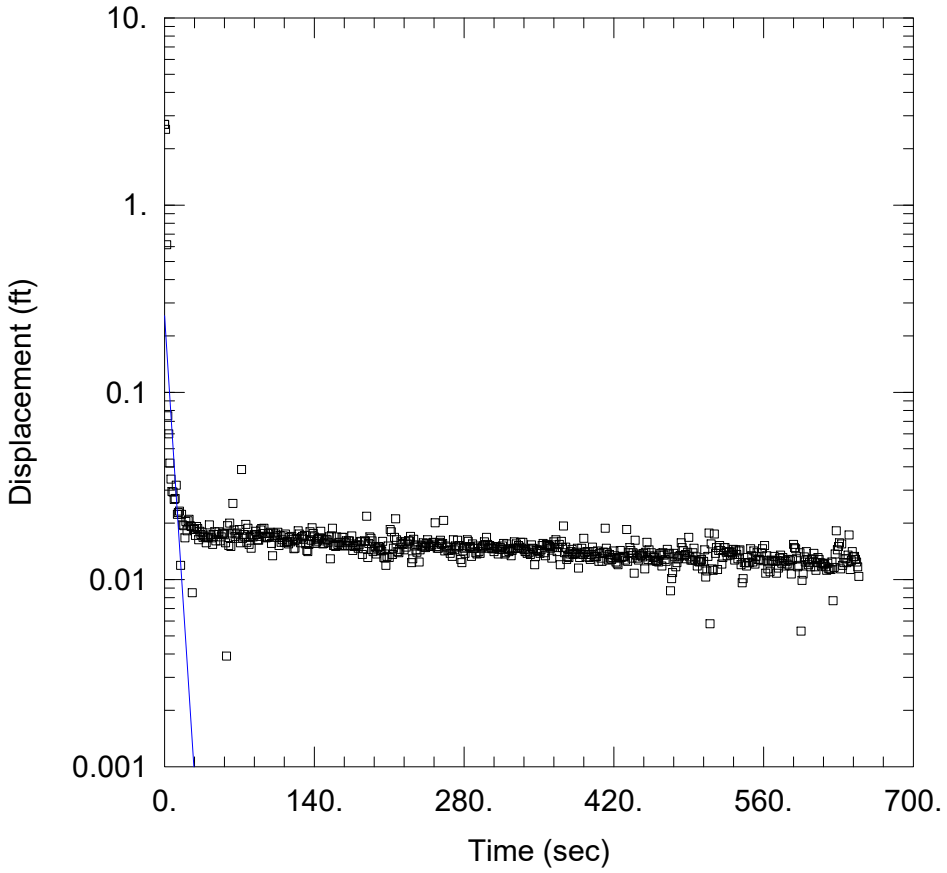
WELL DATA (CF-15-04)

Initial Displacement: 2.697 ft Static Water Column Height: 12.24 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.005947 cm/sec y0 = 0.1693 ft



IN-B

Data Set: Y:\...\CF-15-04_IN-B-H.aqt
Date: 08/19/16 Time: 14:17:22

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

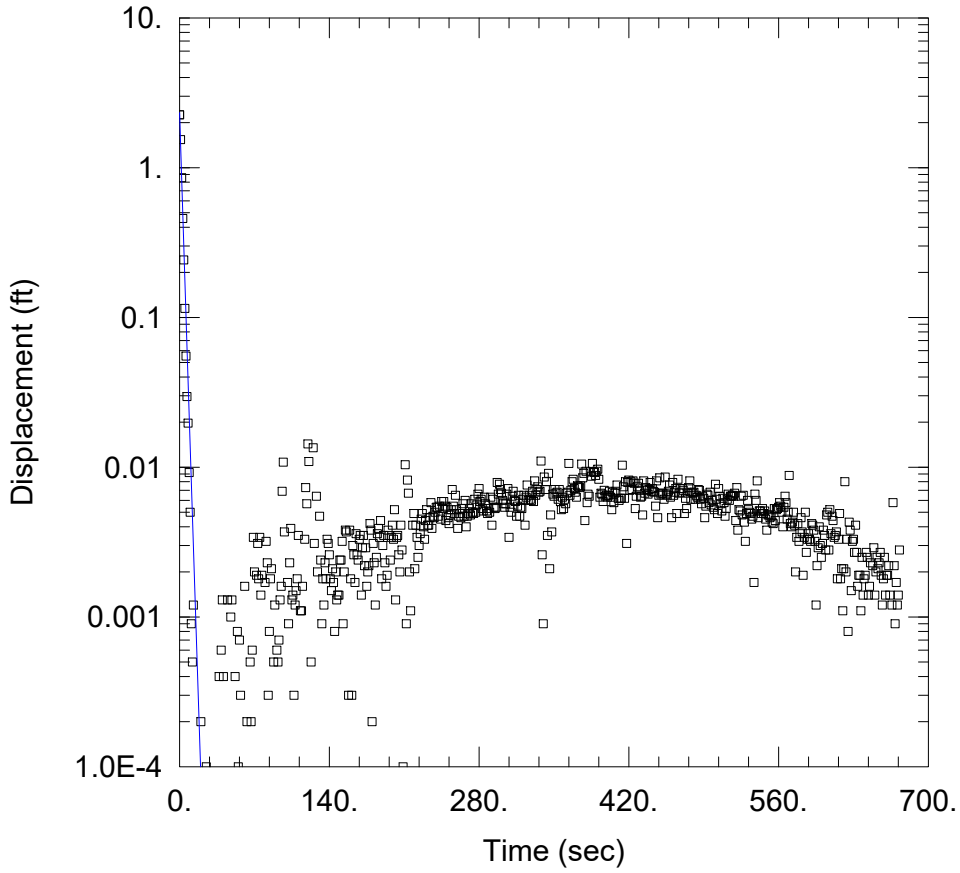
Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-04)

Initial Displacement: 2.697 ft Static Water Column Height: 12.24 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.008677 cm/sec y0 = 0.2563 ft



OUT-A

Data Set: Y:\...\CF-15-04_OUT-A-BR.aqt
Date: 08/19/16 Time: 14:18:16

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

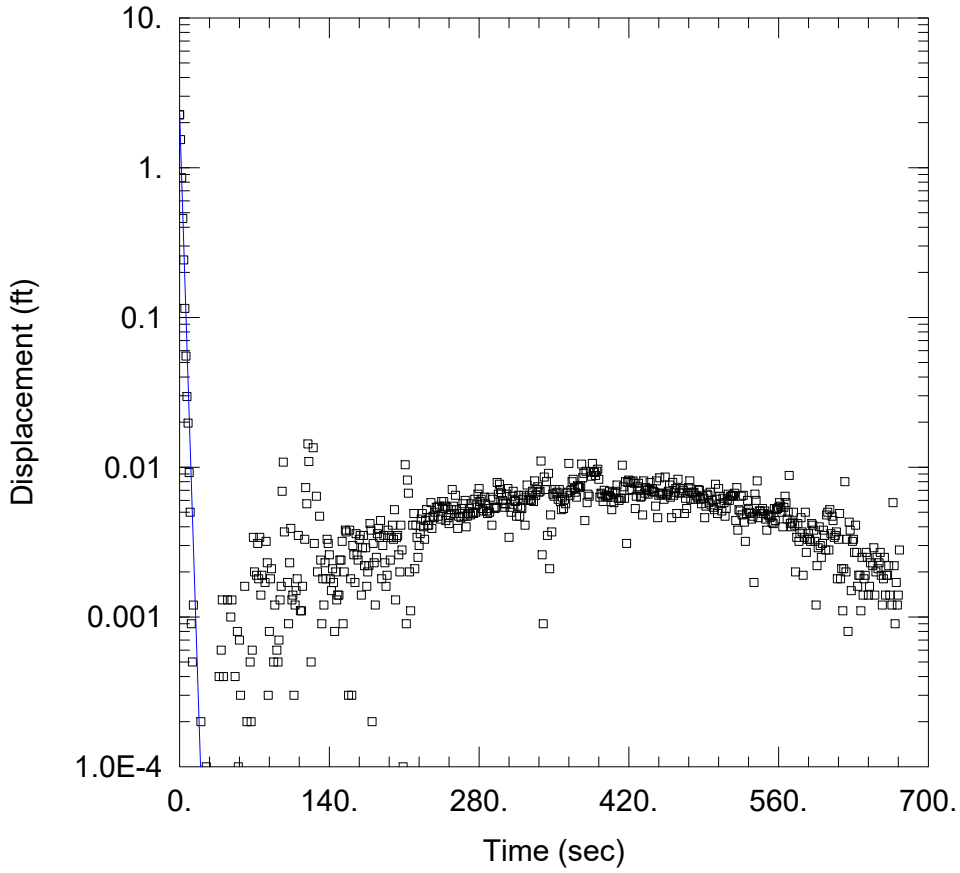
WELL DATA (CF-15-04)

Initial Displacement: 2.254 ft Static Water Column Height: 12.25 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.01815 cm/sec y0 = 2.326 ft



OUT-A

Data Set: Y:\...\CF-15-04_OUT-A-H.aqt
Date: 08/19/16 Time: 14:19:10

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

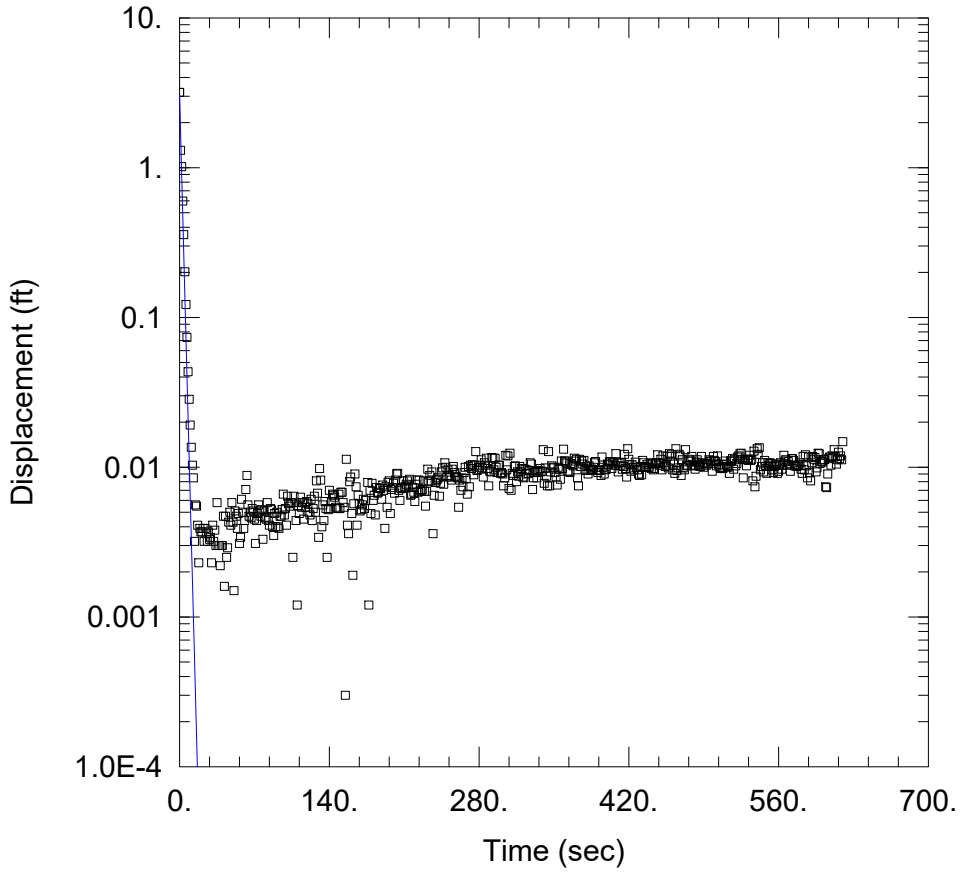
Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-04)

Initial Displacement: 2.254 ft Static Water Column Height: 12.25 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.02206 cm/sec y0 = 2.326 ft



OUT-B

Data Set: Y:\...\CF-15-04_OUT-B-BR.aqt
Date: 08/19/16 Time: 14:20:16

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

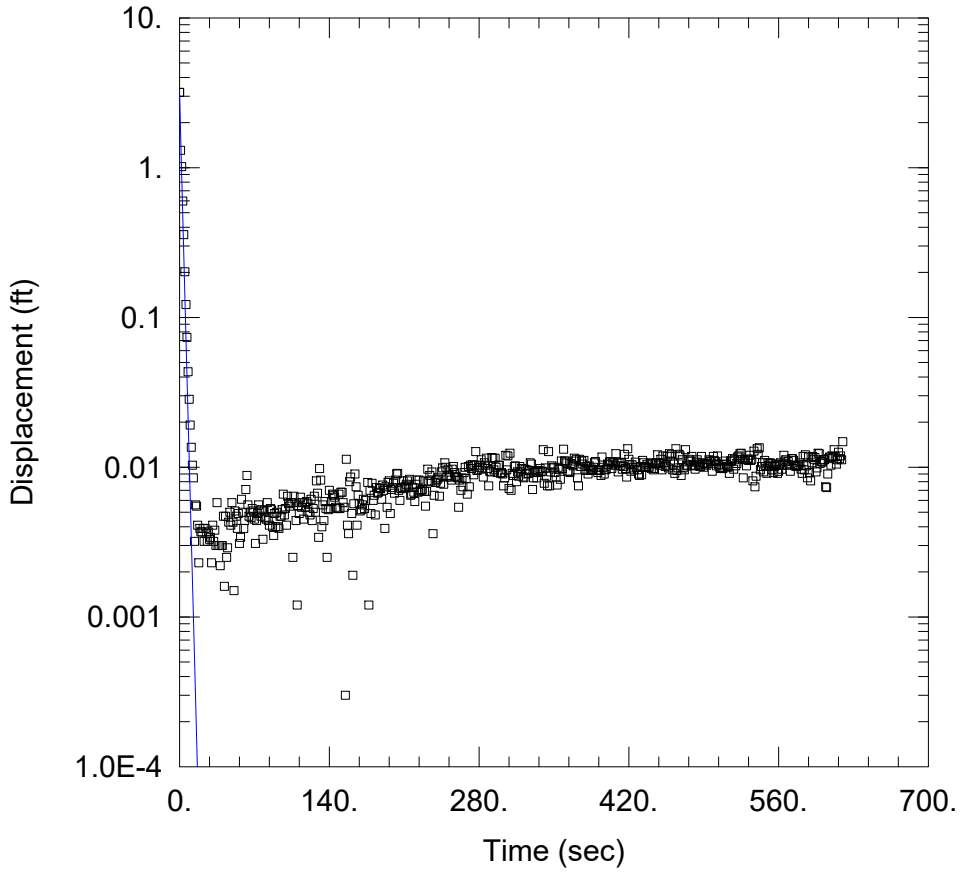
WELL DATA (CF-15-04)

Initial Displacement: 3.18 ft Static Water Column Height: 12.25 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.02184 cm/sec y0 = 3.061 ft



OUT-B

Data Set: Y:\...\CF-15-04_OUT-B-H.aqt
Date: 08/19/16 Time: 14:21:26

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-04
Test Date: 05/17/2016

AQUIFER DATA

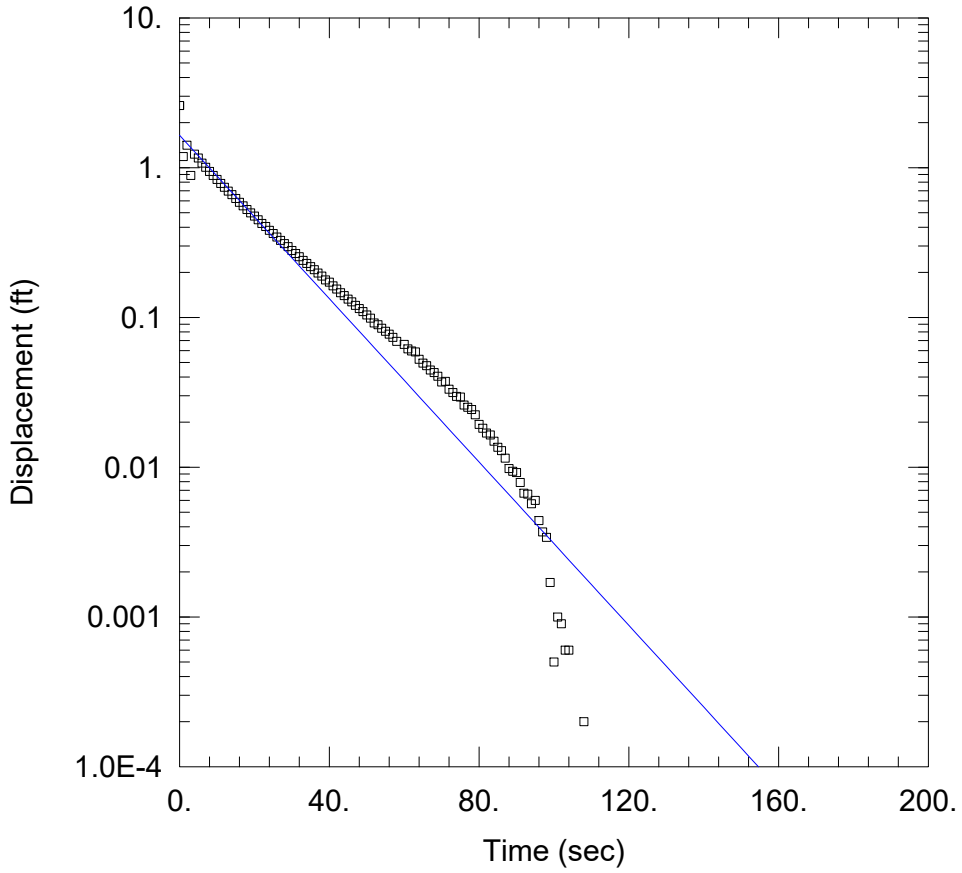
Saturated Thickness: 10.16 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-04)

Initial Displacement: 3.18 ft Static Water Column Height: 12.25 ft
Total Well Penetration Depth: 39. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.02651 cm/sec y0 = 3.061 ft



IN-A

Data Set: Y:\...\CF-15-08_IN-A-BR.aqt
Date: 08/19/16 Time: 14:22:21

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

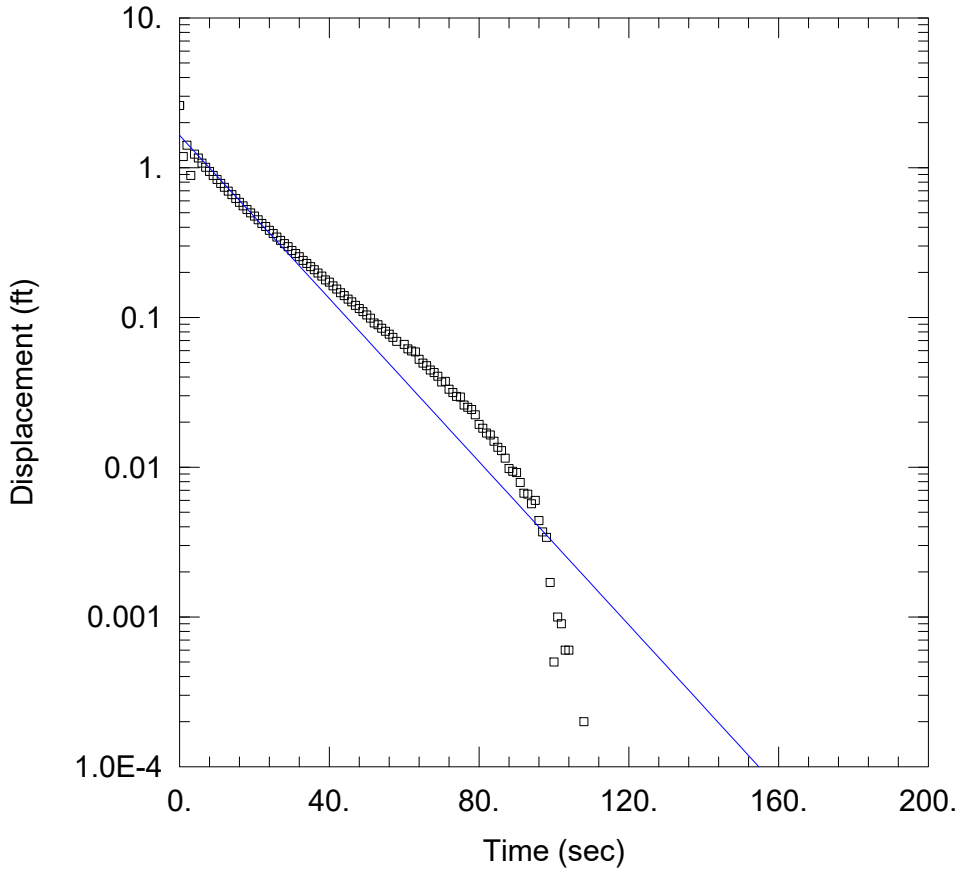
WELL DATA (CF-15-08)

Initial Displacement: 2.599 ft
Total Well Penetration Depth: 41. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.6 ft
Screen Length: 10. ft
Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.002241 cm/sec
y0 = 1.646 ft



IN-A

Data Set: Y:\...\CF-15-08_IN-A-H.aqt
Date: 08/19/16 Time: 14:23:18

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

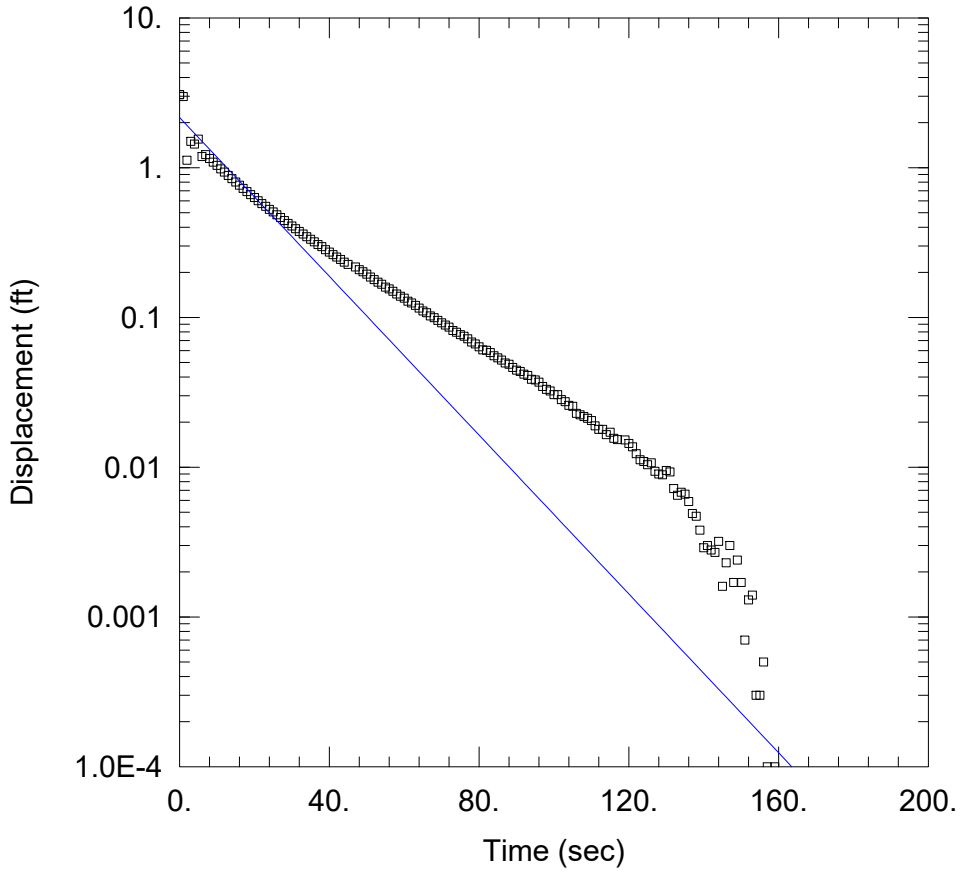
Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-08)

Initial Displacement: 2.599 ft Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.002698 cm/sec y0 = 1.645 ft



IN-B

Data Set: Y:\...\CF-15-08_IN-B-BR.aqt
Date: 08/19/16 Time: 14:24:13

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

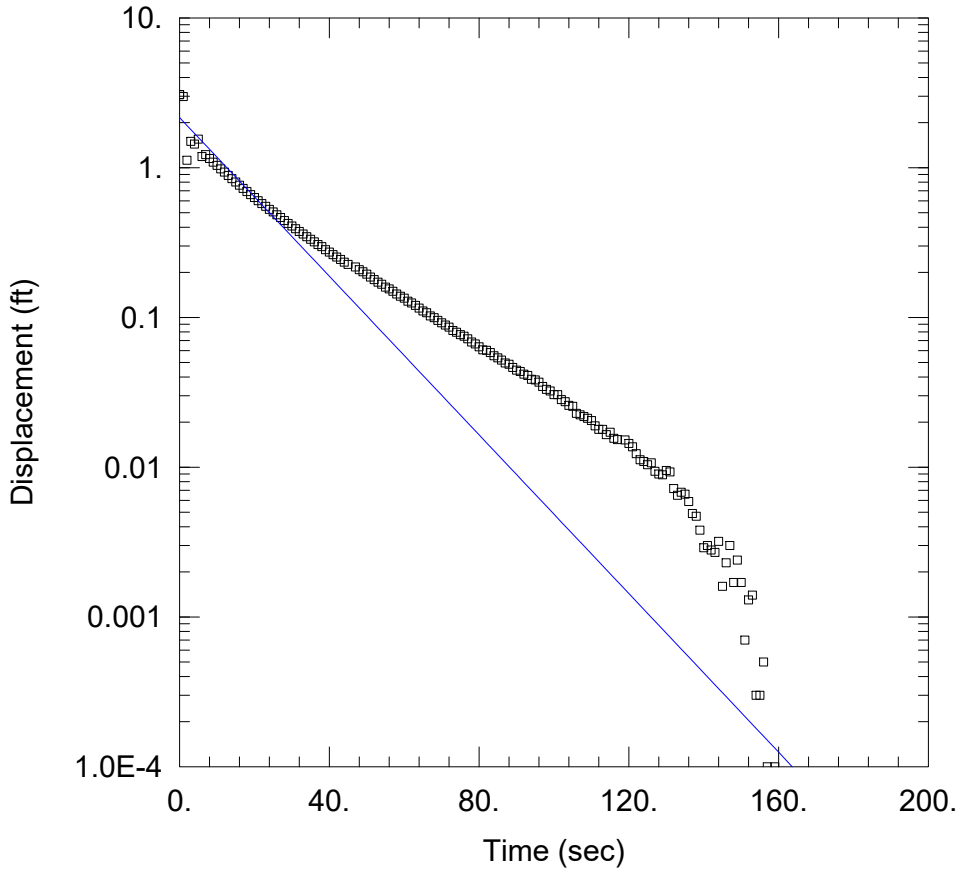
WELL DATA (CF-15-08)

Initial Displacement: 3.077 ft Static Water Column Height: 22.61 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.002179 cm/sec y0 = 2.164 ft



IN-B

Data Set: Y:\...\CF-15-08_IN-B-H.aqt
Date: 08/19/16 Time: 14:25:06

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

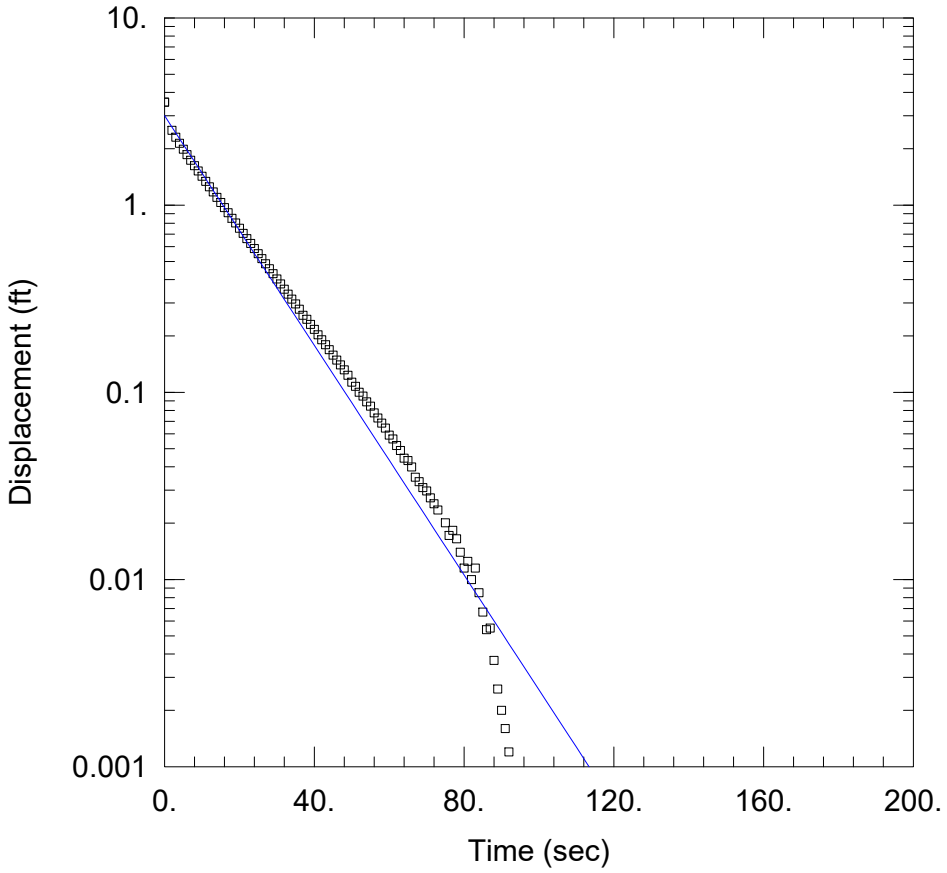
Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-08)

Initial Displacement: 3.077 ft Static Water Column Height: 22.61 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.002622 cm/sec y0 = 2.163 ft



OUT-A

Data Set: Y:\...\CF-15-08_OUT-A-BR.aqt
Date: 08/19/16 Time: 14:25:52

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

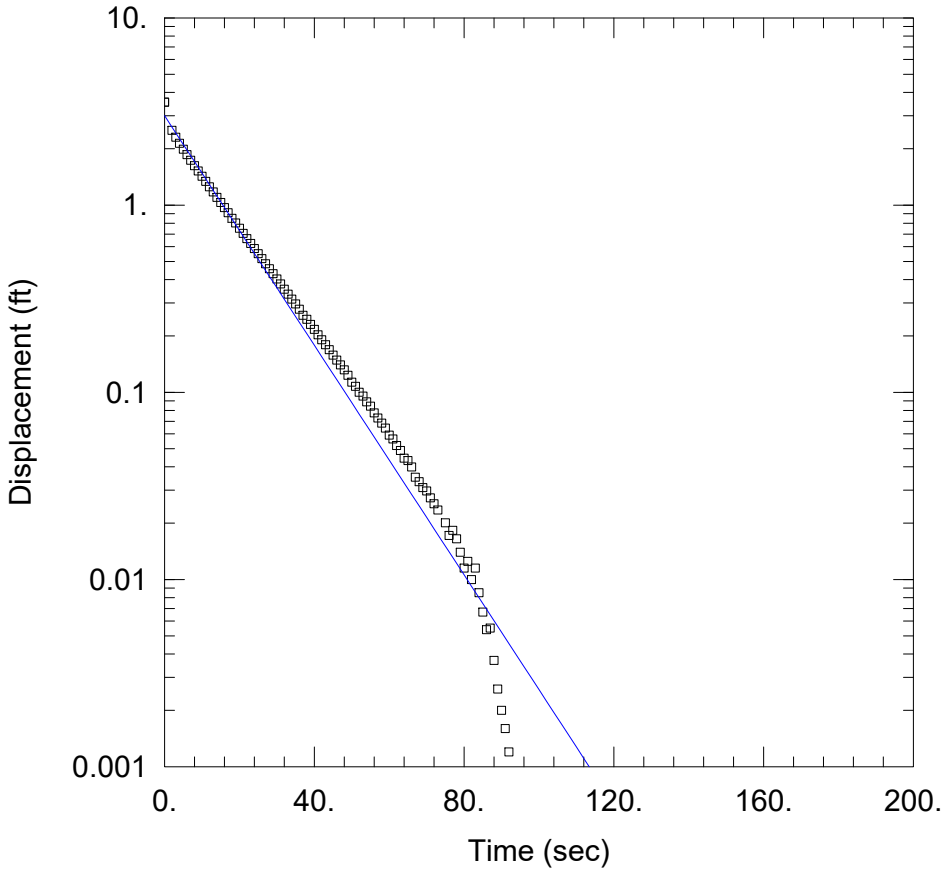
WELL DATA (CF-15-08)

Initial Displacement: 3.549 ft Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.002521 cm/sec y0 = 3.006 ft



OUT-A

Data Set: Y:\...\CF-15-08_OUT-A-H.aqt
Date: 08/19/16 Time: 14:26:41

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

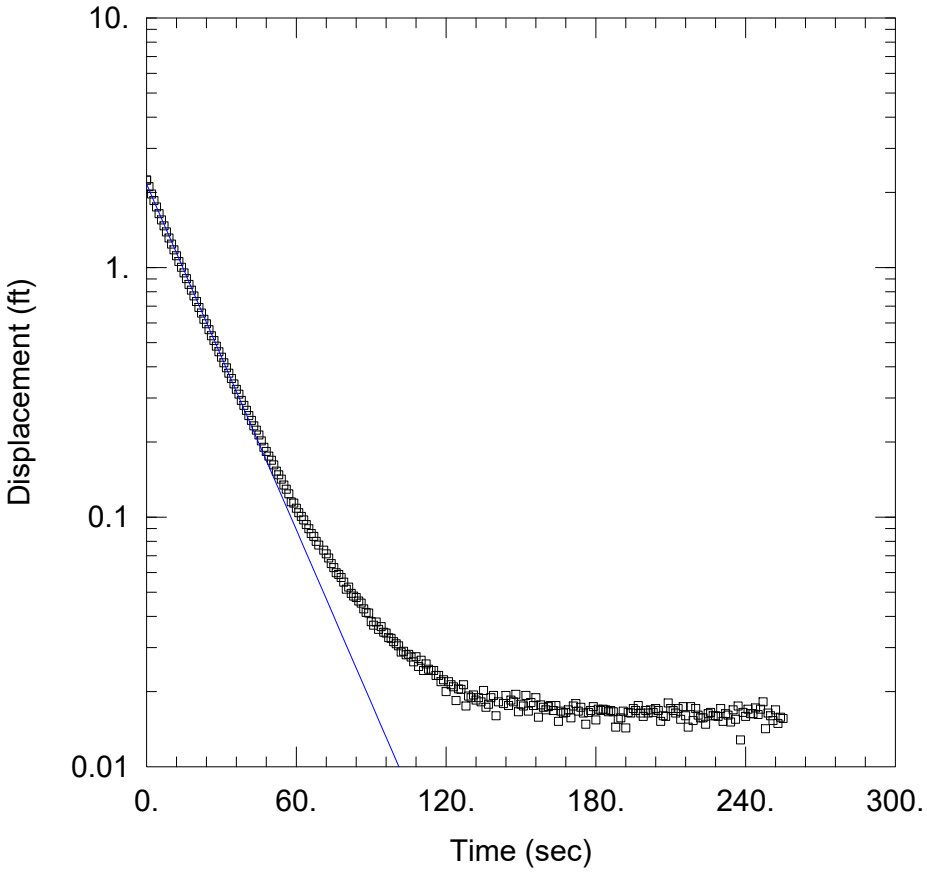
Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-08)

Initial Displacement: 3.549 ft Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.003035 cm/sec y0 = 3.005 ft



OUT-B

Data Set: Y:\...\CF-15-08_OUT-B-BR.aqt
Date: 08/19/16 Time: 14:27:29

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

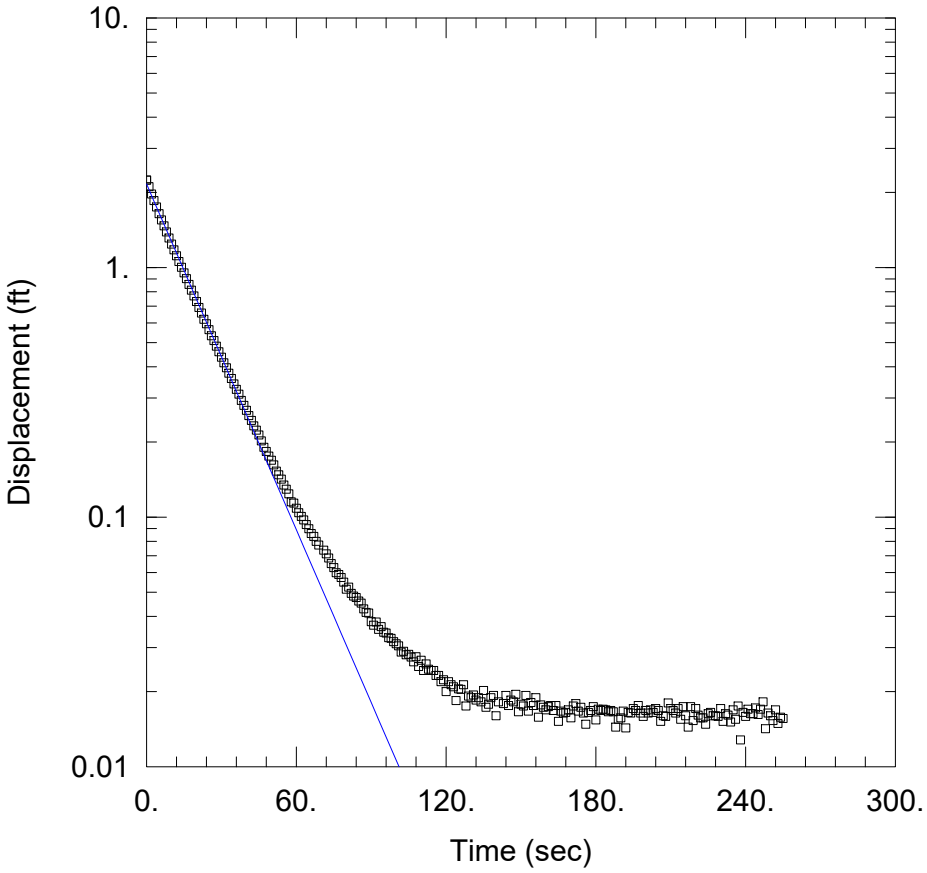
WELL DATA (CF-15-08)

Initial Displacement: 2.239 ft Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.001898 cm/sec y0 = 2.162 ft



OUT-B

Data Set: Y:\...\CF-15-08_OUT-B-H.aqt
Date: 08/19/16 Time: 14:28:16

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: CF-15-08
Test Date: 05/16/2016

AQUIFER DATA

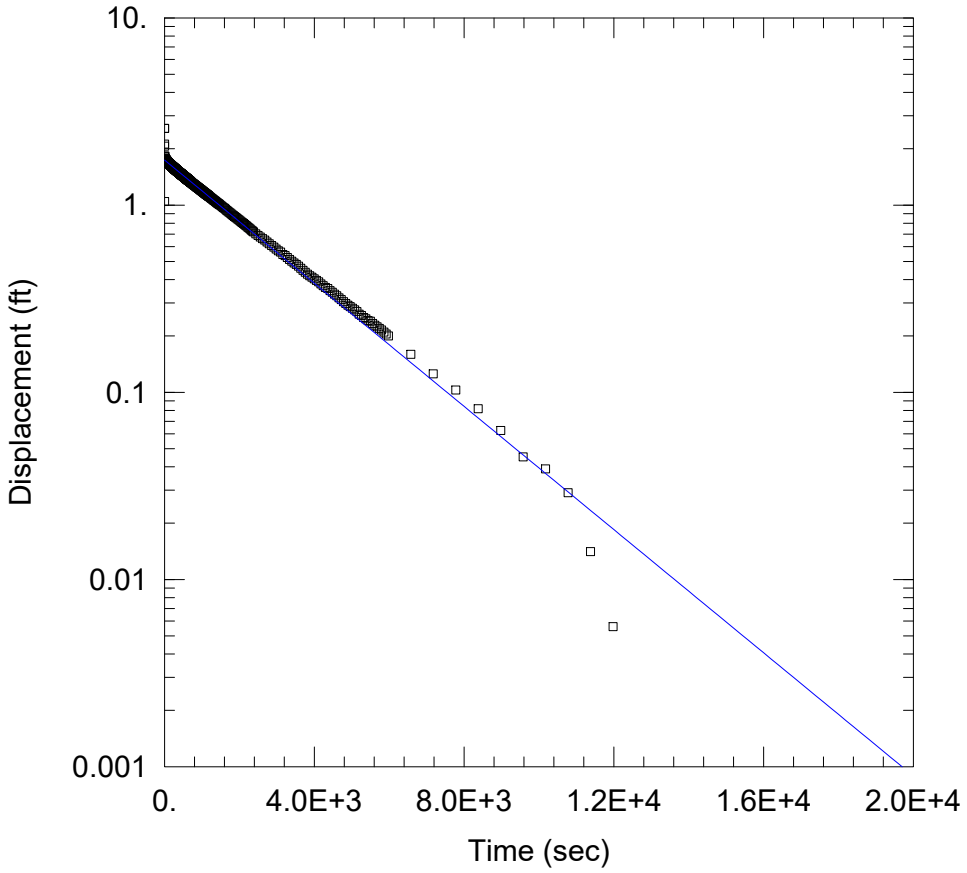
Saturated Thickness: 20.05 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CF-15-08)

Initial Displacement: 2.239 ft Static Water Column Height: 22.6 ft
Total Well Penetration Depth: 41. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.002285 cm/sec y0 = 2.161 ft



IN-B

Data Set: Y:\...\WBSP-15-02_IN-B-BR.aqt
Date: 08/19/16 Time: 14:30:08

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-02
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 17.61 ft Anisotropy Ratio (Kz/Kr): 1.

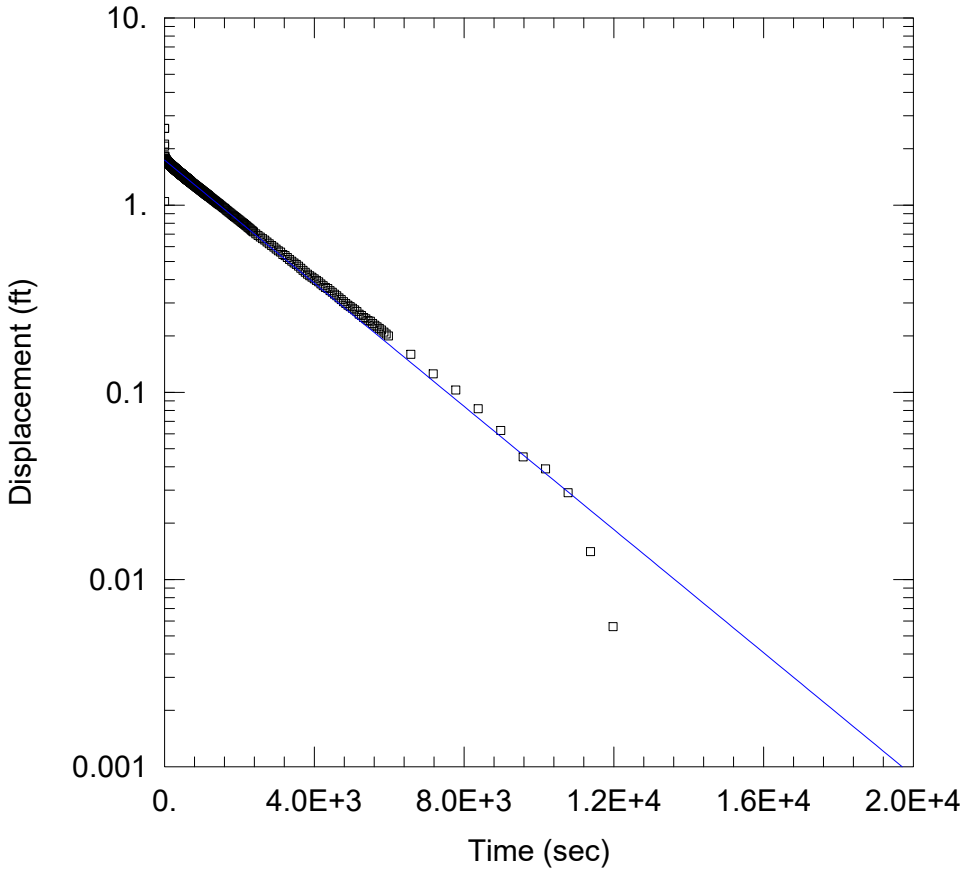
WELL DATA (WBSP-15-02)

Initial Displacement: 2.57 ft
Static Water Column Height: 17.83 ft
Total Well Penetration Depth: 24. ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.232E-5 cm/sec
y0 = 1.741 ft



IN-B

Data Set: Y:\...\WBSP-15-02_IN-B-H.aqt
Date: 08/19/16 Time: 14:30:41

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-02
Test Date: 05/17/2016

AQUIFER DATA

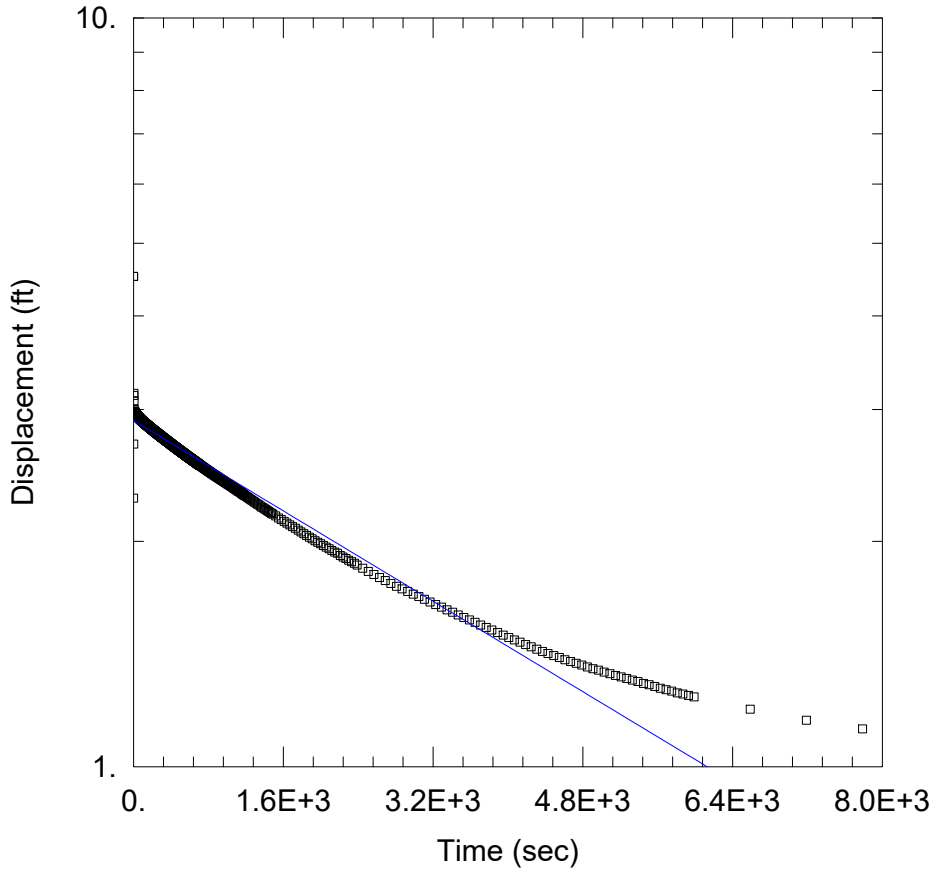
Saturated Thickness: 17.61 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-02)

Initial Displacement: 2.57 ft
Static Water Column Height: 17.83 ft
Total Well Penetration Depth: 24. ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 1.629E-5 cm/sec
y0 = 1.741 ft



OUT-A

Data Set: Y:\...\WBSP-15-02_OUT-A-BR.aqt
Date: 08/19/16 Time: 14:31:45

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-02
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 17.61 ft Anisotropy Ratio (Kz/Kr): 1.

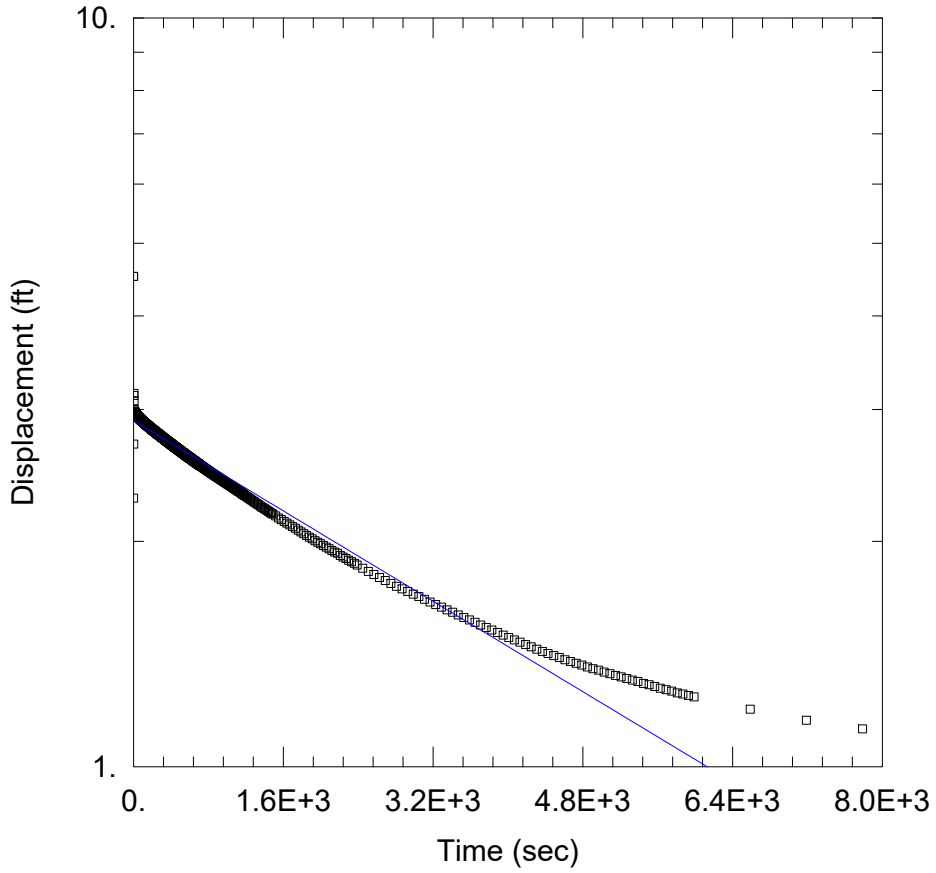
WELL DATA (WBSP-15-02)

Initial Displacement: 4.516 ft Static Water Column Height: 20.8 ft
Total Well Penetration Depth: 24. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 5.652E-6 cm/sec y0 = 2.9 ft



OUT-A

Data Set: Y:\...\WBSP-15-02_OUT-A-H.aqt
Date: 08/19/16 Time: 14:32:32

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-02
Test Date: 05/17/2016

AQUIFER DATA

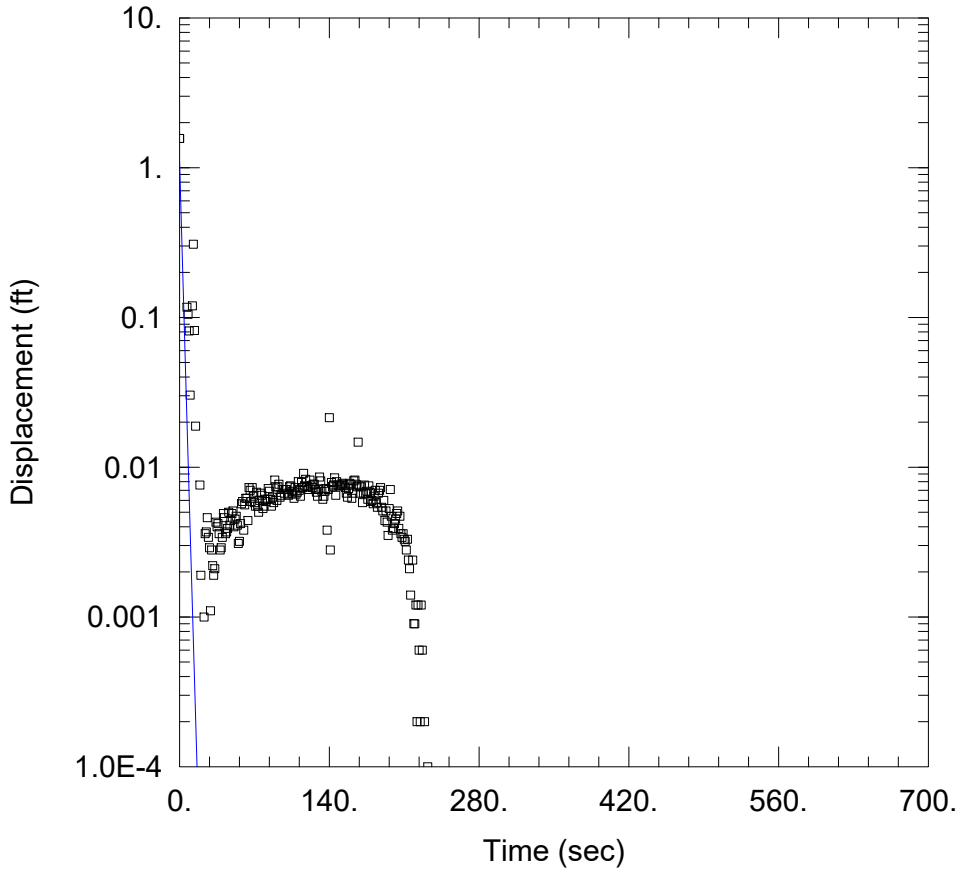
Saturated Thickness: 17.61 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-02)

Initial Displacement: 4.516 ft Static Water Column Height: 20.8 ft
Total Well Penetration Depth: 24. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 7.471E-6 cm/sec y0 = 2.9 ft



IN-A

Data Set: Y:\...\WBSP-15-06_IN-A-BR.aqt
Date: 08/19/16 Time: 14:33:29

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

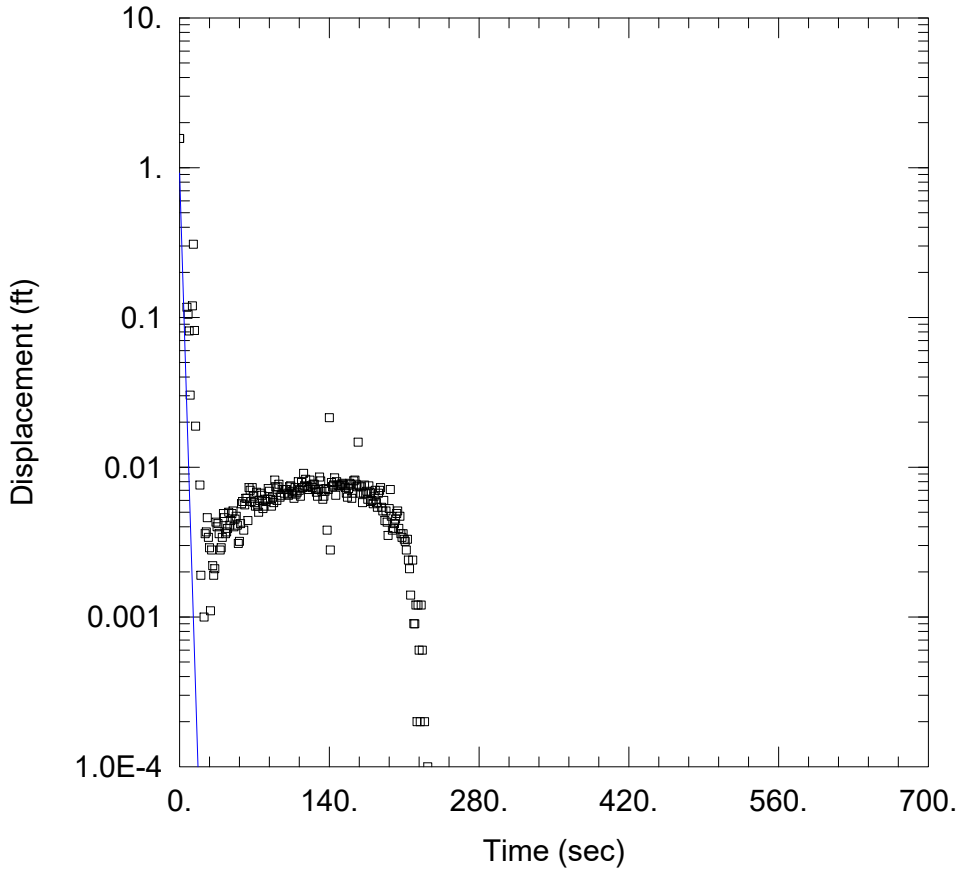
WELL DATA (WBSP-15-06)

Initial Displacement: 1.565 ft Static Water Column Height: 26.69 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.02271 cm/sec y0 = 1.09 ft



IN-A

Data Set: Y:\...\WBSP-15-06_IN-A-H.aqt
Date: 08/19/16 Time: 14:34:42

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

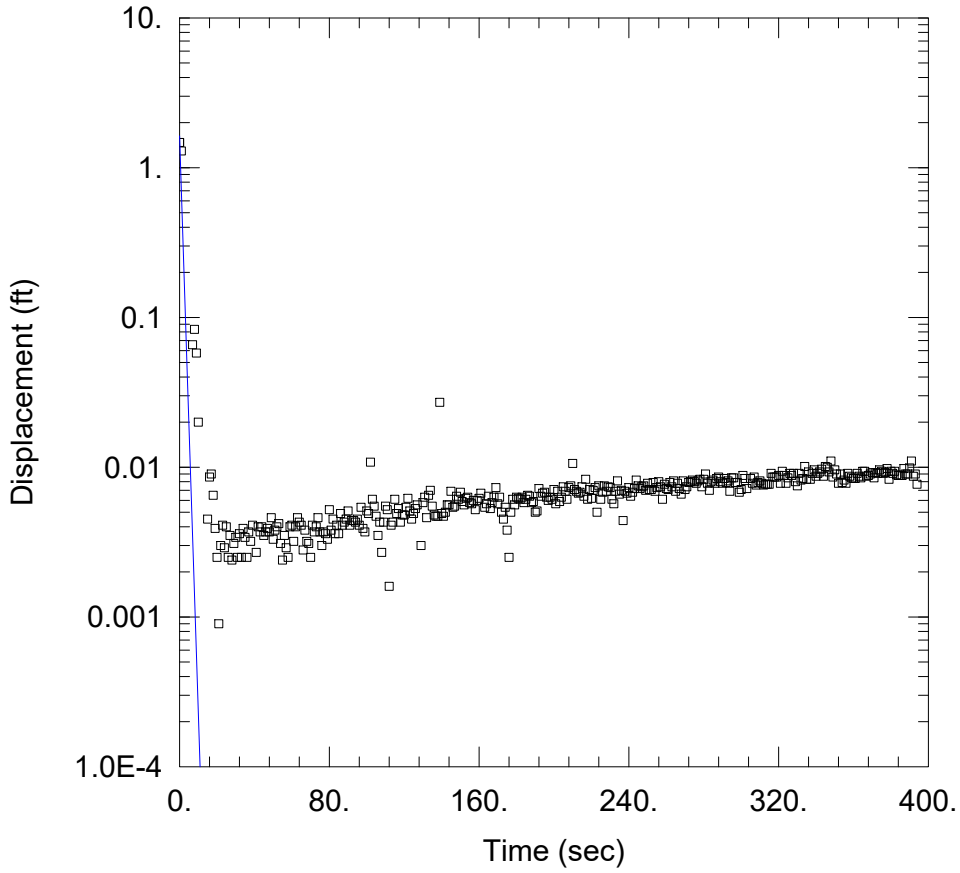
Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-06)

Initial Displacement: 1.565 ft Static Water Column Height: 26.69 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.02271 cm/sec y0 = 0.922 ft



IN-B

Data Set: Y:\...\WBSP-15-06_IN-B-BR.aqt
Date: 08/19/16 Time: 14:35:56

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

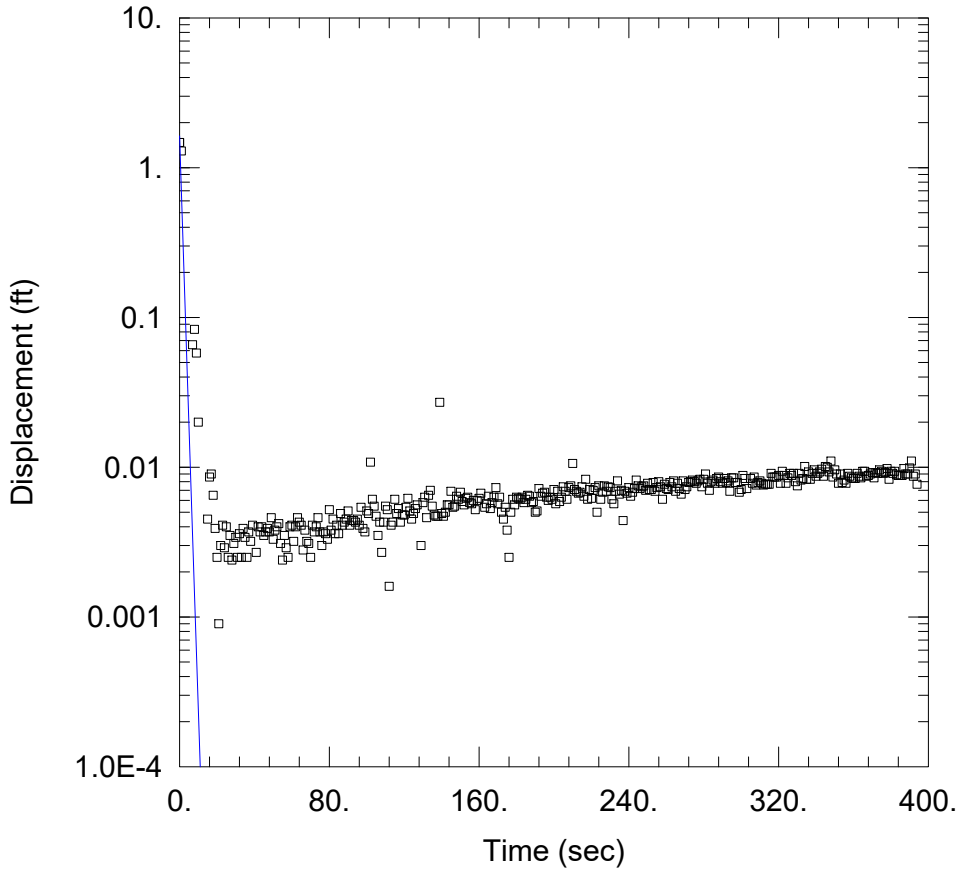
WELL DATA (WBSP-15-06)

Initial Displacement: 1.472 ft Static Water Column Height: 26.64 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.03521 cm/sec y0 = 1.629 ft



IN-B

Data Set: Y:\...\WBSP-15-06_IN-B-H.aqt
Date: 08/19/16 Time: 14:37:05

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

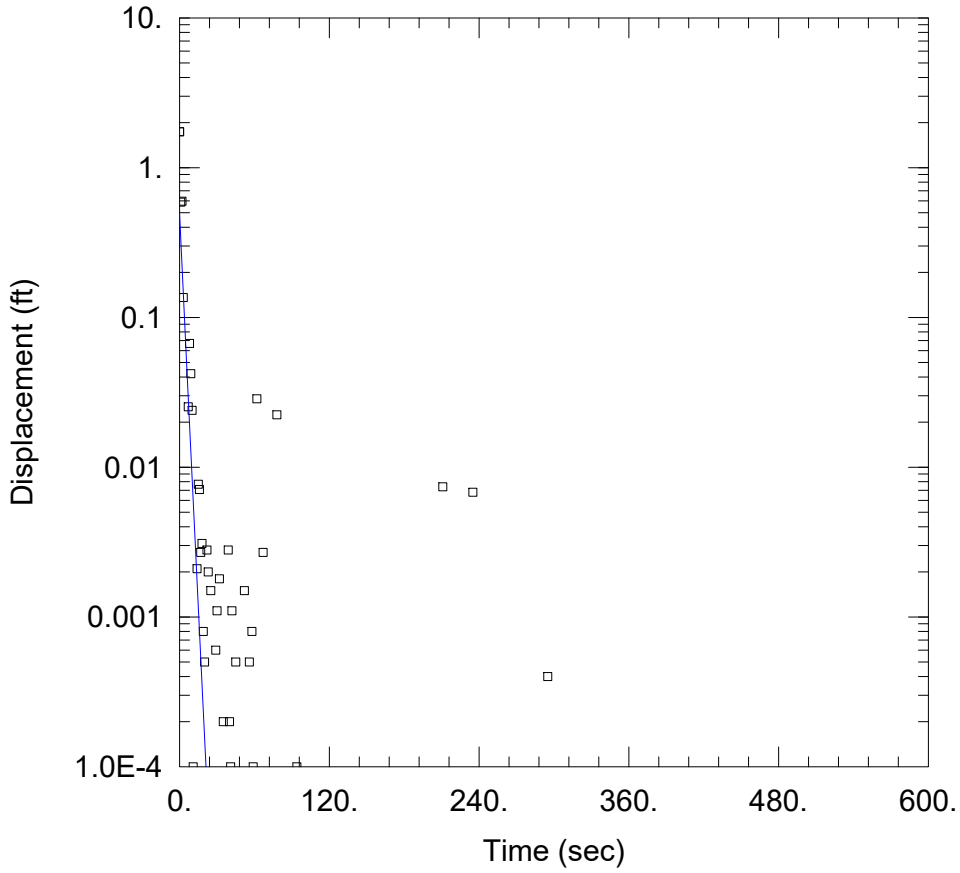
WELL DATA (WBSP-15-06)

Initial Displacement: 1.472 ft Static Water Column Height: 26.64 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 0.03781 cm/sec y0 = 1.628 ft



OUT-A

Data Set: Y:\...\WBSP-15-06_OUT-A-BR.aqt
Date: 08/19/16 Time: 14:38:02

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

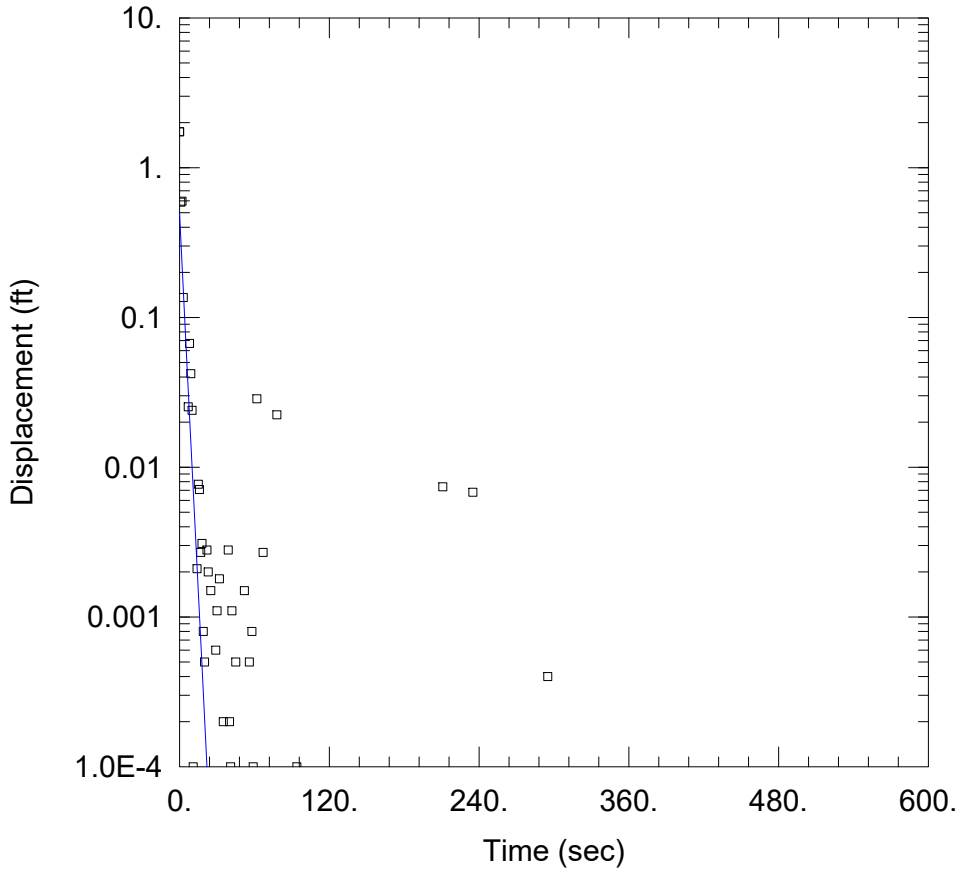
WELL DATA (WBSP-15-06)

Initial Displacement: 1.737 ft Static Water Column Height: 26.6 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.01605 cm/sec y0 = 0.4891 ft



OUT-A

Data Set: Y:\...\WBSP-15-06_OUT-A-H.aqt
Date: 08/19/16 Time: 14:38:52

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

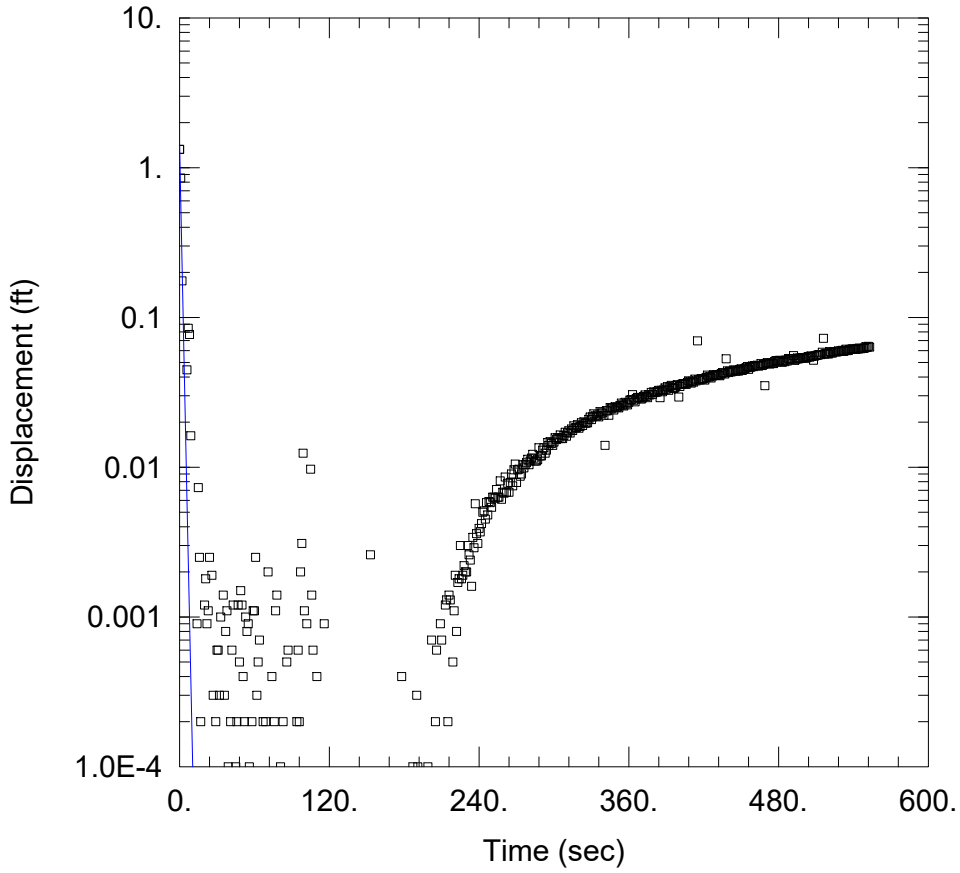
Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-06)

Initial Displacement: 1.737 ft Static Water Column Height: 26.6 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.01657 cm/sec y0 = 0.4891 ft



OUT-B

Data Set: Y:\...\WBSP-15-06_OUT-B-BR.aqt
Date: 08/19/16 Time: 14:39:38

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

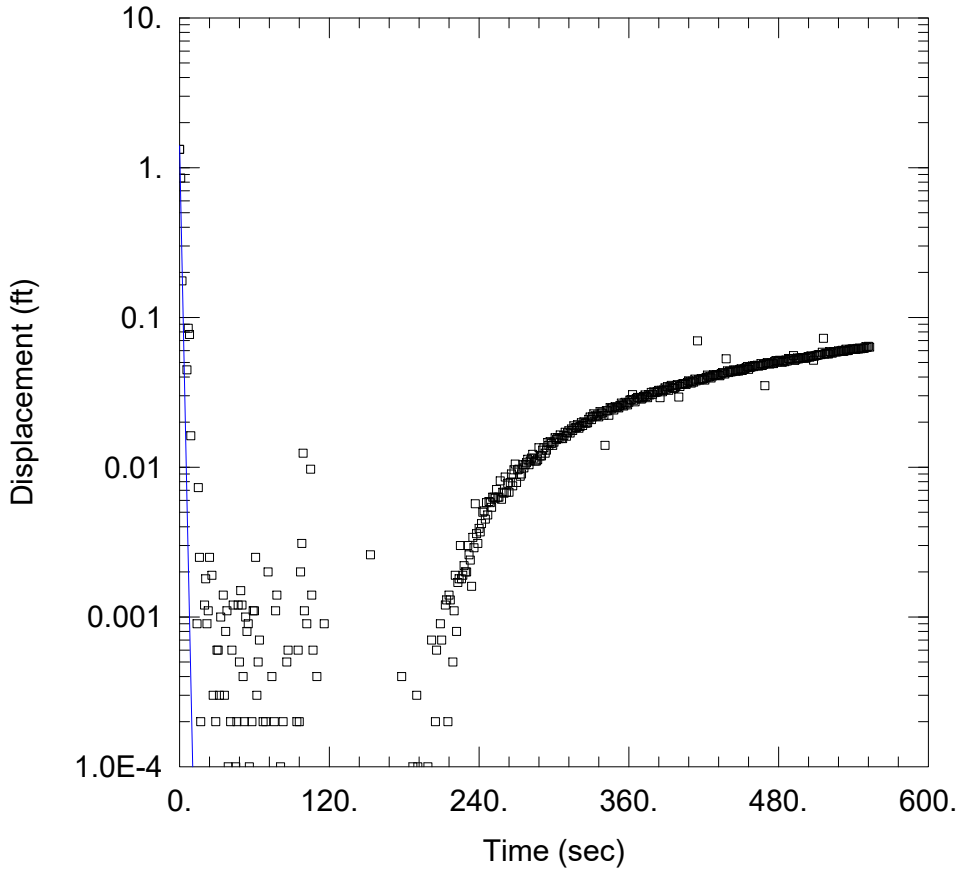
WELL DATA (WBSP-15-06)

Initial Displacement: 1.326 ft Static Water Column Height: 26.66 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.03628 cm/sec y0 = 1.404 ft



OUT-B

Data Set: Y:\...\WBSP-15-06_OUT-B-H.aqt
Date: 08/19/16 Time: 14:40:26

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-06
Test Date: 05/17/2016

AQUIFER DATA

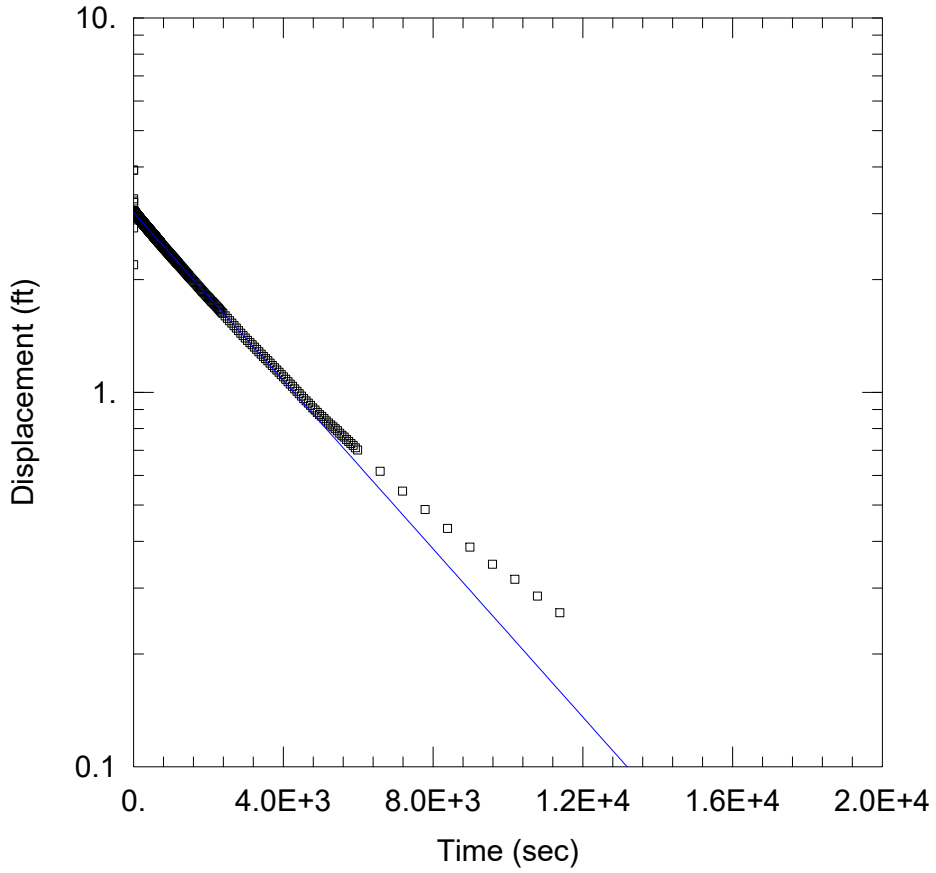
Saturated Thickness: 40.81 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-06)

Initial Displacement: 1.326 ft Static Water Column Height: 26.66 ft
Total Well Penetration Depth: 89. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 0.03906 cm/sec y0 = 1.404 ft



IN-A

Data Set: Y:\...\WBSP-15-07_IN-A-BR.aqt
Date: 08/19/16 Time: 14:41:16

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-07
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 15.17 ft Anisotropy Ratio (Kz/Kr): 1.

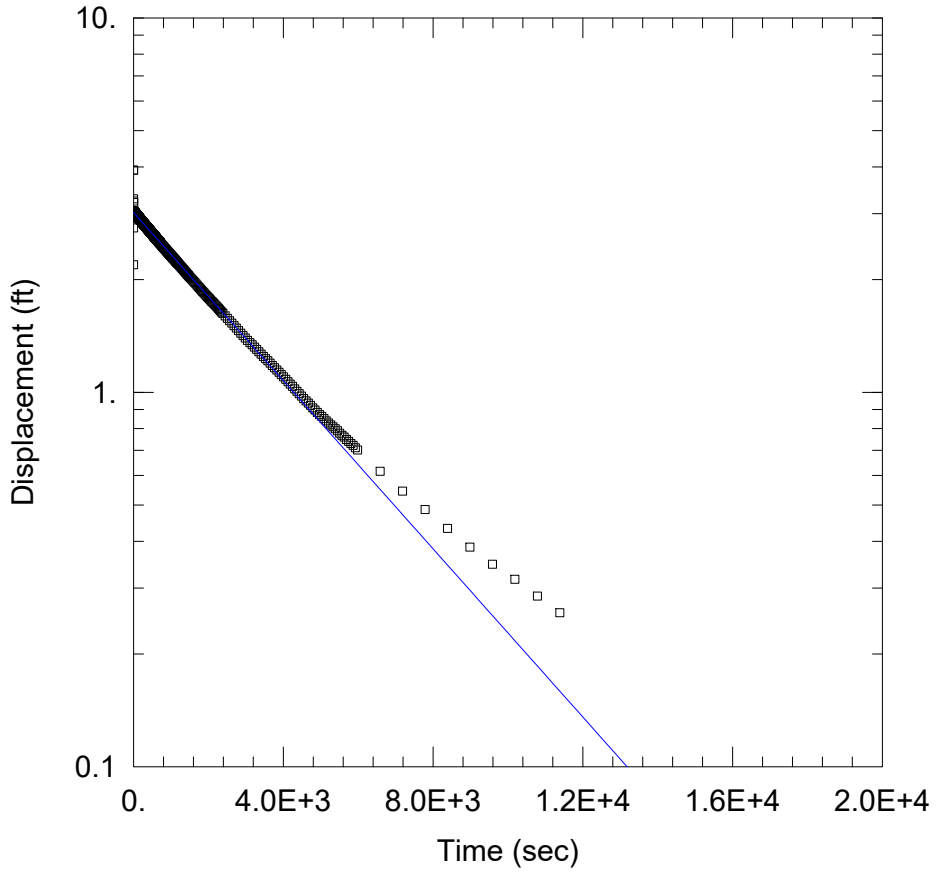
WELL DATA (WBSP-15-07)

Initial Displacement: 3.919 ft Static Water Column Height: 16.94 ft
Total Well Penetration Depth: 55. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 9.663E-6 cm/sec y0 = 3.024 ft



IN-A

Data Set: Y:\...\WBSP-15-07_IN-A-H.aqt
Date: 08/19/16 Time: 14:41:57

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-07
Test Date: 05/17/2016

AQUIFER DATA

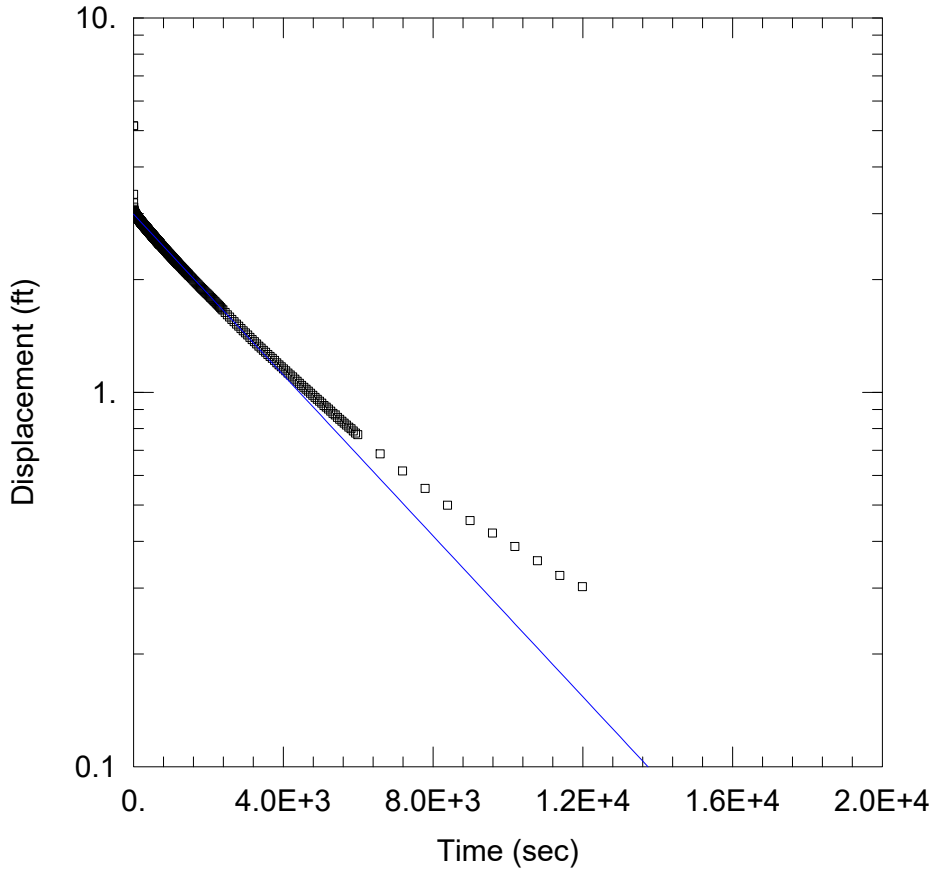
Saturated Thickness: 15.17 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-07)

Initial Displacement: 3.919 ft Static Water Column Height: 16.94 ft
Total Well Penetration Depth: 55. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 1.112E-5 cm/sec y0 = 3.024 ft



OUT-B

Data Set: Y:\...\WBSP-15-07_OUT-B-BR.aqt
Date: 08/19/16 Time: 14:42:48

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-07
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 15.17 ft Anisotropy Ratio (Kz/Kr): 1.

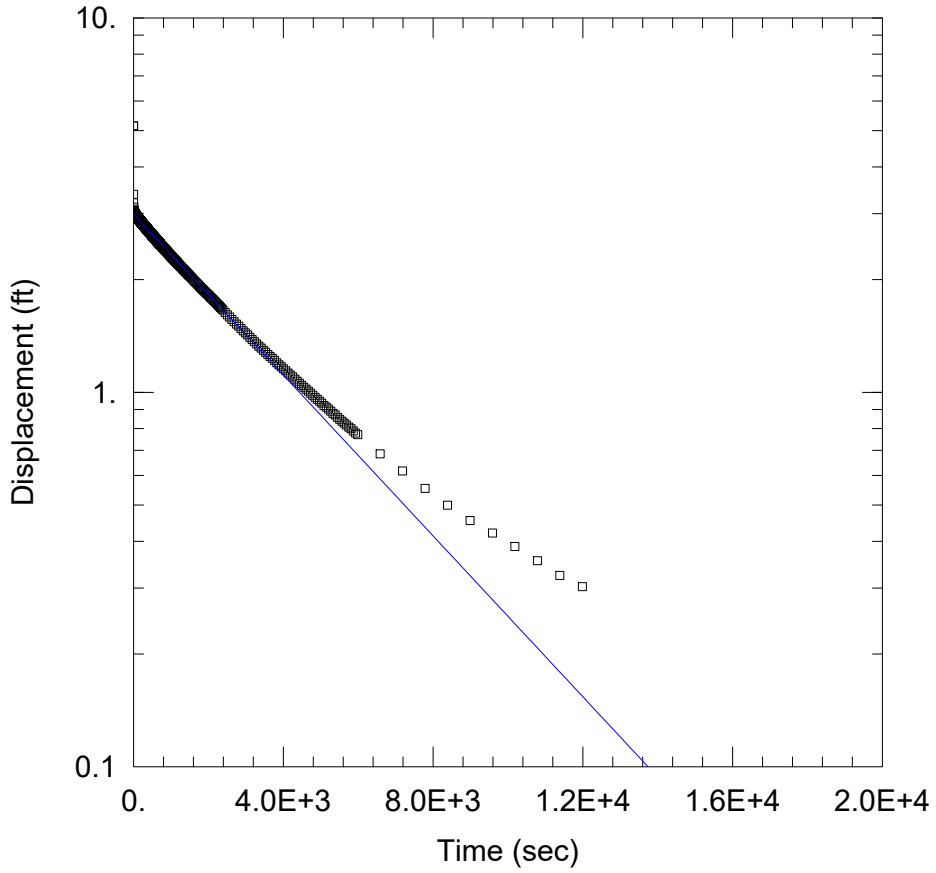
WELL DATA (WBSP-15-07)

Initial Displacement: 5.152 ft Static Water Column Height: 17.19 ft
Total Well Penetration Depth: 55. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 9.242E-6 cm/sec y0 = 2.992 ft



OUT-B

Data Set: Y:\...\WBSP-15-07_OUT-B-H.aqt
Date: 08/19/16 Time: 14:43:40

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2016002
Location: Clifty Creek Station
Test Well: WBSP-15-07
Test Date: 05/17/2016

AQUIFER DATA

Saturated Thickness: 15.17 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-15-07)

Initial Displacement: 5.152 ft Static Water Column Height: 17.19 ft
Total Well Penetration Depth: 55. ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.333 ft

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev
K = 1.064E-5 cm/sec y0 = 2.992 ft