INDIANA-KENTUCKY ELECTRIC CORPORATION
3932 U. S. Route 23
P. O. Box 468
Piketon, Ohio 45661
740-289-7200

WRITER'S DIRECT DIAL NO:
740-289-7259

October 27, 2023

Delivered Electronically

Mr. Brian Rockensuess
Commissioner
Indiana Department of Environmental Management
100 N. Senate Avenue
Mail Code 50-01
Indianapolis, IN 46204-2251

Re: Indiana-Kentucky Electric Corporation
West Boiler Slag Pond Notification of Availability of Assessment of Corrective Measure Report

Dear Mr. Rockensuess:

As required by 40 CFR 257.106(h)(7), on August 28, 2023, the Indiana-Kentucky Electric Corporation (IKEC) provided notification to the Commissioner of the Indiana Department of Environmental Management that an Assessment of Corrective Measures (ACM) had been initiated for a confirmed Statistically Significant Increase (SSI) of the Appendix IV constituent Arsenic at the Clifty Creek Station's West Boiler Slag Pond.

Further, as required by 40 CFR 257.96(d), a report detailing the effectiveness of potential corrective measures was prepared by AGES, Inc., the site's hydrogeologist, using 40 CFR 257.27 as a basis for the selection of potential remedies. Per 40 CFR 257.106(h)(8), this letter provides notification that the report has been placed in the facility's operating record, as well as on the company's publicly accessible internet site and can be viewed at http://www.ovec.com/CCRCompliance.php . As required by 257.96(e), IKEC will discuss the results of the corrective measures at least 30 days prior to the selection of remedy, in a public meeting with interested and affected parties.

If you have any questions, or require any additional information, please call me at (740) 289-7259 or Gabe Coriell at (740) 289-7267

Sincerely,

Jeremy Galloway
Environmental Specialist

JDG:gsc

Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
www.appliedgeology.net
P 412. 264. 6453
F 412. 264. 6567

COAL COMBUSTION RESIDUALS REGULATION ASSESSMENT OF CORRECTIVE MEASURES REPORT

WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

OCTOBER 2023

Prepared for:

INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

By:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

OCTOBER 2023

Prepared for:

INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

Prepared By:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

Bethany Flaherty

Bethany Flaherty
Senior Scientist II

Robert W. King

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

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

TABLE OF CONTENTS

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

TABLE OF CONTENTS
(continued)

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

LIST OF ACRONYMS

°C	Degrees Celsius
ACM	Assessment of Corrective Measures
AGES	Applied Geology and Environmental Science, Inc.
ASD	Alternate Source Demonstration
bgs	Below Ground Surface
CCR	Coal Combustion Residuals
cm/sec	Centimeters per Second
ft/day	Feet per Day
GMPP	Groundwater Monitoring Program Plan
gpm	Gallons per Minute
GWPS	Groundwater Protection Standard
IDEM	Indiana Department of Environmental Management
IKEC	Indiana-Kentucky Electric Corporation
K	Hydraulic Conductivity
LRCP	Landfill Runoff Collection Pond
mm	Millimeter
MNA	Monitored Natural Attenuation
msl	Mean Sea Level
mV	Millivolts
MW	Megawatt
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
OVEC	Ohio Valley Electric Corporation
PRB	Permeable Reactive Barrier
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
Stantec	Stantec Consulting Services, Inc.
StAP	Statistical Analysis Plan
SU	Standard Unit
Type I Landfill	Type I Residual Waste Landfill

LIST OF ACRONYMS
(continued)

U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Service
ug/L	Micrograms per Liter
WBSP	West Boiler Slag Pond

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
WEST BOILER SLAG POND
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, referred to as the "CCR Rule." 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 CCR Rule in 40 CFR § 257.96(a) requires that an owner or operator initiate an Assessment of Corrective Measures (ACM) to prevent further release, to remediate any releases, and to restore affected area(s) to original conditions in the event that any Appendix IV constituent has been detected at a Statistically Significant Level (SSL) greater than a Groundwater Protection Standard (GWPS). The ACM must be completed within 90 days after initiation. The CCR Rule allows up to an additional 60 days to complete the ACM if a demonstration shows that more time is needed because of site-specific conditions or circumstances. A certification from a qualified professional engineer attesting that the demonstration is accurate is required. The owner or operator must include the certified demonstration in the annual groundwater monitoring and corrective action report required by 40 CFR § 257.90(e).

This ACM Report has been prepared to comply with 40 CFR § 257.90(c) of the CCR Rule and documents the results that are the basis for the evaluation of potential corrective measure remedial technologies. This report includes a summary of groundwater monitoring conducted to date, along with the results of site characterization activities. Finally, potential remedial technologies are identified in this report and evaluated against requirements, as specified in the CCR Rule.

2.0 SITE BACKGROUND

The Clifty Creek Station, located in Madison, Indiana, is a 1,304-megawatt (MW) coal-fired generating plant operated by the Indiana-Kentucky Electric Corporation (IKEC), a subsidiary of the Ohio Valley Electric Corporation (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 2-1):

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

Under the CCR program, IKEC installed a groundwater monitoring network at each unit in accordance with the requirements of the CCR Rule. From January 2016 through August 2017, nine (9) rounds of background groundwater monitoring were conducted at all of the CCR units. The first round of Detection Monitoring was performed in March 2018.

From 2018 through 2021, no Statistically Significant Increases (SSIs) were identified for Appendix III constituents at the WBSP; therefore, this unit remained in Detection Monitoring under the CCR program. In March 2022, a potential SSI for Fluoride (Appendix III constituent) in well WBSP-15-09 was confirmed during a resampling event in June 2022. Based on the results presented above, in accordance with 40 CFR § 257.94(e), IKEC established an Assessment Monitoring Program meeting the requirements of 40 CFR § 257.95 and prepared a notification stating that an Assessment Monitoring Program had been established.

Based on the results of the Assessment Monitoring Program, further action was required for the WBSP. Details regarding these efforts are presented in the following sections of this report.

3.0 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Setting

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, near or adjacent to the Ohio River valley 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.

3.2 Unit-Specific Setting

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 2-1 and 3-1). The Devil's Backbone borders the northern side of the WBSP.

A generalized geologic cross-section of this unit is presented in Figure 3-2; the location of the cross-section is shown on Figure 3-3. Based on logs from soil borings drilled during well installation at the unit, the WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt and silty sand ranging from approximately 15 feet below ground surface (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). 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 420 feet mean sea level (msl) is the uppermost aquifer beneath the WBSP.

4.0 SUMMARY OF GROUNDWATER MONITORING PROGRAM: WEST BOILER SLAG POND

In accordance with 40 CFR § 257.90 (e) of the CCR Rule, annual Groundwater Monitoring and Corrective Action Reports have been prepared for the Clifty Creek Station for CCR program activities conducted from 2017 through 2022 (AGES 2017, 2018a, 2019, 2020, 2021 and 2022). The reports documented the status of the groundwater monitoring and corrective action program for each CCR unit, summarized the key actions completed during these years, described any problems encountered, discussed actions to resolve the problems and projected key activities for the upcoming year.

4.1 Groundwater Monitoring Network

As detailed in the Monitoring Well Installation Report (AGES 2018b) and the 2022 Annual Groundwater Monitoring and Corrective Action Report (AGES 2022), the CCR groundwater monitoring network for the WBSP includes the following 13 wells:

- CF-15-04 (Background);
- CF-15-05 (Background);
- CF-15-06 (Background);
- WBSP-15-01 (Upgradient);

- WBSP-15-02 (Upgradient);
- WBSP-15-03 (Upgradient);
- WBSP-15-04a (Downgradient);
- WBSP-15-05a (Downgradient);
- WBSP-15-06a (Downgradient);
- WBSP-15-07 (Downgradient);
- WBSP-15-08 (Downgradient);
- WBSP-15-09 (Downgradient); and
- WBSP-15-10 (Downgradient).

The locations of the wells in the groundwater monitoring network are shown on Figure 3-3. As listed above and shown on Table 4-1, the CCR groundwater monitoring network for the WBSP includes six (6) background and upgradient wells and seven (7) downgradient wells, which satisfies the requirements of the CCR Rule. Generalized groundwater flow maps (including the Ohio River) for March 2022, September 2022 and March 2023 are included in Appendix A. Note that wells CF-15-04, CF-15-05 and CF-15-06 are not shown on the groundwater flow maps as they are background wells and are not screened in the uppermost aquifer beneath the WBSP.

4.2 Groundwater Sampling

All groundwater samples were collected in accordance with the Groundwater Monitoring Program Plan (GMPP) (AGES 2018c). The Detection Monitoring samples were analyzed for Appendix III constituents, and the Assessment Monitoring samples were analyzed for Appendix III and Appendix IV constituents. All samples were shipped to an analytical laboratory to be analyzed for all of the constituents listed in Appendix III and/or Appendix IV of the CCR Rule.

4.3 Analytical Results

Upon receipt, the March 2022 Detection Monitoring data were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the Statistical Analysis Plan (StAP) (Stantec Consulting Services, Inc. [Stantec] 2021) for the CCR program. Based on the results of the sampling, a SSI for Fluoride was confirmed in well WBSP-15-09 (Table 4-2). Therefore, the unit entered into Assessment Monitoring.

The analytical results for groundwater samples collected during the Assessment Monitoring program in September 2022 and March 2023 are summarized in Appendix B. Upon receipt, the September 2022 Assessment Monitoring data were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the StAP (Stantec 2021). No SSIs for Appendix III constituents were identified. However, Arsenic (Appendix IV constituent) was detected in downgradient wells; IKEC therefore began the process of establishing a GWPS for any detected Appendix IV constituent.

Upon receipt, the March 2023 Assessment Monitoring results were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the StAP (Stantec 2021). No SSIs for Appendix III constituents were identified. However, Arsenic and Cobalt (Appendix IV constituents) were detected in downgradient wells.

4.4 GWPS-WBSP

In accordance with 40 CFR § 257.95(d), IKEC established GWPS for all Appendix IV constituents that were detected at the WBSP.

The statistical evaluation of the Appendix IV constituents from the September 2022 Assessment Monitoring event identified potential SSIs in wells WBSP-15-07 (Arsenic), WBSP-15-08 (Arsenic) and WBSP-15-09 (Arsenic). In accordance with the StAP, IKEC resampled the wells on December 21, 2022. Based on the results of the resampling event, the potential SSI in well WBSP-15-07 was not confirmed. However, Arsenic was detected above the GWPS of 10 micrograms per liter (ug/L) in wells WBSP-15-08 (66 ug/L and 58 ug/L [resampling]) and WBSP-15-09 (23 ug/L and 16 ug/L [resampling]). Therefore, the Arsenic SSIs for those two (2) wells were confirmed.

The statistical evaluation of the Appendix IV constituents from the March 2023 Assessment Monitoring event identified potential SSIs in wells WBSP-15-07 (Arsenic), WBSP-15-08 (Arsenic), WBSP-15-09 (Arsenic) and WBSP-15-10 (Arsenic and Cobalt). In accordance with the StAP, IKEC resampled the wells on June 13, 2023. Based on the results of the resampling event, the potential SSIs in well WBSP-15-10 for Arsenic and Cobalt were not confirmed. However, Arsenic was detected above the GWPS of 10 ug/L in wells WBSP-15-07 (87 ug/L and 25 ug/L [resampling]), WBSP-15-08 (100 ug/L and 70 ug/L [resampling]) and WBSP-15-09 (25 ug/L and 26 ug/L [resampling]). Therefore, the Arsenic SSIs for those three (3) wells were confirmed.

4.5 Alternate Source Demonstration (ASD)

To evaluate if an alternate source of Arsenic in groundwater was present at the WBSP, IKEC opted to pursue an ASD that included redevelopment of select wells and well sampling using a modified long-purge sampling method that were intended to reduce the presence of micro-sediments in the groundwater samples. Based on the resampling, the ASD was not successful and IKEC therefore began implementation of site characterization and an ACM for the WBSP.

Based on these results, IKEC proceeded to characterize the nature and extent of the release, completed required notifications, and initiated an ACM in accordance with 40 CFR § 257.95(g). Results of these activities are presented in the following sections of this report.

5.0 CCR SITE CHARACTERIZATION ACTIVITIES

As specified in the CCR Rule in 40 CFR § 257.95(g)(1), further characterization of the nature and extent of the release to groundwater at the WBSP was required. The objectives of the characterization were to:

- Install additional monitoring wells necessary to define the contaminant plume(s);
- Collect data on the nature of material released including specific information on the constituents listed in Appendix IV and at the levels at which they are present in the material released;
- Install at least one (1) additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with 40 CFR § 257.95 (d)(1); and
- Sample all wells in accordance with 40 CFR § 257.95 (d)(1) to characterize the nature and extent of the release.

To meet the requirement of 40 CFR § 257.95 (d)(1), IKEC attempted to locate four (4) wells at the facility boundary in the direction of contaminant migration. However, the property boundary in this area of the facility is heavily wooded and could not be safely accessed by a drilling rig without cutting down several trees (Figure 5-1). As the facility is located within the habitat of the Indiana Bat, the Programmatic Biological Opinion (BO) for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat prepared by U.S. Fish and Wildlife Service (U.S. FWS) is appliable (U.S. FWS 2018). Per this regulation, tree clearing in Indiana can only occur during inactive bat season. As the current inactive bat season is from October 1 to March 31, IKEC could not clear trees and safely access the area along the Ohio River with a drilling rig until after October 1, 2023. Therefore, monitoring wells could not be installed along the property boundary within the timeframe required for this ACM Report.

Per 40 CFR § 257.95 (d)(1), IKEC will install at least one (1) monitoring well at the facility boundary when access to the area can be safely obtained in accordance with USFWS regulations.

Details regarding the work conducted in July and August 2023 to collect additional data to aid in characterization are presented in the following sections of this report.

5.1 Monitoring Well Installation, Development, Sampling, and Testing

5.1.1 Monitoring Well Installation

To evaluate the extent of Arsenic impacts, four (4) interim wells (WBSP-23-01 through WBSP-23-04) were installed in the uppermost aquifer downgradient of the WBSP but not at the property boundary (Figures 5-1 and 5-2). Two (2)-inch diameter, 0.01” slotted Schedule 40 polyvinyl chloride (PVC) pre-packed screens designed specifically for sampling metals in groundwater were selected for use in the wells at the WBSP to reduce turbidity. The pre-packed well screens were constructed using an inner filter pack consisting of 0.40 millimeter (mm) clean quartz filter sand between two (2) 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.

During hollow-stem auger drilling, the drill bit was simultaneously pushed down and rotated. Continuous split-spoon samples were collected and logged by the AGES geologist. The augers were used to advance each boring to the desired depth and were kept in place to keep the borehole open during well installation. The augers were then removed as the well installation progressed.

Once each borehole was advanced to the desired depth, a 10-foot pre-packed well screen was set into the 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 augers were 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 one (1)-foot above the top of the screen.

An approximate two (2)-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 an above-ground protective steel casing and a locking well cap. Following installation, each monitoring well was surveyed for elevation and location by IKEC personnel.

Well construction details for the four (4) interim wells are presented in Table 5-1. All boring and well logs are included in Appendix C.

5.1.2 <u>Monitoring Well Development</u>

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. During development of the monitoring wells, field parameters including temperature, specific conductance, pH, and turbidity were recorded at regular intervals. Development continued until field parameters stabilized. Well development data for each well is summarized on Table 5-2.

5.1.3 <u>Groundwater Sampling</u>

In August 2023, the four (4) interim monitoring wells were sampled for Arsenic in accordance with the GMPP for the Clifty Creek Station (AGES 2018c). The monitoring wells were purged using a pump to remove stagnant water in the casings and to ensure that representative groundwater samples were collected.

Samples were collected in laboratory provided, pre-preserved bottleware. All bottles were labeled with the unique sample number, time and date of sample collection, and the identity of the sampling fraction. Field parameters were measured and recorded on purging forms at the time of sample collection.

Following sample collection, the samples were packed on ice in coolers insulated to four (4) degrees centigrade (ºC) and shipped to the Eurofins Environment Testing analytical laboratory located in Buffalo, New York.

5.1.4 Aquifer Testing

In August 2023, slug tests were conducted on all of the interim wells (WBSP-23-01 through WBSP-23-04) to obtain data to calculate the saturated hydraulic conductivity (K) for the shallow and deep aquifers beneath the WBSP. Both rising and falling head slug tests were performed on each well. The falling head tests were performed by lowering a pre-fabricated 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 for each well and the slug was decontaminated between wells using the procedures specified in the GMPP for the Clifty Creek Station (AGES 2018c).

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 (with automatic curve matching) which are straight-line analytical techniques commonly used to analyze rising and falling head slug test data. The AQTESOLV data for each well are presented in Appendix D.

5.2 Results of Site Characterization

5.2.1 Site Geology Updates

Based on the results of the site characterization, a comprehensive update to the understanding of the geology at the unit is not necessary. However, as shown on Figure 3-2, south of the WBSP (in the area of the interim wells), the uppermost aquifer does become finer-grained, transitioning from a silt with fine sand to a silty clay with fine/medium sand.

5.2.2 Groundwater Flow

A complete round of groundwater level data was collected in August 2023 from the existing and interim wells at the WBSP (Table 5-3). A groundwater flow map generated using these data indicates that groundwater in the uppermost aquifer beneath the WBSP flows to the south toward the Ohio River (Figure 5-3).

5.2.3 Slug Testing

Slug test results from testing completed in August 2023 are summarized on Table 5-4. The revised mean K for the uppermost aquifer downgradient of the WBSP is 4.71 x 10^{-5} centimeters per second (cm/sec) or 0.13 feet per day (ft/day). This K value is consistent with previous results at the site and with published literature (Fetter 1980).

5.2.4 Groundwater Flow Velocity

Using water level data collected in August 2023 hydraulic conductivity data from the recent slug tests (Table 5-4), the average groundwater velocity for the uppermost aquifer beneath the WBSP was calculated as 0.005 ft/day (Table 5-5). With this flow velocity and a distance between interim well WBSP-23-03 and the Ohio River (the property boundary) at 110 feet, the travel time for groundwater to flow between WBSP-23-03 and the Ohio River is approximately 60 years. This travel time may likely be greater due to the periods of flow reversal due to flooding of the Ohio River.

5.2.5 Groundwater Sampling Results

Analytical results for Arsenic in the four (4) interim wells are presented in Table 5-6. Analytical results for the previously installed CCR wells during the September 2022 and March 2023 sampling events are also included in Appendix B.

In the uppermost aquifer, Arsenic concentrations at the downgradient wells ranged from 2.5 ug/L at WBSP-15-10 to 70 ug/L at WBSP-15-08 in June 2023 (Figure 5-4). In the interim wells, Arsenic concentrations ranged from 16 ug/L at WBSP-23-03 to 69 ug/L at WBSP-23-01 in August 2023 (Figure 5-4).

5.2.6 Evaluation of Groundwater Geochemistry-Arsenic

Field parameter results for 2023 for downgradient wells WBSP-15-07 through WBSP-15-10 and the interim wells WBSP-23-01 through WBSP-23-04 are presented in Table 5-6. As Arsenic exceedances were not identified in the area of downgradient wells WBSP-15-04a, WBSP-15-05a and WBSP-15-06a, these wells are not discussed further in this report. In 2023, ORP values in three (3) downgradient wells at the WBSP were very low, with results of -144 mV at WBSP-15-07, -72 mV at WBSP-15-08 and -173 mV at WBSP-15-09. Arsenic values at these wells ranged from 25 ug/L at WBSP-15-07 to 70 ug/L at WBSP-15-08. All of these results exceed the GWPS of 10 ug/L. The only positive ORP value was at WBSP-15-10 at 116 mV; at this well, Arsenic was detected at 2.5 ug/L. Given these results, it appears that the reducing conditions in groundwater have resulted in the mobilization of Arsenic at wells WBSP-15-07 through WBSP-15-09. Conditions at well WBSP-15-10 are oxidizing, which results in a lesser mobility of Arsenic and a lesser concentration.

ORP values in the interim wells were even lower than the downgradient wells, ranging from -174 mV at WBSP-23-02 to -279 mV at WBSP-23-03. Arsenic values at the interim wells ranged from 16 ug/L at WBSP-23-03 to 69 ug/L at WBSP-23-01. All of these results exceed the GWPS of 10 ug/L. As with the downgradient wells, the reducing conditions in groundwater have resulted in the mobilization of Arsenic in groundwater at all of these wells.

In 2023, pH values in the downgradient wells ranged from 7.06 Standard Unit (SU) at WBSP-15-09 to 7.41 SU at WBSP-15-07. In the interim wells, pH values ranged from 7.46 SU at WBSP-23-02 to 7.93 SU at WSBP-23-03. In the environment, Arsenic is more mobile at pH values greater than 8.5 SU, when it will desorb from mineral oxides (Smedley and Kinniburgh 2002). Given these values, the pH of groundwater does not appear to have a significant effect on the mobility of Arsenic at the WBSP.

Highly reducing conditions at near neutral pH (as observed at the WBSP) would also lead to mobilization of Arsenic as it desorbs from oxides. In groundwater with high concentrations of Arsenic III and Iron II and low Sulfate concentrations, the reductive dissolution of Iron and Manganese Oxides can also release Arsenic to the environment.

In 2023, turbidity values at the WBSP were relatively high in the downgradient wells, ranging from 4.05 NTU (Nephelometric Turbidity Unit) at WBSP-15-10 to 37.7 NTU at WBSP-15-01. At well WBSP-15-08, a value was not obtained due to a meter malfunction. In the interim wells, turbidity values ranged from 12.4 NTU at WBSP-23-04 to 44.1 at WSBP-23-03.

Turbidity can be a critical factor affecting Arsenic concentrations in groundwater. A recent study noted that greater than 95% of Cobalt was irreversibly adsorbed to solids when exposed to groundwater. Total Cobalt concentrations were therefore believed to be an artifact of stabilized turbidity and not a release of Cobalt from a source area (Hostetler, Rehm, Karkowski and Kron 2020). Given that Arsenic has a similar affinity for adsorption as Cobalt, an evaluation of the turbidity of groundwater samples, even at a micro scale, is therefore important for evaluating if Arsenic results are due to suspended sediments.

5.3 Analytical Data for Boiler Slag Outfall at Clifty Creek Station

From January 2018 through August 2023, Arsenic results collected from the WBSP intake and outfall sample points have been mostly non-detect with a few detections below the GWPS noted.

5.4 Additional Planned Site Characterization Activities

Arsenic concentrations at groundwater in interim wells WBSP-23-01 through WBSP-23-04 exceeded the applicable GWPS. As noted above, property boundary wells could not be installed due to access uses; the extent of Arsenic exceedance in groundwater have therefore not been determined. To determine extent of Arsenic exceedances and to comply with 40 CFR § 257.95 (d)(1), IKEC will install at least one (1) monitoring well at the facility boundary when access to the area can be safely obtained in accordance with U.S. FWS regulations. After installation, the well will be developed and sampled for analysis of Arsenic. The results of the well installation and sampling will be presented in an addendum to this ACM Report.

6.0 ASSESSMENT OF CORRECTIVE MEASURES

Groundwater monitoring of the uppermost aquifer at the WBSP has identified Arsenic (Appendix IV constituent) at concentrations that exceed the GWPS defined under 40 CFR § 257.95(h); therefore, an ACM is necessary. The ACM will require identification and evaluation of technologies and methods that may be used as elements of remedial actions to meet the requirements of the CCR Rule. These elements include potential source control methods and various groundwater remedial technologies that may be applicable to the WBSP. Additional remedial technologies may also be evaluated at a later date, if determined to be applicable and appropriate.

Presented below is a discussion of the objectives of the ACM, the potential source control measures, a list of remedial technologies, a summary of the assessment process and the detailed ACM evaluation.

6.1 Objectives of Remedial Technology Evaluation

Per 40 CFR § 257.96(a), the objectives of the corrective measures evaluated in this ACM Report are "to prevent further releases, to remediate any releases, and to restore affected area to original conditions." As required in 40 CFR § 257.97(b), corrective measures, at minimum, must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;

(5) Comply with standards for management of wastes as specified in § 257.98(d).

6.2 Potential Source Control Measures

The objective of source control measures is to prevent further releases from the source (i.e., the WBSP). According to 40 CFR § 257:

"Remedies must control the source of the contamination to reduce or eliminate further releases by identifying and locating the cause of the release. Source control measures may include the following: Modifying the operational procedures (e.g., banning waste disposal); undertaking more extensive and effective maintenance activities (e.g., excavate waste to repair a liner failure); or, in extreme cases, excavation of deposited wastes for treatment and/ or offsite disposal. Construction and operation requirements also should be evaluated."

The detailed evaluation of source control measures at the WBSP is provided in Table 6-1. Three (3) technologies are included in this evaluation:

- Dewatering of Pond Water;
- Engineered Cover System; and
- Excavation of Ash.

In accordance with the CCR closure and post-closure requirements of 40 CFR § 257.102 and 40 CFR § 257.104, IKEC will close and maintain the WBSP in a manner consistent with recognized and generally accepted good engineering practices and in compliance within timeframes specified within the CCR Rule.

6.3 Potential Remedial Technologies

The focus of corrective measures for the WBSP is to address Arsenic in groundwater that exceeded the GWPS. To accomplish this, the following three (3) types of technologies will be presented in Sections 6.3.1 through 6.3.3:

- In-Situ Groundwater Remedial Technologies;
- Ex-Situ Groundwater Remedial Technologies; and
- Treatment of Extracted Groundwater.

The detailed ACM evaluation is provided in Table 6-2 and summarized below in Section 6.4. Additional remedial technologies may also be evaluated if determined to be applicable and appropriate.

6.3.1 <u>In-Situ Groundwater Remedial Technologies</u>

In-situ groundwater remediation approach involves treating the groundwater where it is presently situated, rather than removing and transferring it elsewhere for treatment and disposal. In-situ remediation is typically a less expensive alternative to removing and treating it away from the property. Long-term groundwater monitoring would be required to evaluate the effectiveness of any of these technologies. In-situ groundwater remediation technologies are discussed below.

6.3.1.1 Monitored Natural Attenuation (MNA)

MNA is a strategy and set of procedures used to demonstrate that physical, chemical and/or biological processes in an aquifer will reduce concentrations of constituents to levels below applicable standards. These processes attenuate the concentrations of inorganics in groundwater by physical and chemical means (e.g., dispersion, dilution, sorption and/or precipitation). Dilution from recharge to shallow groundwater, mineral precipitation, and constituent adsorption will occur over time, which will further reduce constituent concentrations through attenuation. Regular monitoring of select groundwater monitoring wells is conducted to ensure constituent concentrations in groundwater are attenuating over time.

6.3.1.2 Groundwater Migration Barriers

Low permeability barriers can be installed below the ground surface to prevent groundwater flow from reaching locations that pose a threat to receptors. Barriers can be installed with continuous trenching techniques using bentonite or other slurries as a barrier material to prevent migration of groundwater. Barriers of cement/concrete and sheet piling can also be used.

Barriers are most effective at preventing flow to relatively small areas or to protect specific receptors. Protecting larger areas is possible if the constituent of concern is not highly soluble and cannot follow a diverted groundwater flow pattern. The barrier will change the groundwater flow conditions, and at some point the increased head (pressure) will cause a change in flow patterns. This will generally be around the flanks or beneath the barrier. To ensure that groundwater will not flow beneath the barrier, it must be sealed at an underlying impermeable layer such as a clay layer.

Groundwater migration barriers are often used in conjunction with groundwater extraction systems. The barriers are used to restrict flow to allow extraction systems upgradient of the barrier to collect groundwater. However, the challenges discussed above for creating a competent seal with any underlying unit may still apply.

6.3.1.3 Permeable Reactive Barriers (PRBs)

PRBs can be an effective in-situ groundwater treatment technology. General design involves excavation of a narrow trench perpendicular to groundwater flow similar to migration barriers and then backfilling the trench with a reactive material that either removes or transforms the constituents as the groundwater passes through the PRB. Unlike simple barriers, the PRB can be designed to include impermeable sections to funnel the flow through a more narrow and permeable reactive zone. The ability to maintain adequate and reactive reagent concentrations at depth over an extended period of time is a significant operational and performance assurance challenge. As with other in-situ approaches, reconstruction or regeneration may be needed on a periodic basis.

6.3.1.4 In-Situ Chemical Stabilization

The placement of chemical reactants to immobilize dissolved phase constituents through precipitation or sorption can be an effective approach to reducing downgradient migration. Reagents such as ferrous sulfate, calcium polysulfide, zero-valent iron, organo-phosphorous mixtures, sodium dithionate and oxygen have been evaluated as potentially effective for coal ash related constituents.

Two (2) issues that must be considered with this technology are permanence of the reaction product insolubility and the ability to inject the reactants sufficiently to ensure adequate contact with the constituents. Most stabilization reactions can be reversible depending on environmental conditions such as pH and oxidation state. Given the long periods of time for which the reaction products must remain insoluble, it may be difficult to predict future conditions sufficiently to ensure permanence of this technology. Recurring treatment, based on routine testing, may be an option. Contact between reagents and the constituents must also be evaluated. This technology may need to be considered more as a source reduction technology than a capture or barrier technology, as the reactants may not be viable over an extended period of time.

Given that the Arsenic levels in groundwater at the WBSP appear to be related to reducing conditions at the site, in-situ stabilization through the injection of oxygenating compounds would be a viable alternative for the site.

6.3.2 Ex-Situ Groundwater Remedial Technologies

Ex-situ remedial technologies require groundwater extraction to remove constituent mass from the groundwater and can provide hydraulic control to reduce or prevent groundwater constituent migration. Groundwater can be removed from the aquifer through the use of conventional vertical extraction wells, horizontal wells, collection trenches and associated pumping systems. The type of well or trench system selected is based upon site-specific conditions. Long-term groundwater monitoring would be required to evaluate the effectiveness of any of these technologies. Ex-situ groundwater remediation technologies are discussed below.

6.3.2.1 Conventional Vertical Well System

Conventional vertical wells can usually be used in most cases unless accessibility is an issue. Well spacing and depths depend upon the aquifer characteristics. If flow production from the aquifer is extremely limited, conventional wells may not be feasible due to the extremely close spacing that would be required. Vertical wells may be used at any depth and can be screened in unconsolidated soils or completed as open-hole borings in bedrock.

6.3.2.2 Horizontal Well Systems

The use of horizontal recovery wells has increased due to development of more efficient horizontal drilling techniques. These systems can cover a significant horizontal cross-section and may be much more efficient than conventional vertical wells. They are not well suited to aquifers with wide variation in water levels, as the horizontal well may end up being dry. Costs associated with this type of system can also be very high.

6.3.2.3 Trenching Systems

Horizontal collection trenches function similarly to horizontal wells but are installed with excavation techniques. They can be more cost effective at shallow depths and with higher flow regimes. However, they may not be cost effective for deeper installations.

6.3.3 Treatment of Extracted Groundwater

Several technologies exist for treatment of extracted groundwater to remove or immobilize constituents ex-situ. The following technologies would be considered if treatment of extracted groundwater became necessary prior to a permitted discharge:

- Precipitation;
- Adsorption;
- Exchange;
- Filtration; and
- Biological & Oxidation.

Brief overviews of these technologies are presented below.

6.3.3.1 Precipitation

Treating impacted groundwater through the precipitation of metals is a well proven and often-used technology. In this process, soluble (dissolved) constituents are converted to insoluble particles that will precipitate such as hydroxides, carbonates, or sulfides. Insoluble particles are then removed by physical methods like clarification and/or filtration. The process typically involves pH adjustment, addition of a precipitant, and flocculation. The details of the process are driven by the solubility of the constituents and the effluent limit requirements. For many constituents, low effluent concentrations can be achieved; however, this technology has not been extensively used for all constituents related to CCR sites.

6.3.3.2 Adsorption

Groundwater containing dissolved constituents can be treated with adsorption media to reduce their concentration in the bulk fluid phase. The column must be regenerated or disposed of and replaced with new media, on a routine basis. Common adsorbent media include activated alumina, copper-zinc granules, granular ferric hydroxide, ferric oxide-coated sand, greensand, zeolite, and other proprietary materials. This technology may also generate significant regeneration of waste stream.

6.3.3.3 Exchange

Ion exchange is a well proven technology for removing metals from groundwater. With some constituents, ion exchange can achieve very low effluent concentrations. Ion exchange is a physical process in which ions held electrostatically on the surface of a solid are exchanged for target ions of similar charge in a solution. The medium used for ion exchange is typically a resin made from synthetic organic materials, inorganic materials, or natural polymeric materials that contain ionic functional groups to which exchangeable ions are attached. The resin must be regenerated routinely, which involves treatment of the resin with a concentrated solution, often containing sodium or hydrogen ions (acid). There must be a feasible method to dispose of the regeneration effluent for this technology. Pretreatment may be required based on site specific conditions.

6.3.3.4 Filtration

There are a number of permeable membrane technologies that can be used to treat impacted groundwater for metals and other constituents. The most common is reverse osmosis, although microfiltration, ultrafiltration and nanofiltration are also used. All of these technologies use pressure to force impacted water through a permeable membrane which rejects the target constituents. The differences in the technologies are based on the size of the molecules rejected and the corresponding pressures needed to allow the permeate to pass through. These technologies can capture a number of target compounds simultaneously and can achieve low effluent concentrations, but they are also very sensitive to fouling and often require a pretreatment step. Like ion exchange, they also result in a relatively high volume reject effluent which may require additional treatment prior to disposal.

6.3.3.5 Biological & Oxidation

Several biological treatment methods and other oxidation methods have been used to treat metals and other CCR constituents. For Arsenic removal, biological systems can require a relatively long residence time (several hours) (Reinsel 2015). Another chemical oxidation approach to remove Arsenic uses the biological formation of Bioscorodite ($FeAsO_4 \cdot 2H_2O$); in this process bacteria oxidize Iron and available Arsenic to Ferric Iron and Arsenate. In general, biological systems are used to alter the oxidation state of the constituents so that it is less soluble and may be removed through adsorption or other means.

6.4 Evaluation to Meet Requirements in 40 CFR § 257.96(c)

For this evaluation, each of the potential remedial technologies identified above will be screened against evaluation criteria requirements in 40 CFR § 257.96(c) listed below:

The assessment under paragraph (a) of this section must include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

The ACM evaluation is provided in Table 6-2 and detailed below.

6.4.1 <u>Performance</u>

This criterion includes the ability of the technology to effectively achieve the specified goal of corrective measures to prevent further releases, to remediate any releases, and to restore the affected area to original conditions.

6.4.1.1 In-Situ Groundwater Remedial Technologies

MNA is a proven technology that can be implemented to reduce constituent concentrations over time through natural processes of geochemical and physical attenuation. Typical attenuation mechanisms that could affect Arsenic would include sorption, microbial activity and dispersion. Sorption to solid phases is a primary mechanism for removing Arsenic from groundwater. Hydroxides of Iron, Aluminum and Manganese, Sulfide Minerals and organic matter are known to significantly adsorb Arsenic in groundwater (Wang and Mulligan 2006). The rate and amount of sorption is influenced by groundwater pH, redox potential, other ions and the associated species of Arsenic (Ford, Wilkin and Puls 2007). Microbial activity may also catalyze the transformation of Arsenic species, or impact redox reactions; this would also influence the mobility of the Arsenic.

Dispersion, the mixing and spreading of constituents due to microscopic variations in velocity within and between interstitial voids in the aquifer, and dilution would reduce Arsenic concentrations but would not destroy the Arsenic. Given groundwater flow conditions, with periodic flood events, dispersion and dilution of Arsenic would likely be a major factor in natural attenuation.

At the WBSP, the existing well network would be used to monitor constituent trends over time. Given that Arsenic concentrations are less than the GWPS at the property boundary, a long-term timeframe would likely be acceptable.

Although migration barriers and PRBs are proven technologies, conditions at the WBSP would limit the performance of each of these approaches. A groundwater extraction system may be coupled with these technologies to increase their long-term effectiveness. To be effective, a migration barrier would need to be tied into a lower competent unit at the WBSP. Given that the uppermost aquifer extends to a depth of at least 50 feet bgs and the unit is located along the banks of the Ohio River, these conditions are not practical for a migration barrier or PRB. Periodic flooding of the area by the Ohio River would also adversely impact the performance of these technologies.

Given site conditions, in-situ chemical stabilization reagents could be injected into the uppermost aquifer and distributed to where impacts occur. It would be critical to fully evaluate future groundwater conditions (i.e., pH, ORP, etc.) to maintain this approach. Given that the Arsenic levels in groundwater at the WBSP appear to be related to reducing conditions at the site, in-situ stabilization through the injection of oxygenating compounds would be a viable alternative for the site. As with the barrier technologies above, periodic flooding of the area by the Ohio River might also impact the performance of in-situ chemical stabilization through dilution of the reagents.

6.4.1.2 Ex-Situ Groundwater Remedial Technologies

Groundwater extraction is a proven technology that has been successfully implemented for decades at many sites. Conventional vertical wells are the most often used approach; although the use of horizontal wells has been increasing. At the WBSP, a series of vertical recovery wells can likely be installed and operated to address impacted groundwater. Horizontal wells operate in a similar manner to vertical wells but are less effective in areas with significant water level fluctuations, like the WBSP. The performance of both types of wells would be significantly impacted by the Iron content of groundwater, which can lead to clogging. Significant levels of operation and maintenance would likely be necessary.

Trenching systems are often used when groundwater impacts are encountered in a shallow unit. The depth to groundwater at the WBSP is over 40 ft bgs. Although this depth is not ideal for a trench, it does not preclude the use of a trench at the WBSP.

Note that periodic flooding of the area by the Ohio River could also impact the performance of these ex-situ technologies.

6.4.1.3 Treatment of Extracted Groundwater

Groundwater treatment is required as a supplemental technology to be used in conjunction with groundwater extraction. The need for treatment depends on permit requirements for discharge of the treated water via a National Pollution Discharge Elimination System (NPDES) permit. The concentrations of Arsenic would need to be reduced to less than the required permit limits. Treatment for other constituents may also be required based on permit requirements.

Treatment of extracted groundwater can be performed as several proven methods for Arsenic treatment exist. Precipitation is a frequently used and proven technology to treat Arsenic in water at various concentrations (U.S. EPA 2002). As the effectiveness of adsorption and ion exchange can be impacted by the presence of other constituents, these technologies are often used when Arsenic is the only constituent requiring treatment. Filtration is used less frequently because it tends to have higher costs and produce a larger volume of residuals than other technologies that are available for treatment of Arsenic. Several biological treatment methods and other oxidation methods have been used to treat Arsenic. However, most would not likely be practical for the scope of this project.

6.4.2 Reliability

This criterion includes the degree of certainty that the technology will consistently work toward and achieve the specified goal of corrective measures over time.

6.4.2.1 In-Situ Groundwater Remedial Technologies

As the process of MNA is based on natural processes, this approach would be considered to be reliable. However, as groundwater geochemistry can vary over time, routine monitoring is required to evaluate conditions and ensure the ongoing effectiveness of the MNA process. Geochemical changes in groundwater could significantly impact the effectiveness of MNA, which could lead to the need to implement other remedial measures at the WBSP.

Migration barriers and PRBs are typically reliable technologies; the primary issue being the potential for altered groundwater flow directions and further migration of constituents. In addition, maintaining adequate and reactive reagent concentrations at depth over an extended period of time in a PRB can also be a significant operational and maintenance issue.

For in-situ chemical stabilization, reagents must be injected uniformly and consistently to adequately distribute them into the aquifer. Lack of a uniform and consistent approach could lead to reliability issues. Finally, changes in the geochemistry of the aquifer can lead to the need for adjustments in reagent type, concentrations and injection approach.

6.4.2.2 Ex-Situ Groundwater Remedial Technologies

Groundwater extraction solutions are generally considered reliable at controlling and removing constituents from the subsurface. At the WBSP, conventional vertical wells would be the more reliable approach, as the large water level fluctuations at the unit would significantly impact the reliability of horizontal wells. There can be significant operation and maintenance issues associated with both conventional vertical and horizontal wells, but these issues are well understood and can be readily addressed. Once in place, trenching systems would also be reliable at the WBSP although long term Operations and Maintenance (O&M) would be required.

6.4.2.3 Treatment of Extracted Groundwater

Treatment of Arsenic in extracted groundwater would be reliable as long as the bench-scale/pilot-test process outlined above is properly implemented.

6.4.3 Ease of Implementation

This criterion includes the ease with which the technologies can be implemented at the WBSP.

6.4.3.1 In-Situ Groundwater Remedial Technologies

MNA is among the easiest of corrective measures to implement at a unit. A sufficient number of monitoring wells already exist at the WBSP, which could be used to monitor the effectiveness of MNA.

Due to the significant amount of time, cost, effort and disturbance required for implementation at the WBSP, migration barriers, in-situ chemical stabilization and PRBs implementation would be difficult. Difficulties in construction would be related to the depth of installation and the need to install a barrier into a lower clay layer at the site at a depth of 40 ft bgs. Once constructed, the barrier technology would be passive and would operate immediately. The PRB would likely require periodic recharging with appropriate reagents. In-situ chemical stabilization may require less time and effort than with a migration barrier or PRB.

6.4.3.2 Ex-Situ Technologies for Groundwater Extraction

Implementation of both conventional vertical and horizontal wells at the WBSP would require drilling and limited field construction; however, the conventional vertical wells would be more easily implemented. The orientation of the horizontal wells could present potential installation issues. Trenching systems would require significant construction and would be difficult to implement at the WBSP.

6.4.3.3 Treatment of Extracted Groundwater

Treatment of Arsenic in extracted groundwater can be implemented but would require the bench-scale/pilot-test process outlined above.

6.4.4 Potential Safety Impacts

This criterion includes potential safety impacts that may result from implementation and use of the technology at the WBSP.

6.4.4.1 In-Situ Groundwater Remedial Technologies

Potential safety impacts associated with MNA are very minimal; especially as no additional well installation is required. Minimal safety concerns are therefore associated with the ongoing groundwater monitoring program.

Migration barriers and PRBs require a significant construction effort and use of construction equipment, which would entail a relatively high risk of potential safety impacts. However, neither technology would have any potential significant safety impacts following construction. Potential safety concerns related to in-situ chemical stabilization are moderate. The potential for incidents during injection well construction or unintended worker contact with the chemicals used for treatment would be the primary safety concerns with this technology.

6.4.4.2 Ex-Situ Groundwater Remedial Technologies

Groundwater extraction through use of wells (conventional vertical or horizontal) would involve drilling, construction and installation of extraction wells, pumps and associated control wiring and piping. Potential safety concerns exist with the activities associated with installation of these wells, as well as the ongoing O&M of the system, including inspection, maintenance or replacement of the various system components.

Trenching systems would require use of significant construction equipment and present worker safety concerns, especially with the depth of the trench. Ongoing operation of the system would present minimal safety concerns.

6.4.4.3 Treatment of Extracted Groundwater

Treatment of extracted Arsenic in groundwater would have minimal safety concerns.

6.4.5 Potential Cross-Media Impacts

This criterion includes the ability to control cross-media impacts during implementation and use of the technology at the WBSP.

6.4.5.1 In-Situ Groundwater Remedial Technologies

MNA poses no significant cross-media impact potential. Migration barriers and PRBs pose minimal risk of cross-media impacts, as they primarily involve an intended modification in groundwater flow. For a barrier technology, there could be some risk with the migration of impacted groundwater to other areas of the site; this concern is minimal. In the case of PRBs, constituents are removed from the groundwater through use of reagents; this includes minimal potential for cross-media impacts.

6.4.5.2 Ex-Situ Groundwater Remedial Technologies

Well and trench systems pose a moderate risk of cross-media impacts.

6.4.5.3 Treatment of Extracted Groundwater

Treatment of extracted groundwater would pose minimal risk of cross-media impacts.

6.4.6 Potential Impacts from Control of Exposure to Residual Constituents

This criterion includes the ability to control exposure of humans and the environment to residual constituents through implementation and use of the technology at the WBSP.

6.4.6.1 In-Situ Groundwater Remedial Technologies

MNA poses no significant potential for human or environmental exposure to impacted groundwater. Overall, in-situ technologies involve placement or injection of a structure or reagent to treat impacted groundwater in place. Consequently, there is no increased risk of exposure of humans and the environment to residual contamination.

6.4.6.2 Ex-Situ Groundwater Remedial Technologies

Groundwater extraction involves bringing impacted groundwater from the subsurface to the surface for potential treatment and discharge. This would slightly increase the potential for exposure of humans or the environment to impacted groundwater. The groundwater would be conveyed through an engineered system designed to prevent the release of water into the environment and to limit the potential for human or environmental exposure to the impacted groundwater. The potential for exposure to residual contamination associated with this technology is therefore unlikely.

6.4.6.3 Treatment of Extracted Groundwater

Treatment of extracted groundwater would pose minimal risk of exposure to residual contamination.

6.4.7 Time Required to Begin Remedy

This criterion includes the time necessary for planning, pilot testing, design, permitting, procurement, installation and startup of this technology at the WBSP.

6.4.7.1 In-Situ Groundwater Remedial Technologies

An MNA program could be implemented at the WBSP within three (3) months, as a sufficient monitoring well network already exists at the site and a monitoring program is already established. This potential remedy would require the least amount of time to implement of the technologies considered.

Migration barriers, in-situ chemical stabilization and PRBs could take a significant amount of time to design and install. Either technology would also involve a significant amount of regulatory permitting. The design and implementation time could take one (1) to 1.5 years.

6.4.7.2 Ex-Situ Groundwater Remedial Technologies

Design and installation of groundwater extraction systems could be completed in six (6) months to one (1) year. This could vary depending on potential groundwater modeling efforts and regulatory approval and permitting.

6.4.7.3 Treatment of Extracted Groundwater

Design and installation of the system, including bench-scale and pilot testing, could be completed in six (6) months to one (1) year. This would depend on the regulatory approval and permitting process.

6.4.8 Time Required to Complete Remedy

This criterion includes the estimated time necessary to achieve the stated goals of corrective measures to prevent further releases from the WBSP, to remediate any releases, and to restore the affected area to original conditions.

6.4.8.1 In-Situ Groundwater Remedial Technologies

As MNA does not require additional physical or chemical remedial treatment, the timeframe is the longest period to reach remedial goals. The use of a groundwater model is required to more accurately predict the anticipated time required to complete the remediation.

A significant amount of time is expected to be required to meet remedial goals with migration barriers and PRB. However, as groundwater modeling has not been performed for the site, an accurate estimate cannot be developed at this time. If in-situ chemical stabilization option can effectively treat Arsenic at the unit boundary, this approach has the potential to treat groundwater more quickly than a barrier or PRB.

6.4.8.2 Ex-Situ Groundwater Remedial Technologies

A significant amount of time is expected to be required to meet remedial goals with ex-situ technologies. However, as groundwater modeling has not been performed for the site, an accurate estimate cannot be developed at this time.

6.4.8.3 Treatment of Extracted Groundwater

The time required to meet remedial goals depends on the type of groundwater extraction system implemented. The time required for treatment of extracted groundwater is insignificant.

6.4.9 <u>State, Local, or Other Environmental Permit Requirements That May Impact Implementation</u>

This criterion includes anticipation of any state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the technology at the WBSP.

6.4.9.1 In-Situ Groundwater Remedial Technologies

An MNA program would likely require coordination with IDEM but likely not formal approval. Therefore, it could be implemented in as little as (3) months, as a sufficient monitoring well network already exists at the site.

Migration barriers, in-situ chemical stabilization and PRBs would require installation of barrier walls and associated components in the aquifer and/or chemical injections, which may require permitting through IDEM. This would require an anticipated minimum of one (1) to 1.5 years of review and approval.

6.4.9.2 Ex-Situ Groundwater Remedial Technologies

A groundwater extraction system would require the installation of new wells and a treatment system at the WBSP, which may require permitting through IDEM. This would require an anticipated minimum of one (1) to 1.5 years of review and approval.

6.4.9.3 Treatment of Extracted Groundwater

The selection of a treatment system may require permitting through IDEM, especially if a NPDES permit is required. This would require an anticipated minimum of one (1) to 1.5 years of review and approval.

6.5 Conclusions

For this evaluation, several in-situ and ex-situ remedial technologies to address Arsenic in groundwater at the WBSP were screened against evaluation criteria requirements in 40 CFR § 257.96(c). As presented in Table 6-2, during the screening, the technologies were ranked as High, Medium or Low using professional judgement and past experience. Based on these rankings, the three (3) technologies that appear to be most likely for selection as a remedy were:

- MNA;
- In-Situ Chemical Stabilization (Oxygenation); and
- Conventional Vertical Well System (Groundwater Extraction) (Ex-Situ).

Groundwater treatment would be required as a supplemental technology in conjunction with a Conventional Vertical Well System. The selection of a treatment technology would be based on conditions at the time of selection of a final remedy.

The technologies that appear to be less likely for selection as a remedy were:

- Groundwater Migration Barriers (In-Situ);
- PRB (In-Situ);
- Horizontal Well Systems (Ex-Situ); and
- Trenching Systems (Ex-Situ).

As groundwater quality near the WBSP is anticipated to significantly improve over time as a result of planned closure activities, a flexible and adaptive approach to groundwater remediation that begins with post-closure groundwater monitoring at the unit is planned. During the post-closure monitoring period, the positive impacts of closure and the effects of natural attenuation on groundwater quality will be fully evaluated. The need for more active remedial measures will be determined after sufficient post-closure groundwater quality data has been collected and evaluated.

The final selection of a remedy will be made based on the results of the post-closure groundwater monitoring program.

Additional remedial technologies may also be evaluated at a later date if determined to be applicable and appropriate.

7.0 SELECTION OF REMEDY PROCESS

The remedy selection begins following completion of the ACM Report. Per 40 CFR § 257.97(a):

Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator must, as soon as feasible, select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. This requirement applies to, not in place of, any applicable standards under the Occupational Safety and Health Act. The owner or operator must prepare a semiannual report describing the progress in selecting and designing the remedy. Upon selection of a remedy, the owner or operator must prepare a final report describing the selected remedy and how it meets the standards specified in paragraph (b) of this section. The owner or operator must obtain a certification from a qualified professional engineer that the remedy selected meets the requirements of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(12).

This ACM Report provides a high-level assessment of groundwater remedial technologies that could potentially address Arsenic concentrations in groundwater that exceed the GWPS at the WBSP. With the submittal of this report, IKEC will begin the remedy selection process and ultimately select a remedy. The remedy selection process and selected remedy will satisfy standards listed in 40 CFR § 257.97(b) with consideration to evaluation factors listed in 40 CFR § 257.97(c).

7.1 Data Gaps

Based on a review of data to date, the following recommendations for additional data collection/evaluation have been identified:

- To determine the extent of Arsenic exceedances and to comply with 40 CFR § 257.95 (d)(1), IKEC will install at least one (1) monitoring well at the facility boundary when access to the area can be safely obtained in accordance with U.S. FWS regulations. After installation, the well will be developed and sampled for analysis of Arsenic. The results of the well installation and sampling will be presented in an addendum to this ACM Report;

- Ongoing sampling of monitoring wells at the WBSP should continue to evaluate whether Arsenic concentrations in groundwater trends are increasing, decreasing or are asymptotic and to evaluate redox conditions in groundwater. This data will be useful in developing time-series evaluations and in supporting an evaluation of MNA and In-Situ Chemical Stabilization;

- Given the dynamic nature of groundwater flow at the WBSP, additional depth-to-groundwater data from wells in the area would be useful to support ongoing evaluation of remedial technologies; and

- Given that reducing conditions in groundwater at the site are likely leading to the mobilization of Arsenic, a pilot test to evaluate the potential for an In-Situ Chemical Stabilization (Oxygenation) approach to address the Arsenic is recommended.

7.2 Selection of Remedy

As noted above, IKEC will begin the process of selecting a remedy following submittal of this ACM Report. Per 40 CFR § 257.97, the remedy will be selected and implemented as soon as feasible and progress toward selecting the remedy will be documented in future annual reports. As part of the process, one (1) or more preferred remedial approaches will be developed based upon technology effectiveness under site conditions, implementability, cost effectiveness and other considerations.

7.3 Public Meeting Requirement in 40 CFR § 257.96(e)

Per 40 CFR § 257.96(e), IKEC will hold a public meeting to discuss ACM results, the remedy selection process, and selection of one (1) or more preferred remedial approaches. The public meeting will be conducted at least 30 days prior to selection of a final remedy, in accordance with the above-referenced rule. Prior to the meeting, citizen and governmental stakeholders will be formally notified as to the schedule for the public meeting.

7.4 Final Remedy Selection

After selection of a remedy, a report documenting the remedy selection process will be prepared. The report will demonstrate how the remedy selection process was performed and how the selected remedial approach satisfies 40 CFR § 257.97 requirements.

8.0 REFERENCES

Applied Geology and Environmental Science, Inc. (AGES) 2022. Coal Combustion Residuals Regulation 2022 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2023.

Applied Geology and Environmental Science, Inc. (AGES) 2021. Coal Combustion Residuals Regulation 2021 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2022.

Applied Geology and Environmental Science, Inc. (AGES) 2020. Coal Combustion Residuals Regulation 2020 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2021.

Applied Geology and Environmental Science, Inc. (AGES) 2019. Coal Combustion Residuals Regulation 2019 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2020.

Applied Geology and Environmental Science, Inc. (AGES) 2018a. Coal Combustion Residuals Regulation 2018 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2019.

Applied Geology and Environmental Science, Inc. (AGES) 2018b. Coal Combustion Residuals Regulation Monitoring Well Installation Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. Revision 1.0. November 2018.

Applied Geology and Environmental Science, Inc. (AGES) 2018c. Coal Combustion Residuals Regulation Groundwater Monitoring Program Plan, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. Revision 1.0. November 2018.

Applied Geology and Environmental Science, Inc. (AGES) 2017. Coal Combustion Residuals Regulation 2017 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2018.

Fetter, Charles W. 1980. Applied Hydrogeology. Merrill, 1980.

Ford, R., Wilkin, R. and Puls, R. (Editors) 2007. Monitored Natural Attenuation of Inorganic Contaminants in Groundwater, National Risk Management Research Laboratory, EPA 600/R-07/140, Volume 2.

Hostetler, C., Rehm, B. Karwoski, T., and Kron, N. 2020. Groundwater Monitoring Plan Considerations for Corrective Action Sites, SCS Engineers, Inc.: www.scsengineers.com.

Indiana Department of Environmental Management (IDEM) 2019. Screening Level Table A-6.

Reinsel, M. 2015. Arsenic Removal Technologies: A Review, www.wateronline.com.

Smedley, P. and Kinniburgh, D. 2017. Arsenic in Natural Waters, A Review of Occurrence, Distributions and Controls, Journal of Applied Geochemistry, Volume 84.

Stantec Consulting Services, Inc. (Stantec) 2021. Coal Combustion Residuals Regulation Statistical Analysis Plan, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. July 2021.

United States Environmental Protection Agency (U.S. EPA) 2002. Office of Solid Waste and Emergency Response. Arsenic Treatment Technologies for Soil, Waste, and Water. U.S. EPA 542-R-02-004. June 2002.

United States Fish and Wildlife Service (U.S. FWS) 2018. Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat. Consultation Code: 09E00000-2016-F-0001. February 2018.

Wang S. and Mulligan, C. 2006. Natural Attenuation Processes for Remediation of Arsenic Contaminated Soils and Groundwater, Journal of Hazardous Materials, Volume 138, Issue 3.

TABLES

TABLE 4-1
GROUNDWATER MONITORING NETWORK
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)	Top of Casing Elevation (ft)	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	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
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-15-04a	Downgradient	7/28/2021	450669.20	568855.3	472.03	474.47	418.47	408.47	68.44
WBSP-15-05a	Downgradient	8/4/2021	450072.00	568895.20	473.66	476.20	413.20	402.20	76.54
WBSP-15-06a	Downgradient	8/6/2021	449478.8	568659.8	471.96	475.12	399.12	389.12	89.16
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:
The well locations are referenced to the North American Datum (NAD83), east zone coordinate system.
Elevations are referenced to the North American Vertical Datum (NAVD) 1988.

TABLE 4-2
SUMMARY OF CONFIRMED APPENDIX III STATISTICALLY SIGNIFICANT INCREASES – MARCH 2022
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Well ID	Potential SSI Parameter (Units)	9th Detection Monitoring Sampling Event March 2022		9th Detection Monitoring Resampling Event June 2022	
		Potential SSI Result	UPL	Potential SSI Result	Confirmed SSI (Yes/No)
WBSP-15-09	Fluoride (mg/L)	0.72	0.57	0.60	**Yes**

Notes:
1. SSI: Statistically Significant Increase.
2. UPL: Upper Prediction Limit (Maximum Interwell UPL).
3. mg/L: Milligrams per liter.

TABLE 5-1
INTERIM MONITORING WELL CONSTRUCTION DETAILS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Latitude	Longitude					
WBSP-23-01	Interim	7/26/2023	N 38°44.0002'	W 085°25.5860'	443.08	445.35	417.08	407.08	38.27
WBSP-23-02	Interim	7/25/2023	N 38°43.8788'	W 085°25.8618'	444.02	446.24	414.02	404.02	42.22
WBSP-23-03	Interim	7/25/2023	N 38°43.8411'	W 085°25.9612'	443.03	445.27	413.03	403.03	42.24
WBSP-23-04	Interim	7/26/2023	N 38°43.8086'	W 085°26.0606'	443.04	445.35	423.04	413.04	32.31

Note:
Elevations are referenced to the North American Vertical Datum (NAVD) 1988.

TABLE 5-2
SUMMARY OF INTERIM MONITORING WELL DEVELOPMENT DATA
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Date	Development Method	Volume Purged (gallons)	Final Turbidity (NTU)
WBSP-23-01	8/3/2023	Pump	6.5	42.5
WBSP-23-02	8/2/2023	Pump	6.5	60.8
WBSP-23-03	8/2/2023	Pump	6.5	30.3
WBSP-23-04	8/3/2023	Pump	6.5	7.51

Note:
NTU: Nephelometric Turbidity Unit

TABLE 5-3
SUMMARY OF GROUNDWATER ELEVATION DATA – AUGUST 2023
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Top of Casing Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
WBSP-15-01	469.36	19.88	449.48
WBSP-15-02	476.76	12.53	464.23
WBSP-15-03	488.03	10.1	477.93
WBSP-15-04a	474.47	54.28	420.19
WBSP-15-05a	476.20	56.65	419.55
WBSP-15-06a	475.12	54.69	420.43
WBSP-15-07	471.31	41.18	430.13
WBSP-15-08	471.06	41.61	429.45
WBSP-15-09	470.09	39.9	430.19
WBSP-15-10	470.69	39.96	430.73
WBSP-23-01	445.35	16.15	429.20
WBSP-23-02	446.24	13.26	432.98
WBSP-23-03	445.27	16.39	428.88
WBSP-23-04	445.35	19.91	425.44

TABLE 5-4
SUMMARY OF SLUG TEST RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Test	Solution Method	K (cm/sec)	Mean K (cm/sec)
Completed in May 2016				
WBSP-15-07	Rising Head	Bouwer-Rice	9.24E-06	1.02E-05
		Hvorslev	1.06E-05	
	Falling Head	Bouwer-Rice	9.66E-06	
		Hvorslev	1.11E-05	
Completed in August 2023				
WBSP-23-01	Falling Head	Bouwer-Rice	8.39E-05	8.39E-05
		Hvorslev	8.39E-05	
WBSP-23-02	Falling Head	Bouwer-Rice	5.29E-06	5.80E-06
		Hvorslev	6.31E-06	
WBSP-23-03	Falling Head	Bouwer-Rice	2.87E-05	3.14E-05
		Hvorslev	3.42E-05	
WBSP-23-04	Falling Head	Bouwer-Rice	9.35E-05	1.04E-04
		Hvorslev	1.10E-04	
			Mean K (cm/sec)	**4.71E-05**
			Mean K (ft/day)	**0.13**

TABLE 5-5
SUMMARY OF GROUNDWATER VELOCITY CALCULATIONS – AUGUST 2023
WEST BOLER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well Pair		h_1 (ft)	h_2 (ft)	d (ft)	K (ft/day)	n	i	V (ft/day)
Uppermost Aquifer								
WBSP-15-09 (h_1)	WBSP-23-03 (h_2)	430.19	428.88	160	0.13	0.2	0.008	0.005

h_1 = Head elevation in well #1
h_2 = Head elevation in well #2
d = distance between wells
K = Hydraulic conductivity
n = effective porosity
i = Horizontal Hydraulic Gradient
V = Groundwater Velocity

Horizontal Hydraulic Gradient:

$$i = \frac{h_1 - h_2}{d}$$

Groundwater Velocity:

$$V = K\left(\frac{i}{n}\right)$$

TABLE 5-6
SUMMARY OF FIELD PARAMETERS AND GROUNDWATER ANALYTICAL RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Arsenic (ug/L)	ORP (mV)	Turbidity (NTU)	pH (SU)
Downgradient Monitoring Wells – Sampled June 2023				
WBSP-15-07	25	-144	37.7	7.41
WBSP-15-08	70	-72	NA	7.14
WBSP-15-09	26	-173	4.96	7.06
WBSP-15-10	2.5	116	4.05	7.08
Interim Monitoring Wells – Sampled August 2023				
WBSP-23-01	69	-193	23.3	7.50
WBSP-23-02	41	-174	30.4	7.46
WBSP-23-03	16	-279	44.1	7.93
WBSP-23-04	42	-185	12.4	7.57

Notes:
mV: Millivolts
NTU: Nephelometric Turbidity Unit
NA: No Reading Obtained
ORP: Oxidation Reduction Potential
SU: Standard Unit

TABLE 6-1
SOURCE CONTROL TECHNOLOGIES SCREENING MATRIX - 40 CFR § 257.96(c) REQUIREMENTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

	Source Control Technologies		
	Dewatering of Pond Water	**Engineered Cover System**	**Excavation of Ash**
257.96(c)(1)			
Performance	Low	Medium	High
Reliability	Low	Medium	High
Ease of Implementation	Medium Water Removal, Treatment & Discharge Required	Medium Field Construction Required	Medium Field Construction Required
Potential Safety Impacts	Low Field Construction Required	Medium Field Construction Required	High Field Construction Required
Potential Cross-Media Impacts	Medium	Low	Medium
Potential Impacts from Control of Exposure to Residual Constituents	Low	Low	Low
257.96(c)(2)			
Time To Begin Remedy	6 months to 1 year	1 to 1.5 years	1 to 1.5 years
Time To Complete Remedy	6 months to 1 year	1 to 1.5 years	1 to 1.5 years
257.96(c)(3)			
State, Local or other Environmental Permit Requirements that May Impact Implementation	Requires Approval from IDEM	Requires Approval from IDEM	Requires Approval from IDEM
Additional Information	Required for In-Place Closure or Closure by Removal	Boiler Slag Remains in Place as Long-Term Source for Groundwater	Groundwater Issues Need to be Addressed

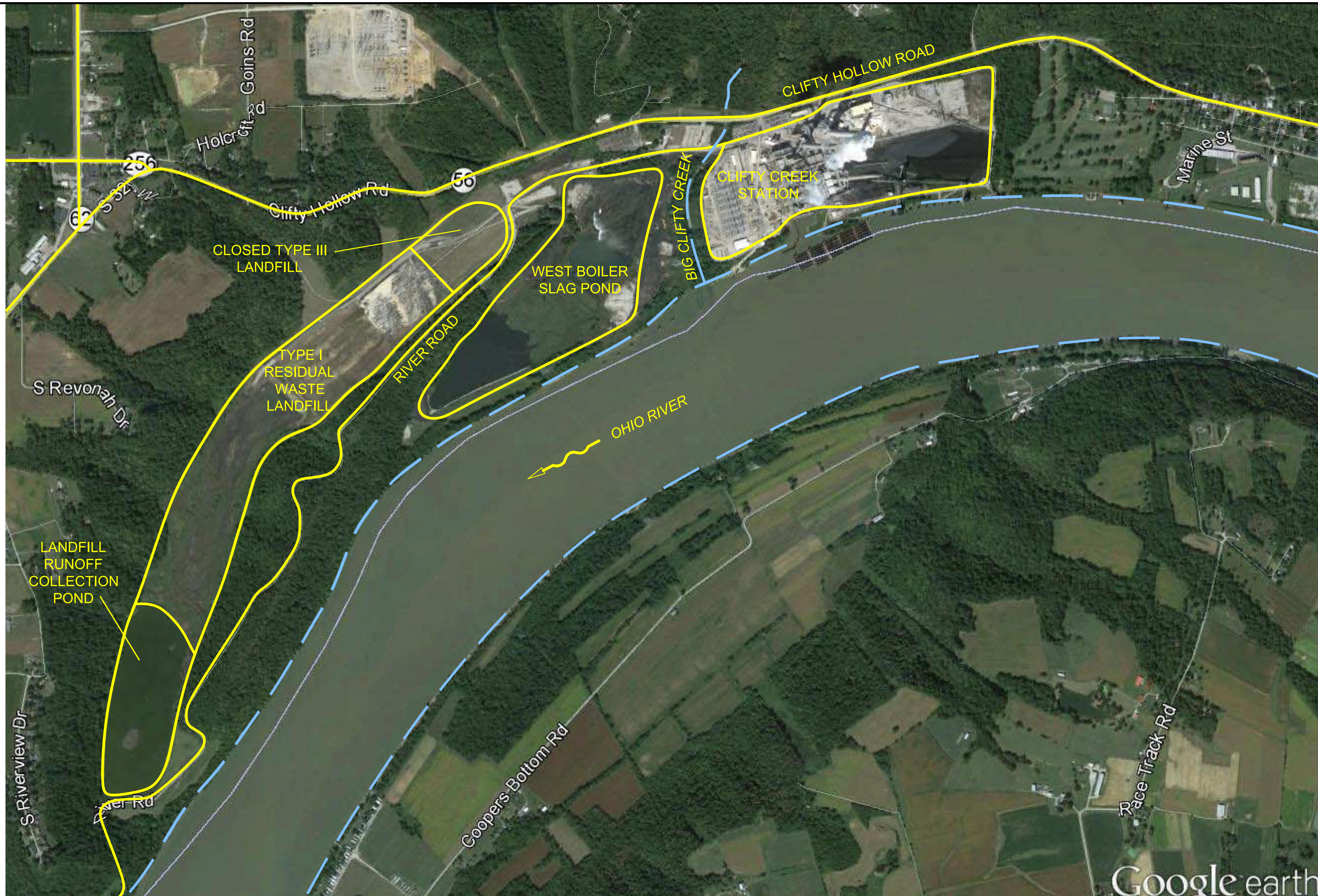
Notes:
Relative assessments (low, medium, high) are based on experience and professional judgement

TABLE 6-2
IN-SITU AND EX-SITU GROUNDWATER REMEDIAL TECHNOLOGIES SCREENING MATRIX - 40 CFR § 257.96(c) REQUIREMENTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

	In-Situ Groundwater Remedial Technologies				*Ex-Situ Groundwater Remedial Technologies*		
	Monitored Natural Attenuation	**Groundwater Migration Barriers**	**In-situ Chemical Stabilization**	**Permeable Reactive Barrier**	**Conventional Well System**	**Horizontal Well System**	**Trenching System**
257.96(c)(1)							
Performance	Medium	Medium	Medium	Low	High	Low	High
Reliability	High	Medium	High	Medium	High Long Term O&M Required	Low	High Long Term O&M Required
Ease of Implementation	High	Low	Medium	Low	High Drilling and Limited Field Construction Required	Medium Drilling and Limited Field Construction Required	Low Trench Construction Required
Potential Safety Impacts	Low	Medium Field Construction Required	Medium Field Construction Required	Medium Field Construction Required	Medium Drilling Required	Medium Drilling Required	Medium Trench Construction Required
Potential Cross-Media Impacts	Low	Low	Low	Low	Medium	Medium	Medium
Potential Impacts from Control of Exposure to Residual Constituents	Low	Low	Low	Low	Medium	Medium	Medium
257.96(c)(2)							
Time To Begin Remedy	3 months	1 to 1.5 years	1 to 1.5 years	1 to 1.5 years	6 months to 1 year	6 months to 1 year	6 months to 1 year
Time To Complete Remedy	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required
257.96(c)(3)							
State, Local or other Environmental Permit Requirements that May Impact Implementation	Requires Coordination with IDEM	Requires Approval from IDEM	Requires Approval from IDEM	Requires Approval from IDEM	Requires Approval from IDEM	Requires Approval from IDEM	Requires Approval from IDEM
Additional Information	Groundwater F&T Modeling Required to Evaluate the Timing for This Approach for Arsenic	Groundwater Flow Modeling Required to Fully Evaluate This Approach	Bench Scale Testing Required to Further Evaluate Applicability for Arsenic	Bench Scale Testing Required to Further Evaluate Applicability for Arsenic	Groundwater Flow Modeling Required to Fully Evaluate This Approach	Groundwater Flow Modeling Required to Fully Evaluate This Approach	Groundwater Flow Modeling Required to Fully Evaluate This Approach

Notes:
Relative assessments (low, medium, high) are based on experience and professional judgement

FIGURES



N

1200' 0' 1200' 2400'

SCALE: 1"= 1200'

DRAWN BY	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	IKEC_Clifty_Site Loc.dwg
DRAWING SCALE	AS SHOWN

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

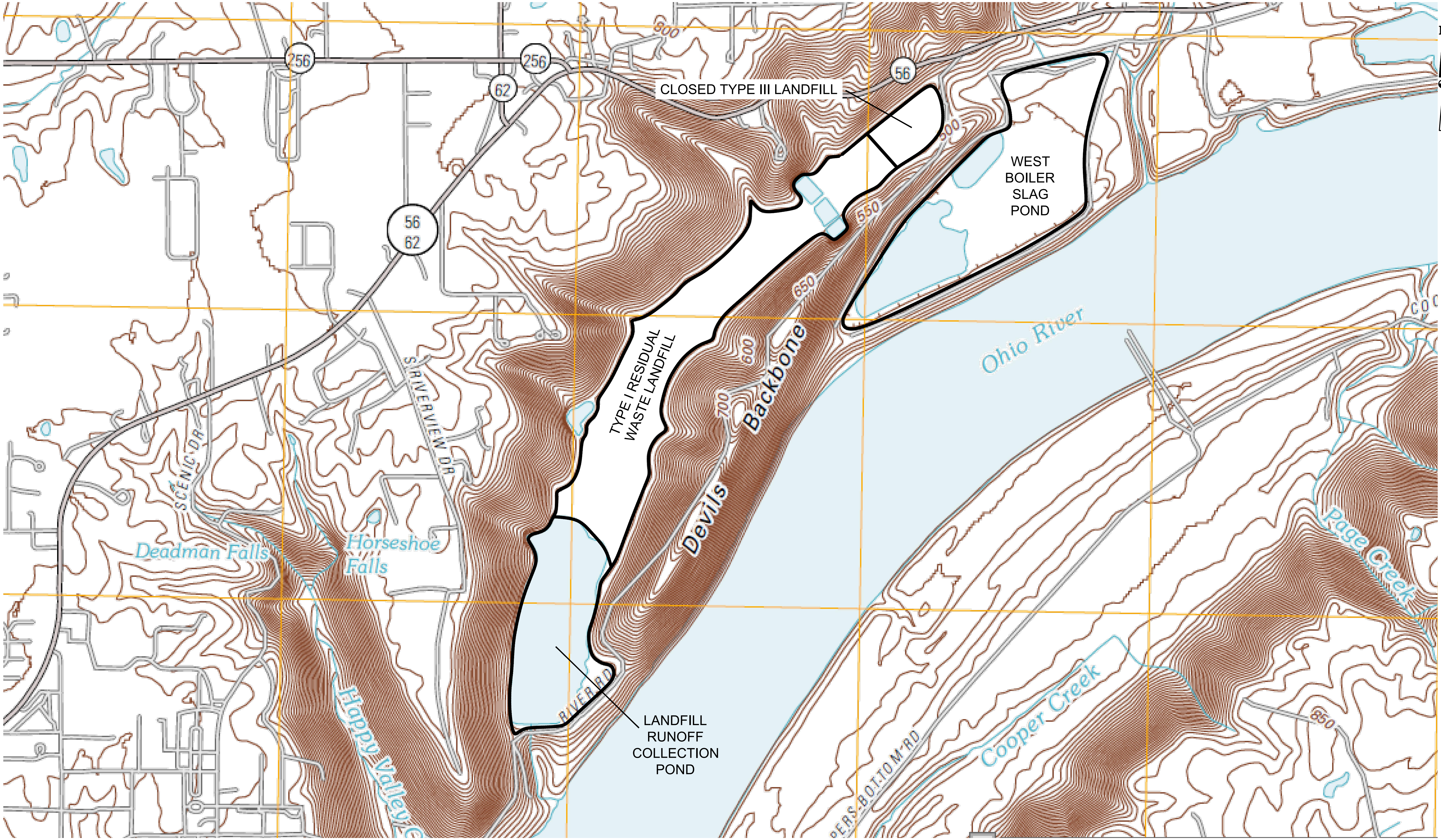
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
SITE LOCATION MAP

DRAWING NAME: FIGURE 2–1

REV. 0

Plot: 09/14/2023 14:55 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\IKEC_Clifty_Site Loc.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

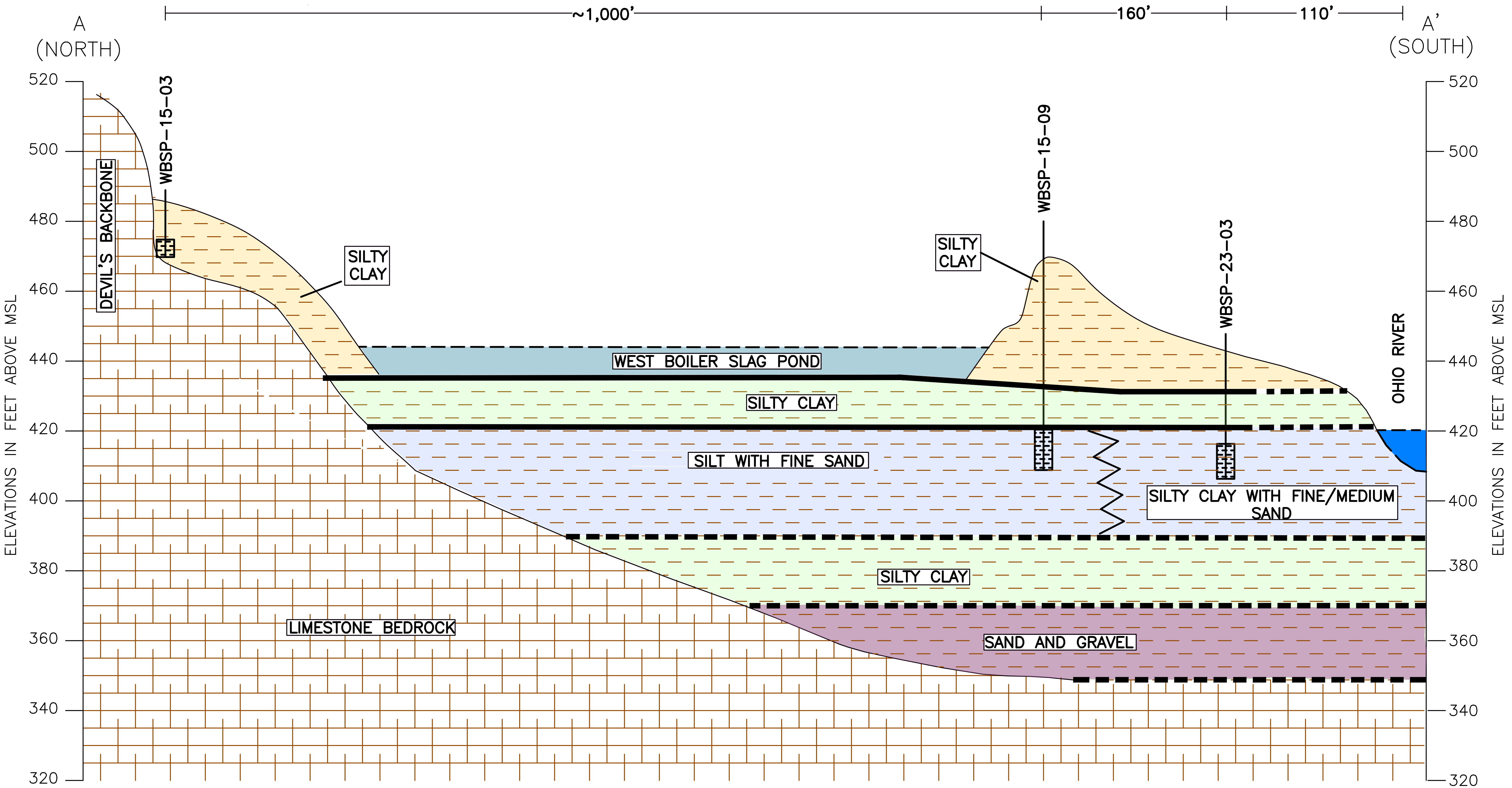
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TOPOGRAPHIC MAP

DRAWING NAME: FIGURE 3–1
REV. 0

Plot: 09/28/2018 15:46 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_USGS TOPO b05.dwg



NOTE:
HORIZONTAL AXIS IS NOT TO SCALE.

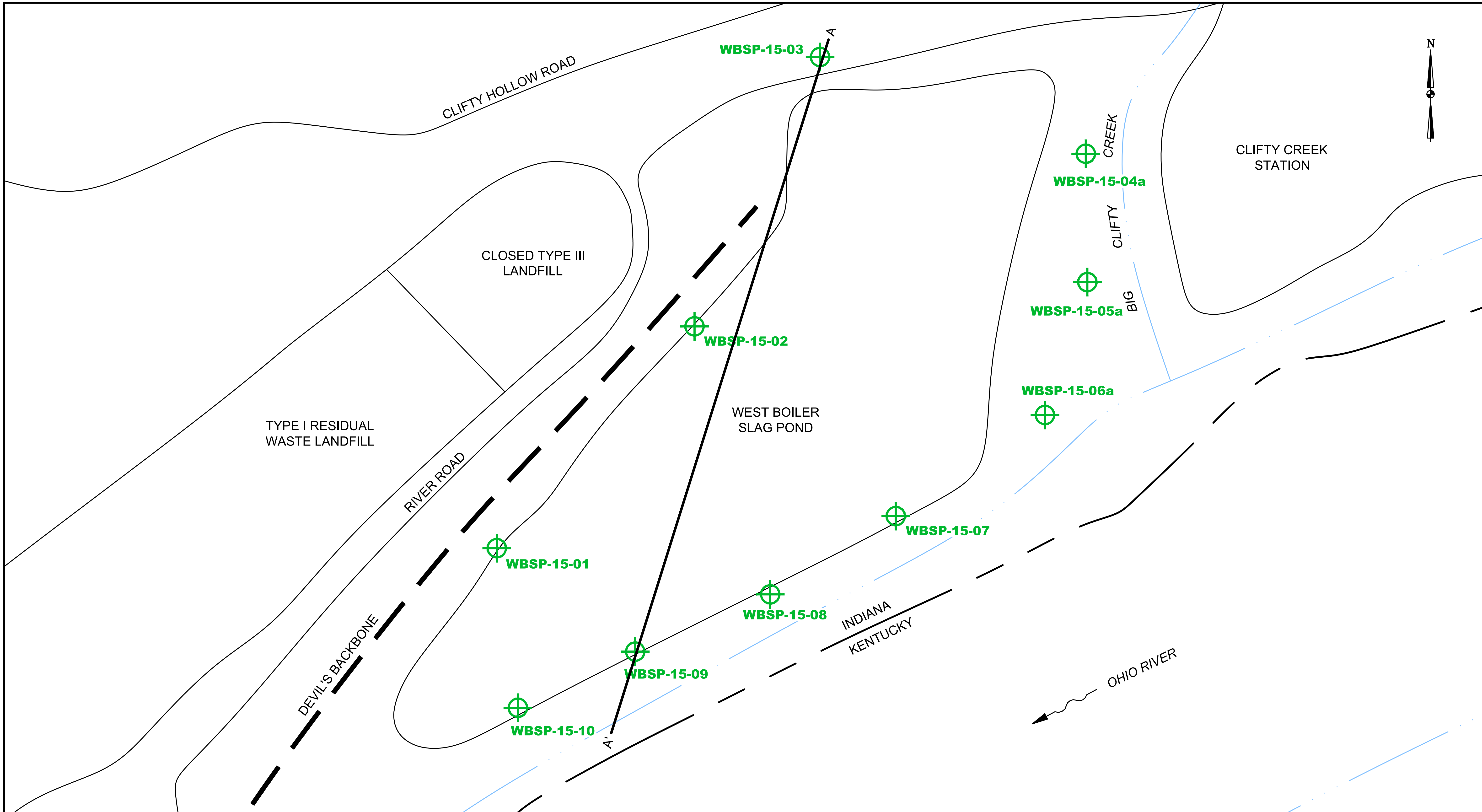
DRAWN BY	AB
DATE	10/10/23
CHECKED BY	BF
JOB NO.	CLIFTY
DWG FILE	IKEC_Clifty_WBSP_Cross Sec.dwg
DRAWING SCALE	NOT TO SCALE

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 A-A'

DRAWING NAME: FIGURE 3-2
REV. 0



LEGEND:

⌖ CCR EXISTING PROGRAM MONITORING WELL

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	IKEC–Clifty_WBSP_Monitoring Locations.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
EXISTING MONITORING WELL LOCATION MAP

DRAWING NAME: FIGURE 3–3

REV.: 0

Plot: 09/14/2023 15:19 _PROGRAMS–IKEC\IKEC–Clifty_WBSP_Monitoring Locations

LEGEND:

CCR EXISTING PROGRAM MONITORING WELL

CCR INTERIM PROGRAM MONITORING WELL

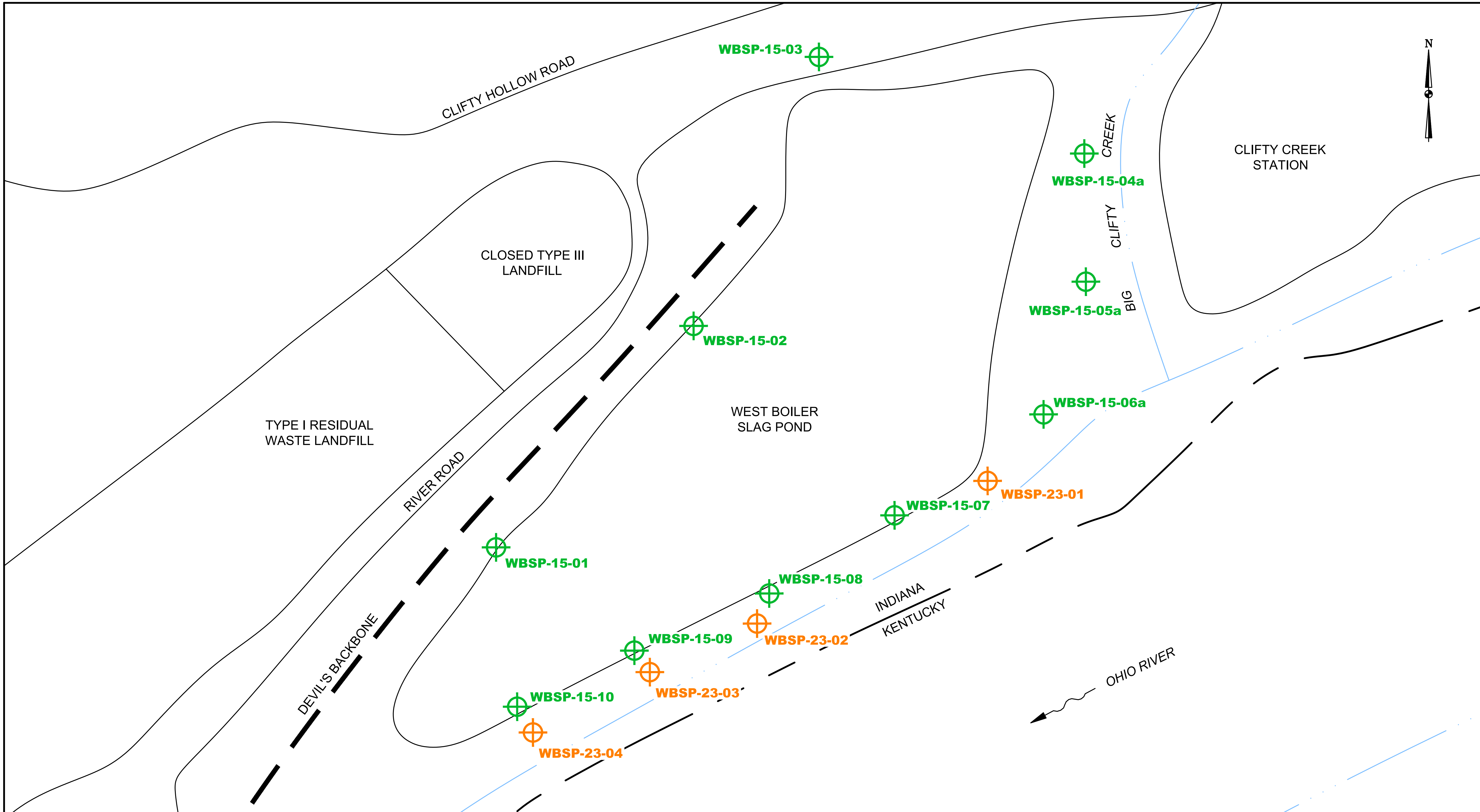
DRAWN BY	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	IKEC–Clifty_WBSP_Restricted Work Area.dwg
DRAWING SCALE	NOT TO SCALE

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
RESTRICTED WORK AREA

DRAWING NAME	REV.
FIGURE 5–1	0



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004-CLI
DWG FILE	IKEC-Clifty_WBSP_Additional Locations.dwg
DRAWING SCALE	AS SHOWN

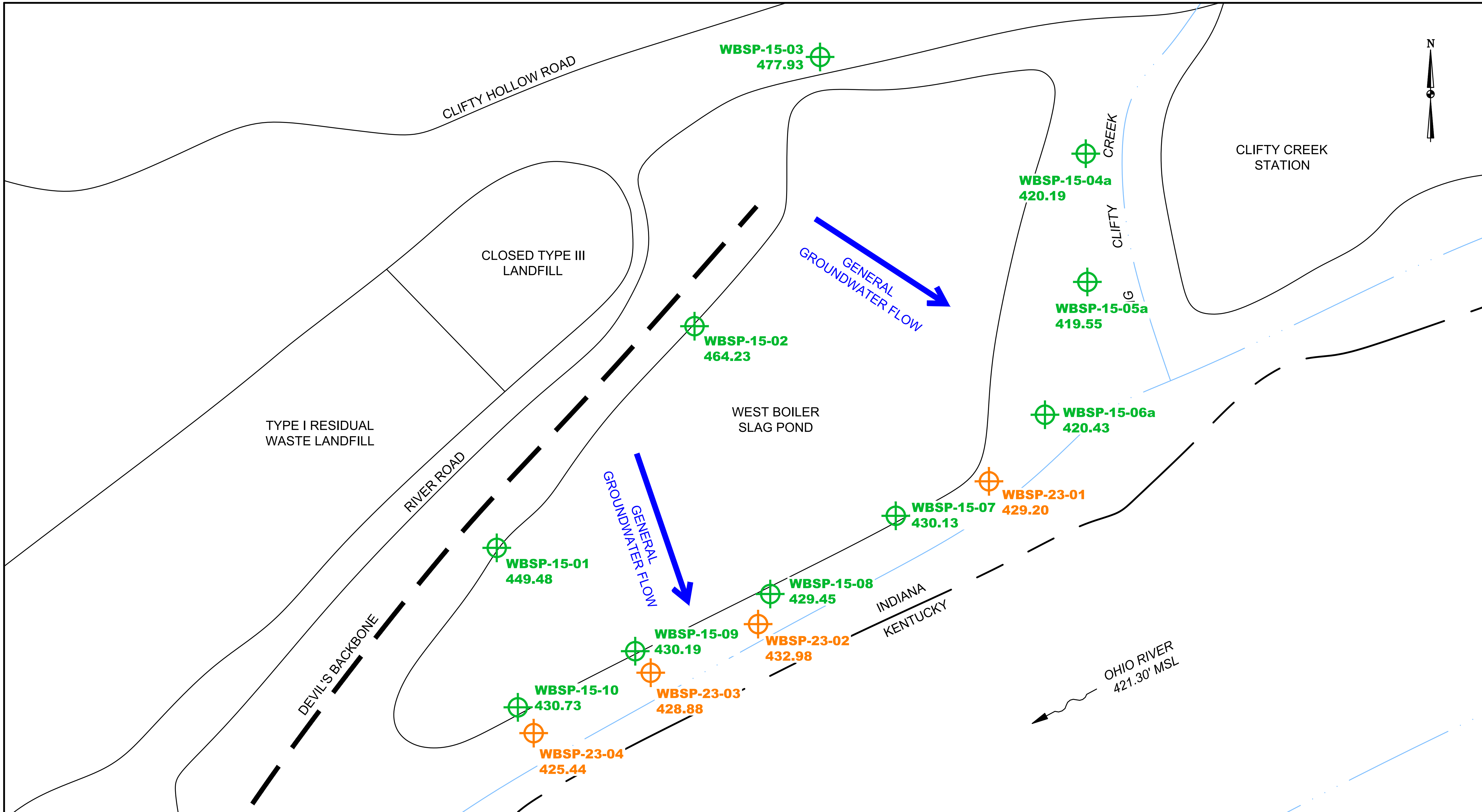
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
EXISTING AND INTERIM MONITORING WELL LOCATION MAP

DRAWING NAME	REV.
FIGURE 5-2	0

Plot: 09/14/2023 15:36 _PROGRAMS-IKEC\IKEC-Clifty_WBSP_Additional Locations



LEGEND:

CCR EXISTING PROGRAM MONITORING WELL

CCR INTERIM PROGRAM MONITORING WELL

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	IKEC–Clifty_WBSP_Aug 2023 GW Flow.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.

2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

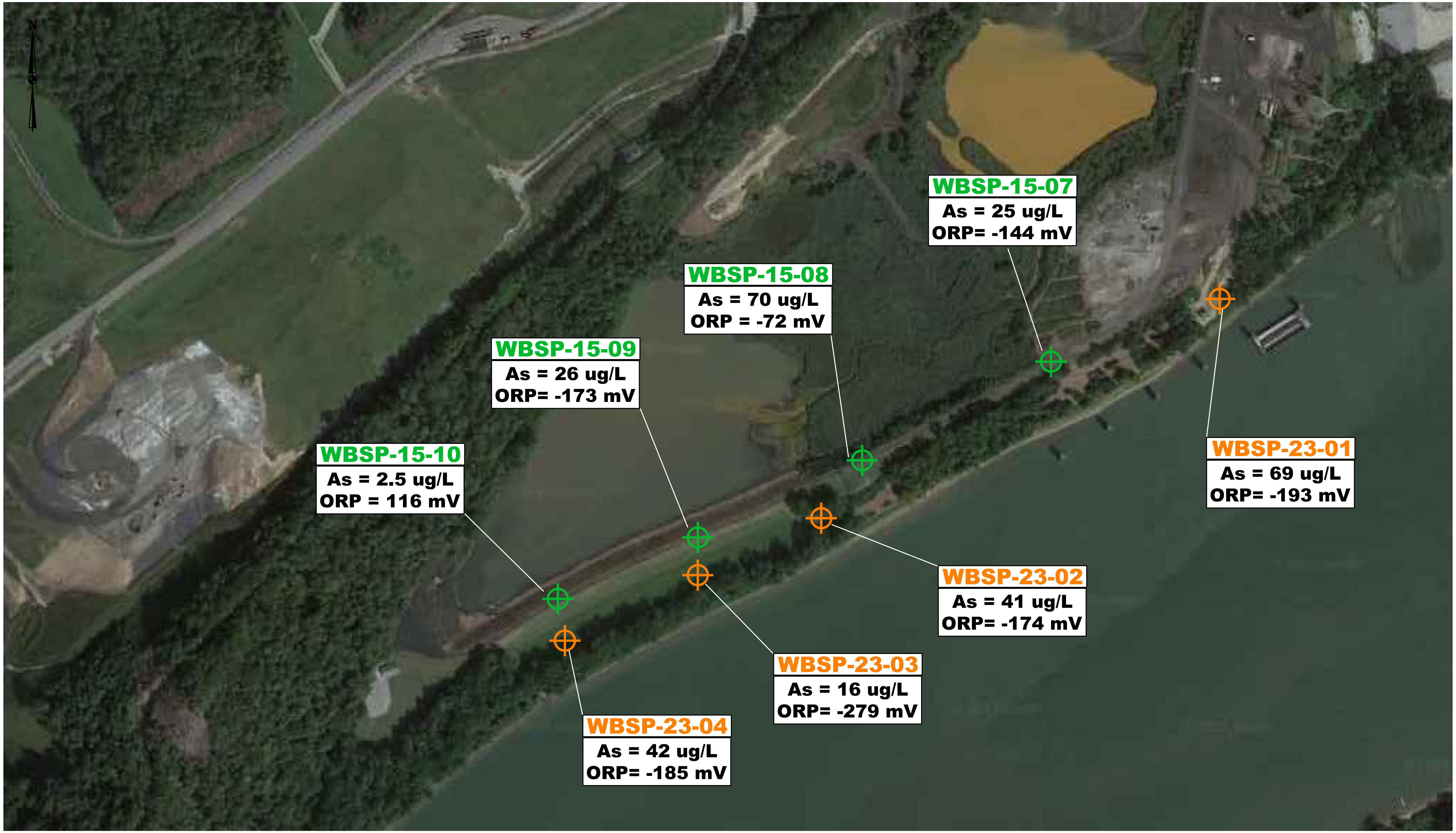
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GROUNDWATER FLOW
AUGUST 2023

DRAWING NAME: FIGURE 5–3

REV. 0

Plot: 09/15/2023 10:57 _PROGRAMS–IKEC\IKEC–Clifty_WBSP_Aug 2023 GW Flow



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL

NOTES:

ARSENIC RESULTS PROVIDED IN MICROGRAMS PER LITER (UG/L).

GWPS FOR ARSENIC IS 10 UG/L.

OXIDATION REDUCTION POTENTIAL (ORP) RESULTS PROVIDED IN MILLIVOLTS (MV).

DRAWN BY	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	IKEC–Clifty_WBSP_Arsenic Concentrations in GW.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

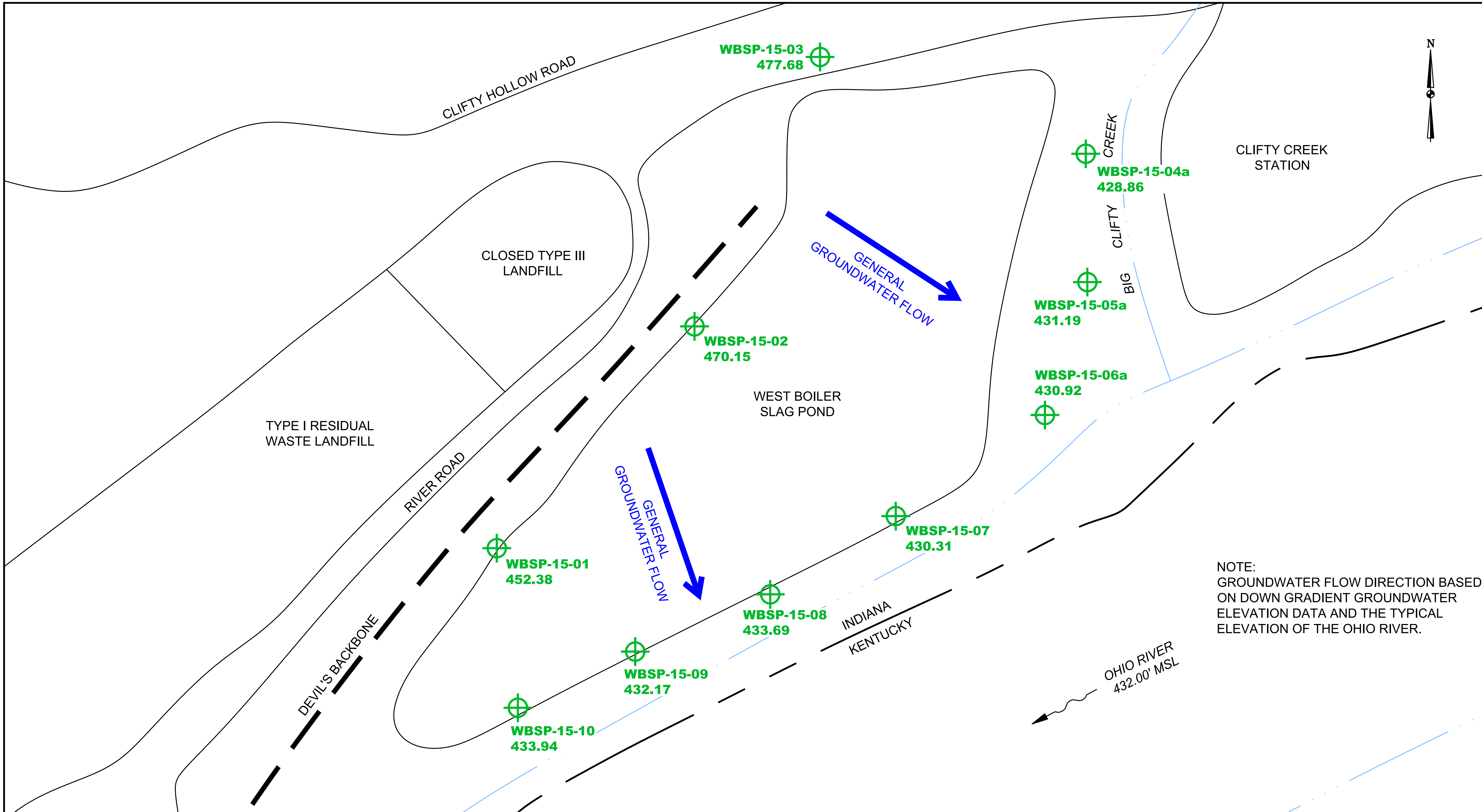
CLIFTY CREEK STATION
MADISON, INDIANA
ARSENIC CONCENTRATIONS IN GROUNDWATER – JUNE & AUGUST 2023

DRAWING NAME: FIGURE 5–4

REV. 0

APPENDIX A

GENERALIZED GROUNDWATER FLOW MAPS FOR MARCH 2022, SEPTEMBER 2022 & MARCH 2023



LEGEND:

CCR PROGRAM MONITORING WELL

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	A-1_IKEC-Clifty_GW Flow_MAR22_WBSP.dwg
DRAWING SCALE	AS SHOWN

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

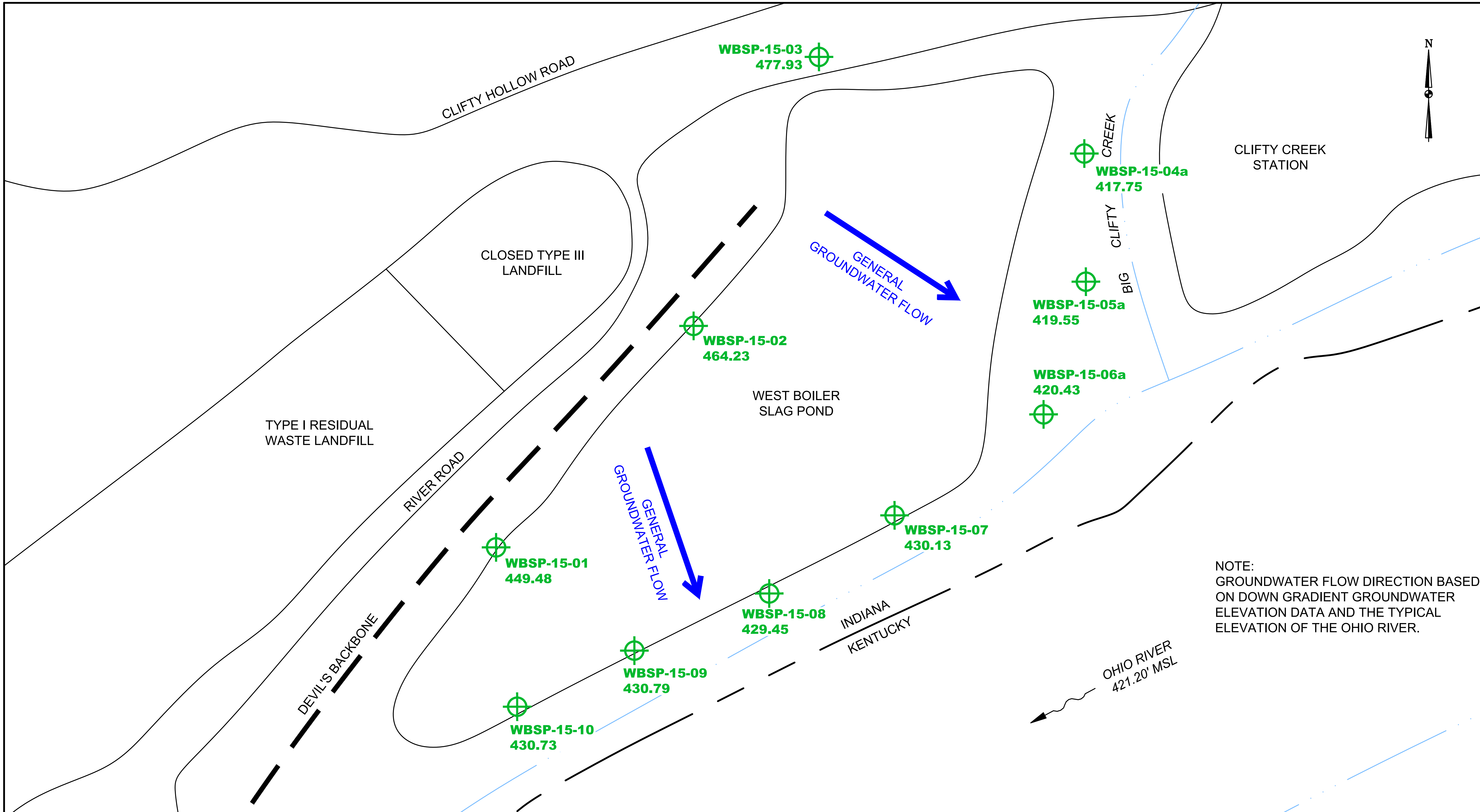
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH 2022

DRAWING NAME: FIGURE A–1

REV. 0

Plot: 12/21/2022 14:41 _PROGRAMS–IKEC\IKEC–CCR Program\CAD\2022 GW Monitoring–Corrective Action Rpt\B–4_IKEC–Clifty_GW Flow_Appx B_Annual GW Rpt_MAR22_WBSP\well loc



LEGEND:

CCR PROGRAM MONITORING WELL

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004-CLI
DWG FILE	A-2_IKEC-Clifty_GW Flow_SEPT22_WBSP.dwg
DRAWING SCALE	AS SHOWN

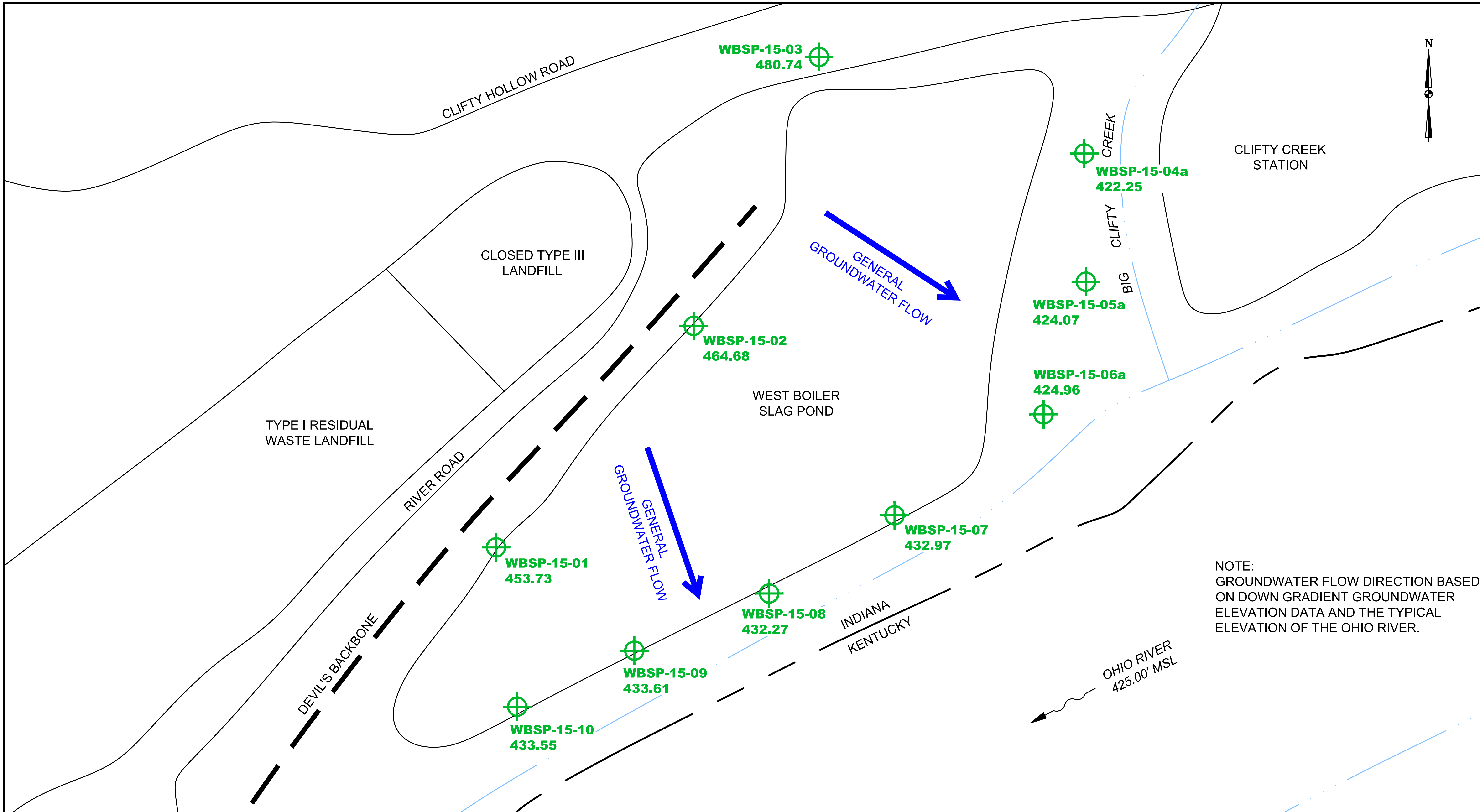
AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
SEPTEMBER 2022

DRAWING NAME	REV.
FIGURE A–2	0

Plot: 12/21/2022 14:52 _PROGRAMS-IKEC\IKEC-CCR Program\CAD\2022 GW Monitoring-Corrective Action Rpt\B-5_IKEC-Clifty_GW Flow_Appx B_Annual GW Rpt_SEPT22_WBSP\well loc



LEGEND:

CCR PROGRAM MONITORING WELL

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	A-3_IKEC-Clifty_GW Flow_MAR23_WBSP.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 AND FLOW DIRECTION
MARCH 2023

DRAWING NAME: FIGURE A–3

REV.: 0

Plot: 10/04/2023 09:31 _PROGRAMS–IKEC\IKEC–CCR Program\CAD\A–3_IKEC–Clifty_GW Flow_MAR23_WBSP\well loc

APPENDIX B

ANALYTICAL RESULTS FOR SEPTEMBER 2022 & MARCH 2023 ASSESSMENT MONITORING EVENTS

TABLE B-1
SUMMARY OF SEPTEMBER 2022 ANALYTICAL RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Parameter	Units	WBSP-15-01	WBSP-15-02	WBSP-15-03	WBSP-15-04a*	WBSP-15-05a*	WBSP-15-06a*	WBSP-15-07	WBSP-15-08	WBSP-15-09	WBSP-15-10	CF-15-04	CF-15-05	CF-15-06
Appendix III Constituents														
Boron, B	mg/L	NS	3.7	0.13	0.49	2.2	0.32	0.018	0.022	0.014	0.018	0.039	0.097	NS
Calcium, Ca	mg/L	NS	260	150	140	100	20	190	79	64	90	75	110	NS
Chloride, Cl	mg/L	NS	9.7	37	25	28	7.4	12	18	3.7	24	39	29	NS
Fluoride, F	mg/L	NS	0.36	0.32	0.18	0.28	0.058	0.3	0.22	0.63	0.22	0.14	0.46	NS
pH	s.u.	NS	7.2	7.2	7.4	8.3	7.3	7	6.8	6.9	7	8.3	8.2	NS
Sulfate, SO4	mg/L	NS	550	120	110	300	22	13	4.0 U	4.0 U	73	36	41	NS
Total Dissolved Solids (TDS)	mg/L	NS	1100	620	480	510	10 U	640	320	280	38	130	70	NS
Appendix IV Constituents														
Antimony, Sb	ug/L	NS	1.0 U	1.0 U	1.0 U	2.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS
Arsenic, As	ug/L	NS	0.52	0.3	0.53	1	1.3	51	66	23	4	0.58	5.6	NS
Barium, Ba	ug/L	NS	29	12	77	120	39	410	290	180	190	49	82	NS
Beryllium, Be	ug/L	NS	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.11	NS
Cadmium, Cd	ug/L	NS	0.50 U	0.50 U	0.19	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NS
Chromium, Cr	ug/L	NS	1.5	0.88	1.7	3.2	1.4	1.1	0.97	2.1	0.9	1.2	2.9	NS
Cobalt, Co	ug/L	NS	0.52	0.25	12	1.6	0.15	2.6	1.2	0.45	2.3	0.23	1.9	NS
Fluoride, F	mg/L	NS	0.36	0.32	0.18	0.28	0.058	0.3	0.22	0.63	0.22	0.14	0.46	NS
Lead, Pb	ug/L	NS	1.0 U	1.0 U	0.4	1.0 U	1.0 U	1.0 U	1.0 U	0.43	1.0 U	1.0 U	1.1	NS
Lithium, Li	mg/L	NS	0.073	0.012	0.016	0.076	0.004 U	0.0013	0.004 U	0.0013	0.0015	0.0013	0.015	NS
Mercury, Hg	ug/L	NS	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS
Molybdenum, Mo	ug/L	NS	2.9	0.71	0.33	50	13	4.4	0.96	7.8	1.4	1.3	1.1	NS
Radium 226 & 228 (combined)	pCi/L	NS	0.802	0.791	1.45	1.33	1.64	1.85	1.69	2.25	1.37	0.676	0.66	NS
Selenium, Se	ug/L	NS	1.0 U	1.0 U	0.49	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS
Thallium, Tl	ug/L	NS	0.2 U	0.024	0.04	0.038	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.045	NS

Notes:
NA: Sampling not required for this parameter.
NS: Well not sampled.
*The facility is evaluating whether the sampling results for these wells are the result of an error in accordance with 40 C.F.R. § 257.95(g)(3)(ii) as presented in CCR 2022 Groundwater Monitoring and Corrective Action Report (AGES 2022).

TABLE B-2
SUMMARY OF DECEMBER 2022 ANALYTICAL RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Parameter	Units	WBSP-15-04a*	WBSP-15-05a*	WBSP-15-06a*	WBSP-15-07	WBSP-15-08	WBSP-15-09
Appendix III Constituents							
Boron, B	mg/L	0.41	2.4	1.4	NA	NA	NA
Calcium, Ca	mg/L	NA	NA	NA	NA	NA	NA
Chloride, Cl	mg/L	NA	NA	NA	NA	NA	NA
Fluoride, F	mg/L	NA	NA	NA	NA	NA	0.47
pH	s.u.	NA	NA	NA	NA	NA	NA
Sulfate, SO4	mg/L	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (TDS)	mg/L	NA	NA	NA	NA	NA	NA
Appendix IV Constituents							
Antimony, Sb	ug/L	NA	NA	NA	NA	NA	NA
Arsenic, As	ug/L	NA	NA	NA	10	58	16
Barium, Ba	ug/L	NA	NA	NA	NA	NA	NA
Beryllium, Be	ug/L	NA	NA	NA	NA	NA	NA
Cadmium, Cd	ug/L	NA	NA	NA	NA	NA	NA
Chromium, Cr	ug/L	NA	NA	NA	NA	NA	NA
Cobalt, Co	ug/L	7.8	NA	NA	NA	NA	NA
Fluoride, F	mg/L	NA	NA	NA	NA	NA	NA
Lead, Pb	ug/L	NA	NA	NA	NA	NA	NA
Lithium, Li	mg/L	NA	NA	NA	NA	NA	NA
Mercury, Hg	ug/L	NA	NA	NA	NA	NA	NA
Molybdenum, Mo	ug/L	NA	NA	NA	NA	NA	NA
Radium 226 & 228 (combined)	pCi/L	NA	NA	NA	NA	NA	NA
Selenium, Se	ug/L	NA	NA	NA	NA	NA	NA
Thallium, Tl	ug/L	NA	NA	NA	NA	NA	NA

Notes:
NA: Sampling not required for this parameter.
*The facility is evaluating whether the sampling results for these wells are the result of an error in accordance with 40 C.F.R. § 257.95(g)(3)(ii) as presented in CCR 2022 Groundwater Monitoring and Corrective Action Report (AGES 2022).

TABLE B-3
SUMMARY OF MARCH 2023 ANALYTICAL RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Parameter	Units	WBSP-15-01	WBSP-15-02	WBSP-15-03	WBSP-15-04a*	WBSP-15-05a*	WBSP-15-06a*	WBSP-15-07	WBSP-15-08	WBSP-15-09	WBSP-15-10	CF-15-04	CF-15-05	CF-15-06
Appendix III Constituents														
Boron, B	mg/L	NS	4.1	0.085	0.51	2.4	1.5	0.017	0.028	0.014	0.039	0.038	0.13	0.11
Calcium, Ca	mg/L	NS	280	150	150	140	99	200	85	63	97	76	110	150
Chloride, Cl	mg/L	NS	8.9	79	24	24	45	11	17	3.5	24	30	34	5.3
Fluoride, F	mg/L	NS	0.28	0.19	0.25 U	0.17	0.22	0.23	0.15	0.55	0.21	0.1	0.44	0.2
pH	s.u.	NS	7.27	7.01	7.95	7.07	7.34	6.94	6.95	7.25	7.01	7.89	7.64	7.53
Sulfate, SO4	mg/L	NS	550	140	98	310	85	6.2	4 U	4 U	65	32	49	85
Total Dissolved Solids (TDS)	mg/L	NS	1100	550	550	690	500	270	330	96	10 U	420	500	550
Appendix IV Constituents														
Antimony, Sb	ug/L	NS	1 U	1 U	1 U	0.6	1 U	1 U	1 U	1.1	0.53	1 U	1 U	1 U
Arsenic, As	ug/L	NS	0.54	1 U	0.3	1.2	9.1	87	100	25	12	0.39	0.35	4.8
Barium, Ba	ug/L	NS	24	12	73	140	210	650	490	170	290	44	49	82
Beryllium, Be	ug/L	NS	0.7 U	0.7 U	0.7 U	0.037	0.7 U	0.047	0.15	0.036	0.55	0.7 U	0.7 U	0.36
Cadmium, Cd	ug/L	NS	0.5 U	0.5 U	0.18	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16	0.5 U	0.5 U	0.11
Chromium, Cr	ug/L	NS	1.2	0.82	0.79	2.4	0.98	2.2	3.5	1.2	12	1	0.67	9.4
Cobalt, Co	ug/L	NS	0.43	0.22	9.5	1.8	0.6	3.3	2.3	0.36	9.1	0.17	0.41	9.5
Fluoride, F	mg/L	NS	0.28	0.19	0.25 U	0.17	0.22	0.23	0.15	0.55	0.21	0.1	0.44	0.2
Lead, Pb	ug/L	NS	0.2	1 U	0.21	0.43	1 U	0.43	2.3	0.49	6.1	1 U	1 U	6.7
Lithium, Li	mg/L	NS	0.069	0.011	0.0014	0.039	0.0039	0.0016	0.0025	0.004 U	0.011	0.0014	0.016	0.016
Mercury, Hg	ug/L	NS	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.000047
Molybdenum, Mo	ug/L	NS	3.8	1.2	0.28	34	50	4.7	0.79	6.2	3	0.91	1 U	0.64
Radium 226 & 228 (combined)	pCi/L	NS	5 U	5 U	5 U	5 U	1.05	1.11	5 U	0.749	5 U	5 U	5 U	3.29
Selenium, Se	ug/L	NS	1 U	1 U	0.46	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Thallium, Tl	ug/L	NS	0.2 U	0.2 U	0.025	0.037	0.2 U	0.2 U	0.019	0.2 U	0.14	0.2 U	0.2 U	0.08

Notes:
NA: Sampling not required for this parameter.
NS: Well not sampled.
*The facility is evaluating whether the sampling results for these wells are the result of an error in accordance with 40 C.F.R. § 257.95(g)(3)(ii) as presented in CCR 2022 Groundwater Monitoring and Corrective Action Report (AGES 2022).

TABLE B-4
SUMMARY OF JUNE 2023 ANALYTICAL RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Parameter	Units	WBSP-15-04a*	WBSP-15-05a*	WBSP-15-06a*	WBSP-15-07	WBSP-15-08	WBSP-15-09	WBSP-15-10
Appendix III Constituents								
Boron, B	mg/L	0.51	2.2	1.4	NA	NA	NA	NA
Calcium, Ca	mg/L	NA	NA	NA	NA	NA	NA	NA
Chloride, Cl	mg/L	NA	NA	NA	NA	NA	NA	NA
Fluoride, F	mg/L	NA	NA	NA	NA	NA	NA	NA
pH	s.u.	7.95	NA	NA	NA	NA	NA	NA
Sulfate, SO4	mg/L	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (TDS)	mg/L	NA	NA	NA	NA	NA	NA	NA
Appendix IV Constituents								
Antimony, Sb	ug/L	NA	NA	NA	NA	NA	NA	NA
Arsenic, As	ug/L	NA	NA	NA	25	70	26	2.5
Barium, Ba	ug/L	NA	NA	NA	NA	NA	NA	NA
Beryllium, Be	ug/L	NA	NA	NA	NA	NA	NA	NA
Cadmium, Cd	ug/L	NA	NA	NA	NA	NA	NA	NA
Chromium, Cr	ug/L	NA	NA	NA	NA	NA	NA	NA
Cobalt, Co	ug/L	12	NA	NA	NA	NA	NA	2.4
Fluoride, F	mg/L	NA	NA	NA	NA	NA	NA	NA
Lead, Pb	ug/L	NA	NA	NA	NA	NA	NA	NA
Lithium, Li	mg/L	NA	NA	NA	NA	NA	NA	NA
Mercury, Hg	ug/L	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Mo	ug/L	NA	NA	NA	NA	NA	NA	NA
Radium 226 & 228 (combined)	pCi/L	NA	NA	NA	NA	NA	NA	NA
Selenium, Se	ug/L	NA	NA	NA	NA	NA	NA	NA
Thallium, Tl	ug/L	NA	NA	NA	NA	NA	NA	NA

Notes:
NA: Sampling not required for this parameter.
*The facility is evaluating whether the sampling results for these wells are the result of an error in accordance with 40 C.F.R. § 257.95(g)(3)(ii) as presented in CCR 2022 Groundwater Monitoring and Corrective Action Report (AGES 2022).

APPENDIX C

BORING AND WELL LOGS

BORING NO. WBSP-23-01
SAMPLE/CORE LOG

Project Number:	2023122	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	7/26/23-7/27/23	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	36’	Surface Elevation:	443.08

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	1.6	3-3-5-5	Orange brown silty clay, moist	N/A
2-4	1	2-3-5-7	Orange brown silty clay, moist	N/A
4-6	1.6	2-4-5-7	Orange brown silty clay, moist	N/A
6-8	1.6	3-3-3-7	Orange brown silty clay, slightly plastic, moist	N/A
8-10	2	3-5-7-10	Orange brown silty clay, slightly plastic, moist	N/A
10-12	1.6	2-3-5-7	Orange brown silty clay, slightly plastic, moist	N/A
12-14	2	2-3-3-4	12-12.5 Orange brown silty clay, slightly plastic, moist; 12.5-14 Gray silty clay, slightly plastic, moist	N/A
14-16	1.6	1-1-1-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
16-18	2	1-1-1-2	Gray silty clay, slightly plastic, moist; trace sand seems, wet	N/A
18-20	2	1-1-1-2	Gray silty clay, slightly plastic, moist; trace sand seems, wet	N/A
20-22	2	Wt/1-1-1	Gray silty clay, slightly plastic, moist; trace sand seems, wet	N/A
22-24	2	Wt/3-2-3	Gray silty clay, slightly plastic, moist; trace sand seems, wet	N/A
24-26	2	2-3-4-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
26-28	2	Wt/2-2	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
28-30	2	Wt/2-2-2	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
30-32	2	Wt/2-2-2	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
32-34	2	1-2-1-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
34-36	2	1-1-1-2	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-23-01

Project Number: 2023122

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 7/26/23-7/27/23

Drilling Method: HSA
Drilling Contractor: HAD Inc

Development Date(s): 8/3/23

Development Method: Submersible Pump and Bladder Pump

Volume Purged: Approx. 6 gallons

Static Water-Level*: 429.22

Top of Well Casing Elevation: 445.35

Well Purpose:
Groundwter Monitoring
Latitude (N): N 38°44.0002'
Longitude (W): 085°25.5860'

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

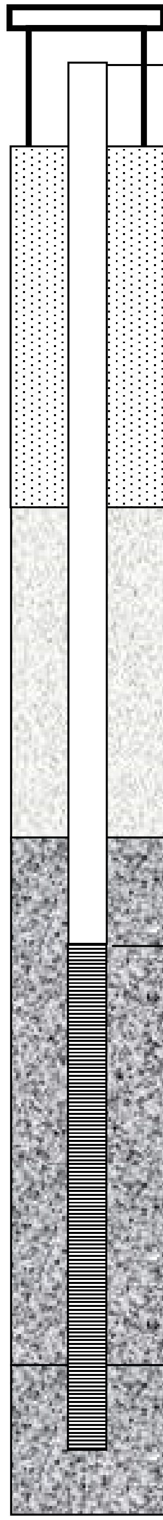
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

1 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 445.35 ft.
Stick-up: 2.27 ft.

Land Surface Elevation: 443.08 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 22 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: 36 ft.*

Total Depth of Well Below Top of Casing: 38.27 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-23-02
SAMPLE/CORE LOG

Project Number:	2023122	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	7/25/23-7/27/23	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	40’	Surface Elevation:	444.02

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	2	1-1-5-8	Orange brown silty clay, moist	N/A
2-4	1.2	1-4-4-7	Orange brown silty clay, moist	N/A
4-6	0.4	1-2-4-9	Gray brown silty clay, moist	N/A
6-8	1.4	3-4-5-6	Orange brown silty clay, moist	N/A
8-10	1.8	3-3-4-5	Orange brown silty clay, moist	N/A
10-12	2	3-3-5-6	Orange brown silty clay, moist	N/A
12-14	2	2-4-4-6	12-12.5 Orange brown silty clay, moist; 12.5-14 Gray brown silty clay, stiff, moist	N/A
14-16	2	1-2-2-3	Gray brown silty clay, moist	N/A
16-18	2	3-3-2-3	Gray brown silty clay, moist	N/A
18-20	2	1-1-1-1	Gray brown silty clay, slightly plastic, moist	N/A
20-22	2	Wt/2	Gray silty clay, plastic, soft, moist	N/A
22-24	2	Wt/1-3	Gray silty clay, slightly plastic, moist	N/A
24-26	2	Wt/1-2-2	Gray silty clay, slightly plastic, moist	N/A
26-28	2	Wt/2-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
28-30	2	Wt/2-2-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
30-32	2	1-2-1-2	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
32-34	2	Wt/3-2	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
34-36	2	2-3-3-5	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
36-38	2	1-2-1-2	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
38-40	2	Wt/2-3-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-23-02

Project Number: 2023122

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 7/25/23-7/27/23

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 8/2/23

Development Method: Submersible Pump and Bladder Pump

Volume Purged: Approx. 6 gallons

Static Water-Level* 433.16

Top of Well Casing Elevation: 446.24

Well Purpose:
Groundwter Monitoring

Latitude (N): N 38°44.0002'

Longitude (W): 085°25.5860'

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

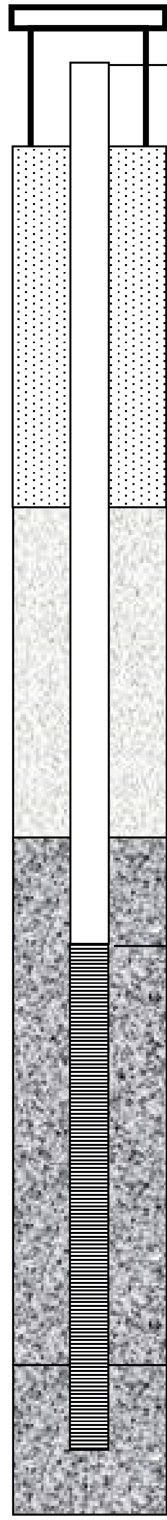
CONSTRUCTION MATERIALS USED:

6.5 Bags of Sand

1 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 446.24 ft.

Stick-up: 2.22 ft.

Land Surface Elevation: 444.02 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 25.5 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: 42.22 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-23-03
SAMPLE/CORE LOG

Project Number:	2023122	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	7/25/23-7/27/23	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	40’	Surface Elevation:	443.03

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	2	2-4-6-10	0-1 Brown silty clay, moist; 1-2 Orange brown silty clay, moist	N/A
2-4	1.2	1-3-5-7	Orange brown silty clay, moist	N/A
4-6	1.6	2-5-7-7	Orange brown silty clay, moist	N/A
6-8	1.6	3-6-8-11	Orange brown silty clay, moist	N/A
8-10	1.6	3-5-9-10	Orange brown silty clay, moist	N/A
10-12	1.6	2-5-5-10	Orange brown silty clay, slightly plastic, moist	N/A
12-14	1.6	4-7-7-9	Orange brown silty clay, slightly plastic, moist	N/A
14-16	2	2-4-7-9	Orange brown silty clay, slightly plastic, moist	N/A
16-18	2	2-4-5-7	Orange brown silty clay, slightly plastic, moist	N/A
18-20	2	1-3-4-6	Orange brown silty clay, slightly plastic, moist	N/A
20-22	1.2	1-2-3-3	Orange brown silty clay, slightly plastic, moist	N/A
22-24	2	1-3-4-6	Gray brown silty clay, slightly plastic, moist	N/A
24-26	2	1-3-4-4	Gray brown silty clay, slightly plastic, moist	N/A
26-28	2	1-1-2-4	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
28-30	2	1-1-2-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
30-32	1.6	Wt/2-3-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
32-34	2	Wt/1-3-4	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
34-36	2	2-2-3-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
36-38	2	Wt/1-2-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A
38-40	2	Wt/1-2-3	Gray silty clay, slightly plastic, moist; fine and medium sand seems, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-23-03

Project Number: 2023122

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 7/25/23-7/27/23

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 8/2/23

Development Method: Submersible Pump and Bladder Pump

Volume Purged: Approx. 6 gallons

Static Water-Level* 428.88

Top of Well Casing Elevation: 445.27

Well Purpose:
Groundwter Monitoring

Latitude (N): N 38°44.0002'

Longitude (W): 085°25.5860'

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

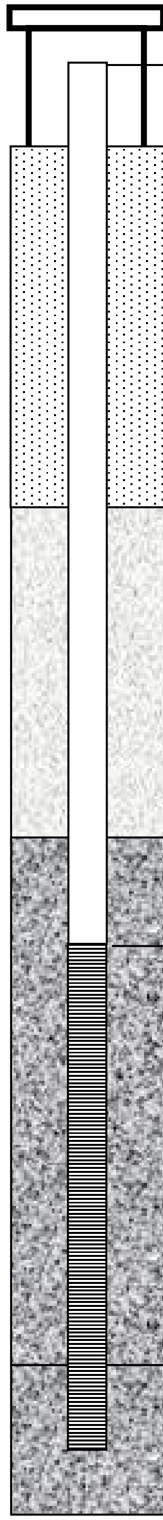
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

1 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 445.27 ft.

Stick-up: 2.24 ft.

Land Surface Elevation: 443.03 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 25.5 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: 42.24 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-23-04
SAMPLE/CORE LOG

Project Number:	2023122	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	7/26/23-7/27/23	AGES Geologist:	Mike Gelles

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt. 160lb.	and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	30’	Surface Elevation:	443.04

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	2	2-3-6-6	Orange brown silty clay, moist	N/A
2-4	1	1-2-2-3	Orange brown silty clay, moist	N/A
4-6	1.2	1-2-6-7	Gray brown silty clay, moist	N/A
6-8	2	2-3-4-6	Orange brown silty clay, moist	N/A
8-10	2	1-2-4-4	Orange brown silty clay, slightly plastic, moist	N/A
10-12	1.6	2-2-3-5	Orange brown silty clay, slightly plastic, moist	N/A
12-14	1.6	2-3-4-6	Orange brown silty clay, slightly plastic, moist	N/A
14-16	1.6	1-2-2-3	14-15 Orange brown silty clay, moist; 12.5-14 Gray silty clay, slightly plastic, moist	N/A
16-18	2	Wt/1-1-1	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
18-20	2	Wt/1-1-1	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
20-22	2	Wt	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
22-24	2	Wt/1-2-1	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
24-26	2	1-1-2-3	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
26-28	2	1-1-1-2	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A
28-30	2	1-1-1-2	Gray silty clay, slightly plastic, moist; fine sand seems, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-23-04

Project Number: 2023122

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 7/26/23-7/27/23

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 8/3/23

Development Method: Submersible Pump and Bladder Pump

Volume Purged: Approx. 6 gallons

Static Water-Level*: 425.44

Top of Well Casing Elevation: 445.35

Well Purpose:
Groundwter Monitoring

Latitude (N): N 38°44.0002'

Longitude (W): 085°25.5860'

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

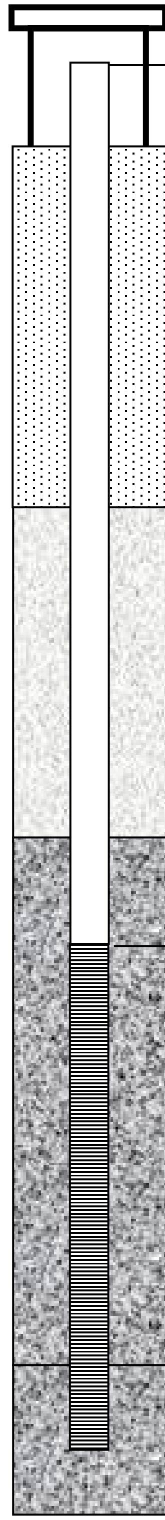
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

1 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 445.35 ft.

Stick-up: NA ft.

Land Surface Elevation: 443.04 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 16 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 18 ft*

Top of Well Screen 20 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 30 ft.*

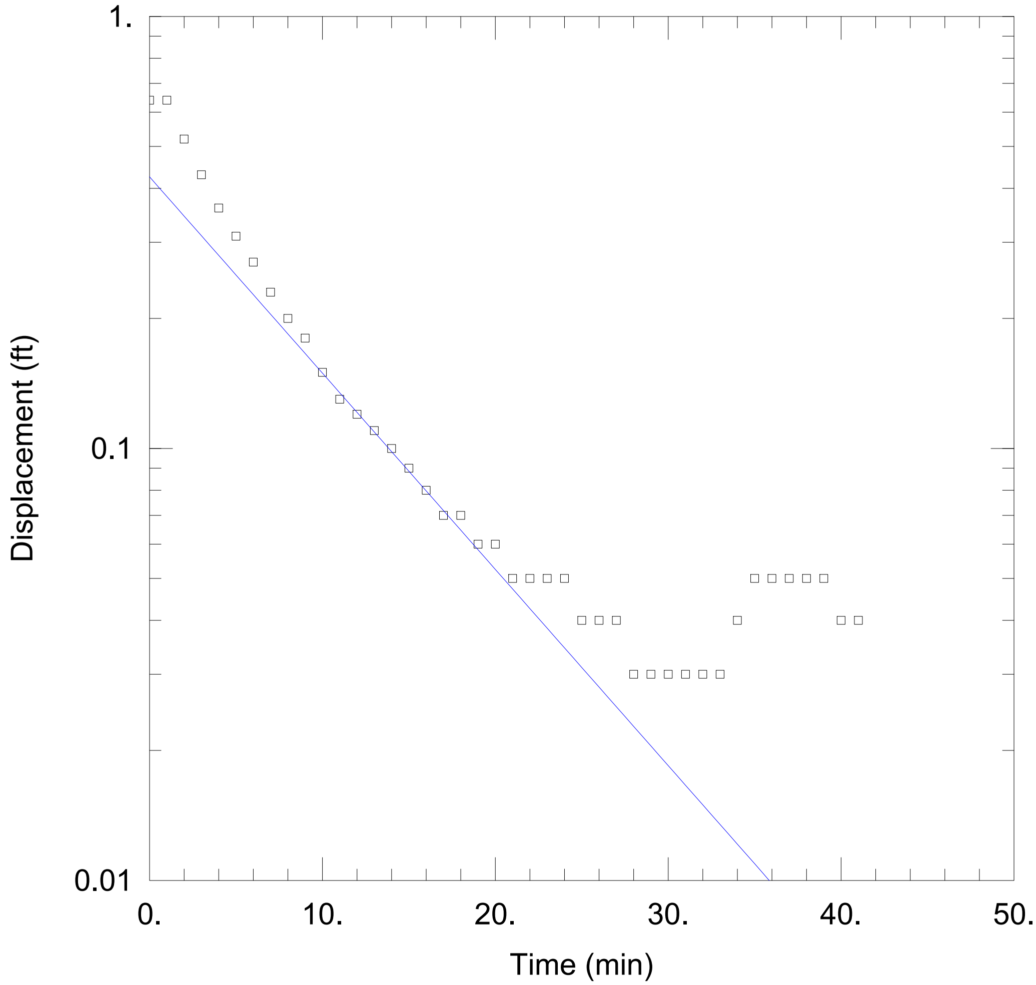
Base of Borehole: 30 ft.*

Total Depth of Well Below Top of Casing: 32.31 ft.

*Indicates Depth Below Land Surface

APPENDIX D

SLUG TEST RESULTS



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-01.aqt
Date: 09/29/23 Time: 11:34:16

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-01
Test Date: 7-31-23

AQUIFER DATA

Saturated Thickness: 23.46 ft Anisotropy Ratio (Kz/Kr): 1.

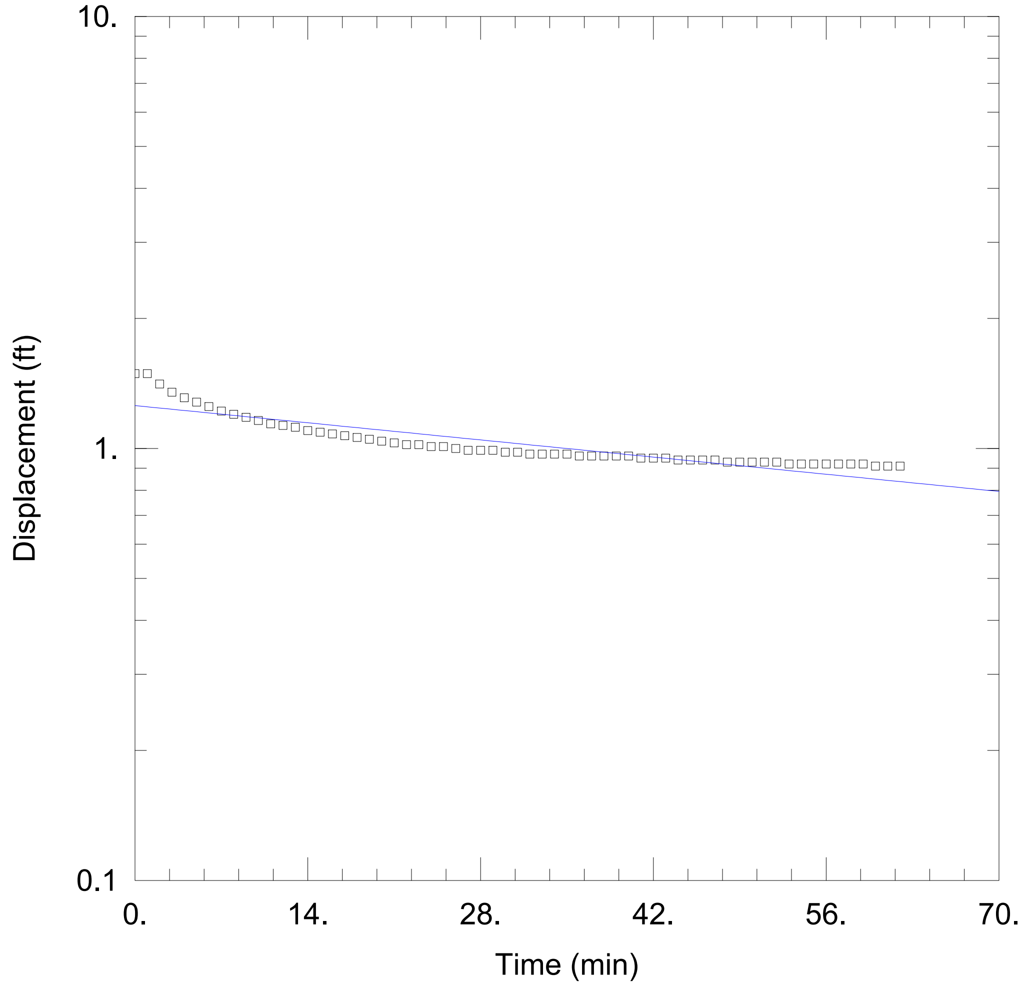
WELL DATA (WBSP-23-01)

Initial Displacement: 0.64 ft
Total Well Penetration Depth: 39.42 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 23.46 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 8.391E-5 cm/sec y0 = 0.4251 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-02.aqt
Date: 10/02/23 Time: 11:37:39

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft
Anisotropy Ratio (Kz/Kr): 1.

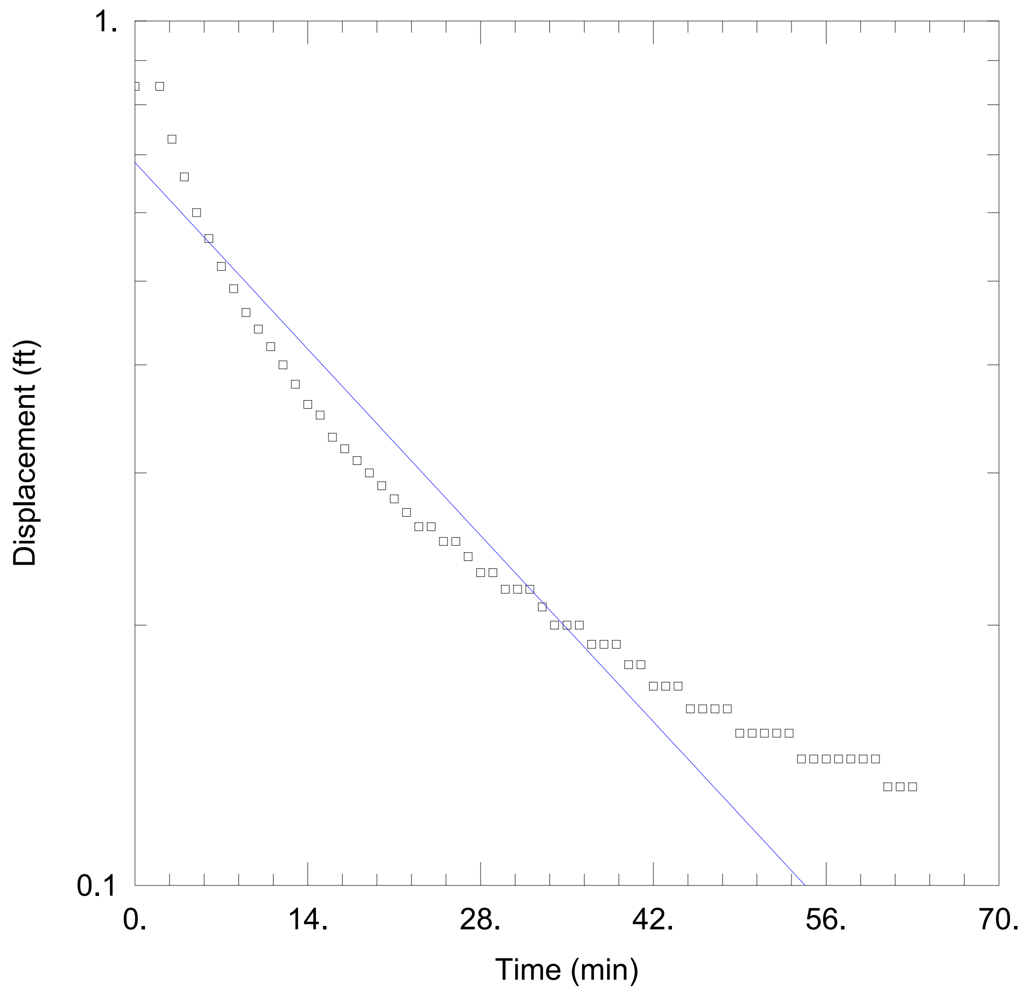
WELL DATA (WBSP-23-02)

Initial Displacement: 1.49 ft
Total Well Penetration Depth: 42.4 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 28. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.294E-6 cm/sec
y0 = 1.256 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-03.aqt
Date: 09/29/23
Time: 11:36:33

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-03
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 25.58 ft
Anisotropy Ratio (Kz/Kr): 1.

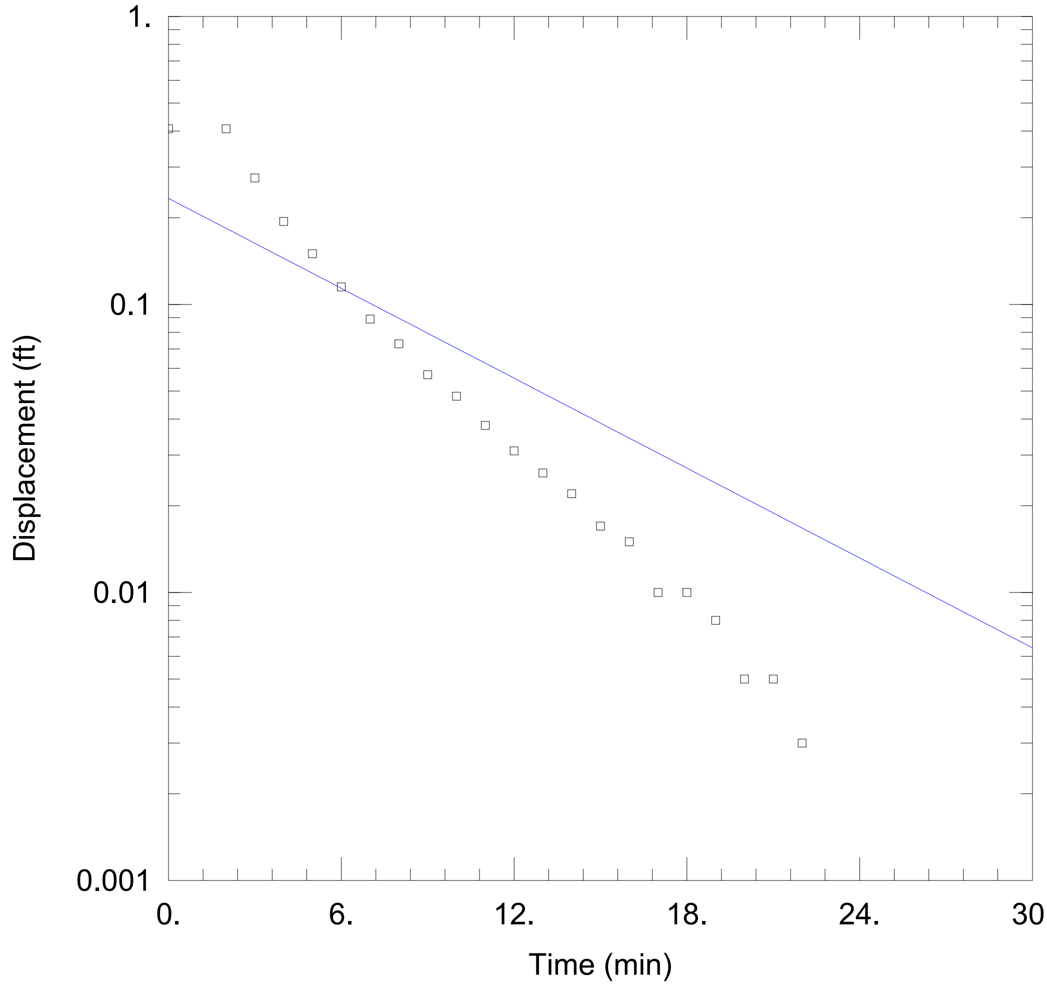
WELL DATA (WBSP-23-03)

Initial Displacement: 0.84 ft
Total Well Penetration Depth: 42.4 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 25.58 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.872E-5 cm/sec
y0 = 0.6857 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-04.aqt
Date: 09/29/23 Time: 11:40:23

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-04
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 13.51 ft
Anisotropy Ratio (Kz/Kr): 1.

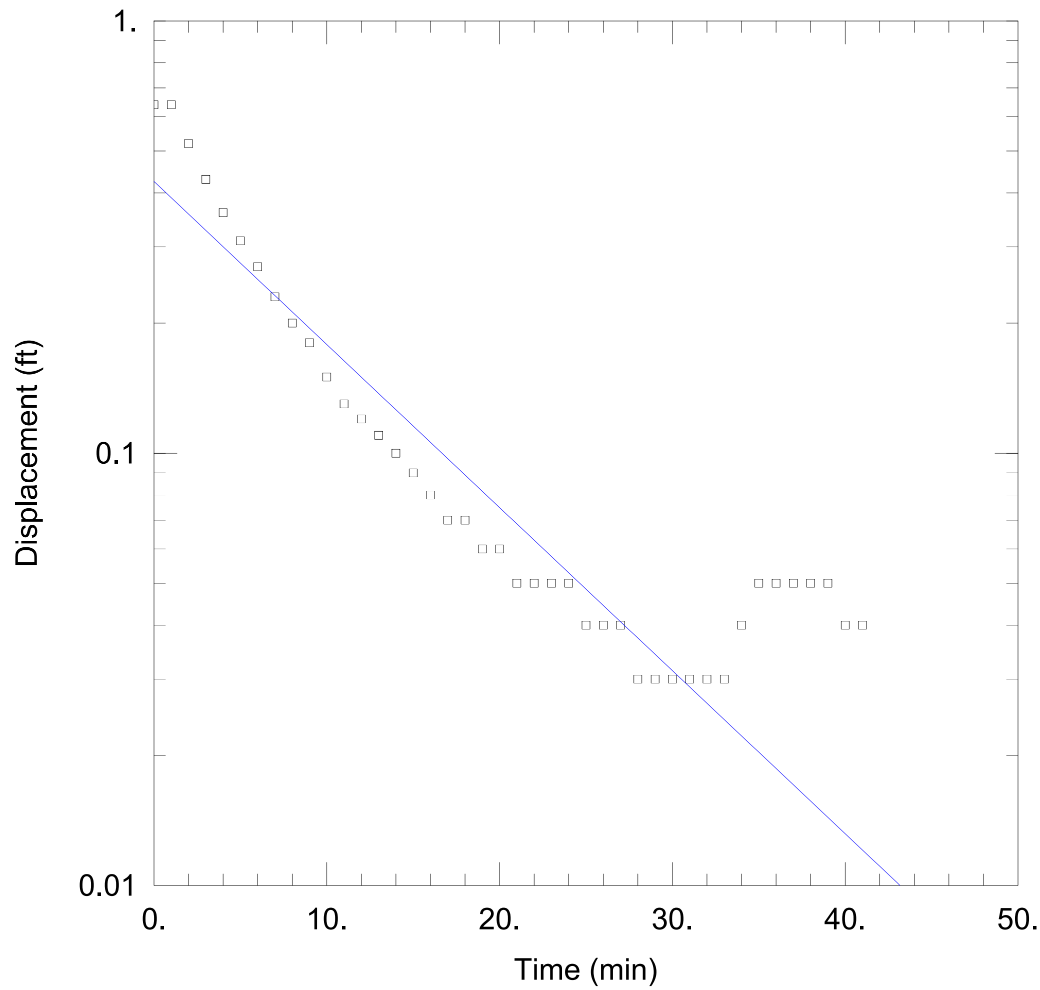
WELL DATA (WBSP-23-04)

Initial Displacement: 0.407 ft
Total Well Penetration Depth: 32.31 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 13.51 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 9.358E-5 cm/sec
y0 = 0.2335 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-01.aqt
Date: 09/29/23 Time: 11:33:26

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-01
Test Date: 7-31-23

AQUIFER DATA

Saturated Thickness: 23.46 ft
Anisotropy Ratio (Kz/Kr): 1.

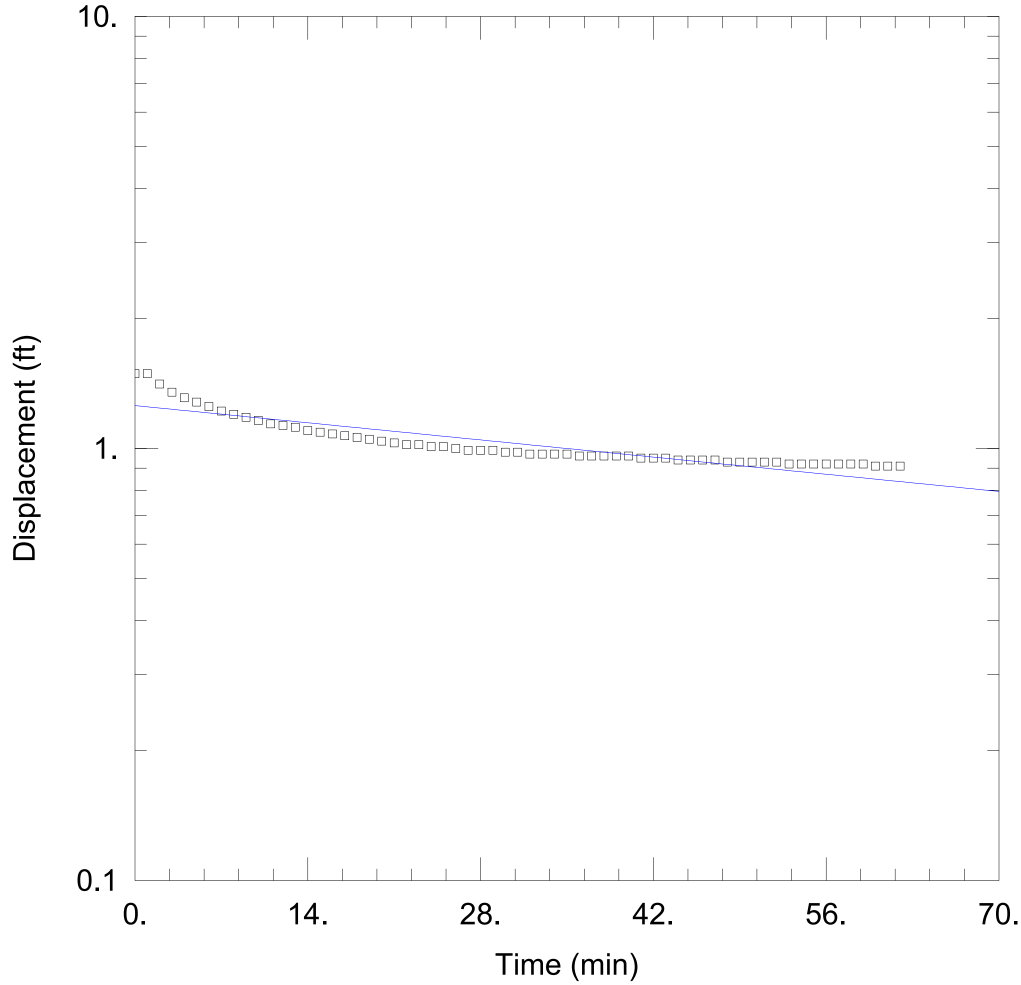
WELL DATA (WBSP-23-01)

Initial Displacement: 0.64 ft
Total Well Penetration Depth: 39.42 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 23.46 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 8.391E-5 cm/sec
y0 = 0.4251 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-02.aqt
Date: 10/02/23 Time: 11:37:09

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft Anisotropy Ratio (Kz/Kr): 1.

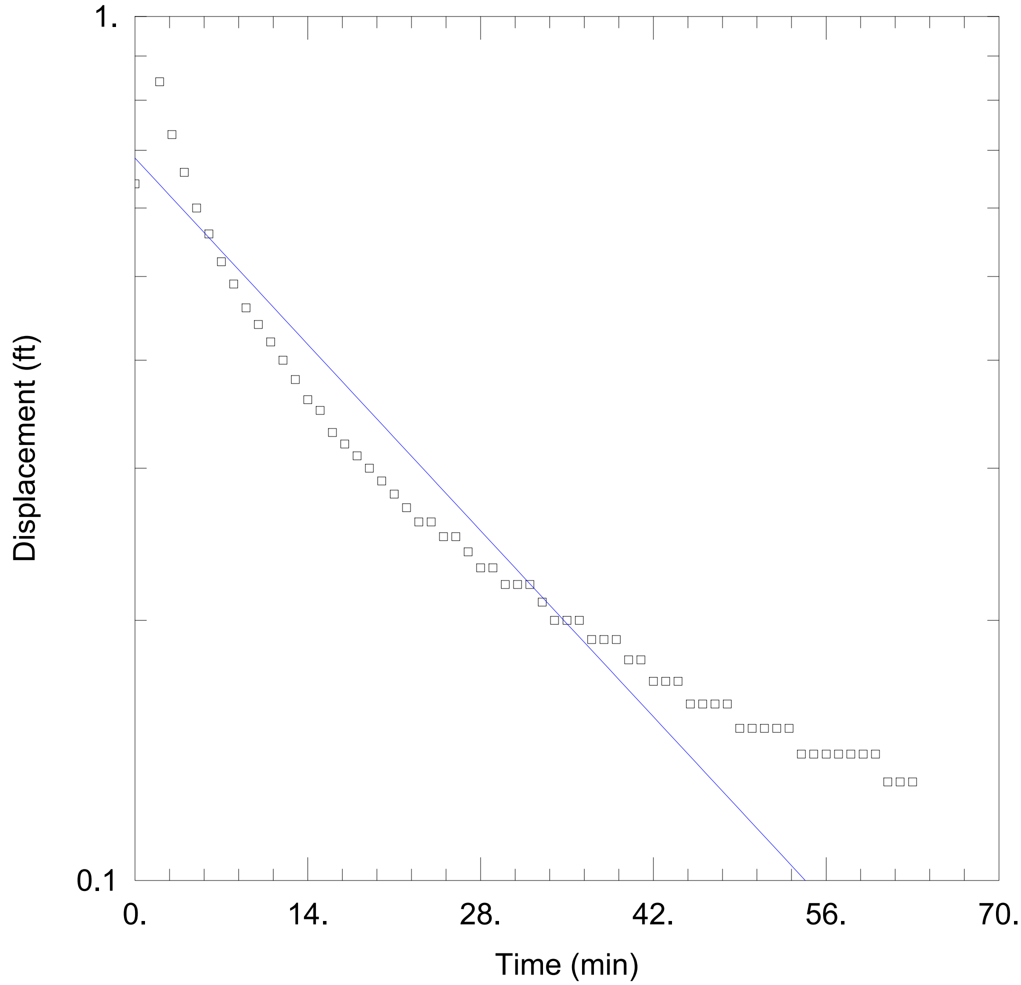
WELL DATA (WBSP-23-02)

Initial Displacement: 1.49 ft
Total Well Penetration Depth: 42.4 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 28. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 6.314E-6 cm/sec y0 = 1.256 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-03.aqt
Date: 09/28/23 Time: 14:14:53

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-03
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 25.58 ft
Anisotropy Ratio (Kz/Kr): 1.

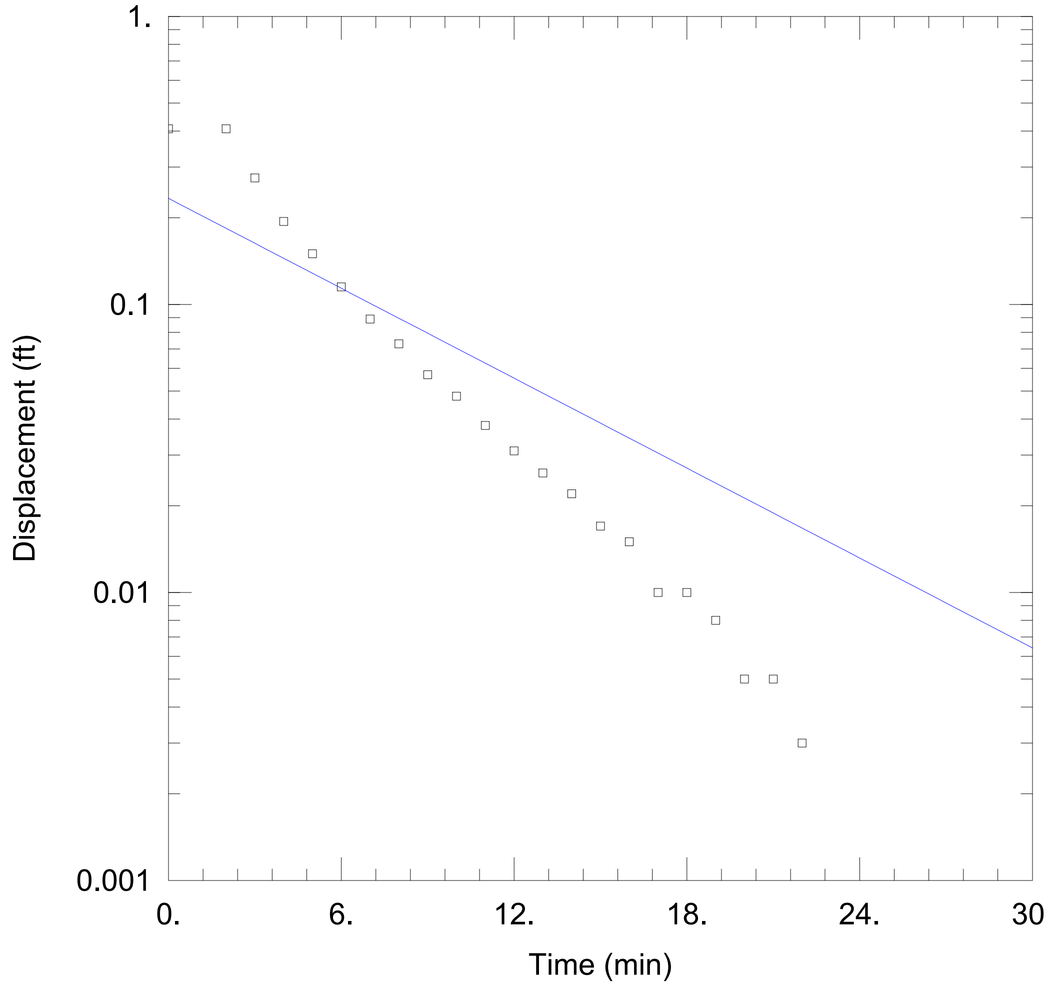
WELL DATA (WBSP-23-03)

Initial Displacement: 0.64 ft
Total Well Penetration Depth: 52.4 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 25.58 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 3.425E-5 cm/sec
y0 = 0.6856 ft



WELL TEST ANALYSIS

Data Set: Y:\...\wbsp-23-04.aqt
Date: 09/29/23 Time: 11:39:58

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-04
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 13.51 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-23-04)

Initial Displacement: 0.407 ft
Total Well Penetration Depth: 32.31 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 13.51 ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 0.0001158 cm/sec y0 = 0.2336 ft