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WRITER'S DIRECT DIAL NO:
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December 1, 2020

**Delivered Electronically**

Ms. Laurie Stevenson, Director
Ohio Environmental Protection Agency
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, OH 43216-1049

Dear Ms. Stevenson:

**Re: Ohio Valley Electric Corporation**
**Notification of Revision to Assessment of Corrective Measure Report**

As required by 40 CFR 257.106(h)(7), on May 15, 2019, the Ohio Valley Electric Corporation (OVEC) provided notification to the Director of the Ohio Environmental Protection Agency that an Assessment of Corrective Measures had been initiated for a confirmed Statistically Significant Increase (SSI) of Appendix IV constituent Arsenic at Kyger Creek Station's 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. 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 original report, dated September 19, 2019, has been revised to include additional information to further characterize the extent of the Appendix IV exceedance, as well as provide additional discussion on potential remedies. An updated version 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.

If you have any questions, or require any additional information, I can be reached at (740) 897-7768.

Sincerely,

Tim Fulk
Engineer II

TLF:gsc

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# COAL COMBUSTION RESIDUALS REGULATION
# ASSESSMENT OF CORRECTIVE MEASURES REPORT

## BOILER SLAG POND (BSP)
## OHIO VALLEY ELECTRIC CORPORATION
## KYGER CREEK STATION
## CHESHIRE, OHIO

**SEPTEMBER 2019**
**NOVEMBER 2020 REVISON 1.0**

**Prepared for:**

**OHIO VALLEY ELECTRIC CORPORATION (OVEC)**

**By:**

**APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.**

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**Bethany Flaherty**
Senior Scientist I

Robert W. King

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

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| | |
|---|---|
| AGES | Applied Geology and Environmental Science, Inc. |
| ACM | Assessment of Corrective Measures |
| ASD | Alternate Source Demonstration |
| ASTM | American Society for Testing and Materials |
| bgs | Below Ground Surface |
| BSP | Boiler Slag Pond |
| CCR | Coal Combustion Residuals |
| ft/day | Feet Per Day |
| ft/sec | Feet Per Second |
| °C | Degrees Celsius |
| GMPP | Groundwater Monitoring Program Plan |
| GWPS | Groundwater Protection Standard |
| HSA | Hollow Stem Auger |
| K | Hydraulic Conductivity |
| Landfill | Class III Residual Waste Landfill |
| MCL | Maximum Contaminant Level |
| mg/kg | Milligrams Per Kilogram |
| mm | Millimeter |
| MNA | Monitored Natural Attenuation |
| mV | Millivolt |
| MW | Megawatt |
| NPDES | National Pollution Discharge Elimination System |
| NTU | Nephelometric Unit |
| O&M | Operations and Maintenance |
| Ohio EPA | Ohio Environmental Protection Agency |
| ORP | Oxidation Reduction Potential |
| OVEC | Ohio Valley Electric Corporation |
| PRB | Permeable Reactive Barrier |
| PVC | Polyvinyl Chloride |
| RCRA | Resource Conservation and Recovery Act |
| SFAP | South Fly Ash Pond |
| SSI | Statistically Significant Increase |
| SSL | Statistically Significant Level |
| Stantec | Stantec Consulting Services, Inc. |
| StAP | Statistical Analysis Plan |
| S.U. | Standard Unit |
| TDS | Total Dissolved Solids |
| ug/L | Micrograms Per Liter |
| U.S. EPA | United States Environmental Protection Agency |

**COAL COMBUSTION RESIDUALS REGULATION**
**ASSESSMENT OF CORRECTIVE MEASURES REPORT**
**BOILER SLAG POND (BSP)**
**OHIO VALLEY ELECTRIC CORPORATION**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

# 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. As required by 40 CFR § 257.90(e), the certified demonstration that more time was needed will be included in the 2019 Groundwater Monitoring and Corrective Action Report.

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 Kyger Creek Station, located in Cheshire, Ohio, is a 1.1 gigawatt coal-fired generating station operated by Ohio Valley Electric Corporation (OVEC). The Kyger Creek Station has five (5), 217-

megawatt (MW) generating units and has been in operation since 1955. Beginning in 1955, CCRs were sluiced to surface impoundments located in the plant site. During the course of plant operations, CCRs have been managed in various units at the station.

There are three (3) CCR units at the Kyger Creek Station (Figure 2-1):

- Class III Residual Waste Landfill (Landfill);
- Boiler Slag Pond (BSP); and,
- South Fly Ash Pond (SFAP).

Under the CCR program, OVEC installed a groundwater monitoring system at each unit in accordance with the requirements of the CCR Rule. From October 2015 through September 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. Based on groundwater monitoring conducted to date, no Statistically Significant Increases (SSIs) have been identified for Appendix III constituents at the Landfill. Therefore, this unit has remained in Detection Monitoring under the CCR program.

During the March 2019 Detection Monitoring event at the SFAP, Appendix III SSIs for Calcium, Sulfate and Total Dissolved Solids (TDS) were identified. OVEC is preparing an Alternate Source Demonstration (ASD) report to show that the SFAP is not the source of the Appendix III constituents. Based on the results of the ASD, the SFAP is anticipated to remain in Detection Monitoring.

During the March 2018 Detection Monitoring event, SSIs were identified for the BSP and it entered into Assessment Monitoring in September 2018. Further action was therefore required for this unit under the CCR program. Details regarding these efforts are presented in the following sections of this report.

# 3.0 GEOLOGY AND HYDROGEOLOGY

## 3.1 Regional Setting

Gallia County is located on the western edge of the Appalachian Basin within the Appalachian Plateau Physiographic Province, Allegheny Section, locally known as the Marietta Plateau. Sedimentary bedrock formations in this area are as much as 7,400 feet thick and range in geologic age from Pennsylvanian to Cambrian. The primary stratigraphic units underlying Gallia County include, from youngest to oldest: recent (Holocene) colluvium and alluvium deposits, Pleistocene lacustrine and glacial sand and gravel deposits, and Pennsylvanian age bedrock composed predominantly of shale and sandstone, with occasional thin limestone and coal seams.

The Appalachian Plateau in Gallia County is bordered on its northern margin by the Glaciated Appalachian Plateau 40 to 50 miles to the northwest. The geomorphology of the Appalachian Plateau in Gallia County consists of steeply sloping ridges and steep, narrow stream valleys. Upland areas are primarily underlain by sandstone bedrock while valleys are underlain by shale bedrock and colluvial and alluvial sediments. Ground elevation ranges from as much as 1,000 feet along ridge tops to 500 feet near the Ohio River Valley. Generally, surface water drainage is to the south and southeast into the Ohio River.

### 3.2 Unit-Specific Setting

Based on available existing data, deposits of silts and clays beneath the base of the BSP range from 15 to over 50 feet thick. The silts and clays transition to a layer of sand and gravel where groundwater is present. A generalized cross section of the geology beneath the BSP is presented in Figure 3-1. Based on previously reported physical properties and yield, the sand and gravel unit was determined to be the uppermost aquifer beneath the BSP and is located more than five (5) feet beneath the bottom of the BSP as required by the CCR Rule. Based on water level data from the existing wells, groundwater was determined to flow primarily toward the south and southwest.

Regional groundwater flows to the south and southeast towards the Ohio River. Appendix A includes groundwater flow maps from February and September 2018. Local groundwater flow beneath the BSP generally flows from the northwest to the south and southeast towards the Ohio River (Figure A-2 in Appendix A). During periods when the water level in the Ohio River rises significantly and flooding occurs, groundwater flow in the uppermost aquifer will temporarily reverse with groundwater flowing toward the north and east beneath the BSP. This flow reversal is evident in groundwater levels measured in February 2018 (Figure A-1 in Appendix A).

## 4.0 SUMMARY OF GROUNDWATER MONITORING PROGRAM: BOILER SLAG POND

In accordance with 40 CFR § 257.90(e) of the CCR Rule, a Groundwater Monitoring and Corrective Action Report was prepared for the Kyger Creek Station. The report documented the status of the groundwater monitoring and corrective action program for each CCR unit, summarized the key actions completed during 2018, described any problems encountered, discussed actions to resolve the problems, and projected key activities for the upcoming year (Applied Geology and Environmental Science, Inc. [AGES] 2019). Applicable details of the report are presented below in Sections 4.1, 4.2 and 4.3.

### 4.1 Groundwater Monitoring Network

As detailed in the Monitoring Well Installation Report (AGES 2016a), the CCR groundwater monitoring network for the BSP consists of the following eight (8) monitoring wells:

- KC-15-01 (Upgradient);
- KC-15-02 (Upgradient);
- KC-15-03 (Variable);
- KC-15-04 (Downgradient);
- KC-15-05 (Downgradient);
- KC-15-06 (Downgradient);
- KC-15-07 (Downgradient); and
- KC-15-08 (Downgradient).

The locations of all the wells in the groundwater monitoring network are shown on Figure 4-1. As listed above and shown on Table 4-1, the CCR groundwater monitoring network includes three (3) upgradient and five (5) downgradient monitoring wells, which satisfies the requirements of the CCR Rule. Groundwater flow maps for the two (2) monitoring events completed in 2018 are included in Appendix A.

### 4.2 Groundwater Sampling

In accordance with 40 CFR § 257.94 of the CCR Rule, the first round of Detection Monitoring was conducted in February and March 2018 and resampling was conducted in May 2018. Based on the results of the statistical evaluation of the Detection Monitoring data, the BSP entered into Assessment Monitoring on September 11, 2018. The first round of Assessment Monitoring samples was collected in September 2018 and resampling was conducted in December 2018.

All groundwater samples were collected in accordance with the Groundwater Monitoring Program Plan (GMPP) (AGES 2016b). The Detection Monitoring samples were analyzed for all Appendix III constituents, and the Assessment Monitoring samples were analyzed for all Appendix III and Appendix IV constituents. All samples were shipped to an analytical laboratory to be analyzed for all of the parameters listed in Appendix III and/or Appendix IV of the CCR Rule.

### 4.3 Analytical Results

The analytical results for groundwater samples collected in 2018 are summarized in Appendix B. Upon receipt, the February/March 2018 groundwater 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] 2018). This initial statistical evaluation of the Detection Monitoring data identified potential SSIs for Boron, Calcium, pH, TDS, and Sulfate in five (5) wells (KC-15-04 through KC-15-08).

As discussed in the 2018 Groundwater Monitoring and Corrective Action Report (AGES 2019), a faulty pH meter was suspected of causing the SSIs for pH. In accordance with the StAP, in May 2018 the wells were resampled for all Appendix III constituents with potential SSIs. Based on the results of the resampling, the following Appendix III SSIs were confirmed:

- KC-15-04: Boron, TDS and Sulfate;
- KC-15-05: Boron, TDS and Sulfate; and
- KC-15-08: Boron, Calcium, TDS and Sulfate.

A partial ASD was completed in September 2018 for the Appendix III constituents identified at the BSP (AGES 2018). The ASD demonstrated that the source of the Calcium, TDS, and Sulfate was likely the active gas production wells located adjacent to the west/northwest of the BSP. However, an alternate source for Boron could not be established by the ASD. Therefore, the BSP entered into Assessment Monitoring under the CCR Rule in September 2018.

The first round of Assessment Monitoring groundwater samples was collected in September 2018, in accordance with § 257.95 of the CCR Rule and the GMPP (AGES 2016b) and analyzed for all Appendix III and Appendix IV constituents. Upon receipt of the September 2018 analytical results, the groundwater monitoring data were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the StAP (Stantec 2018). The initial statistical evaluation identified potential Appendix III SSIs of Boron, Calcium, TDS and Sulfate in wells KC-15-04, KC-15-05 and KC-15-08. In accordance with the StAP, the wells were resampled for those constituents in December 2018. Based on the results of the resampling, Appendix III SSIs were confirmed at the BSP for TDS in well KC-15-04 and Calcium, TDS and Sulfate in well KC-15-05 (Table 4-2).

As Appendix IV constituents were detected in downgradient wells during Assessment Monitoring, OVEC began the process of establishing GWPSs for any detected Appendix IV constituents.

### 4.4 Groundwater Protection Standards-BSP

In accordance with 40 CFR § 257.95(h)(1) through 40 CFR § 257.95(h)(3), OVEC established a GWPS for each Appendix IV constituent that was detected in groundwater (Table 4-3). Results for all Appendix IV constituents were less than the applicable GWPSs, except for Arsenic in well KC-15-07 in September 2018 (152 micrograms per liter [ug/L]) and December 2018 (15.3 ug/L), which exceeded the GWPS of 10 ug/L. Arsenic in the other four (4) downgradient wells, KC-15-04 (1.66 ug/L), KC-15-05 (0.88 ug/L), KC-15-06 (1.58 ug/L) and KC-15-08 (3.86 ug/L), did not exceed the GWPS in September 2018.

Based on the results in well KC-15-07, OVEC 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 BSP 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 Arsenic and the level at which the constituent is 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 § 257.95(d)(1); and
- Sample all wells in accordance with § 257.95(d)(1) to characterize the nature and extent of the release.

This section details the work conducted between March and June 2019 to collect additional data to aid in characterization of the release and assessment of corrective measures. To evaluate the extent of the Arsenic impacts, three (3) additional wells (KC-19-27, KC-19-28 and KC-19-29) were installed in the uppermost aquifer at the property boundary downgradient from the BSP (Figure 5-1). The wells were developed, hydraulically tested and sampled for analysis of Arsenic.

Details regarding this work are presented in the following sections of this report.

## 5.1 Grain Size Analysis and Monitoring Well Design

The CCR Rule requires that unfiltered groundwater samples be submitted for laboratory analysis. According to the preamble to the CCR Rule, the unfiltered sample requirement assumes that groundwater samples with a turbidity of less than five (5) nephelometric turbidity units (NTUs) can be obtained from a properly designed monitoring well. The proper design of the sand pack and well screen in each unconsolidated CCR well is therefore critical to obtaining representative samples.

The three (3) new monitoring wells were designed and installed using the same methods and materials used during the installation of the other wells in the CCR groundwater monitoring network and in accordance with the GMPP (AGES 2016b). During installation, representative samples of the aquifer material were collected from each well boring. These soil samples were submitted to a geotechnical laboratory for grain-size analysis per American Society for Testing and Materials (ASTM) Methods D421 and D422. The results of the grain size analyses were used to confirm that the design of the well screens and filter packs was appropriate for the CCR monitoring program. In accordance with U.S. EPA monitoring well design guidelines (U.S. EPA 1991), the grain size of the filter pack was chosen by multiplying the 70% retention (or 30% passing) size of the formation, as determined by the grain size analysis, by a factor of three (3) (for fine uniform formations) to six (6) (for coarse, non-uniform formations). Table 5-1 summarizes the results of the grain-size analysis and the 70% retention size for each of the samples collected from each boring. The laboratory reports are included in Appendix C.

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 BSP 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 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.

## 5.2 Monitoring Well Installation, Development, Sampling and Testing

### 5.2.1 Monitoring Well Installation

From April 3 through April 5, 2019, a total of three (3) monitoring wells were installed at the BSP using hollow stem auger (HSA) drilling methods (Figure 5-1). During drilling, the drill bit was simultaneously pushed down and rotated. Continuous split-spoon samples were 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 removed as 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.

A 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 OVEC personnel.

Well construction details for the three (3) new wells installed at the BSP are presented in Table 5-2. All well boring and construction logs are included in Appendix D.

### 5.2.2 Monitoring Well Development

Well development was initiated at least 48 hours after installation of each of the monitoring wells. Development consisted of alternating surging and pumping with a submersible pump. During development of the monitoring wells, field parameters including temperature, specific conductance, pH and turbidity were recorded at regular intervals. Development continued until each parameter stabilized and turbidity was less than five (5) NTUs. Well development data for each well is summarized on Table 5-3.

### 5.2.3 Groundwater Sampling

On April 16, 2019, the three (3) new monitoring wells were sampled in accordance with the GMPP (AGES 2016b). The monitoring wells were purged using a submersible pump to remove stagnant water in the casing and to ensure that a representative groundwater sample was collected.

Samples were collected in laboratory-provided, pre-preserved (if necessary) 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 in ice in insulated coolers to maintain a temperature of less than four degrees centigrade (4ºC) and shipped to the TestAmerica analytical laboratory located in Canton, Ohio.

### 5.2.4 Aquifer Testing

In April 2019, both falling and rising head slug tests were conducted on two (2) of the new wells (KC-19-27 and KC-19-28) to obtain data required to calculate the saturated hydraulic conductivity (K) for the uppermost aquifer beneath the BSP. The falling head tests were performed by lowering a prefabricated 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 slug and recording the rise in head over time. The change in 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 (AGES 2016b).

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 E.

## 5.3 Results of Site Characterization

### 5.3.1 Site Geology Updates

Based on the results of the site characterization, an update to the information about the geology at the unit was not necessary. The soil boring logs prepared during monitoring well installation confirmed that the BSP is underlain by deposits of silt and clay ranging from 15 to over 50 feet thick (Appendix D). The uppermost aquifer beneath the BSP is a layer of sand and gravel beneath the deposits of silt and clay (Figure 3-1).

### 5.3.2 Groundwater Flow

A complete round of groundwater level data was collected in June 2019 (Table 5-4). The groundwater flow map generated using these data indicates that groundwater beneath the BSP flows to the southeast toward the Ohio River (Figure 5-2). A review of historic groundwater elevation data indicated that groundwater flow beneath the BSP is affected by the flow and water level in the Ohio River and evidence of several flow reversals has been observed in the historic data (AGES 2018). Data regarding groundwater flow at the unit is consistent with historic results.

### 5.3.3 Slug Testing

Slug test results from testing completed in May 2016 and April 2019 are summarized on Table 5-5. The updated mean K for the uppermost aquifer beneath the BSP is 6.28 x $10^{-4}$ feet per second (ft/sec). Published literature indicates that this is a reasonable K value for unconsolidated deposits of fine to medium sand and gravel (Fetter 1980).

### 5.3.4 Groundwater Flow Velocity

Using water level data collected in June 2019 (Table 5-4) and slug test data collected in May 2016 and April 2019 (Table 5-5), AGES calculated the average groundwater velocity beneath the BSP as 0.197 feet per day (ft/day) (Table 5-6). The distance between wells KC-15-02 and KC-19-28 is approximately 1,600 feet. Given the calculated flow rate and the distance between the wells, the travel time for groundwater to flow from well KC-15-02 (northwest) to well KC-19-28 (southeast) is approximately 22 years. This travel time is likely greater than 22 years due to documented flow reversals (Appendix A), which would significantly increase the travel time between the two (2) wells.

### 5.3.5 Groundwater Sampling Results

March and April 2019 analytical results for the previously installed CCR wells and for the three (3) new wells are shown on Table 5-7. As shown on Figure 5-3, Arsenic concentrations in existing wells (KC-15-01 through KC-15-08) around the BSP ranged from Non-Detect in well KC-15-05 to 160 ug/L in well KC-15-07. Arsenic concentrations in the three (3) new wells ranged from

0.84 ug/L in well KC-19-29 to 1.8 ug/L in well KC-19-27. Based on these results, Arsenic concentrations exceeding the GWPS of 10 ug/L are confined to the site and are not reaching the Ohio River. However, to address Arsenic concentrations in the uppermost aquifer, an ACM is required.

# 6.0 ASSESSMENT OF CORRECTIVE MEASURES

Groundwater monitoring of the uppermost aquifer at the BSP has identified Arsenic (an 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 BSP. 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 BSP). 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 BSP is provided in Table 6-1. Three (3) technologies are included in this evaluation:

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

Per state and federal regulatory requirements and timelines, OVEC tentatively plans to close the BSP. The method and timing of closure of the unit will depend on receipt of approval from the Ohio EPA. Source control through closure will likely initially include the cessation of ongoing placement of material into the BSP, a combination of passive and active decanting of ponded water within the unit, and interstitial dewatering of boiler slag pore-water within the unit.

Groundwater quality near the BSP is anticipated to significantly improve over time as a result of the above-referenced closure activities. Ceasing placement of material in the BSP will reduce the amount of Arsenic being loaded to the unit and thereby reduce the source of Arsenic available to impact groundwater. Decanting of any ponded water will decrease the hydraulic head in the BSP and thereby reduce infiltration of water from the unit to the underlying groundwater. Finally, dewatering of the boiler slag will reduce the contact-time for Arsenic with the boiler slag pore-water, which should reduce the mobility of the Arsenic. Groundwater monitoring over time is necessary to fully evaluate the positive impact that closure of the BSP will have on groundwater quality.

### 6.3 Potential Remedial Technologies

The focus of corrective measures for the BSP 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.

As described in Section 6.2, groundwater quality near the BSP is anticipated to significantly improve over time as a result of planned closure activities. Therefore, 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 (as discussed below) 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.

### 6.3.1 In-Situ Groundwater Remedial Technologies

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. 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)

Monitored natural attenuation (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)

Permeable reactive barriers (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, and sodium dithionate have been evaluated as potentially effective for CCR-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.

### 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.

6.3.2.3 Trenching Systems

Horizontal collection trenches function similarly to horizontal wells but are installed with excavation techniques. They can be more effective at shallow depths and with higher flow regimes. However, they may not be practical 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 a significant regeneration 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). Other systems to remove Arsenic use biological formation of Bioscorodite (FeAsO4•2 H2O); 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 summarized below.

### 6.4.1 Performance

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.

In the environment, Arsenic is more mobile at pH values greater than 8.5 Standard Units (SU), when it will desorb from mineral oxides (Smedley and Kinniburgh 2002). Highly reducing conditions at near neutral pH 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.

At the BSP, Oxidation Reduction Potential (ORP) values varied significantly in 2018 with ranges of -101 millivolts (mV) to 154 mV at KC-15-07, and -10.1 mV to 48 mV at KC-15-06 (AGES 2019). The pH values at the BSP were more consistent ranging from 6.02 to 6.71 SU at both wells over the course of 2018. The range of ORP values are likely related to flood events when the groundwater flow direction reverses and water from the Ohio River recharges groundwater at the site. In the environment, Arsenic is not extremely mobile in this range of pH and ORP values.

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 and flow reversals, dispersion and dilution of Arsenic would likely be a major factor in natural attenuation.

At the BSP, 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, PRBs, and in-situ chemical stabilization are proven technologies, conditions at the BSP 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 BSP. Given that the uppermost aquifer extends to a depth of at least 50 feet below ground surface (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. As with the barrier technologies above, periodic flooding of the area by the Ohio River would 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 BSP, 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 BSP. 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. Periodic flooding of the area by the Ohio River would also impact the performance of these ex-situ technologies.

Trenching systems are often used when groundwater impacts are encountered in a shallow unit. The depth to groundwater at the BSP is approximately 40 feet bgs, which would likely preclude the use of a trench at the unit.

#### 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 at the scope of this project.

Filtration, adsorption, and ion exchange systems may require modification if permit-required discharge limits are at or less than the Maximum Contaminant Level (MCL) of 10 ug/L. System changes may include addition of an adsorption media bed, more frequent regeneration or replacement of ion exchange media, or use of a membrane with a smaller molecular weight cutoff. These technologies could also be supplemental or used in tandem to achieve the required discharge limits.

### 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 BSP.

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 (O&M) 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 BSP, 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 O&M issues associated with both conventional vertical or horizontal wells but these issues are well understood and can be readily addressed. Once in the place, trenching systems would also be reliable at the BSP although long term 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 treatment processes are properly implemented.

### 6.4.3 Ease of Implementation

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

#### 6.4.3.1 In-Situ Groundwater Remedial Technologies

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

Due to the significant amount of time, effort, and disturbance required for implementation at the BSP, migration barrier and PRB implementation would be difficult. Difficulties in construction would be related to the depth of installation and the lack of an impermeable layer at depth. In-situ chemical stabilization may require less time and effort than 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 BSP would require drilling and limited field construction; however, the conventional vertical wells would be the 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 BSP, given site conditions.

#### 6.4.3.3 Treatment of Extracted Groundwater

Treatment of Arsenic in extracted groundwater is implementable, as long as proper processes are used.

### 6.4.4 Potential Safety Impacts

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

#### 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 BSP.

#### 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 for Arsenic 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 BSP.

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 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 for Arsenic 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 BSP. Timeframes presented below and in Table 6-2 are the times to begin the remedy after closure of the unit.

6.4.7.1 In-Situ Groundwater Remedial Technologies

A MNA program could be implemented at the BSP 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 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 <u>Time Required to Complete Remedy</u>

This criterion includes the estimated time necessary to achieve the stated goals of corrective measures to prevent further releases from the BSP, 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. A groundwater model would be useful 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 State, Local, or Other Environmental Permit Requirements That May Impact Implementation

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 BSP.

6.4.9.1 In-Situ Groundwater Remedial Technologies

A MNA program would likely require coordination with the Ohio Environmental Protection Agency (Ohio EPA) 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 Ohio EPA. This would require an anticipated minimum of 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 BSP, which may require permitting through Ohio EPA. This would require an anticipated minimum of 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 Ohio EPA, especially if a NPDES permit is required. This would require an anticipated minimum of 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 BSP 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 two (2) technologies that appear to be most likely for selection as a remedy were:

- MNA; 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);
- In-Situ Chemical Stabilization (In-Situ);
- Horizontal Well Systems (Ex-Situ); and
- Trenching Systems (Ex-Situ).

As groundwater quality near the BSP 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 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 BSP. With the submittal of this report, OVEC began the remedy selection process and will 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). The progress toward selecting a remedy will be documented in semiannual reports.

Over the course of 2020, the ongoing groundwater monitoring program continued at the site. The results of this program have been used to develop a 2020 Update on Groundwater Conditions at the unit (Appendix F). This update includes a detailed evaluation of groundwater flow and Arsenic concentrations at the BSP and the impact that these conditions have on the remedy selection process.

## 7.1 Data Gaps

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

- With the results of the monitoring program from 2018 through 2020, sufficient data is now available to develop a three-dimensional (3-D) groundwater model of the site using Modflow or another commercially available software. This model would be useful in supporting the evaluation of the positive impact of the closure of the BSP and ongoing natural attenuation on groundwater quality and the application of various potential remedial techniques at the site.

- Ongoing sampling of monitoring wells prior to and after closure of the BSP should continue to evaluate whether Arsenic concentrations in groundwater are increasing, decreasing or are asymptotic. This data will be useful in supporting potential groundwater modeling efforts and the final selection of a remedy for the BSP.

- Additional hydraulic testing near the BSP would provide more accurate data regarding the hydraulic conductivity and storage coefficient of the uppermost aquifer. This data will be useful in supporting the potential groundwater modeling effort.

- Given the dynamic nature of groundwater flow at the BSP, additional depth-to-groundwater data from wells in the area would be useful to support the potential groundwater modeling effort. This data can be most efficiently collected by installing downhole transducers in select wells near the BSP.

## 7.2 Selection of Remedy

As noted above, OVEC began the process of selecting a remedy following submittal of the 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 semiannual reports. As of the process, one or more preferred remedial approaches will be developed based upon technology effectiveness under site conditions, implementability and other considerations. As discussed above, a flexible and adaptive approach to groundwater remediation that begins with post-closure monitoring is planned.

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

Per 40 CFR § 257.96(e), OVEC held a public meeting in November 2019 to discuss ACM results, the remedy selection process, and selection of one or more preferred remedial approaches. The public meeting was 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 were 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.

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# TABLES

**TABLE 4-1**
**GROUNDWATER MONITORING NETWORK**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID | Designation | Date of Installation | Coordinates | | Ground Elevation (ft)² | Top of Casing Elevation (ft)² | Top of Screen Elevation (ft) | Base of Screen Elevation (ft) | Total Depth From Top of Casing (ft) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Northing | Easting | | | | | |
| KC-15-01 | Upgradient | 8/5/2015 | 332114.55 | 2072393.84 | 579.77 | 579.20 | 519.77 | 509.77 | 69.43 |
| KC-15-02 | Upgradient | 8/7/2012 | 332500.654 | 2072569.222 | 580.79 | 580.25 | 520.79 | 510.79 | 69.46 |
| KC-15-03 | Variable | 8/12/2015 | 332546.402 | 2073001.342 | 582.03 | 581.55 | 520.03 | 510.03 | 71.52 |
| KC-15-04 | Downgradient | 8/12/2015 | 331782.439 | 2073755.607 | 579.89 | 579.37 | 519.89 | 509.89 | 69.48 |
| KC-15-05 | Downgradient | 8/19/2015 | 331569.994 | 2073574.832 | 580.52 | 580.07 | 520.52 | 510.52 | 69.55 |
| KC-15-06 | Downgradient | 8/18/2015 | 331218.52 | 2073210.42 | 579.98 | 579.48 | 519.98 | 509.98 | 69.50 |
| KC-15-07 | Downgradient | 8/11/2015 | 331291.75 | 2072957.79 | 578.54 | 578.04 | 508.54 | 498.54 | 79.50 |
| KC-15-08 | Downgradient | 8/10/2015 | 331460.59 | 2072675.87 | 579.41 | 578.75 | 509.41 | 499.41 | 79.34 |

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

**TABLE 4-2**
**SUMMARY OF POTENTIAL AND CONFIRMED APPENDIX III SSIs**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well Id | Parameter | 1st Detection Monitoring Event February/March 2018 | 1st Detection Monitoring Resampling May 2018 | 1st Assessment Monitoring Event September 2018 | 1st Assessment Monitoring Resampling December 2018 |
|---|---|---|---|---|---|
| | | Potential SSI | Confirmed SSI (Yes/No) | Potential SSI | Confirmed SSI (Yes/No) |
| KC-15-04 | Boron | **Yes** | **Yes** | **Yes** | **No** |
| | pH | **Yes** | No | No | -- |
| | TDS | **Yes** | **Yes** | **Yes** | **Yes** |
| | Sulfate | **Yes** | **Yes** | **Yes** | **No** |
| KC-15-05 | Boron | **Yes** | **Yes** | No | -- |
| | Calcium | **Yes** | No | **Yes** | **Yes** |
| | pH | **Yes** | No | No | -- |
| | TDS | **Yes** | **Yes** | **Yes** | **Yes** |
| | Sulfate | **Yes** | **Yes** | **Yes** | **Yes** |
| KC-15-06 | pH | **Yes** | No | No | -- |
| KC-15-07 | Calcium | **Yes** | No | No | -- |
| | pH | **Yes** | No | No | -- |
| KC-15-08 | Boron | **Yes** | **Yes** | No | -- |
| | Calcium | **Yes** | **Yes** | **Yes** | **No** |
| | pH | **Yes** | No | No | -- |
| | TDS | **Yes** | **Yes** | **Yes** | **No** |
| | Sulfate | **Yes** | **Yes** | **Yes** | **No** |

Notes:
SSI: Statistically Significant Increase
-- :  Not evaluated

**TABLE 4-3**
**GROUNDWATER PROTECTION STANDARDS**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| **Appendix IV Constituents** | | | |
|---|---|---|---|
| **Constituent** | **Background** | **MCL/SMCL** | **GWPS** |
| Antimony, Sb | 0.3273 (ug/L) | 6 (ug/L) | 6 (ug/L) |
| Arsenic, As | 7.604 (ug/L) | 10 (ug/L) | 10 (ug/L) |
| Barium, Ba | 133.7 (ug/L) | 2000 (ug/L) | 2000 (ug/L) |
| Beryllium, Be | 0.094 (ug/L) | 4 (ug/L) | 4 (ug/L) |
| Cadmium, Cd | 0.1482 (ug/L) | 5 (ug/L) | 5 (ug/L) |
| Chromium, Cr | 1.959 (ug/L) | 100 (ug/L) | 100 (ug/L) |
| Cobalt, Co | 9.745 (ug/L) | 6 (ug/L)* | 9.745 (ug/L) |
| Fluoride, F | 1.29 (mg/L) | 4 (mg/L) | 4 (mg/L) |
| Lithium, Li | 0.0125 (ug/L) | 40 (ug/L)* | 40 (ug/L) |
| Lead, Pb | 0.5159 (ug/L) | 15 (ug/L)* | 15 (ug/L) |
| Mercury, Hg | 0.25 (ug/L) | 2 (ug/L) | 2 (ug/L) |
| Molybdenum, Mo | 6.122 (ug/L) | 100 (ug/L)* | 100 (ug/L) |
| Radium 226 & 228 (combined) | 1.695(pCi/L) | 5(pCi/L) | 5(pCi/L) |
| Selenium, Se | 0.4 (ug/L) | 50 (ug/L) | 50 (ug/L) |
| Thallium, Tl | 0.03 (ug/L) | 2 (ug/L) | 2 (ug/L) |

Notes:
GWPS: Groundwater Protection Standard
MCL: Maximum Contaminant Level
SMCL: Secondary Maximum Contaminant Level
ug/L: Micrograms per liter
pCi/L: Pico Curies per Liter
* Established by EPA as part of 2018 decision.

**TABLE 5-1**
**GRAIN SIZE ANALYSIS RESULTS**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Boring Number | Sample Depth (feet) | 70% Retention (30% Passing) Size (mm) | Filter Pack Size (mm) | Screen Mesh (inches) | Unified Soil Classification Symbol & Description | |
|---|---|---|---|---|---|---|
| KC-19-27 | 28 - 38 | 0.079 | 0.40 | 0.01 | SM | Silty Sand |
| KC-19-28 | 30 - 40 | 0.11 | 0.40 | 0.01 | SM | Silty Sand |
| KC-19-29 | 32 - 42 | 0.091 | 0.40 | 0.01 | SM | Silty Sand |

Notes:
mm: Millimeters

**TABLE 5-2**
**NEW MONITORING WELL CONSTRUCTION DETAILS**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID | Designation | Date of Installation | Coordinates [1] | | Ground Elevation[2] (feet) | Top of Casing Elevation[2] (feet) | Top of Screen bgs (feet) | Base of Screen bgs (feet) | Total Depth bgs (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Northing | Easting | | | | | |
| KC-19-27 | Downgradient | 4/5/2019 | 331507.38 | 2073611.953 | 558.22 | 561.13 | 28.00 | 38.00 | 38.00 |
| KC-19-28 | Downgradient | 4/4/2019 | 331064.431 | 2073270.027 | 558.41 | 561.10 | 32.00 | 42.00 | 42.00 |
| KC-19-29 | Downgradient | 4/3/2019 | 330558.936 | 2072840.947 | 561.13 | 564.17 | 31.00 | 41.00 | 41.00 |

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

bgs: Below Ground Surface

**TABLE 5-3**
**SUMMARY OF WELL DEVELOPMENT DATA**
**BOILER SLAG POND**
**KYGER CREEK PLANT**
**CHESHIRE, OHIO**

| Well ID | Dates | Method | Volume (gallons) | Final Turbidity (NTU) |
|---|---|---|---|---|
| KC-19-27 | 4/8/2019 | Pump | 213 | 4.89 |
| KC-19-28 | 4/9/2019 | Pump | 232 | 4.7 |
| KC-19-29 | 4/10/2019 | Pump | 106 | 4.51 |

Notes:
NTU: Nephelometric Turbidity Unit

**TABLE 5-4**
**SUMMARY OF GROUNDWATER ELEVATION DATA**
**JUNE 2019**
**BOILER SLAG POND**
**KYGER CREEK PLANT**
**CHESHIRE, OHIO**

| Well ID | Top of Casing Elevation (feet) | Depth to Groundwater (feet) | Groundwater Elevation (feet) |
|---|---|---|---|
| KC-15-01 | 579.20 | 39.49 | 539.71 |
| KC-15-02 | 580.25 | 40.20 | 540.05 |
| KC-15-03 | 581.55 | 41.70 | 539.85 |
| KC-15-04 | 579.37 | 41.06 | 538.31 |
| KC-15-05 | 580.07 | 41.84 | 538.23 |
| KC-15-06 | 579.48 | 41.34 | 538.14 |
| KC-15-07 | 578.04 | 39.66 | 538.38 |
| KC-15-08 | 578.75 | 39.74 | 539.01 |
| KC-19-27 | 561.13 | 22.94 | 538.19 |
| KC-19-28 | 561.10 | 23.19 | 537.91 |
| KC-19-29 | 564.17 | 26.19 | 537.98 |

**TABLE 5-5**
**SUMMARY OF SLUG TEST RESULTS**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID | Test | Analytical Method | K (ft/sec) | Mean K |
|---|---|---|---|---|
| Slug Tests Conducted May 2016 | | | | |
| KC-15-02 | Rising Head #1 | Bouwer-Rice | 4.79E-04 | 6.77E-04 |
| | | Hvorslev | 5.28E-04 | |
| | Falling Head #1 | Bouwer-Rice | 1.17E-03 | |
| | | Hvorslev | 7.31E-04 | |
| | Rising Head #2 | Bouwer-Rice | 6.56E-04 | |
| | | Hvorslev | 7.05E-04 | |
| | Falling Head #2 | Bouwer-Rice | 5.64E-04 | |
| | | Hvorslev | 5.81E-04 | |
| KC-15-05 | Rising Head #1 | Bouwer-Rice | 1.91E-04 | 1.14E-04 |
| | | Hvorslev | 2.13E-04 | |
| | Falling Head #1 | Bouwer-Rice | 5.22E-05 | |
| | | Hvorslev | 5.87E-05 | |
| | Rising Head #2 | Bouwer-Rice | 1.55E-04 | |
| | | Hvorslev | 1.61E-04 | |
| | Falling Head #2 | Bouwer-Rice | 3.77E-05 | |
| | | Hvorslev | 4.17E-05 | |
| Slug Tests Conducted April 2019 | | | | |
| KC-19-27 | Falling Head #1 | Bouwer-Rice | 8.31E-05 | 7.45E-05 |
| | | Hvorslev | 9.95E-05 | |
| | Rising Head #1 | Bouwer-Rice | 5.14E-05 | |
| | | Hvorslev | 6.14E-05 | |
| | Falling Head #2 | Bouwer-Rice | 7.76E-05 | |
| | | Hvorslev | 9.29E-05 | |
| | Rising Head #2 | Bouwer-Rice | 5.92E-05 | |
| | | Hvorslev | 7.08E-05 | |
| KC-19-28 | Falling Head #1 | Bouwer-Rice | 3.22E-03 | 1.65E-03 |
| | | Hvorslev | 4.12E-03 | |
| | Rising Head #1 | Bouwer-Rice | 7.38E-04 | |
| | | Hvorslev | 8.75E-04 | |
| | Falling Head #2 | Bouwer-Rice | 1.17E-03 | |
| | | Hvorslev | 1.39E-03 | |
| | Rising Head #2 | Bouwer-Rice | 7.57E-04 | |
| | | Hvorslev | 8.96E-04 | |
| | | | **Mean K (ft/sec)** | **6.28E-04** |

Notes:
ft/sec: Feet per second
K: Hydraulic Conductivity

**TABLE 5-6**
**SUMMARY OF GROUNDWATER VELOCITY CALCULATIONS**
**JUNE 2019**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well Pair | | $h_1$ (feet) | $h_2$ (feet) | d (feet) | K (feet/day) | n | i | V (feet/day) |
|---|---|---|---|---|---|---|---|---|
| KC-15-02 ($h_1$) | KC-15-06 ($h_2$) | 540.05 | 538.14 | 1400 | 54.26 | 0.25 | 0.001364 | 0.296 |
| KC-15-05 ($h_1$) | KC-19-27 ($h_2$) | 538.23 | 538.19 | 90 | 54.26 | 0.25 | 0.00044 | 0.095 |
| KC-15-06 ($h_1$) | KC-19-28 ($h_2$) | 538.14 | 537.91 | 180 | 54.26 | 0.25 | 0.00128 | 0.278 |
| KC-15-07 ($h_1$) | KC-19-29 ($h_2$) | 538.38 | 537.98 | 740 | 54.26 | 0.25 | 0.00054 | 0.117 |
| | | | | | | | **Average V =** | **0.197** |

Notes:

$h_1$ = 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 5-7**
**SUMMARY OF GROUNDWATER ANALYTICAL RESULTS**
**MARCH AND APRIL 2019**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID / Parameter | Units | GWPS | KC-15-01 Mar-19 | KC-15-02 Mar-19 | KC-15-03 Mar-19 | KC-15-04 Mar-19 | KC-15-05 Mar-19 | KC-15-06 Mar-19 | KC-15-07 Mar-19 | KC-15-08 Mar-19 | KC-19-27 Apr-19 | KC-19-28 Apr-19 | KC-19-29 Apr-19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Constituents** | | | | | | | | | | | | | |
| Boron, B | mg/L | -- | 0.33 | 0.041 J | 0.18 | 0.79 | 0.86 | 0.31 | 0.12 | 0.51 | -- | -- | -- |
| Calcium, Ca | mg/L | -- | 85 | 110 | 120 | 100 | 120 | 92 | 88 | 210 | -- | -- | -- |
| Chloride, Cl | mg/L | -- | 32 | 33 | 29 | 30 | 32 | 34 | 33 | 45 | -- | -- | -- |
| Fluoride, F | mg/L | -- | 0.049 J | 0.12 | 0.089 | 0.071 | 0.12 | 0.095 | 0.064 | 0.092 | -- | -- | -- |
| pH | s.u. | -- | 6.06 | 6.64 | 6.31 | 5.56 | 6.11 | 6.77 | 6.6 | 6.8 | -- | -- | -- |
| Sulfate, SO4 | mg/L | -- | 270 | 120 | 190 | 330 | 390 | 180 | 87 | 550 | -- | -- | -- |
| Total Dissolved Solids (TDS) | mg/L | -- | 510 | 480 | 490 | 620 | 760 | 490 | 410 | 1000 | -- | -- | -- |
| **Appendix IV Constituents** | | | | | | | | | | | | | |
| Antimony, Sb | ug/L | 6 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | -- | -- | -- |
| Arsenic, As | ug/L | 10 | 0.85 J | 2.7 J | 1.3 J | 2.4 J | <5.0 | 2.6 J | 160 | 11 | 1.8 | 0.94 | 0.84 |
| Barium, Ba | ug/L | 2000 | 26 | 100 | 69 | 76 | 37 | 110 | 560 | 54 | -- | -- | -- |
| Beryllium, Be | ug/L | 4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | -- | -- | -- |
| Cadmium, Cd | ug/L | 5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 0.29 J | <1.0 | <1.0 | -- | -- | -- |
| Chromium, Cr | ug/L | 100 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | -- | -- | -- |
| Cobalt, Co | ug/L | 9.745 | 5.7 | 1.4 | 4.6 | 11 | 5.5 | 4.3 | 0.27 J | 5 | -- | -- | -- |
| Fluoride, F | mg/L | 4 | 0.049 J | 0.12 | 0.089 | 0.071 | 0.12 | 0.095 | 0.064 | 0.092 | -- | -- | -- |
| Lithium, Li | mg/L | 0.04 | 0.0036 J | 0.0034 J | 0.0045 J | 0.011 | 0.0027 J | 0.003 J | 0.0024 J | 0.0046 J | -- | -- | -- |
| Lead, Pb | ug/L | 15 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | -- | -- | -- |
| Mercury, Hg | ug/L | 2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | -- | -- | -- |
| Molybdenum, Mo | ug/L | 100 | <5.0 | 1.7 J | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | -- | -- | -- |
| Radium 226 & 228 (combined) | pCi/L | 5 | 0.255 U | 0.604 | 0.501 | 0.486 | 0.587 | 0.417 | 1.29 | 0.539 | -- | -- | -- |
| Selenium, Se | ug/L | 50 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | -- | -- | -- |
| Thallium, Tl | ug/L | 2 | <1.0 | 0.26 J | <1.0 | <1.0 | 0.23 J | 0.25 J | <1.0 | <1.0 | -- | -- | -- |

Notes:
GWPS: Groundwater Protection Standard
mg/L: Milligrams per liter
s.u.: Standard Units
ug/L: Micrograms per liter
pCi/L: Picocuries per liter

# TABLE 6-1
# SOURCE CONTROL TECHNOLOGIES SCREENING MATRIX - 40 CFR § 257.96(c) REQUIREMENTS
# BOILER SLAG POND
# KYGER CREEK STATION
# CHESHIRE, OHIO

| | ***Source Control Technologies*** | | |
|---|---|---|---|
| | **Dewatering of Pond Water** | **Engineered Cover System** | **Excavation of Boiler Slag** |
| **257.96(c)(1)** | | | |
| **Performance** | Low | Medium | High |
| **Reliability** | Low | Medium | High |
| **Ease of Implementation** | Low<br>Water Removal, Treatment & Discharge Required | Medium<br>Field Construction Required | High<br>Field Construction Required |
| **Potential Safety Impacts** | Low<br>Field Construction Required | Medium<br>Field Construction Required | High<br>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 2.5 years | 2 to 3 years |
| **257.96(c)(3)** | | | |
| **State, Local or other Environmental Permit Requirements that May Impact Implementation** | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA |
| **Additional Information** | Required for In-Place Closure or Closure by Removal | Ash 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**
**BOILER SLAG POND**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| | *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** | High | Low | Low | Low | High | Low<br>Significant Water Level Fluctuations Reduce Effectiveness of Horizontal Wells | High |
| **Reliability** | High | Low | Medium | Medium | High<br>Long Term O&M Required | Low<br>Significant Issues with Water Level Fluctuations | High<br>Long Term O&M Required |
| **Ease of Implementation** | High | Low | Low | Low | High<br>Drilling and Limited Field Construction Required | Medium<br>Drilling and Limited Field Construction Required | Low<br>Trench Construction Required |
| **Potential Safety Impacts** | Low | Medium<br>Field Construction Required | Medium<br>Field Construction Required | Medium<br>Field Construction Required | Medium<br>Drilling Required | Medium<br>Drilling Required | Medium<br>Trench Construction Required |
| **Potential Cross-Media Impacts** | Low | Medium | Low | Low | Medium | Medium | Medium |
| **Potential Impacts from Control of Exposure to Residual Constituents** | Low | Low | Low | Low | Low | Low | Low |
| **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<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required | Highly Variable<br>Further Evaluation Required |
| **257.96(c)(3)** | | | | | | | |
| **State, Local or other Environmental Permit Requirements that May Impact Implementation** | Requires Coordination with Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA | Requires Approval from Ohio EPA |
| **Additional Information** | Groundwater F&T Modeling Required to Evaluate the Timing for This Approach for Arsenic | Lack of Competent Lower Unit Likely Precludes This Approach | Pilot Testing Required for This Approach | Lack of Competent Lower Unit Likely Precludes This Approach | 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
*The time to begin the remedy is based on the time after closure of the unit.

# FIGURES


| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYG |
| DWG FILE | 2019 ACM_KYGER_Fig 2-1_Aerial Site.dwg |
| DRAWING SCALE | NOT TO SCALE |

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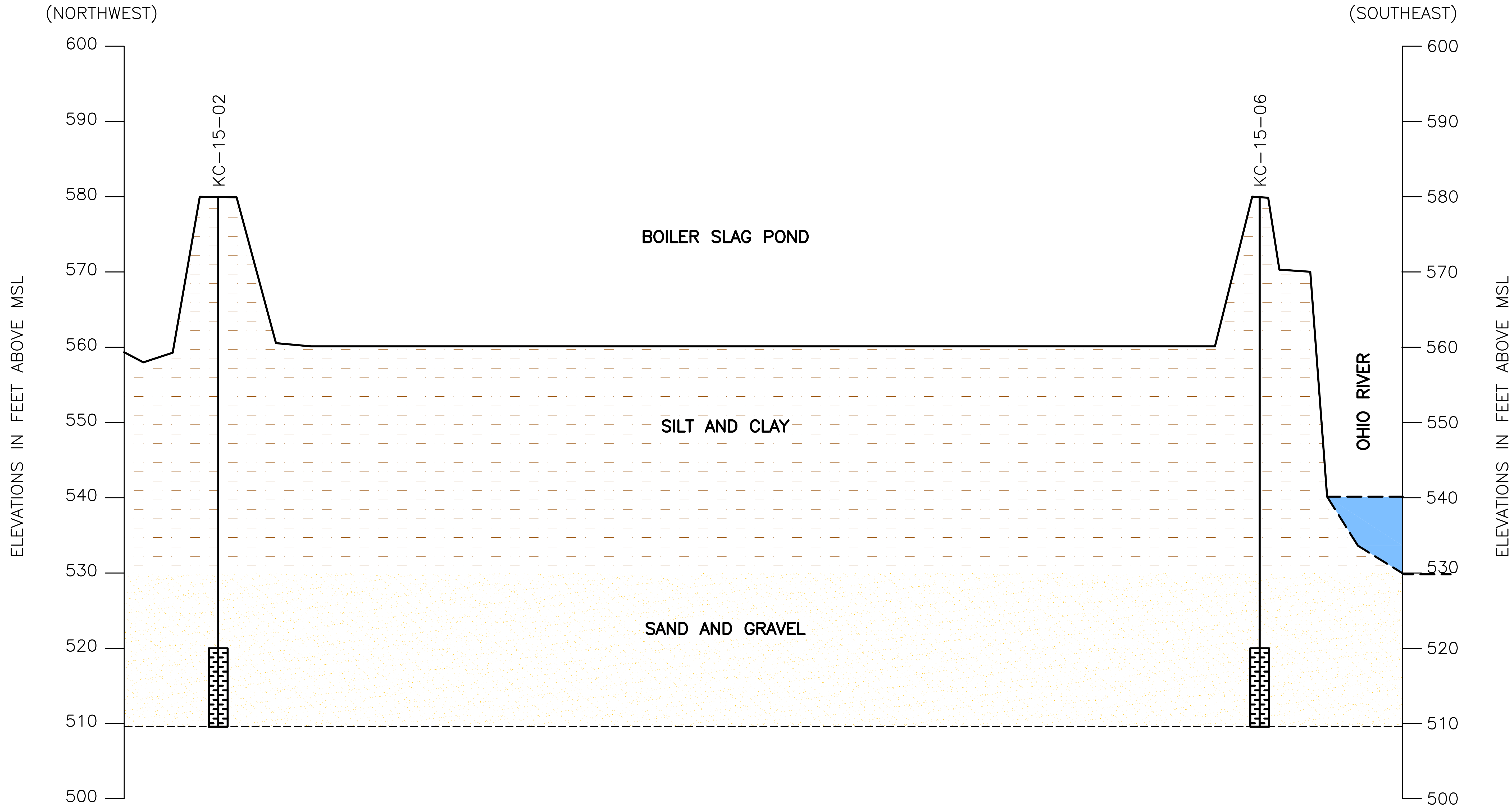
OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
SITE LOCATION MAP

DRAWING NAME: FIGURE 2-1

REV. 0

Plot: 08/13/2019 11:03 _PROGRAMS-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 2-1_Aerial Site.dwg




NOTE:
THE APPROXIMATE LOCATION OF THE CROSS-SECTION IS ILLUSTRATED ON FIGURE 4-1.

| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 3-1_BSP_Cross Sec.dwg |
| DRAWING SCALE | NOT TO SCALE |

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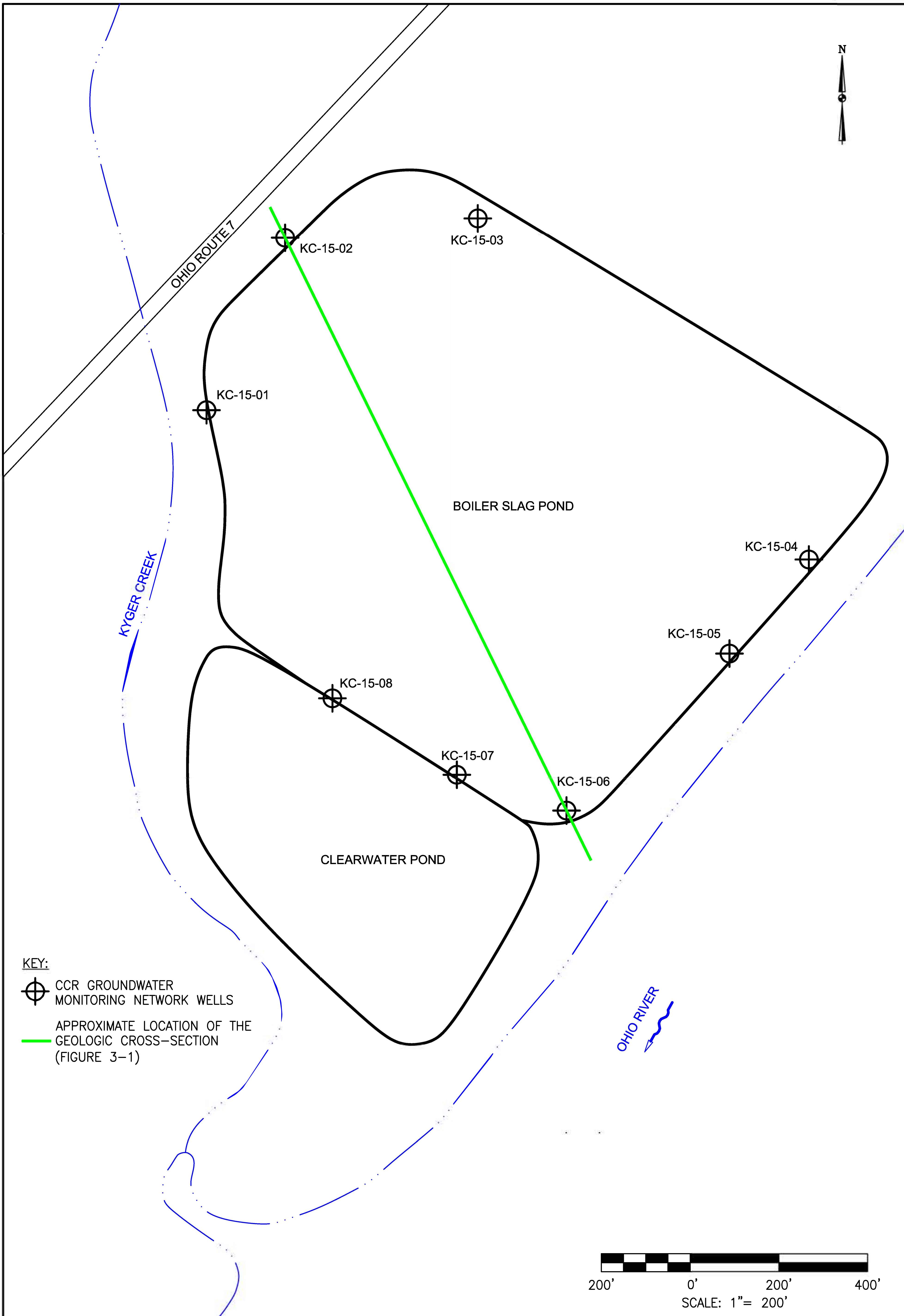
OHIO VALLEY ELECTRIC COMPANY
KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION
(NORTHWEST – SOUTHEAST)

DRAWING NAME: FIGURE 3-1
REV. 0

Plot: 09/10/2019 10:41 _PROGRAM-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 3-1_BSP_Cross Sec.dwg




| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 4-1_BSP_MW LOCs.dwg |
| DRAWING SCALE | 1"=200' |

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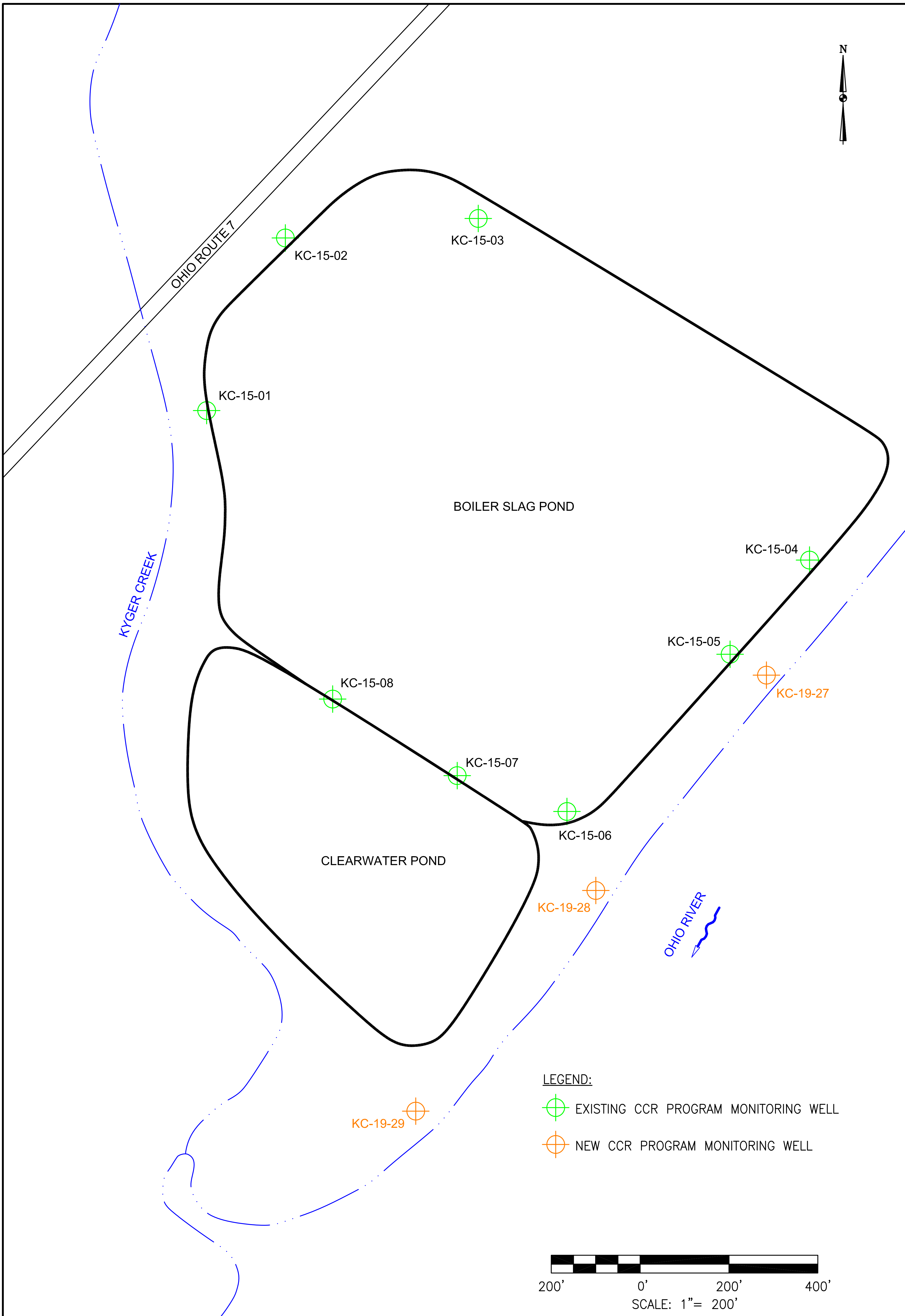
412.264.6453

OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
EXISTING MONITORING WELL LOCATION MAP

DRAWING NAME: FIGURE 4-1
REV. 0

Plot: 12/25/2020 13:25 _PROGRAM-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 4-1_BSP_MW LOCs.dwg




| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 5-1_BSP_MWs&SBs.dwg |
| DRAWING SCALE | 1"=200' |

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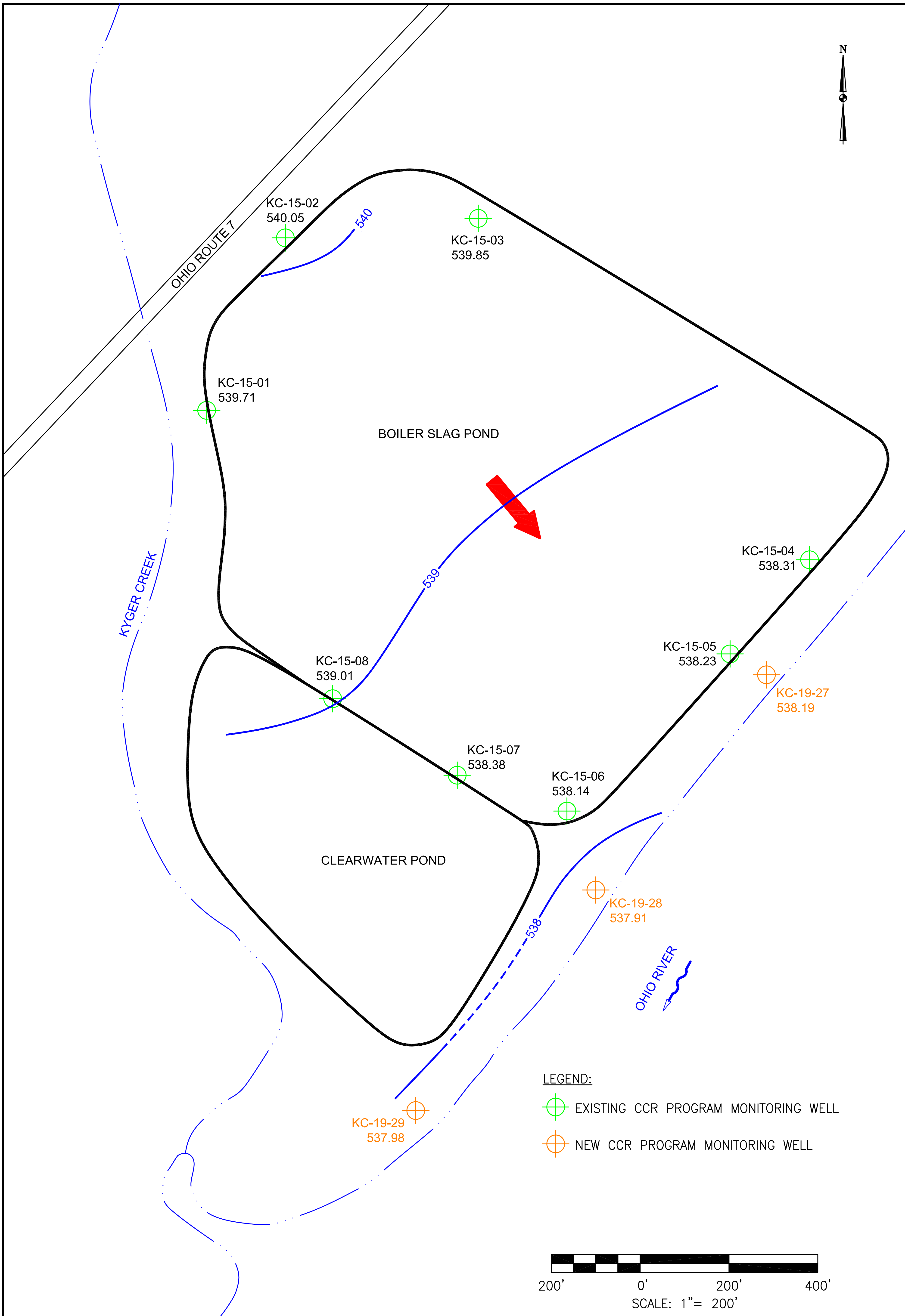
OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
EXISTING AND NEW MONITORING WELL LOCATIONS

DRAWING NAME: FIGURE 5-1
REV.: 0

Plot: 11/25/2020 13:28 _PROGRAM-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 5-1_BSP_MWs&SBs.dwg




| | |
|---|---|
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| CHECKED BY | |
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| DWG FILE | 2019 ACM_KYGER_Fig 5-2_BSP_GW Contours_JUN19.dwg |
| DRAWING SCALE | 1"=200' |

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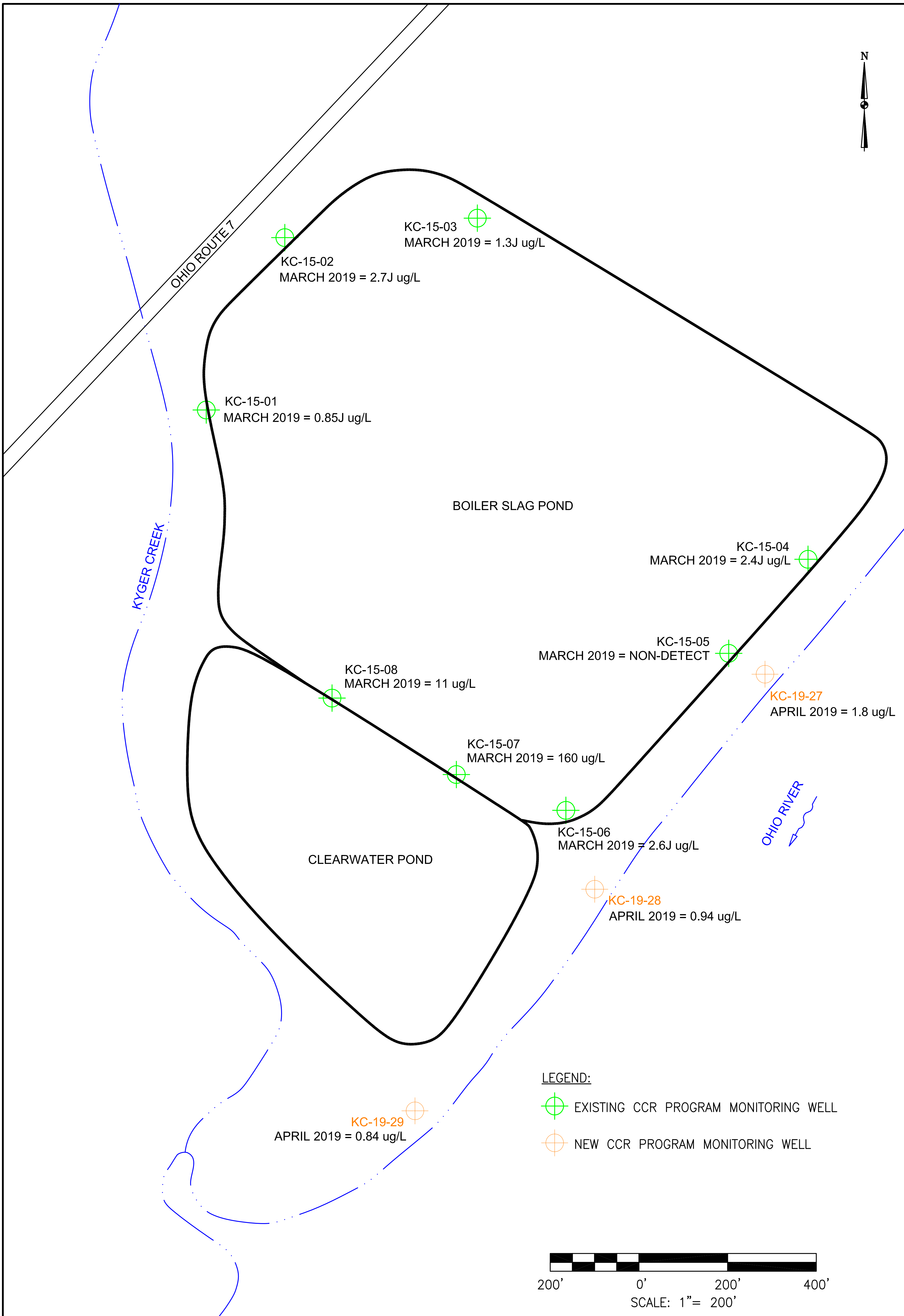
OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER ELEVATIONS AND FLOW MAP
JUNE 2019

DRAWING NAME: FIGURE 5-2

REV. 0

Plot: 11/25/2020 12:53 \Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 5-2_BSP_GW Contours_JUN19.dwg




| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 5-3_BSP_Arsenic.dwg |
| DRAWING SCALE | 1"=200' |

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OHIO VALLEY ELECTRIC COMPANY

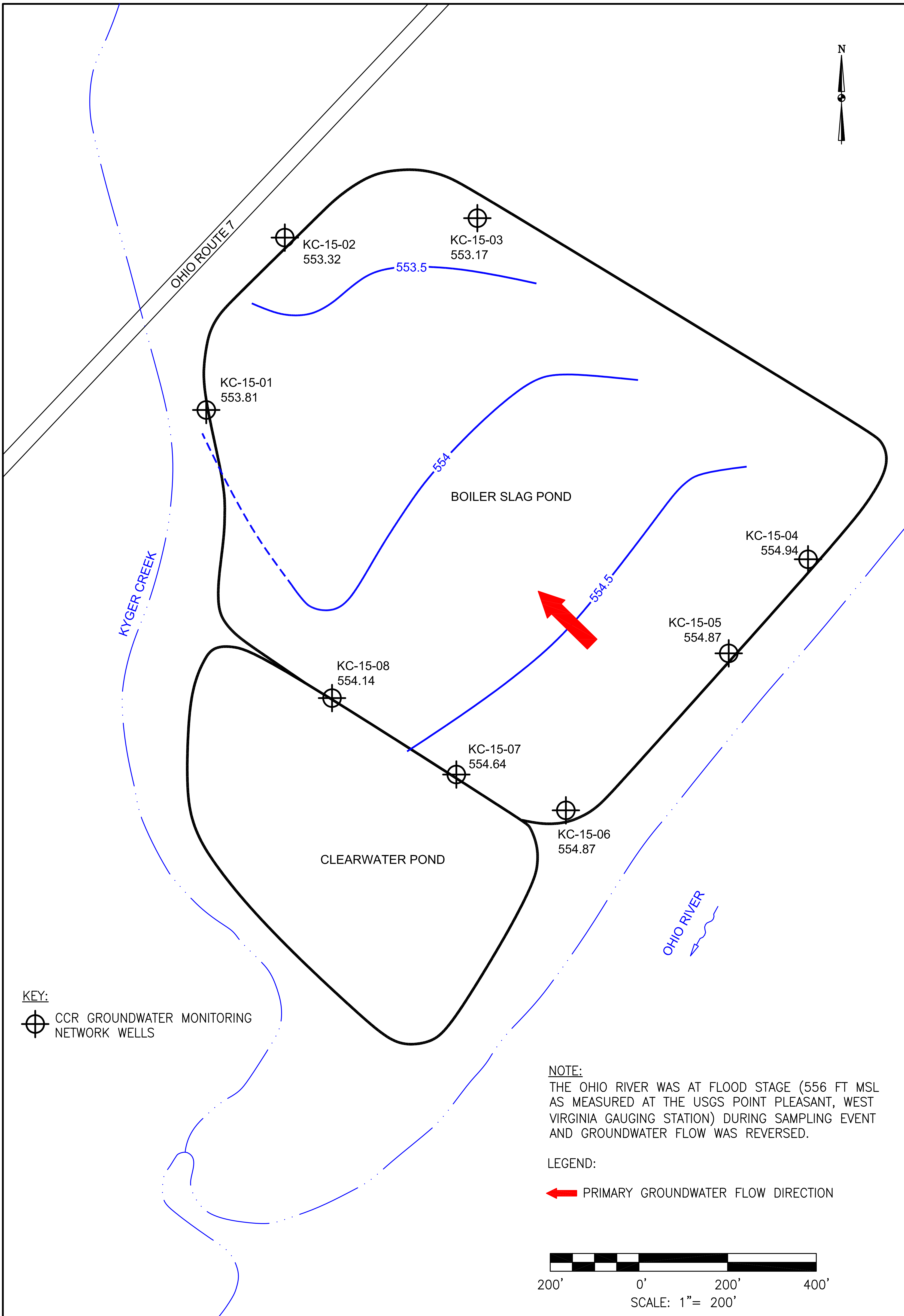
KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
ARSENIC IN GROUNDWATER RESULTS
MARCH 2019 AND APRIL 2019

DRAWING NAME: FIGURE 5-3
REV.: 0

Plot: 09/10/2019 11:02 _PROGRAMS-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 5-3_BSP_Arsenic.dwg

# APPENDIX A

# GROUNDWATER FLOW MAPS FOR 2018




| | |
|---|---|
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| CHECKED BY | |
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| DRAWING SCALE | 1"=200' |

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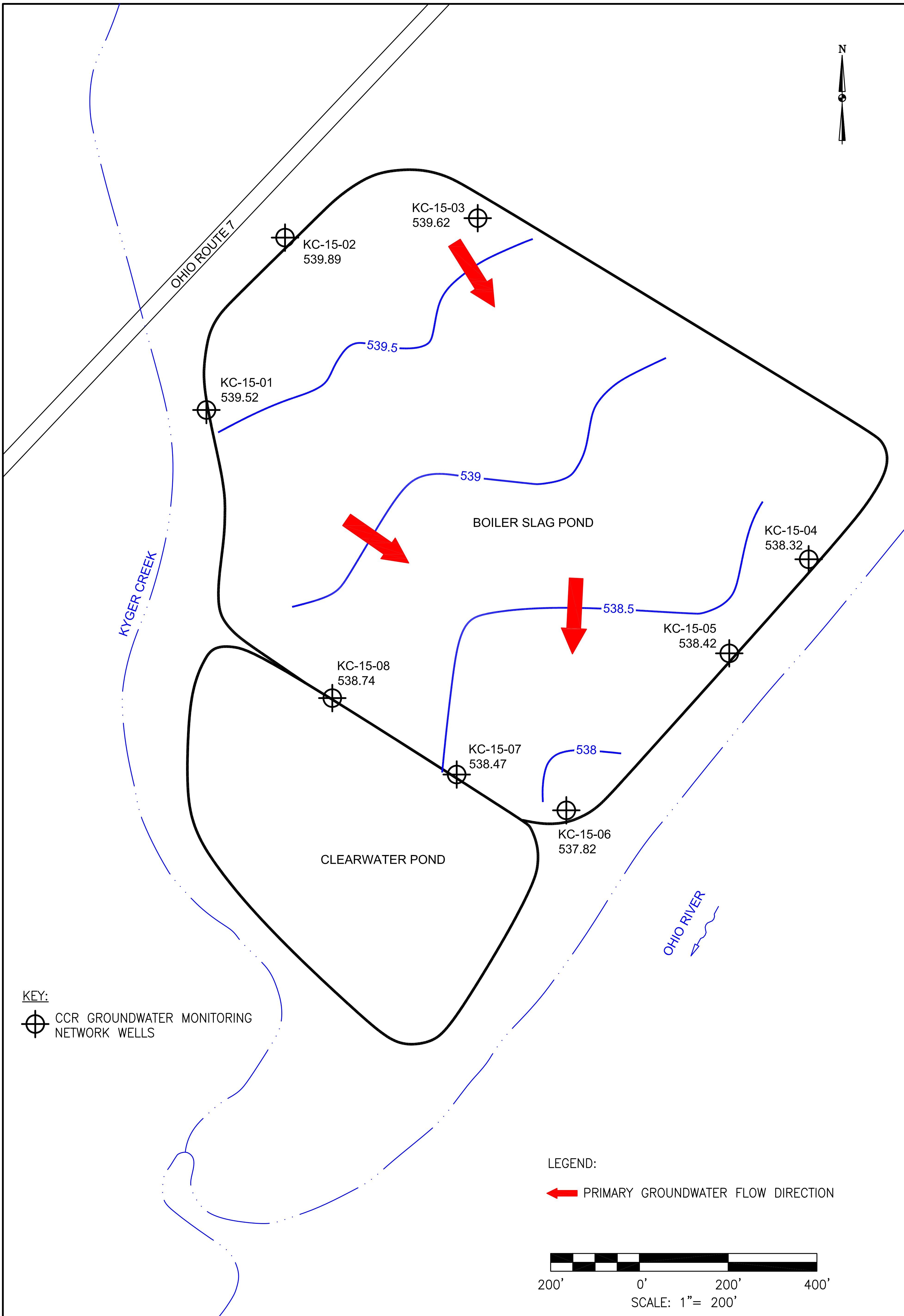
OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER CONTOUR MAP – FEBRUARY 2018

DRAWING NAME: FIGURE A-1
REV. 0

Plot: 08/13/2019 12:12 _PROGRAM-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\Appx A\2019 ACM_KYGER_Fig A-1_BSP_Contours_FEB-18.dwg




| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109–1–KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig A–2_BSP_Contours_SEPT–18.dwg |
| DRAWING SCALE | 1"=200' |

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OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER CONTOUR MAP – SEPTEMBER 2018

DRAWING NAME: FIGURE A–2

REV. 0

Plot: 08/13/2019 12:18 _PROGRAM–KYGER OVEC\Kyger Creek–CCR Program\CAD\2019 Assessment of Corrective Measures\Appx A\2019 ACM_KYGER_Fig A–2_BSP_Contours_SEPT–18.dwg

# APPENDIX B

# ANALYTICAL RESULTS FOR 2018 GROUNDWATER MONITORING

**KC-15-01**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | Assessment Monitoring |
|---|---|---|---|---|
| | | | Mar-18 | Sep-18 |
| **Appendix III Constituents** | | | | |
| Boron, B | mg/L | -- | 0.35 | 0.416 |
| Calcium, Ca | mg/L | -- | 85 | 77.6 |
| Chloride, Cl | mg/L | -- | 30.2 | 24.9 |
| Fluoride, F | mg/L | -- | 0.04 J | 0.04 J |
| pH | s.u. | -- | 9.09 | 5.64 |
| Sulfate, SO4 | mg/L | -- | 239 | 257 |
| Total Dissolved Solids (TDS) | mg/L | -- | 460 | 453 |
| **Appendix IV Constituents** | | | | |
| Antimony, Sb | ug/L | 6 | NA | 0.07 |
| Arsenic, As | ug/L | 10 | NA | 0.33 |
| Barium, Ba | ug/L | 2000 | NA | 23.4 |
| Beryllium, Be | ug/L | 4 | NA | 0.067 |
| Cadmium, Cd | ug/L | 5 | NA | 0.02 |
| Chromium, Cr | ug/L | 100 | NA | 0.171 |
| Cobalt, Co | ug/L | 9.745 | NA | 4.3 |
| Fluoride, F | mg/L | 4 | NA | 0.04 J |
| Lithium, Li | mg/L | 0.04 | NA | 0.018 |
| Lead, Pb | ug/L | 15 | NA | 0.06 |
| Mercury, Hg | ug/L | 2 | NA | 0.005 |
| Molybdenum, Mo | ug/L | 100 | NA | 0.29 |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | 2.0065 |
| Selenium, Se | ug/L | 50 | NA | 0.1 |
| Thallium, Tl | ug/L | 2 | NA | 0.03 J |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-02**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | Assessment Monitoring |
|---|---|---|---|---|
| | | | Mar-18 | Sep-18 |
| **Appendix III Constituents** | | | | |
| Boron, B | mg/L | -- | 0.03 | 0.128 |
| Calcium, Ca | mg/L | -- | 112 | 101 |
| Chloride, Cl | mg/L | -- | 34.1 | 36.4 |
| Fluoride, F | mg/L | -- | 0.1 J | 0.1 J |
| pH | s.u. | -- | 12.44 | 6.42 |
| Sulfate, SO4 | mg/L | -- | 109 | 105 |
| Total Dissolved Solids (TDS) | mg/L | -- | 478 | 452 |
| **Appendix IV Constituents** | | | | |
| Antimony, Sb | ug/L | 6 | NA | 0.03 J |
| Arsenic, As | ug/L | 10 | NA | 2.39 |
| Barium, Ba | ug/L | 2000 | NA | 85.7 |
| Beryllium, Be | ug/L | 4 | NA | 0.009 J |
| Cadmium, Cd | ug/L | 5 | NA | 0.14 |
| Chromium, Cr | ug/L | 100 | NA | 0.391 |
| Cobalt, Co | ug/L | 9.745 | NA | 2.26 |
| Fluoride, F | mg/L | 4 | NA | 0.1 J |
| Lithium, Li | mg/L | 0.04 | NA | 0.0007 J |
| Lead, Pb | ug/L | 15 | NA | 0.189 |
| Mercury, Hg | ug/L | 2 | NA | 0.003 J |
| Molybdenum, Mo | ug/L | 100 | NA | 1.25 |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | 0.976 |
| Selenium, Se | ug/L | 50 | NA | 0.08 J |
| Thallium, Tl | ug/L | 2 | NA | 0.02 J |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-03**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | Assessment Monitoring |
|---|---|---|---|---|
| | | | Mar-18 | Sep-18 |
| **Appendix III Constituents** | | | | |
| Boron, B | mg/L | -- | 0.096 | 0.131 |
| Calcium, Ca | mg/L | -- | 109 | 105 |
| Chloride, Cl | mg/L | -- | 28.1 | 29.1 |
| Fluoride, F | mg/L | -- | 0.08 | 0.1 J |
| pH | s.u. | -- | 11 | 6.31 |
| Sulfate, SO4 | mg/L | -- | 192 | 181 |
| Total Dissolved Solids (TDS) | mg/L | -- | 490 | 472 |
| **Appendix IV Constituents** | | | | |
| Antimony, Sb | ug/L | 6 | NA | 0.02 J |
| Arsenic, As | ug/L | 10 | NA | 1.44 |
| Barium, Ba | ug/L | 2000 | NA | 66.5 |
| Beryllium, Be | ug/L | 4 | NA | 0.02 U |
| Cadmium, Cd | ug/L | 5 | NA | 0.06 |
| Chromium, Cr | ug/L | 100 | NA | 0.103 |
| Cobalt, Co | ug/L | 9.745 | NA | 7.58 |
| Fluoride, F | mg/L | 4 | NA | 0.1 J |
| Lithium, Li | mg/L | 0.04 | NA | 0.032 |
| Lead, Pb | ug/L | 15 | NA | 0.02 J |
| Mercury, Hg | ug/L | 2 | NA | 0.003 J |
| Molybdenum, Mo | ug/L | 100 | NA | 0.89 |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | 0.285 |
| Selenium, Se | ug/L | 50 | NA | 0.1 U |
| Thallium, Tl | ug/L | 2 | NA | 0.05 U |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-04**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | | Assessment Monitoring | |
|---|---|---|---|---|---|---|
| | | | Mar-18 | May-18 | Sep-18 | Dec-18 |
| **Appendix III Constituents** | | | | | | |
| Boron, B | mg/L | -- | 0.717 | 1.01 | 0.924 | 0.781 |
| Calcium, Ca | mg/L | -- | 105 | NA | 109 | NA |
| Chloride, Cl | mg/L | -- | 24.6 | NA | 28.3 | NA |
| Fluoride, F | mg/L | -- | 0.06 | NA | 0.09 | NA |
| pH | s.u. | -- | 10.2 | 6.49 | 6.34 | NA |
| Sulfate, SO4 | mg/L | -- | 344 | 369 | 358 | 300 |
| Total Dissolved Solids (TDS) | mg/L | -- | 600 | 660 | 600 | 585 |
| **Appendix IV Constituents** | | | | | | |
| Antimony, Sb | ug/L | 6 | NA | NA | 0.17 | NA |
| Arsenic, As | ug/L | 10 | NA | NA | 1.66 | NA |
| Barium, Ba | ug/L | 2000 | NA | NA | 58.3 | NA |
| Beryllium, Be | ug/L | 4 | NA | NA | 0.01 J | NA |
| Cadmium, Cd | ug/L | 5 | NA | NA | 0.03 | NA |
| Chromium, Cr | ug/L | 100 | NA | NA | 0.161 | NA |
| Cobalt, Co | ug/L | 9.745 | NA | NA | 8.83 | NA |
| Fluoride, F | mg/L | 4 | NA | NA | 0.09 | NA |
| Lithium, Li | mg/L | 0.04 | NA | NA | 0.014 | NA |
| Lead, Pb | ug/L | 15 | NA | NA | 0.081 | NA |
| Mercury, Hg | ug/L | 2 | NA | NA | 0.003 J | NA |
| Molybdenum, Mo | ug/L | 100 | NA | NA | 0.52 | NA |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | NA | 0.403 | NA |
| Selenium, Se | ug/L | 50 | NA | NA | 0.1 | NA |
| Thallium, Tl | ug/L | 2 | NA | NA | 0.02 J | NA |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-05**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | | Assessment Monitoring | |
|---|---|---|---|---|---|---|
| | | | Mar-18 | May-18 | Sep-18 | Dec-18 |
| **Appendix III Constituents** | | | | | | |
| Boron, B | mg/L | -- | 0.889 | 0.815 | 0.762 | NA |
| Calcium, Ca | mg/L | -- | 136 | 109 | 129 | 129 |
| Chloride, Cl | mg/L | -- | 27.9 | NA | 28.9 | NA |
| Fluoride, F | mg/L | -- | 0.09 | NA | 0.13 | NA |
| pH | s.u. | -- | 9.01 | 6.57 | 6.35 | NA |
| Sulfate, SO4 | mg/L | -- | 363 | 318 | 346 | 333 |
| Total Dissolved Solids (TDS) | mg/L | -- | 691 | 652 | 664 | 689 |
| **Appendix IV Constituents** | | | | | | |
| Antimony, Sb | ug/L | 6 | NA | NA | 0.02 J | NA |
| Arsenic, As | ug/L | 10 | NA | NA | 0.88 | NA |
| Barium, Ba | ug/L | 2000 | NA | NA | 35.4 | NA |
| Beryllium, Be | ug/L | 4 | NA | NA | 0.005 J | NA |
| Cadmium, Cd | ug/L | 5 | NA | NA | 0.07 | NA |
| Chromium, Cr | ug/L | 100 | NA | NA | 0.21 | NA |
| Cobalt, Co | ug/L | 9.745 | NA | NA | 5.27 | NA |
| Fluoride, F | mg/L | 4 | NA | NA | 0.13 | NA |
| Lithium, Li | mg/L | 0.04 | NA | NA | 0.027 | NA |
| Lead, Pb | ug/L | 15 | NA | NA | 0.07 | NA |
| Mercury, Hg | ug/L | 2 | NA | NA | 0.004 J | NA |
| Molybdenum, Mo | ug/L | 100 | NA | NA | 0.57 | NA |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | NA | 3.086 | NA |
| Selenium, Se | ug/L | 50 | NA | NA | 0.1 | NA |
| Thallium, Tl | ug/L | 2 | NA | NA | 0.04 J | NA |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-06**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | Assessment Monitoring |
|---|---|---|---|---|
| | | | Mar-18 | Sep-18 |
| **Appendix III Constituents** | | | | |
| Boron, B | mg/L | -- | 0.275 | 0.306 |
| Calcium, Ca | mg/L | -- | 108 | 94.8 |
| Chloride, Cl | mg/L | -- | 38 | 36.1 |
| Fluoride, F | mg/L | -- | 0.09 J | 0.1 J |
| pH | s.u. | -- | 9.33 | 6.52 |
| Sulfate, SO4 | mg/L | -- | 177 | 144 |
| Total Dissolved Solids (TDS) | mg/L | -- | 502 | 465 |
| **Appendix IV Constituents** | | | | |
| Antimony, Sb | ug/L | 6 | NA | 0.01 J |
| Arsenic, As | ug/L | 10 | NA | 1.58 |
| Barium, Ba | ug/L | 2000 | NA | 110 |
| Beryllium, Be | ug/L | 4 | NA | 0.02 U |
| Cadmium, Cd | ug/L | 5 | NA | 0.13 |
| Chromium, Cr | ug/L | 100 | NA | 0.238 |
| Cobalt, Co | ug/L | 9.745 | NA | 2.76 |
| Fluoride, F | mg/L | 4 | NA | 0.1 J |
| Lithium, Li | mg/L | 0.04 | NA | 0.001 |
| Lead, Pb | ug/L | 15 | NA | 0.044 |
| Mercury, Hg | ug/L | 2 | NA | 0.002 J |
| Molybdenum, Mo | ug/L | 100 | NA | 0.37 |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | 0.916 |
| Selenium, Se | ug/L | 50 | NA | 0.06 J |
| Thallium, Tl | ug/L | 2 | NA | 0.02 J |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-07**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | | Assessment Monitoring | |
|---|---|---|---|---|---|---|
| | | | Mar-18 | May-18 | Sep-18 | Dec-18 |
| **Appendix III Constituents** | | | | | | |
| Boron, B | mg/L | -- | 0.256 | NA | 0.078 | NA |
| Calcium, Ca | mg/L | -- | 123 | 78.8 | 69.3 | NA |
| Chloride, Cl | mg/L | -- | 39.8 | NA | 30.9 | NA |
| Fluoride, F | mg/L | -- | 0.08 J | NA | 0.07 J | NA |
| pH | s.u. | -- | 8.45 | 6.02 | 6.27 | NA |
| Sulfate, SO4 | mg/L | -- | 191 | NA | 46.1 | NA |
| Total Dissolved Solids (TDS) | mg/L | -- | 544 | NA | 367 | NA |
| **Appendix IV Constituents** | | | | | | |
| Antimony, Sb | ug/L | 6 | NA | NA | 0.01 J | NA |
| Arsenic, As | ug/L | 10 | NA | NA | 152 | 15.3 |
| Barium, Ba | ug/L | 2000 | NA | NA | 510 | NA |
| Beryllium, Be | ug/L | 4 | NA | NA | 0.006 J | NA |
| Cadmium, Cd | ug/L | 5 | NA | NA | 0.01 J | NA |
| Chromium, Cr | ug/L | 100 | NA | NA | 0.189 | NA |
| Cobalt, Co | ug/L | 9.745 | NA | NA | 0.132 | NA |
| Fluoride, F | mg/L | 4 | NA | NA | 0.07 J | NA |
| Lithium, Li | mg/L | 0.04 | NA | NA | 0.004 | NA |
| Lead, Pb | ug/L | 15 | NA | NA | 0.01 J | NA |
| Mercury, Hg | ug/L | 2 | NA | NA | 0.004 J | NA |
| Molybdenum, Mo | ug/L | 100 | NA | NA | 0.75 | NA |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | NA | 1.62 | NA |
| Selenium, Se | ug/L | 50 | NA | NA | 0.09 J | NA |
| Thallium, Tl | ug/L | 2 | NA | NA | 0.01 J | NA |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

**KC-15-08**
**SUMMARY OF ANALYTICAL RESULTS**
**Ohio Valley Electric Corporation**
**Kyger Creek Station**
**Gallia County, Ohio**

| Parameter | Units | GWPS | Detection Monitoring | | Assessment Monitoring | |
|---|---|---|---|---|---|---|
| | | | Mar-18 | May-18 | Sep-18 | Dec-18 |
| **Appendix III Constituents** | | | | | | |
| Boron, B | mg/L | -- | 0.58 | 0.495 | 0.332 | NA |
| Calcium, Ca | mg/L | -- | 245 | 187 | 153 | 105 |
| Chloride, Cl | mg/L | -- | 42.9 | NA | 39.7 | NA |
| Fluoride, F | mg/L | -- | 0.08 | NA | 0.12 | NA |
| pH | s.u. | -- | 8.45 | 6.25 | 6.85 | NA |
| Sulfate, SO4 | mg/L | -- | 599 | 510 | 375 | 150 |
| Total Dissolved Solids (TDS) | mg/L | -- | 1130 | 1070 | 842 | 510 |
| **Appendix IV Constituents** | | | | | | |
| Antimony, Sb | ug/L | 6 | NA | NA | 0.02 J | NA |
| Arsenic, As | ug/L | 10 | NA | NA | 3.86 | NA |
| Barium, Ba | ug/L | 2000 | NA | NA | 50.2 | NA |
| Beryllium, Be | ug/L | 4 | NA | NA | 0.02 U | NA |
| Cadmium, Cd | ug/L | 5 | NA | NA | 0.02 | NA |
| Chromium, Cr | ug/L | 100 | NA | NA | 0.479 | NA |
| Cobalt, Co | ug/L | 9.745 | NA | NA | 5.99 | NA |
| Fluoride, F | mg/L | 4 | NA | NA | 0.12 | NA |
| Lithium, Li | mg/L | 0.04 | NA | NA | 0.024 | NA |
| Lead, Pb | ug/L | 15 | NA | NA | 0.02 J | NA |
| Mercury, Hg | ug/L | 2 | NA | NA | 0.003 J | NA |
| Molybdenum, Mo | ug/L | 100 | NA | NA | 0.56 | NA |
| Radium 226 & 228 (combined) | pCi/L | 5 | NA | NA | 0.582 | NA |
| Selenium, Se | ug/L | 50 | NA | NA | 0.04 J | NA |
| Thallium, Tl | ug/L | 2 | NA | NA | 0.01 J | NA |

Notes:
Yellow highlight indicates compound exceeds
NA = Sample not analyzed for the parameter
-- = not applicable

# APPENDIX C

# GRAIN SIZE ANALYSIS LAB REPORTS

Stantec

# Summary of Soil Tests

Project Name: Kyger Creek CCR Rule - Groundwater
Project Number: 175534017
Source: KC-19-27-28-38
Lab ID: 7

Sample Type: BULK
Date Received: 4-9-19
Date Reported: 4-15-19

## Test Results

### Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 27.6

### Particle Size Analysis

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

| Particle Size | | % |
|---|---|---|
| Sieve Size | (mm) | Passing |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| No. 4 | 4.75 | 100.0 |
| No. 10 | 2 | 99.9 |
| No. 40 | 0.425 | 99.1 |
| No. 200 | 0.075 | 28.3 |
| | 0.02 | 15.9 |
| | 0.005 | 9.8 |
| | 0.002 | 7.2 |
| estimated | 0.001 | 5.9 |

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

| Range | ASTM (%) | AASHTO (%) |
|---|---|---|
| Gravel | 0.0 | 0.1 |
| Coarse Sand | 0.1 | 0.8 |
| Medium Sand | 0.8 | --- |
| Fine Sand | 70.8 | 70.8 |
| Silt | 18.5 | 21.1 |
| Clay | 9.8 | 7.2 |

### Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

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

### Moisture-Density Relationship

Test Not Performed

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

### California Bearing Ratio

Test Not Performed

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

### Specific Gravity

Estimated

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

### Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 ( 0 )

Comments:

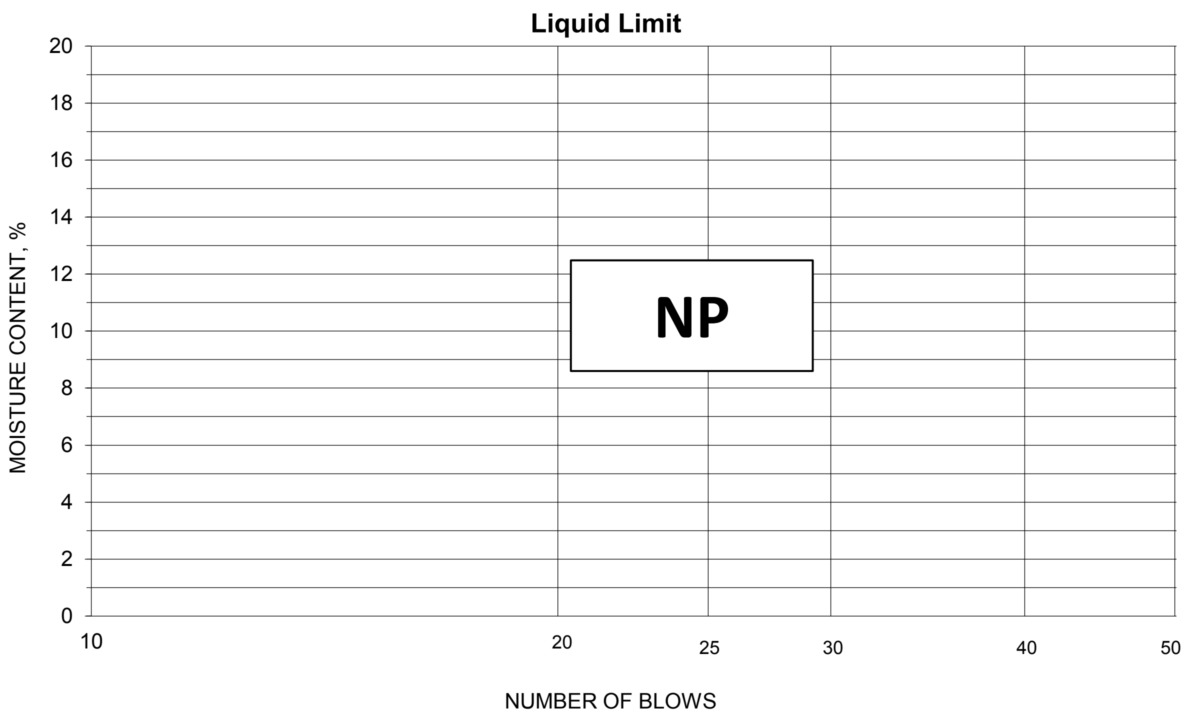
Reviewed By JS

Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

# ATTERBERG LIMITS

| | | | |
|---|---|---|---|
| Project | Kyger Creek CCR Rule - Groundwater | Project No. | 175534017 |
| Source | KC-19-27-28-38 | Lab ID | 7 |
| | | % + No. 40 | 1 |
| Tested By | MP | Test Method | ASTM D 4318 Method A |
| Date Received | 04-09-2019 | | |
| Test Date | 04-11-2019 | Prepared | Dry |

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Number of Blows | Water Content (%) | Liquid Limit |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |




PLASTIC LIMIT AND PLASTICITY INDEX

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Water Content (%) | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Remarks:

Reviewed By JS

# Particle-Size Analysis of Soils
ASTM D 422

Stantec

| | | | |
|---|---|---|---|
| Project Name | Kyger Creek CCR Rule - Groundwater | Project Number | 175534017 |
| Source | KC-19-27-28-38 | Lab ID | 7 |

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

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: GW
Test Date: 04-10-2019
Date Received: 04-09-2019

Maximum Particle size: No. 4 Sieve

| Sieve Size | % Passing |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| No. 4 | 100.0 |
| No. 10 | 99.9 |

## Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity: 2.7

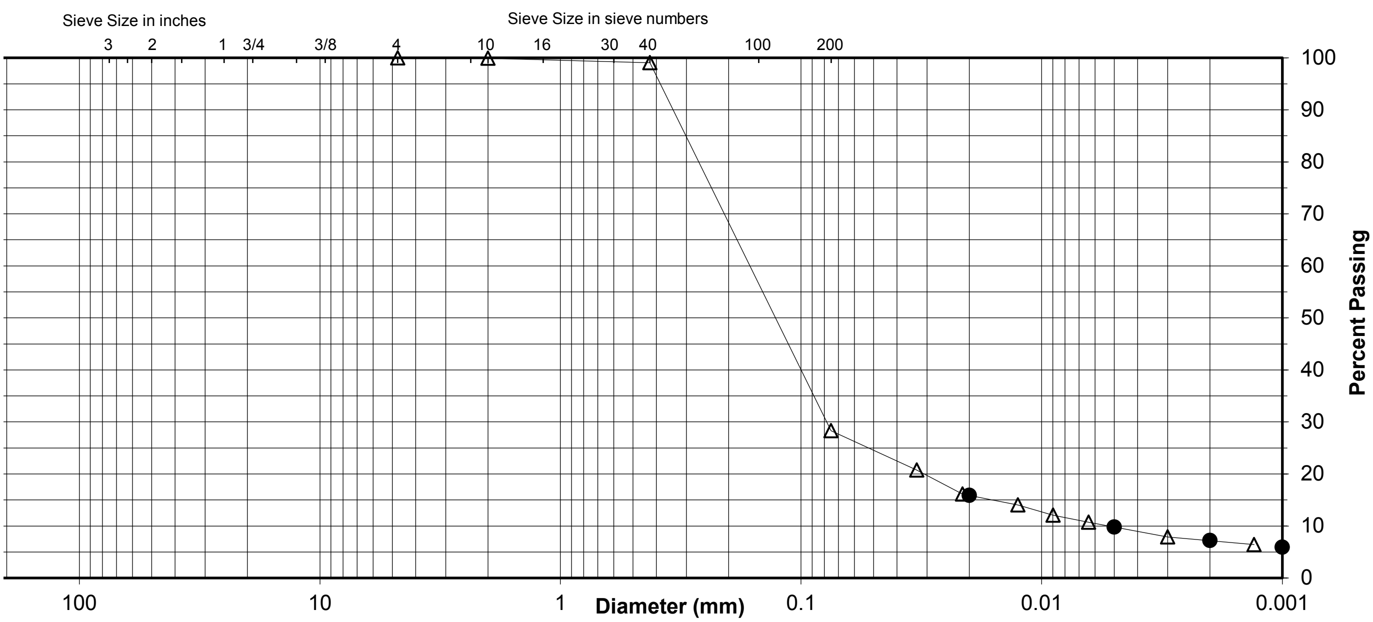
Dispersed using Apparatus A - Mechanical, for 1 minute

| Sieve Size | % Passing |
|---|---|
| No. 40 | 99.1 |
| No. 200 | 28.3 |
| 0.02 mm | 15.9 |
| 0.005 mm | 9.8 |
| 0.002 mm | 7.2 |
| 0.001 mm | 5.9 |

## Particle Size Distribution

| ASTM | Coarse Gravel | Fine Gravel | C. Sand | Medium Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|---|---|
| | 0.0 | 0.0 | 0.1 | 0.8 | 70.8 | 18.5 | 9.8 |

| AASHTO | Gravel | Coarse Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|
| | 0.1 | 0.8 | 70.8 | 21.1 | 7.2 |




Comments ____________________

Reviewed By JS

Stantec

# Summary of Soil Tests

| | | | |
|---|---|---|---|
| Project Name | Kyger Creek CCR Rule - Groundwater | Project Number | 175534017 |
| Source | KC-19-28-30-40 | Lab ID | 8 |
| Sample Type | BULK | Date Received | 4-9-19 |
| | | Date Reported | 4-15-19 |

## Test Results

### Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.5

### Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

| Particle Size | | % |
|---|---|---|
| Sieve Size | (mm) | Passing |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| 3/8" | 9.5 | 100.0 |
| No. 4 | 4.75 | 99.8 |
| No. 10 | 2 | 99.5 |
| No. 40 | 0.425 | 95.9 |
| No. 200 | 0.075 | 13.4 |
| | 0.02 | 7.4 |
| | 0.005 | 4.5 |
| | 0.002 | 3.2 |
| estimated | 0.001 | 2.0 |

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

| Range | ASTM (%) | AASHTO (%) |
|---|---|---|
| Gravel | 0.2 | 0.5 |
| Coarse Sand | 0.3 | 3.6 |
| Medium Sand | 3.6 | --- |
| Fine Sand | 82.5 | 82.5 |
| Silt | 8.9 | 10.2 |
| Clay | 4.5 | 3.2 |

### Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: NP

Plastic Limit: NP

Plasticity Index: NP

Activity Index: N/A

### Moisture-Density Relationship

Test Not Performed

Maximum Dry Density ($lb/ft^3$): N/A

Maximum Dry Density ($kg/m^3$): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

### California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density ($lb/ft^3$): N/A

Compacted Moisture Content (%): N/A

### Specific Gravity

Estimated

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

### Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-2-4 ( 0 )

Comments:

Reviewed By JS

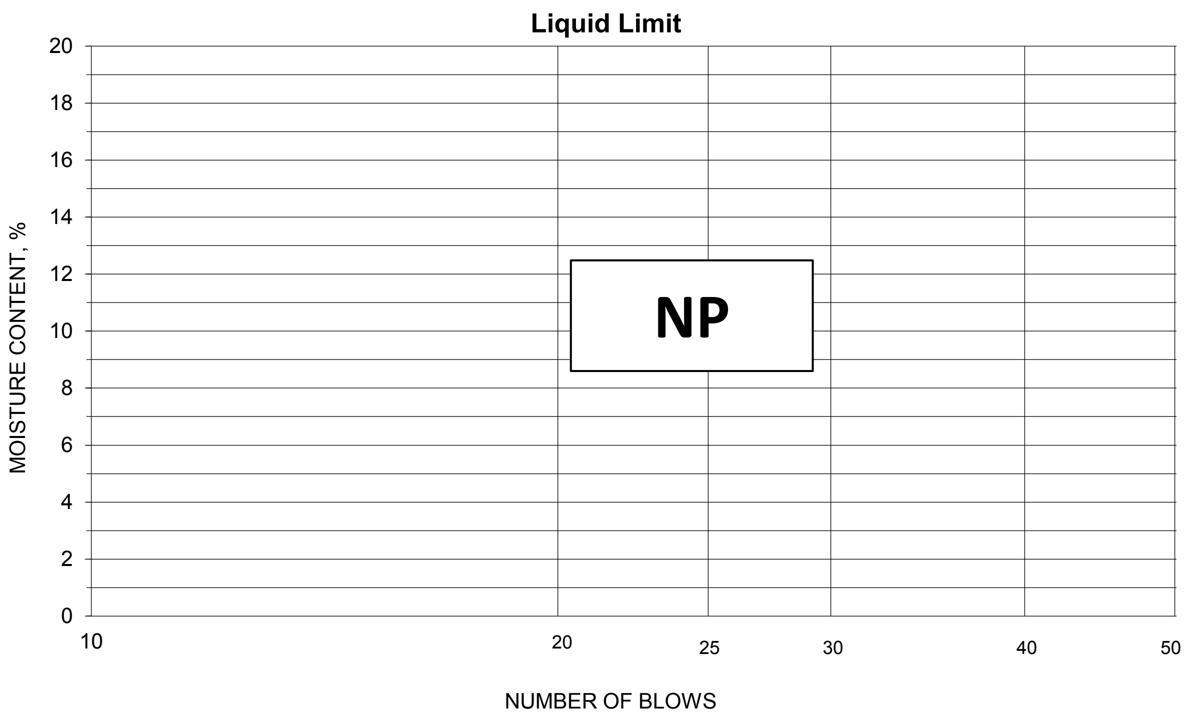
Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

# ATTERBERG LIMITS

Stantec

| | | | |
|---|---|---|---|
| Project | Kyger Creek CCR Rule - Groundwater | Project No. | 175534017 |
| Source | KC-19-28-30-40 | Lab ID | 8 |
| | | % + No. 40 | 4 |
| Tested By | MP | Test Method | ASTM D 4318 Method A |
| Date Received | 04-09-2019 | | |
| Test Date | 04-11-2019 | Prepared | Dry |

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Number of Blows | Water Content (%) | Liquid Limit |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |




PLASTIC LIMIT AND PLASTICITY INDEX

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Water Content (%) | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Remarks:

Reviewed By JS

Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

Stantec Consulting Services Inc.

# Particle-Size Analysis of Soils
ASTM D 422

| | | | |
|---|---|---|---|
| Project Name | Kyger Creek CCR Rule - Groundwater | Project Number | 175534017 |
| Source | KC-19-28-30-40 | Lab ID | 8 |

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

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: GW
Test Date: 04-10-2019
Date Received: 04-09-2019

Maximum Particle size: 3/8" Sieve

| Sieve Size | % Passing |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 3/8" | 100.0 |
| No. 4 | 99.8 |
| No. 10 | 99.5 |

## Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity: 2.7

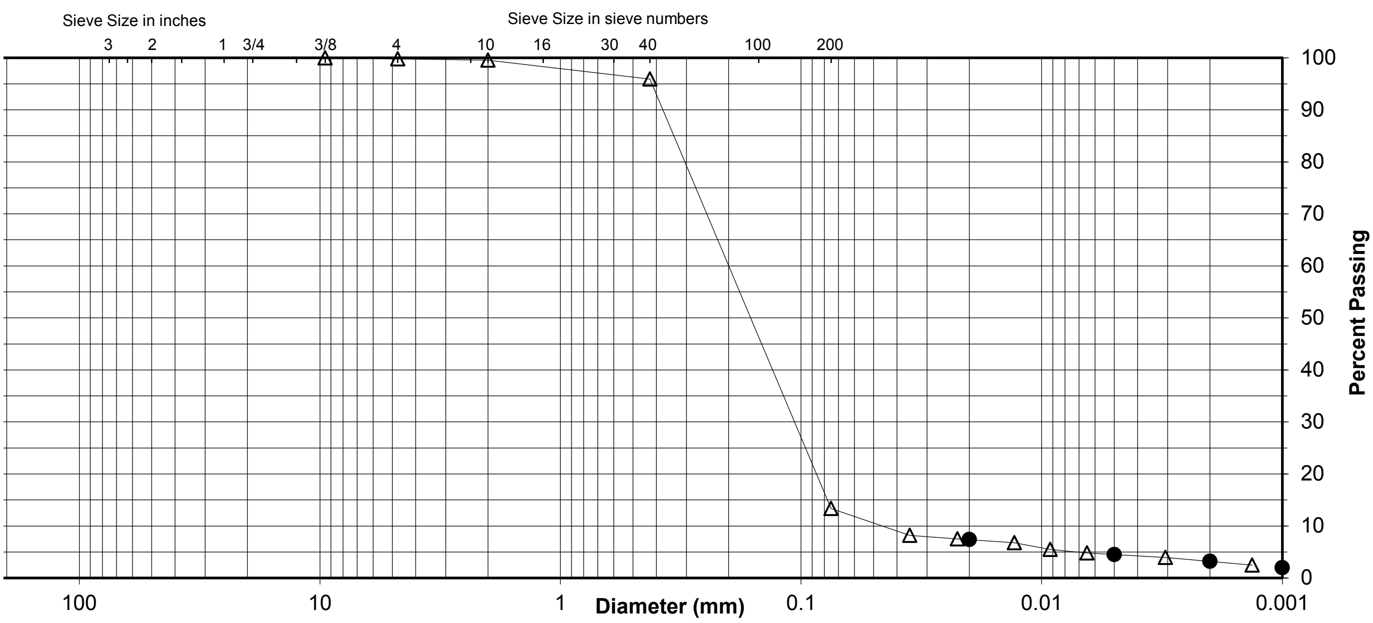
Dispersed using Apparatus A - Mechanical, for 1 minute

| | |
|---|---|
| No. 40 | 95.9 |
| No. 200 | 13.4 |
| 0.02 mm | 7.4 |
| 0.005 mm | 4.5 |
| 0.002 mm | 3.2 |
| 0.001 mm | 2.0 |

## Particle Size Distribution

| ASTM | Coarse Gravel | Fine Gravel | C. Sand | Medium Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|---|---|
| | 0.0 | 0.2 | 0.3 | 3.6 | 82.5 | 8.9 | 4.5 |

| AASHTO | Gravel | Coarse Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|
| | 0.5 | 3.6 | 82.5 | 10.2 | 3.2 |




Comments ____________________

Reviewed By JS

Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

Stantec

# Summary of Soil Tests

Project Name: Kyger Creek CCR Rule - Groundwater
Project Number: 175534017
Source: KC-19-29-32-42
Lab ID: 9

Sample Type: BULK
Date Received: 4-9-19
Date Reported: 4-15-19

## Test Results

### Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 21.3

### Particle Size Analysis

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

| Particle Size: Sieve Size | Particle Size: (mm) | % Passing |
|---|---|---|
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| | N/A | |
| 3/8" | 9.5 | 100.0 |
| No. 4 | 4.75 | 100.0 |
| No. 10 | 2 | 99.9 |
| No. 40 | 0.425 | 99.2 |
| No. 200 | 0.075 | 20.8 |
| | 0.02 | 10.7 |
| | 0.005 | 6.6 |
| | 0.002 | 5.2 |
| estimated | 0.001 | 4.0 |

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

| Range | ASTM (%) | AASHTO (%) |
|---|---|---|
| Gravel | 0.0 | 0.1 |
| Coarse Sand | 0.1 | 0.7 |
| Medium Sand | 0.7 | --- |
| Fine Sand | 78.4 | 78.4 |
| Silt | 14.2 | 15.6 |
| Clay | 6.6 | 5.2 |

### Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

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

### Moisture-Density Relationship

Test Not Performed

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

### California Bearing Ratio

Test Not Performed

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

### Specific Gravity

Estimated

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

### Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 ( 0 )

Comments:

Reviewed By JS

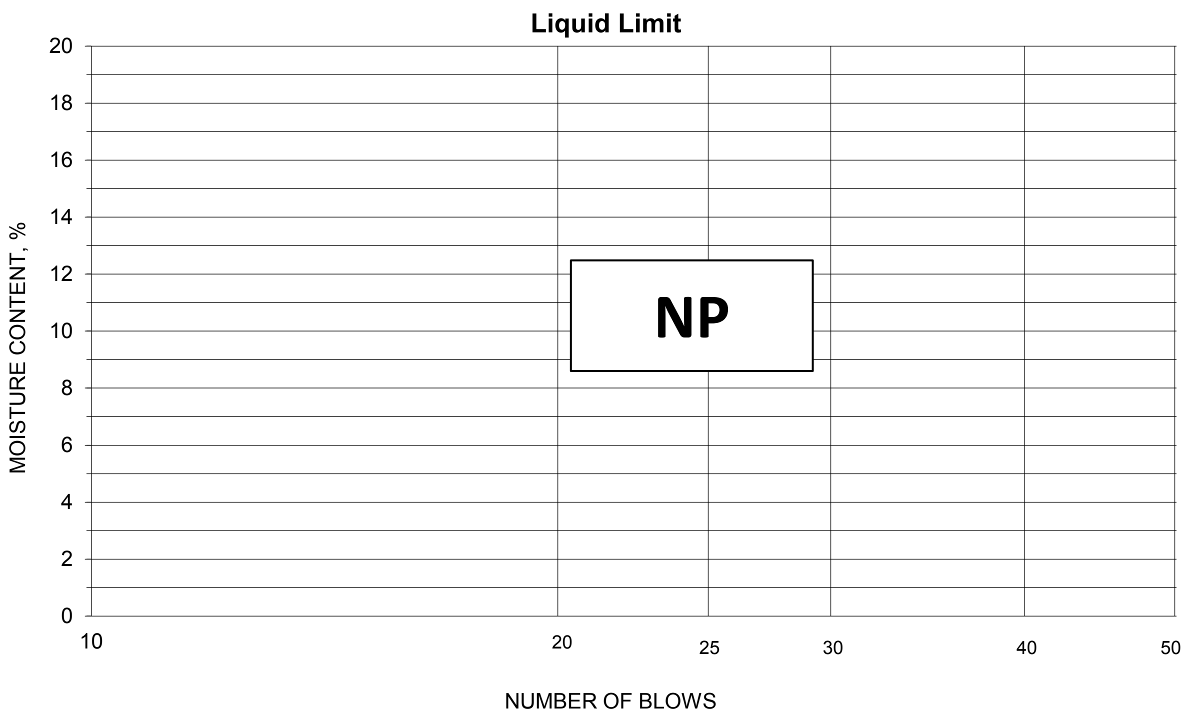
Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

Stantec

# ATTERBERG LIMITS

| | | | |
|---|---|---|---|
| Project | Kyger Creek CCR Rule - Groundwater | Project No. | 175534017 |
| Source | KC-19-29-32-42 | Lab ID | 9 |
| | | % + No. 40 | 1 |
| Tested By | MP | Test Method | ASTM D 4318 Method A |
| Date Received | 04-09-2019 | | |
| Test Date | 04-11-2019 | Prepared | Dry |

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Number of Blows | Water Content (%) | Liquid Limit |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |




PLASTIC LIMIT AND PLASTICITY INDEX

| Wet Soil and Tare Mass (g) | Dry Soil and Tare Mass (g) | Tare Mass (g) | Water Content (%) | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Remarks:

Reviewed By JS

Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

Stantec Consulting Services Inc.

# Stantec

## Particle-Size Analysis of Soils
ASTM D 422

| | | | |
|---|---|---|---|
| Project Name | Kyger Creek CCR Rule - Groundwater | Project Number | 175534017 |
| Source | KC-19-29-32-42 | Lab ID | 9 |

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

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: GW
Test Date: 04-10-2019
Date Received: 04-09-2019

Maximum Particle size: 3/8" Sieve

| Sieve Size | % Passing |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 3/8" | 100.0 |
| No. 4 | 100.0 |
| No. 10 | 99.9 |

### Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity: 2.7

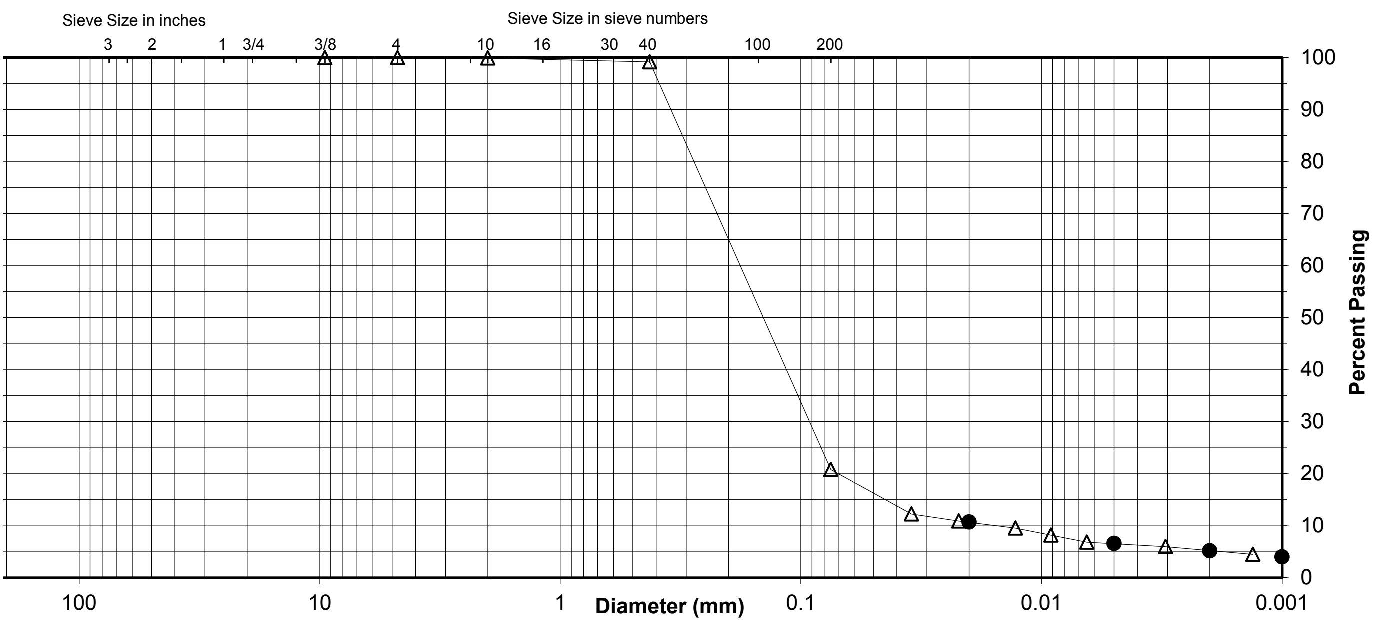
Dispersed using Apparatus A - Mechanical, for 1 minute

| | |
|---|---|
| No. 40 | 99.2 |
| No. 200 | 20.8 |
| 0.02 mm | 10.7 |
| 0.005 mm | 6.6 |
| 0.002 mm | 5.2 |
| 0.001 mm | 4.0 |

### Particle Size Distribution

| ASTM | Coarse Gravel | Fine Gravel | C. Sand | Medium Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|---|---|
| | 0.0 | 0.0 | 0.1 | 0.7 | 78.4 | 14.2 | 6.6 |

| AASHTO | Gravel | Coarse Sand | Fine Sand | Silt | Clay |
|---|---|---|---|---|---|
| | 0.1 | 0.7 | 78.4 | 15.6 | 5.2 |




Comments ______

Reviewed By JS

Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

# APPENDIX D

# WELL BORING AND CONSTRUCTION LOGS

# BORING NO. KC-19-27
# SAMPLE/CORE LOG

| | | | |
|---|---|---|---|
| Project Number: | 2019052 | Log Page | 1 of 2 |
| Project Location: | Kyger Creek Plant Boiler Slag Pond | Drilling Contractor: | HAD |
| Drilling Date(s): | 4/4/2019 to 4/5/2019 | AGES Geologist: | Mike Gelles |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Drilling Method: | Hollow Stem Auger | Coring Device Size: | NA | Hammer Wt. | NA | and Drop | NA |
| Sampling Method: | NA | Borehole Diameter: | 6” | Drilling Fluid Used: | Water | | |
| Sampling Interval: | NA | Borehole Depth: | 38’ | Surface Elevation: | 558.22’ msl | | |

NOTES/COMMENTS:

| Depth Interval (feet) | Sample Recovery (feet) | Penetration (Hyd. Pres. or Blow Counts) | Sample/Core Description | PID (PPM) |
|---|---|---|---|---|
| 0-2 | 1.6 | 4-5-6-6 | Brown silty clay, moist | N/A |
| 2-4 | 1 | Wt/h(2)-3-4 | Brown silty clay, moist | N/A |
| 4-6 | 1.4 | 2-2-4-6 | Brown silty clay, moist | N/A |
| 6-8 | 1.6 | 2-3-5-6 | Brown silty clay, moist | N/A |
| 8-10 | 1.6 | 1-3-4-6 | Brown silty clay, moist | N/A |
| 10-12 | 1.6 | 2-4-5-7 | Brown silty clay, moist | N/A |
| 12-14 | 1.6 | 2-5-6-7 | Brown silty clay, moist | N/A |
| 14-16 | 1.6 | 1-3-5-5 | Brown silty clay, plastic, moist | N/A |
| 16-18 | 2 | 2-3-4-5 | Brown silty clay, plastic, moist | N/A |
| 18-20 | 2 | 4-6-4-6 | Brown silty clay, plastic, moist | N/A |
| 20-22 | 1.4 | Wt/h(2)-2-3 | Brown silty clay, plastic, moist | N/A |
| 22-24 | 1.4 | Wt/h-2-3-3 | Brown silty clay, plastic, moist, trace sand | N/A |
| 24-26 | 2 | 2-2-3-2 | 24.0-25.0’ Brown silty clay, plastic, moist; 25.0’-26.0’ Brown sand, fine and medium, wet | N/A |
| 26-28 | 2 | 1-1-1-3 | Brown sand, fine and medium, wet | N/A |
| 28-30 | 2 | 1-1-2-3 | Brown sand, fine and medium, wet, loose | N/A |
| 30-32 | 2 | 1-2-3-4 | Brown sand, fine and medium, wet, loose | N/A |
| 32-34 | 2 | 2-2-4-6 | Brown sand, fine and medium, wet, loose | N/A |

Project No: 2019052 Geologist: Mike Gelles Page 2 of 2

| | | | | |
|---|---|---|---|---|
| 34-36 | 2 | 2-3-3-4 | Brown sand, fine and medium, wet, loose, some gray sandy clay | N/A |
| 36-38 | 2 | 1-1-4-5 | Brown sand, fine and medium, wet, loose, some gray sand, fine and medium | N/A |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# WELL CONSTRUCTION LOG
# WELL NO. KC-19-27

Project Number: 2019052

Project Location: Kyger Creek Plant – Boiler Slag Pond

Installation Date(s): 4/4/2019-4/5/2019

Drilling Method: Hollow Stem Auger

Drilling Contractor: HAD

Development Date(s): 4/8/2019

Development Method: Pump & Surge until Field Parameters stabilized

Turbidity = 4.89 NTUs

Volume Purged: 213 gallons

Static Water-Level*: 22.25’

Top of Well Casing Elevation: 561.13’ msl

Well Purpose:
Groundwater Monitoring

Northing (Y): 331507.38

Easting (X): 2073611.935

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

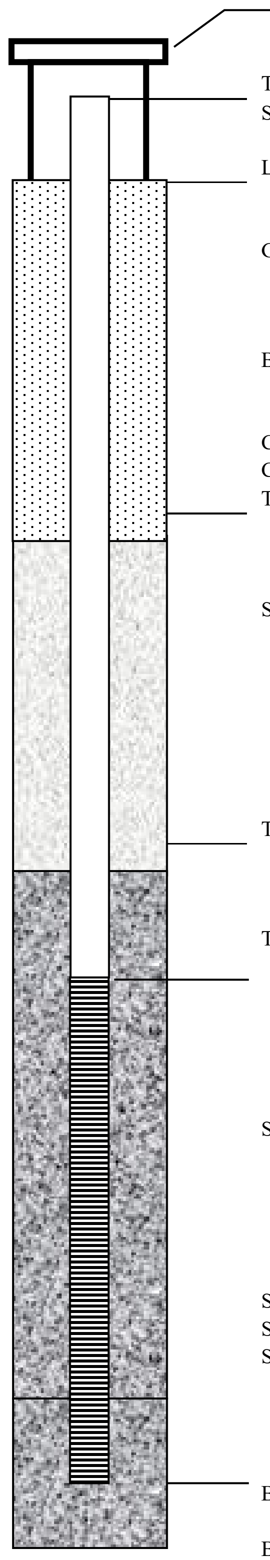
**CONSTRUCTION MATERIALS USED:**

3 Bags of Sand

1 Bags/Buckets Bentonite Pellets

8 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 561.13 ft.

Stick-up: 2.91 ft.

Land Surface Elevation: 558.22 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6” inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 24 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 26 ft*

Top of Well Screen 28 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 38 ft.*

Base of Borehole: 38 ft.*

Total Depth of Well Below Top of Casing: 40.91 ft.

*Indicates Depth Below Land Surface

# BORING NO. KC-19-28
# SAMPLE/CORE LOG

| | | | |
|---|---|---|---|
| Project Number: | 2019052 | Log Page | 1 of 2 |
| Project Location: | Kyger Creek Boiler Slag Pond | Drilling Contractor: | HAD |
| Drilling Date(s): | 4/4/2019 | AGES Geologist: | Mike Gelles |

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Hollow Stem Auger | Coring Device Size: | NA | Hammer Wt. | NA and Drop NA |
| Sampling Method: | NA | Borehole Diameter: | 6” | Drilling Fluid Used: | Water |
| Sampling Interval: | NA | Borehole Depth: | 42’ | Surface Elevation: | 558.41’ msl |

NOTES/COMMENTS:

| Depth Interval (feet) | Sample Recovery (feet) | Penetration (Hyd. Pres. or Blow Counts) | Sample/Core Description | PID (PPM) |
|---|---|---|---|---|
| 0-2 | 1.6 | 2-3-5-7 | Brown silty clay, moist | N/A |
| 2-4 | 1.6 | 3-4-6-4 | Brown silty clay, moist | N/A |
| 4-6 | 1 | 1-1-3-4 | Brown silty clay, moist | N/A |
| 6-8 | 1.4 | 1-2-3-5 | Brown silty clay, moist | N/A |
| 8-10 | 0.4 | 2-2-3-4 | Brown silty clay, moist | N/A |
| 10-12 | 1.6 | 2-3-4-5 | Brown silty clay, moist | N/A |
| 12-14 | 2 | 1-1-3-4 | Brown silty clay, moist | N/A |
| 14-16 | 2 | 2-3-3-5 | Brown silty clay, moist | N/A |
| 16-18 | 2 | 2-3-4-6 | Brown silty clay, moist | N/A |
| 18-20 | 2 | 2-3-4-4 | Brown silty clay, moist | N/A |
| 20-22 | 2 | 5-Wt/h(3) | Brown silty clay, moist | N/A |
| 22-24 | 2 | 2-3-4-4 | Brown silty clay, plastic, moist | N/A |
| 24-26 | 2 | 2-2-3-4 | Brown silty clay, plastic, moist | N/A |
| 26-28 | 2 | 1-1-2-4 | Brown silty clay, plastic, moist | N/A |
| 28-30 | 2 | 1-2-2-3 | Brown silty clay, plastic, moist | N/A |
| 30-32 | 1.4 | Wt/h(4) | Brown sand, fine and medium, trace gravel, trace clay, wet | N/A |
| 32-34 | 2 | 1-2-2-2 | Brown sand, fine and medium, some gravel, wet | N/A |
| 34-36 | 2 | 1-1-3-3 | Brown sand, fine and medium, wet | N/A |

Project No: 2019052 Geologist: Mike Gelles 

| | | | | |
|---|---|---|---|---|
| 36-38 | 2 | 2-5-7-13 | Brown sand, fine and medium, wet | N/A |
| 38-40 | 2 | 2-3-5-9 | Brown sand, fine and medium, wet | N/A |
| | | | | |
| | | | | |
| | | | | |

# WELL CONSTRUCTION LOG
# WELL NO. KC-19-28

Project Number: 2019052

Project Location: Kyger Creek Plant – Boiler Slag Pond

Installation Date(s): 4/4/2019

Drilling Method: Hollow Stem Auger

Drilling Contractor: HAD

Development Date(s): 4/9/2019

Development Method: Pump & Surge until Field Parameters stabilized.
Turbidity = 4.7 NTUs

Volume Purged: 232 gallons

Static Water-Level*: 22.95'

Top of Well Casing Elevation: 561.10' msl

Well Purpose:
Groundwater Monitoring
Northing (Y): 331064.431
Easting (X): 2073270.027

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

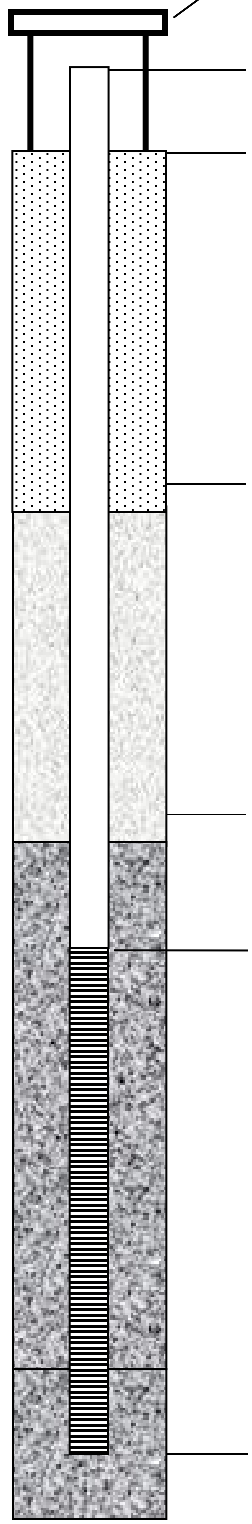
**CONSTRUCTION MATERIALS USED:**

3 Bags of Sand

1 Bags/Buckets Bentonite Pellets

8 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 561.10 ft.
Stick-up: 2.69 ft.

Land Surface Elevation: 558.41 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6" inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 28 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 30 ft*

Top of Well Screen 32 ft*

Sand/Gravel Pack; Type: Global #5

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

Bottom of Well Screen 42 ft.*

Base of Borehole: 42 ft.*

Total Depth of Well Below Top of Casing: 42 ft.

*Indicates Depth Below Land Surface

**WELL BORING NO. KC-19-29**
**SAMPLE/CORE LOG**

| | | | |
|---|---|---|---|
| Project Number: | 2019052 | Log Page | 1 of 2 |
| Project Location: | Kyger Creek Plant – Boiler Slag Pond | Drilling Contractor: | HAD |
| Drilling Date(s): | 4/3/2019 | Geologist: | Michael Gelles |

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Hollow Stem Auger | Coring Device Size: | NA | Hammer Wt. | 160 lbs and Drop 30” |
| Sampling Method: | Split Spoon | Borehole Diameter: | 6” | Drilling Fluid Used: | Water |
| Sampling Interval: | 2’ | Borehole Depth: | 42’ | Surface Elevation: | 561.13’ msl |

NOTES/COMMENTS:

| Depth Interval (feet) | Sample Recovery (feet) | Penetration (Hyd. Pres. or Blow Counts) | Sample/Core Description | PID (PPM) |
|---|---|---|---|---|
| 0-2 | 1.2 | 1-1-2-4 | Orange brown silty clay, moist | NA |
| 2-4 | 1.6 | 2-4-7-8 | Orange brown silty clay, moist | NA |
| 4-6 | 1.6 | 6-10-7-9 | Orange brown silty clay, moist | NA |
| 6-8 | 1.6 | 1-3-4-5 | Orange brown silty clay, moist | NA |
| 8-10 | 1.6 | 1-2-4-4 | Orange brown silty clay, moist | NA |
| 10-12 | 1.6 | 2-2-4-4 | Orange brown silty clay, moist | NA |
| 12-14 | 1.6 | 1-2-3-3 | Orange brown silty clay, moist | NA |
| 14-16 | 2 | 1-1-2-1 | Orange brown silty clay, moist | NA |
| 16-18 | 2 | 2-2-2-2 | Orange brown silty clay, moist | NA |
| 18-20 | 2 | 1-2-2-2 | Orange brown silty clay, moist | NA |
| 20-22 | 2 | 1-1-3-4 | Orange brown silty clay, plastic, moist | NA |
| 22-24 | 2 | 1-1-3-5 | Orange brown silty clay, plastic, moist | NA |
| 24-26 | 2 | 1-1-2-3 | Orange brown silty clay, plastic, moist | NA |
| 26-28 | 2 | 1-2-3-5 | Orange brown silty clay, plastic, moist | NA |
| 28-30 | 2 | 2-3-4-5 | Orange brown silty clay, plastic, moist | NA |
| 30-32 | 2 | 7-6-8-7 | Orange brown sand fine to medium, loose, wet | NA |
| 32-34 | 2 | 7-8-7-7 | Orange brown sand fine to medium, trace clay, loose, wet | NA |
| 34-36 | 2 | Wt/h-1-3-3 | Orange brown sand fine to medium, trace clay, loose, wet | NA |

| | | | | |
|---|---|---|---|---|
| 36-38 | 2 | 4-3-3-5 | Orange brown sand fine to medium, loose, wet | NA |
| 38-40 | 2 | Wt/h(4) | Orange brown sand fine to medium, loose, wet | NA |
| 40-42 | 2 | 2-5-4-8 | Orange brown sand fine to medium, loose, wet | NA |

# WELL CONSTRUCTION LOG
# WELL NO. KC-19-29

Project Number: 2019052
Project Location: Kyger Creek Plant – Boiler Slag Pond
Installation Date(s): 4/3/2019
Drilling Method: Hollow Stem Auger
Drilling Contractor: HAD
Development Date(s): 4/10/2019
Development Method: Pump & Surge until Field Parameters Stabilized
Turbidity = 4.51 NTUs
Volume Purged: 106 gallons
Static Water-Level*: 22.25'
Top of Well Casing Elevation: 564.17' msl

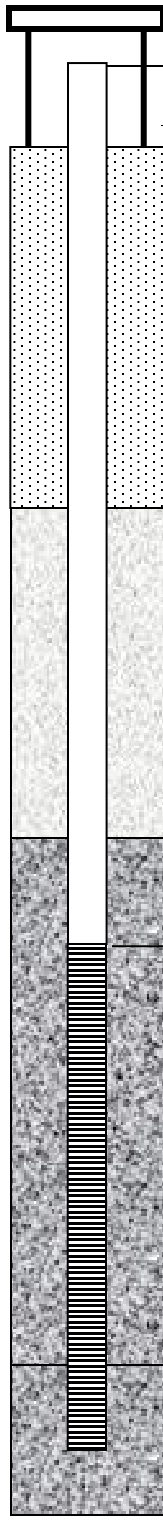
Well Purpose:
Groundwater Monitoring
Northing (Y): 330558.936
Easting (X): 2072840.947

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:**

3 Bags of Sand
1 Bags/Buckets Bentonite Pellets
8 Bags Portland for Grout
____ Bags Concrete/Sakrete

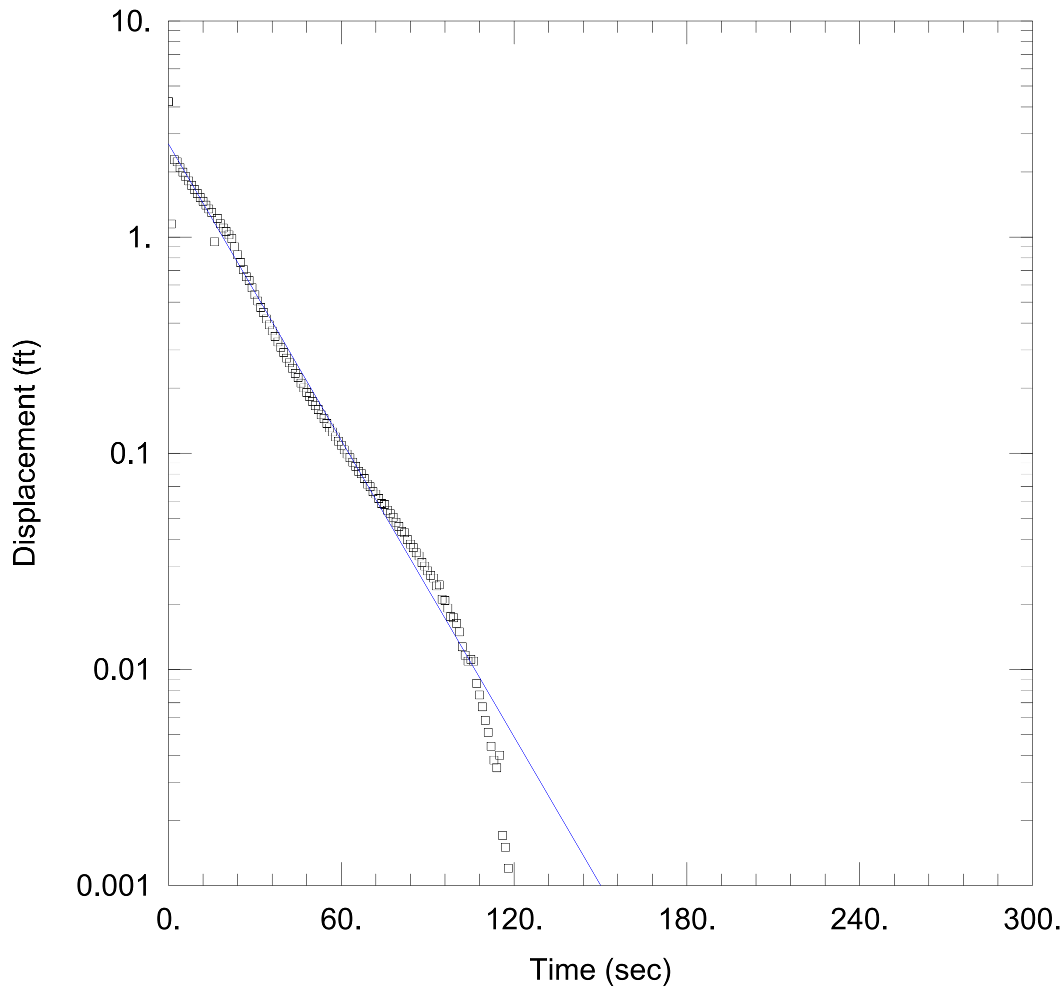


Protective Casing with Locking Cap
Top of Casing Elevation: 564.17 ft.
Stick-up: 3.04 ft.
Land Surface Elevation: 561.13 ft.
Grout; Type: Portland cement/Grout
Borehole Diameter: 6" inch
Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 27 ft*
Seal Type: Bentonite Pellets
Top of Sand/Gravel Pack: 29 ft*
Top of Well Screen 31 ft*
Sand/Gravel Pack; Type: Global #5
Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC
Bottom of Well Screen 41 ft.*
Base of Borehole: 42 ft.*
Total Depth of Well Below Top of Casing: 41 ft.

*Indicates Depth Below Land Surface

# APPENDIX E

# SLUG TEST RESULTS




KC-19-27-IN1

Data Set: \...\KC-19-27-IN1.aqt
Date: 05/30/19 Time: 11:14:19

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

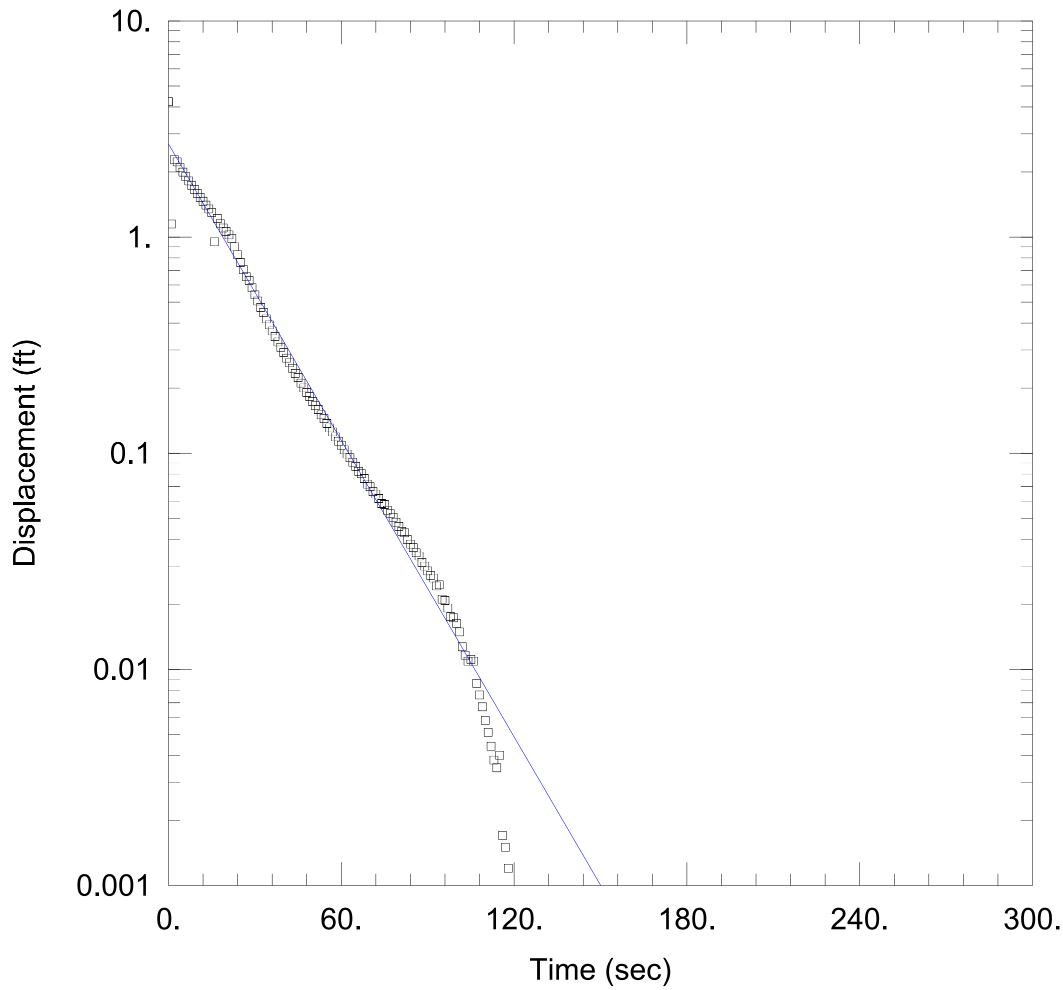
WELL DATA (KC-19-27)

Initial Displacement: 4.231 ft
Static Water Column Height: 22.75 ft
Total Well Penetration Depth: 41.15 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 8.307E-5 ft/sec
y0 = 2.698 ft




KC-19-27-IN1

Data Set: \...\KC-19-27-IN1.aqt
Date: 05/30/19
Time: 11:15:27

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

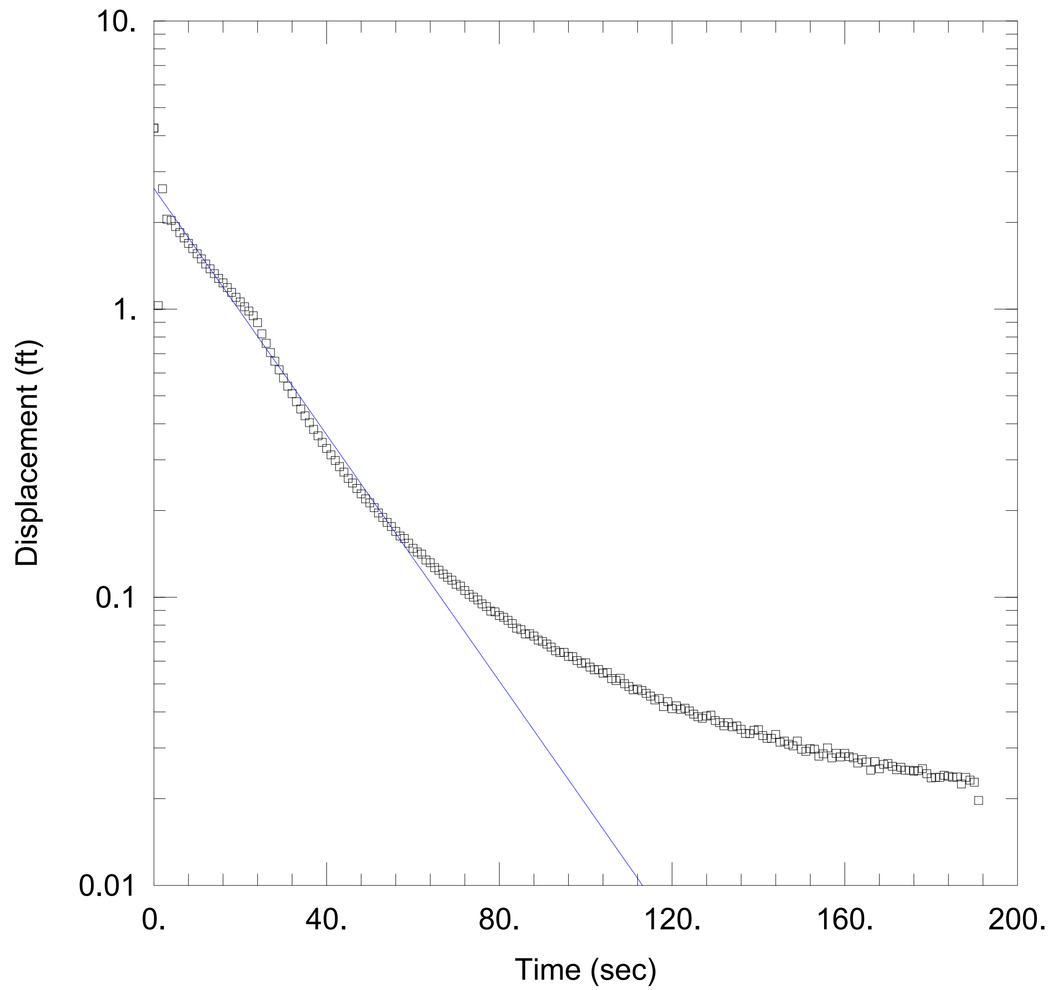
WELL DATA (KC-19-27)

Initial Displacement: 4.231 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 9.946E-5 ft/sec
y0 = 2.698 ft




KC-19-27-IN2

Data Set: \...\KC-19-27-IN2.aqt
Date: 05/30/19
Time: 11:17:47

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

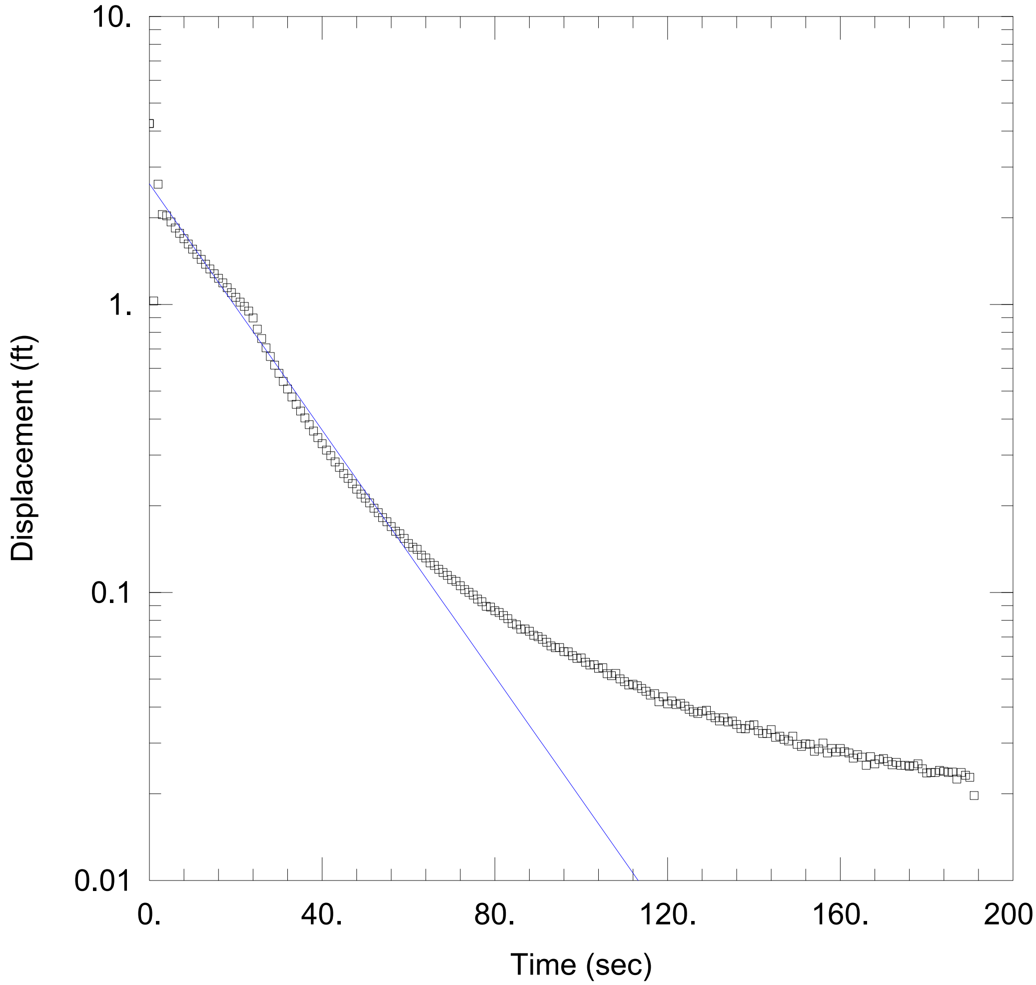
WELL DATA (KC-19-27)

Initial Displacement: 4.248 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 7.764E-5 ft/sec
y0 = 2.621 ft




KC-19-27-IN2

Data Set: \...\KC-19-27-IN2.aqt
Date: 05/30/19 Time: 11:18:30

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft Anisotropy Ratio (Kz/Kr): 1.

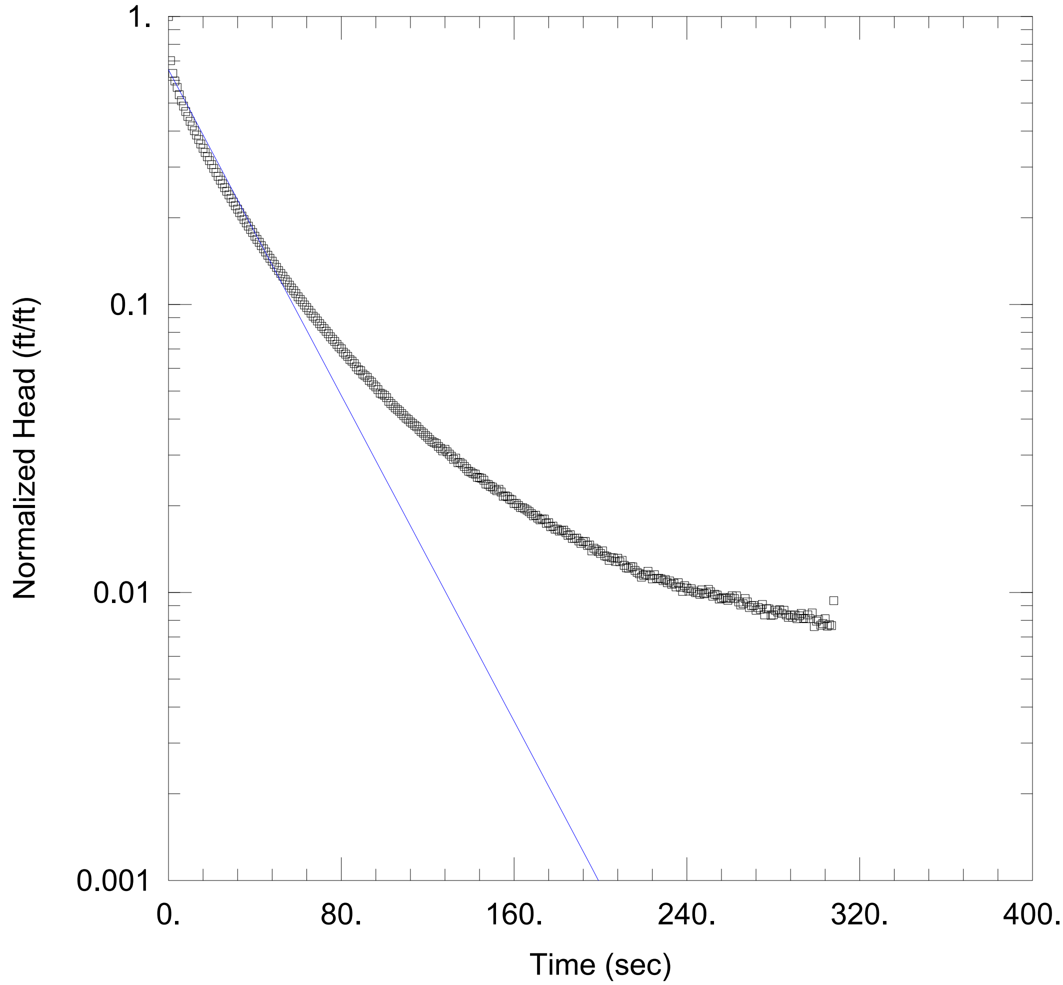
WELL DATA (KC-19-27)

Initial Displacement: 4.248 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 9.294E-5 ft/sec y0 = 2.62 ft




KC-19-27-OUT1

Data Set: \...\KC-19-27-OUT1.aqt
Date: 05/30/19
Time: 11:20:38

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

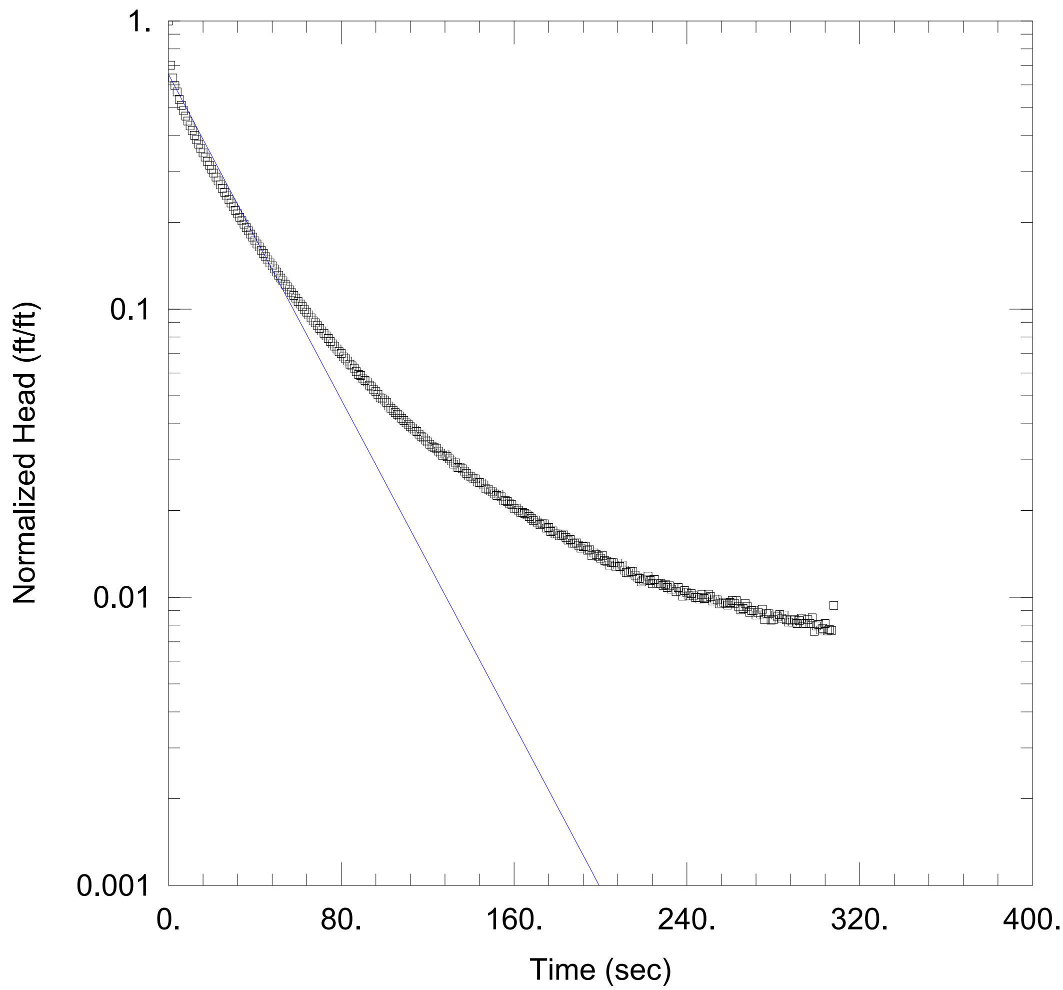
WELL DATA (KC-19-27)

Initial Displacement: -3.195 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.136E-5 ft/sec
y0 = -2.086 ft




KC-19-27-OUT1

Data Set: \...\KC-19-27-OUT1.aqt
Date: 05/30/19
Time: 11:21:18

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

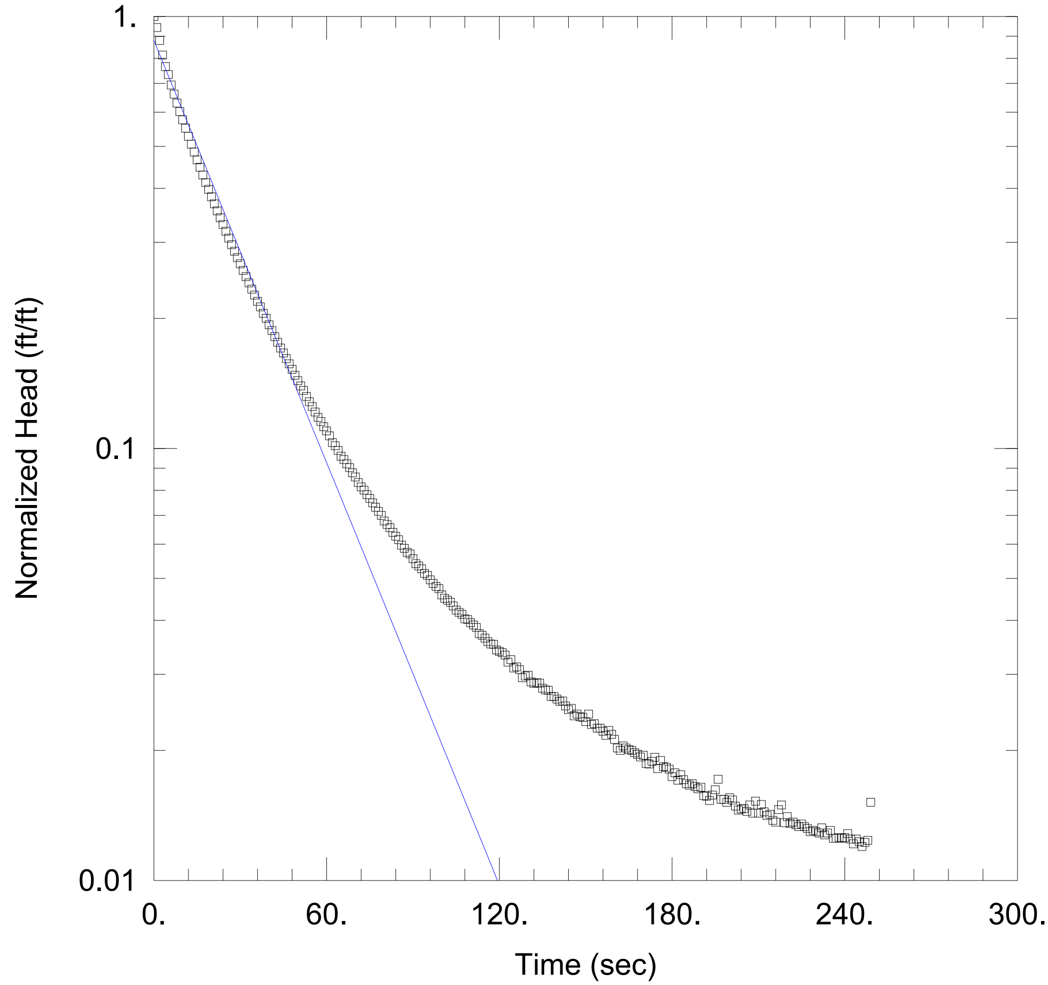
WELL DATA (KC-19-27)

Initial Displacement: -3.195 ft
Static Water Column Height: 22.75 ft
Total Well Penetration Depth: 41.15 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 6.14E-5 ft/sec
y0 = -2.084 ft




KC-19-27-OUT2

Data Set: \...\KC-19-27-OUT2.aqt
Date: 05/30/19
Time: 11:23:38

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

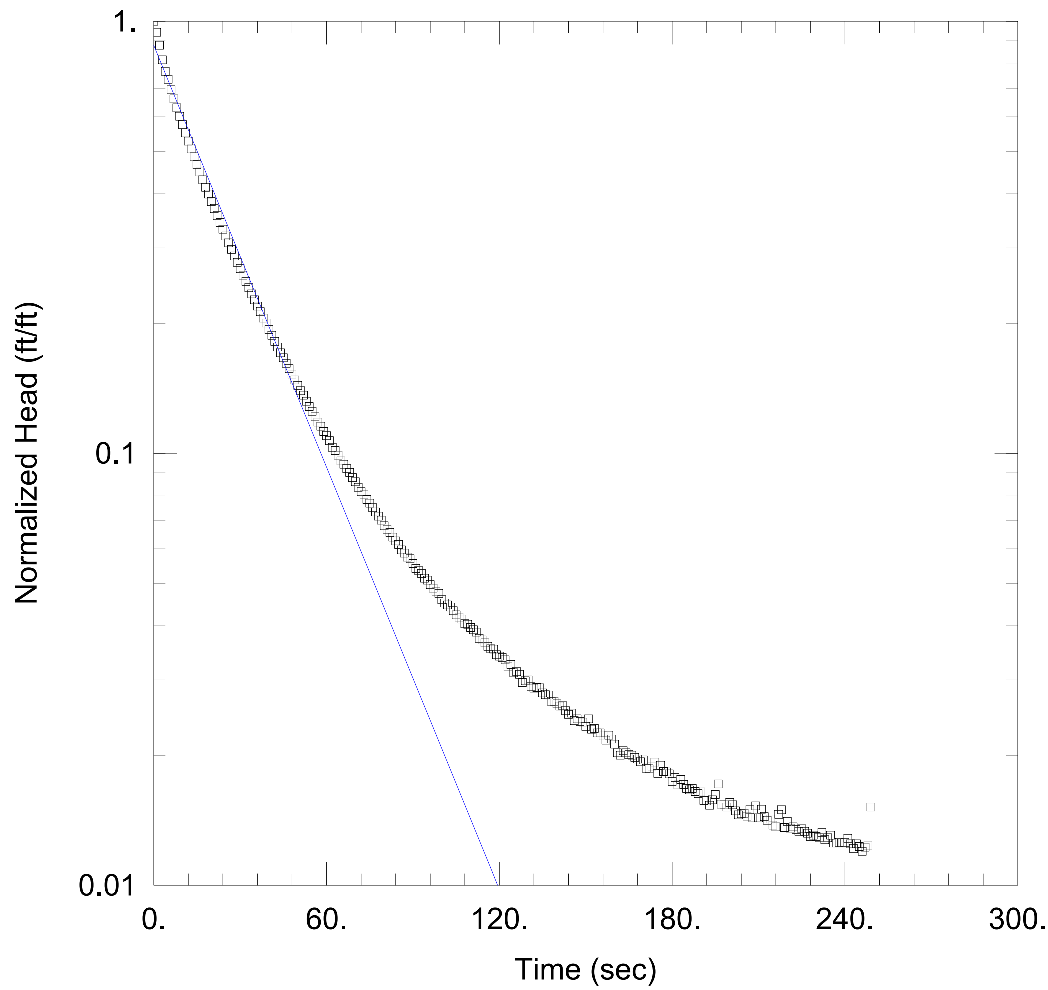
WELL DATA (KC-19-27)

Initial Displacement: -2.221 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.918E-5 ft/sec
y0 = -1.954 ft




KC-19-27-OUT2

Data Set: \...\KC-19-27-OUT2.aqt
Date: 05/30/19
Time: 11:24:29

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-27
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 1.

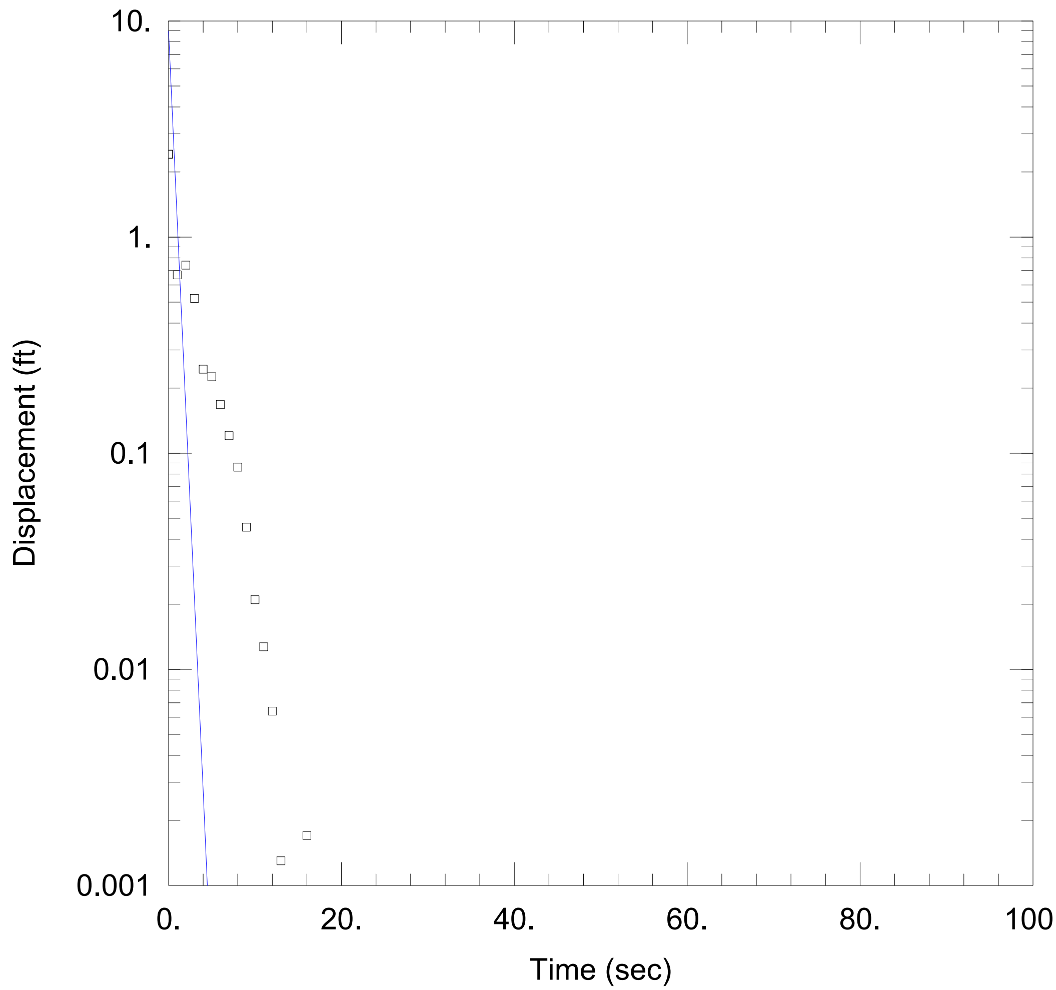
WELL DATA (KC-19-27)

Initial Displacement: -2.221 ft
Total Well Penetration Depth: 41.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.75 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 7.081E-5 ft/sec
y0 = -1.953 ft




KC-19-28-IN1

Data Set: \...\KC-19-28-IN1.aqt
Date: 05/30/19 Time: 11:26:52

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

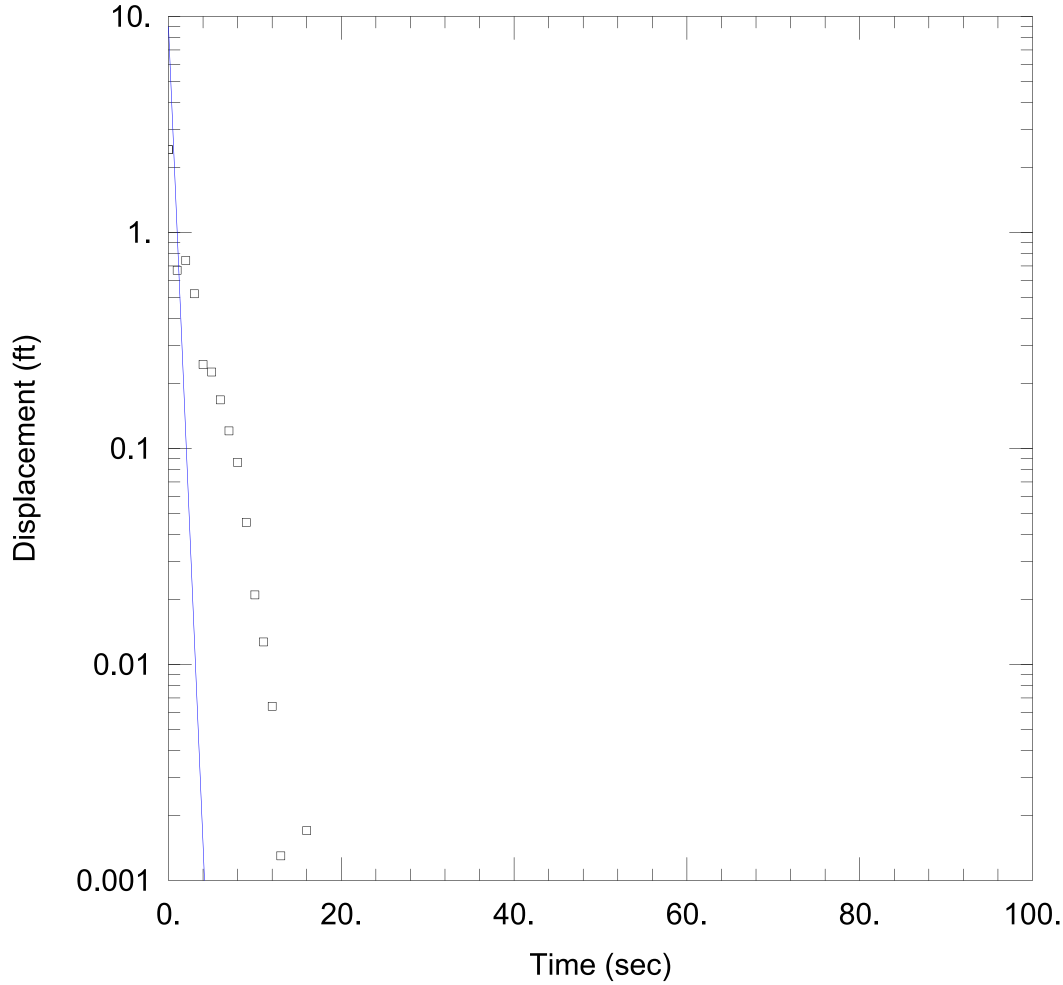
WELL DATA (KC-19-28)

Initial Displacement: 2.416 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.003224 ft/sec
y0 = 8.965 ft




KC-19-28-IN1

Data Set: \...\KC-19-28-IN1.aqt
Date: 05/30/19 Time: 11:27:52

## PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

## AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

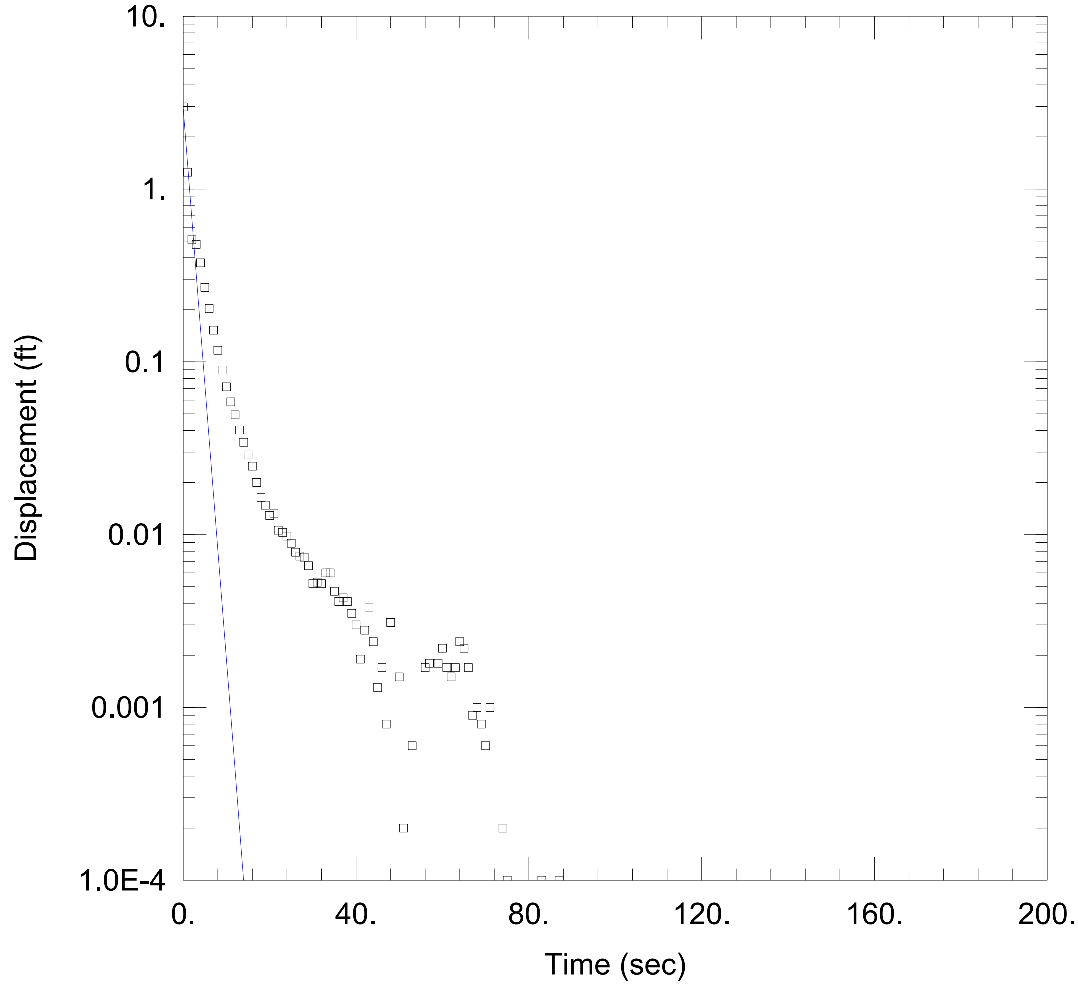
## WELL DATA (KC-19-28)

Initial Displacement: 2.416 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.004117 ft/sec
y0 = 8.965 ft




KC-19-28-IN2

Data Set: \...\KC-19-28-IN2.aqt
Date: 05/30/19 Time: 11:31:49

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

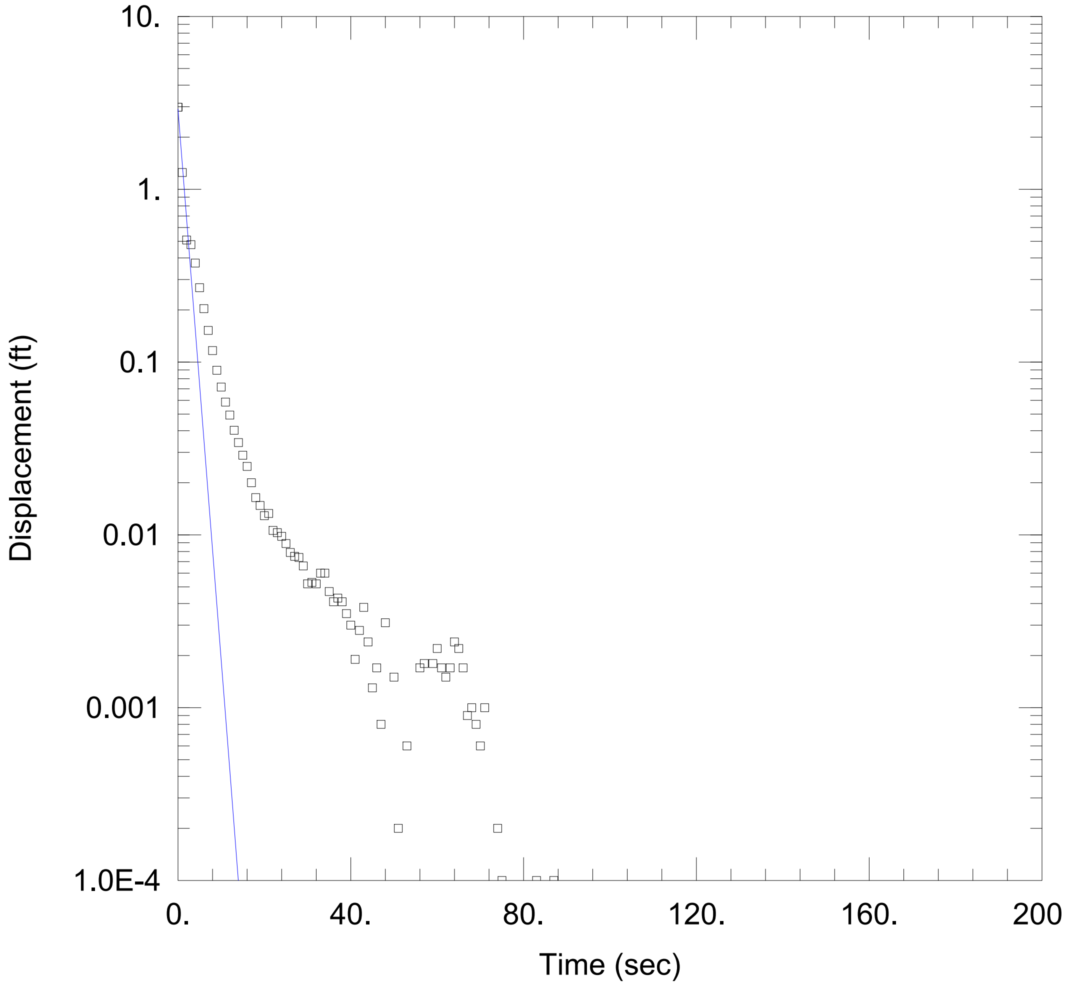
WELL DATA (KC-19-28)

Initial Displacement: 2.979 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.00117 ft/sec
y0 = 2.909 ft




KC-19-28-IN2

Data Set: \...\KC-19-28-IN2.aqt
Date: 05/30/19
Time: 11:32:56

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

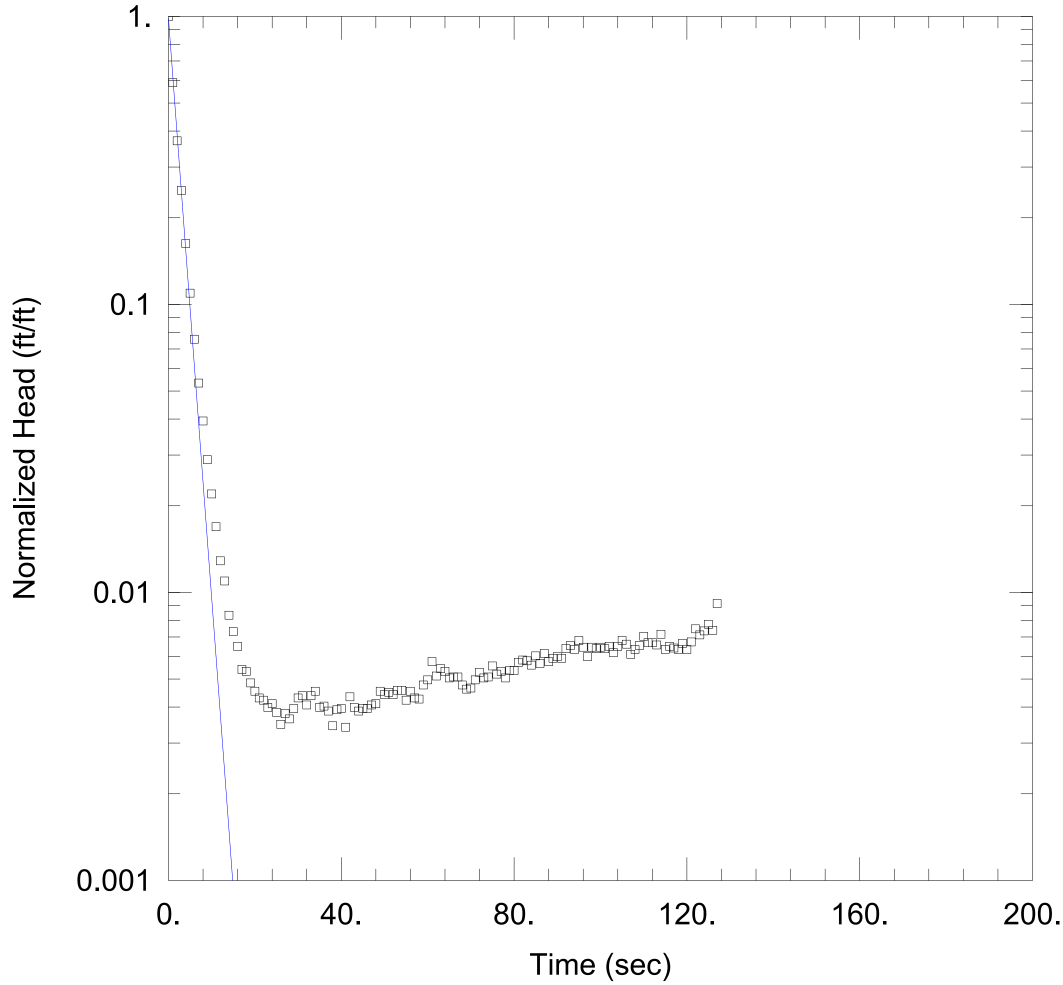
WELL DATA (KC-19-28)

Initial Displacement: 2.979 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.001387 ft/sec
y0 = 2.909 ft




KC-19-28-OUT1

Data Set: \...\KC-19-28-OUT1.aqt
Date: 05/30/19 Time: 11:36:27

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft Anisotropy Ratio (Kz/Kr): 1.

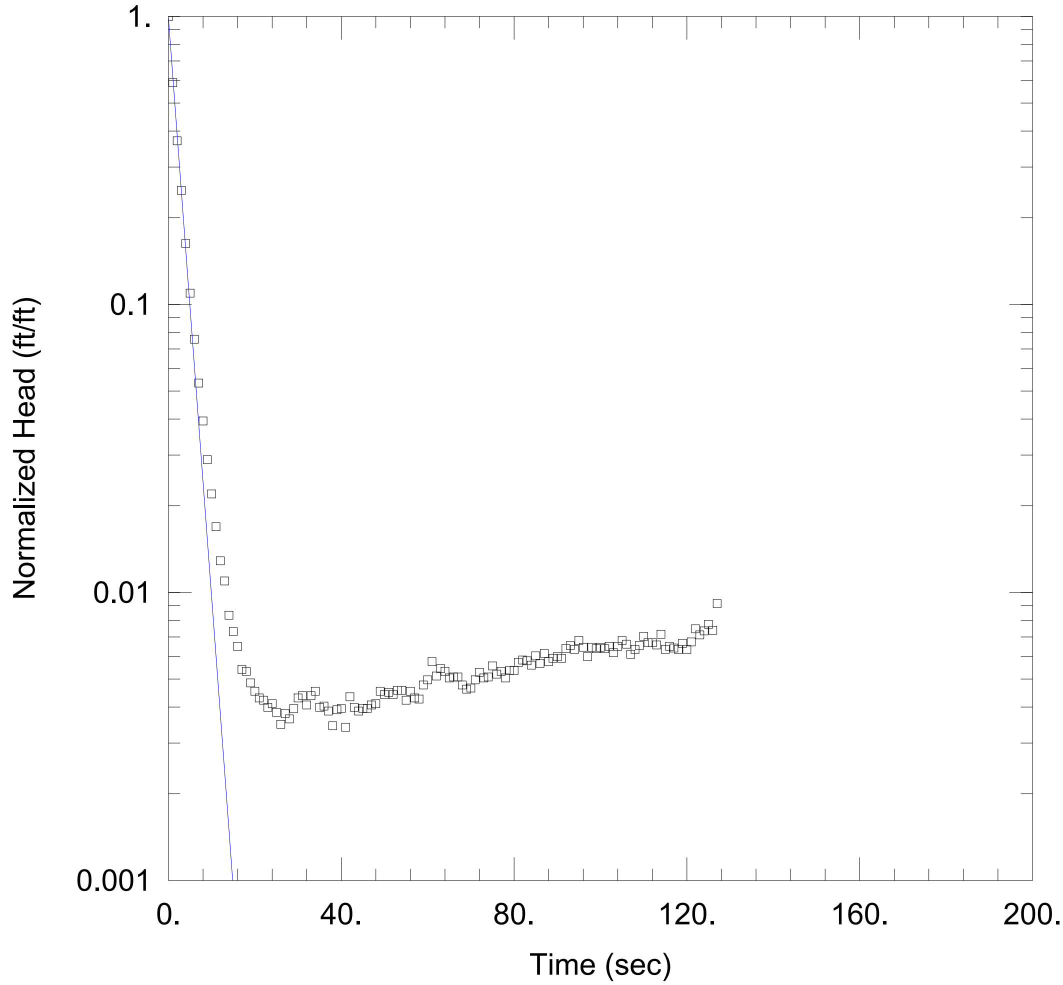
WELL DATA (KC-19-28)

Initial Displacement: -2.557 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.0007384 ft/sec y0 = -2.508 ft




KC-19-28-OUT1

Data Set: \...\KC-19-28-OUT1.aqt
Date: 05/30/19 Time: 11:37:17

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

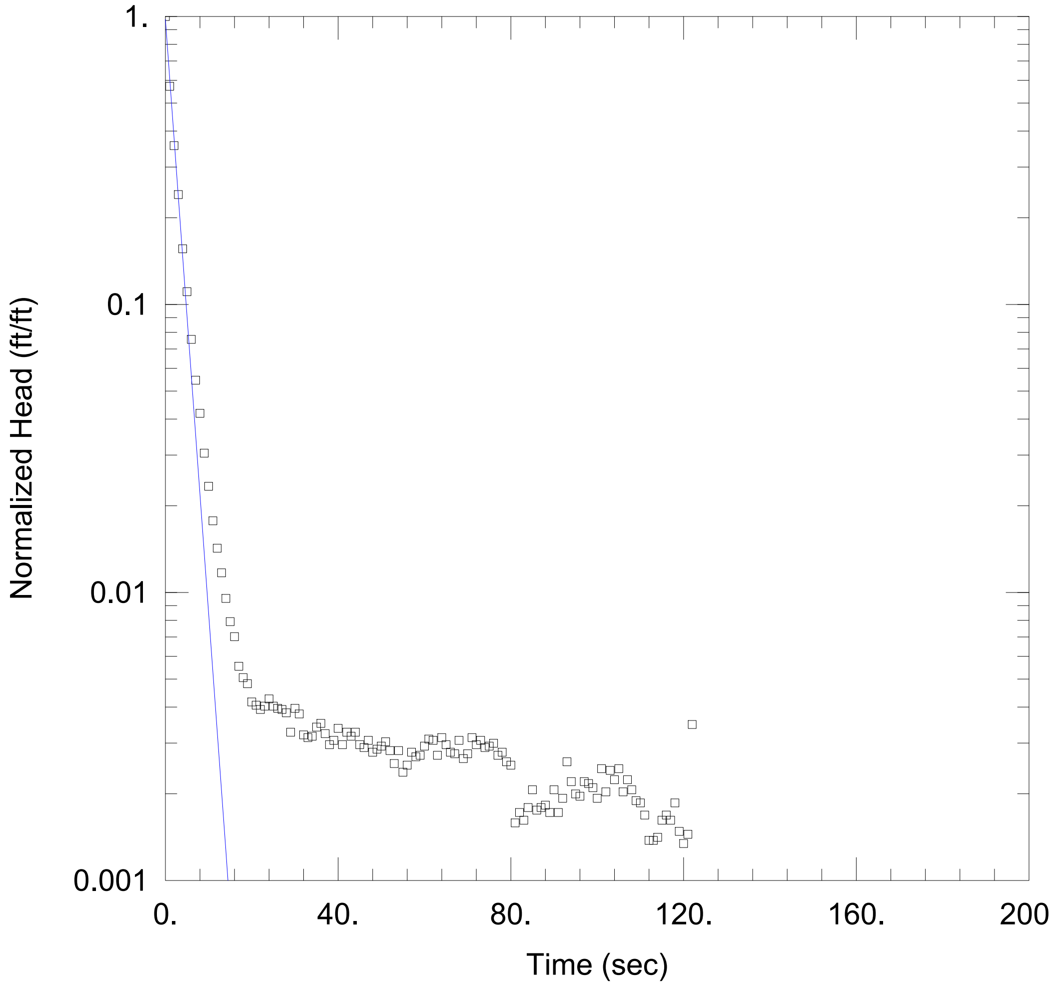
WELL DATA (KC-19-28)

Initial Displacement: -2.557 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.000875 ft/sec
y0 = -2.508 ft




KC-19-28-OUT2

Data Set: \...\KC-19-28-OUT2.aqt
Date: 05/30/19
Time: 11:43:10

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

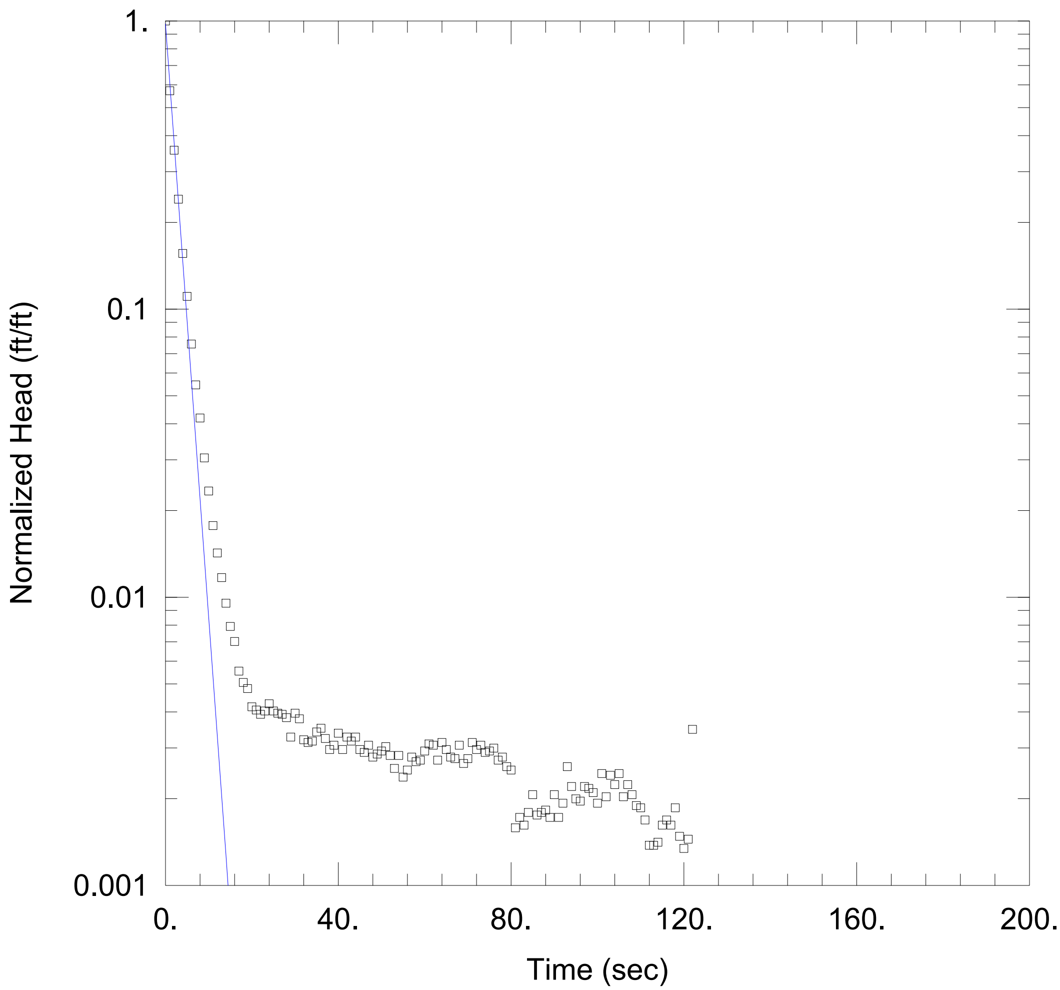
WELL DATA (KC-19-28)

Initial Displacement: -2.905 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0007565 ft/sec
y0 = -2.838 ft




KC-19-28-OUT2

Data Set: \...\KC-19-28-OUT2.aqt
Date: 05/30/19
Time: 11:44:14

PROJECT INFORMATION

Company: AGES, Inc.
Client: OVEC
Project: 2019052-05
Location: Kyger Creek
Test Well: KC-19-28
Test Date: 4/17/2019

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (KC-19-28)

Initial Displacement: -2.905 ft
Total Well Penetration Depth: 44.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.97 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.0008964 ft/sec
y0 = -2.837 ft

# APPENDIX F

# 2020 UPDATE ON GROUNDWATER CONDITIONS BSP

# 2020 UPDATE ON GROUNDWATER CONDITIONS
# BOILER SLAG POND (BSP)
# OHIO VALLEY ELECTRIC CORPORATION
# KYGER CREEK STATION
# CHESHIRE, OHIO

## 1.0 INTRODUCTION

The purpose of this 2020 Update Report is to provide an update on groundwater conditions at the Boiler Slag Pond (BSP) at the Kyger Creek Station, located in Cheshire, Ohio. An Assessment of Corrective Measures (ACM) Report for the BSP was prepared in September 2019 to comply with 40 CFR § 257.90(c) of the CCR Rule. That report documented the results of site characterization activities and ongoing monitoring that were the basis for the evaluation of potential corrective measure remedial technologies to address Arsenic in shallow groundwater at the BSP.

A groundwater monitoring program has been ongoing at the site since 2015; the locations of CCR wells at the site are shown on Figure F-1. As required by the CCR Rule, the results of these events have been documented in annual groundwater monitoring and corrective action reports and in the ACM Report for the BSP. This 2020 Update Report includes an evaluation of results of groundwater monitoring conducted during the characterization event at the BSP in March/April 2019 and monitoring events conducted a year later in March 2020 and September 2020, and the impact of these results on selection of a remedy to address Arsenic in shallow groundwater at the site.

Presented below are an evaluation of shallow groundwater flow (including impacts of flooding from the nearby Ohio River) and a discussion of the extent of Arsenic in shallow groundwater from March/April 2019 through September 2020. A discussion of the impact that these results have on the selection of remedy process at the site is then presented.

## 2.0 UPDATE ON SITE GEOLOGY & HYDROGEOLOGY

As presented in Section 3 of the ACM Report, deposits of silts and clays beneath the base of the BSP range from 15 to over 50 feet thick. The silts and clays transition to a layer of sand and gravel where groundwater is present. A generalized cross section of the geology beneath the BSP is presented in Figure F-2. The sand and gravel unit has been determined to be the uppermost aquifer beneath the BSP.

## 3.0 REVIEW OF GROUNDWATER FLOW AT THE SITE

Complete rounds of groundwater level data were collected at the BSP in March/April 2019 (the site characterization event) and during routine monitoring in March 2020 and September 2020

(Attachment F-1). Groundwater flow maps generated using these data indicates that groundwater in the uppermost aquifer beneath the BSP flows from the northwest to the south and southeast towards the Ohio River (Attachment F-2). Historic groundwater elevation data indicates that groundwater flow beneath the BSP is affected by the flow and water level in the Ohio River and several flow reversals have been observed in the historic data (AGES 2018). Based on the results of groundwater monitoring since 2015, groundwater flow directions at the site have remained extremely consistent.

Based on previous slug tests at the site, the mean K (hydraulic conductivity) value for the uppermost aquifer beneath the BSP is 54.26 feet per day (ft/day) (AGES 2019). Using water level data collected in March/April 2019, March 2020 and September 2020, and this mean K value, the groundwater velocity for the uppermost aquifer beneath the BSP was calculated using the following equation:

$$V=K\ (i/n)$$

**Where:**
K=Hydraulic Conductivity (ft/day)
i=Mean Gradient (Dimensionless)
n=25% (Effective Porosity-From Fetter 1980)

The results are summarized below:

| Sampling Event | Groundwater Flow Velocity (ft/day) |
|---|---|
| March/April 2019 | 0.20 |
| March 2020 | 0.27 |
| September 2020 | 0.15 |
| **Mean** | **0.21** |

With a mean flow velocity of 0.21 ft/day and a distance between wells KC-15-02 and KC-19-28 of approximately 1,600 feet, the travel time for groundwater to flow from KC-15-02 (northwest) to KC-19-28 (southeast) is approximately 21 years. This travel time is likely greater than 21 years due to documented flow reversals, which would significantly increase the travel time between the two (2) wells. Calculations of groundwater flow velocity were performed using the same approach as presented in Section 5 of the ACM Report.

## 4.0 EXTENT OF ARSENIC IN UPPERMOST AQUIFER

All monitoring wells at the BSP were sampled for analysis of Arsenic during the three (3) events noted below. Results for the two (2) wells (KC-15-07 and KC-15-08) where Arsenic exceeded the

Groundwater Protection Standard (GWPS) of 10 micrograms per liter (ug/L) and associated downgradient wells are presented below:

| Arsenic Concentrations (ug/L) | | | | | | |
|---|---|---|---|---|---|---|
| **Sampling Event** | **KC-15-06** | **KC-15-07** | **KC-15-08** | **KC-19-27** | **KC-19-28** | **KC-19-29** |
| March/April 2019 | 2.6 | 160 | 11 | 1.8 | 0.94 | 0.84 |
| March 2020 | 7.3 | 82 | 11 | 5.4 | Non-Detect | 1.0 |
| September 2020 | 2.2 | 130 | 12 | 9.3 | 1.3 | 4.6 |

Note: ug/L = micrograms per liter.

As shown, Arsenic concentrations only exceed the GWPS in wells KC-15-07 and KC-15-08. At KC-15-07, Arsenic concentrations ranged from 82 ug/L to 160 ug/L; at KC-15-08, Arsenic concentrations slightly exceeded the GWPS at 11 ug/L and 12 ug/L (Figure F-3).

All Arsenic results for the three (3) shallow wells at the property boundary (KC-19-27, KC-19-28 and KC-19-29) were less than the GWPS during all events. Based on these results, Arsenic concentrations in the uppermost aquifer exceeding the GWPS of 10 ug/L are confined to the site and are not reaching the Ohio River.

To evaluate Arsenic concentrations in groundwater over time, time-series graphs for wells KC-15-06, KC-15-07 and KC-15-08 were developed for 2015 through 2020 and are presented in Attachment F-3. As shown, Arsenic concentrations in well CF-15-06 exceeded the GWPS once in 2016 but have decreased and remained stable since 2017. All Arsenic results for well CF-15-07 have exceeded the GWPS since 2015 but have been relatively stable since 2017. In well CF-15-08, Arsenic results have periodically exceeded the GWPS but with the exception of one (1) result (September 2018) have stable within a range of 6 ug/L to 12 ug/L. Overall, no significant downward or upward trends are apparent in the data, indicating relatively stable plume conditions in the area.

As shown on Figure F-3, the two (2) wells with Arsenic exceedances of the GWPS (KC-15-07 and KC-15-08) are located on a berm between the BSP and the adjacent Clearwater Pond. Well KC-15-06 is located downgradient of these wells; the Arsenic result for well KC-15-06 is less than the GWPS. Due to the presence of the Clearwater Pond, additional wells could not be installed immediately south of wells KC-15-07 and KC-15-08. The lack of wells, coupled with the fact that the Clearwater Pond is a source of recharge to the uppermost aquifer, makes it impractical to accurately estimate the mass of Arsenic in the uppermost aquifer at the BPS.

## 5.0 IMPACT OF RESULTS ON SELECTION OF REMEDY PROCESS

As presented in the ACM Report, the two (2) technologies that appear to be most likely for selection as a remedy were:

- Monitored Natural Attenuation (MNA); 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.

## 5.1 Review of MNA

As detailed above, the Arsenic plume at the BSP appears to be relatively stable with neither a significant downward or upward trend in concentrations over the past years. These observed stable concentration conditions indicate that natural attenuation, likely via dispersion and the mixing and spreading of constituents due to microscopic variations in velocity within and between interstitial voids in the uppermost aquifer, and dilution are likely acting to reduce Arsenic concentrations in groundwater.

Although the BSP is anticipated to be a current and ongoing source of Arsenic to groundwater in the area, Arsenic concentrations observed in the wells noted above are not representative of the typical waste characteristics of boiler slag. As a result, a limited subsurface investigation was conducted in 2019 to evaluate whether an alternate source of Arsenic was present. That investigation did not provide any conclusive information. Additional subsurface investigation was conducted across the area of the BSP in mid-2020; that information is currently in the process of being evaluated.

Upon closure of the BSP, Arsenic levels in groundwater are anticipated to significantly decrease as a result. In combination with the observed natural attenuation processes, closure of the BSP should provide a flexible and effective approach to groundwater remediation at the site. During the post-closure monitoring period, the positive impacts of closure and the effects of natural attenuation on groundwater quality can be fully evaluated and, if needed, other remedial technologies may be evaluated.

## 5.2 Review of Groundwater Extraction (Ex-Situ)

As discussed above, groundwater elevation data indicates that groundwater flow beneath the BSP is affected by the flow and water level of the Ohio River and, as discussed above, evidence of several flow reversals and routine flooding of the land surface have been observed at the site. This type of flooding would have a significant impact on any groundwater extraction system that was installed south of the BSP. While a conventional well system can be designed to accommodate fluctuations in groundwater elevations, flooding at the land surface would overrun the system and allow for a breakthrough of impacted groundwater. In addition, land surface flooding would result in extreme maintenance issues with operation of the system and its reliability. This type of issue would effectively preclude the installation of an effective groundwater extraction system at the BSP.

Another issue associated with groundwater extraction at the BSP is that the presence of the Clearwater Pond would impact the effectiveness of that remedy in the area. As noted above, both wells with Arsenic exceedances are located on a berm between the BSP and the Clearwater Pond; the Arsenic exceedances are confined to this immediate area. With the Clearwater Pond being a source of recharge to the uppermost aquifer, pumping in this area would more likely capture recharge from the Clearwater Pond than impacted groundwater. Further evaluation is needed to address this issue.

Due to these same issues, it was not appropriate to install a temporary groundwater extraction system at the site but to work toward final closure of the BSP.

### 5.3 Planned Work

Additional work needs to be performed to fully support the selection of the appropriate remedy for the site. That work will include, but may not be limited to:

- Continued sampling and analysis as part of the routine semi-annual program;
- Development of a three-dimensional site model;
- Continued evaluation of the effects of flood events on the site;
- Evaluation of newly obtained subsurface information to determine its impact on the final selected remedy;
- Continued development of time-series graphs to support site evaluation; and,
- Investigation of site geology and hydrogeology, as needed, to support the final closure and selection of a final remedy.

### 5.4 Conclusion

Based on the results of monitoring conducted from March/April 2019 through September 2020, the use of MNA as the selected remedy for the site is still supported, though additional evaluation is underway; the use of groundwater extraction appears to be a less applicable technology. Data collected during the ongoing monitoring programs will be useful in confirming these conclusions.

## 6.0 REFERENCES

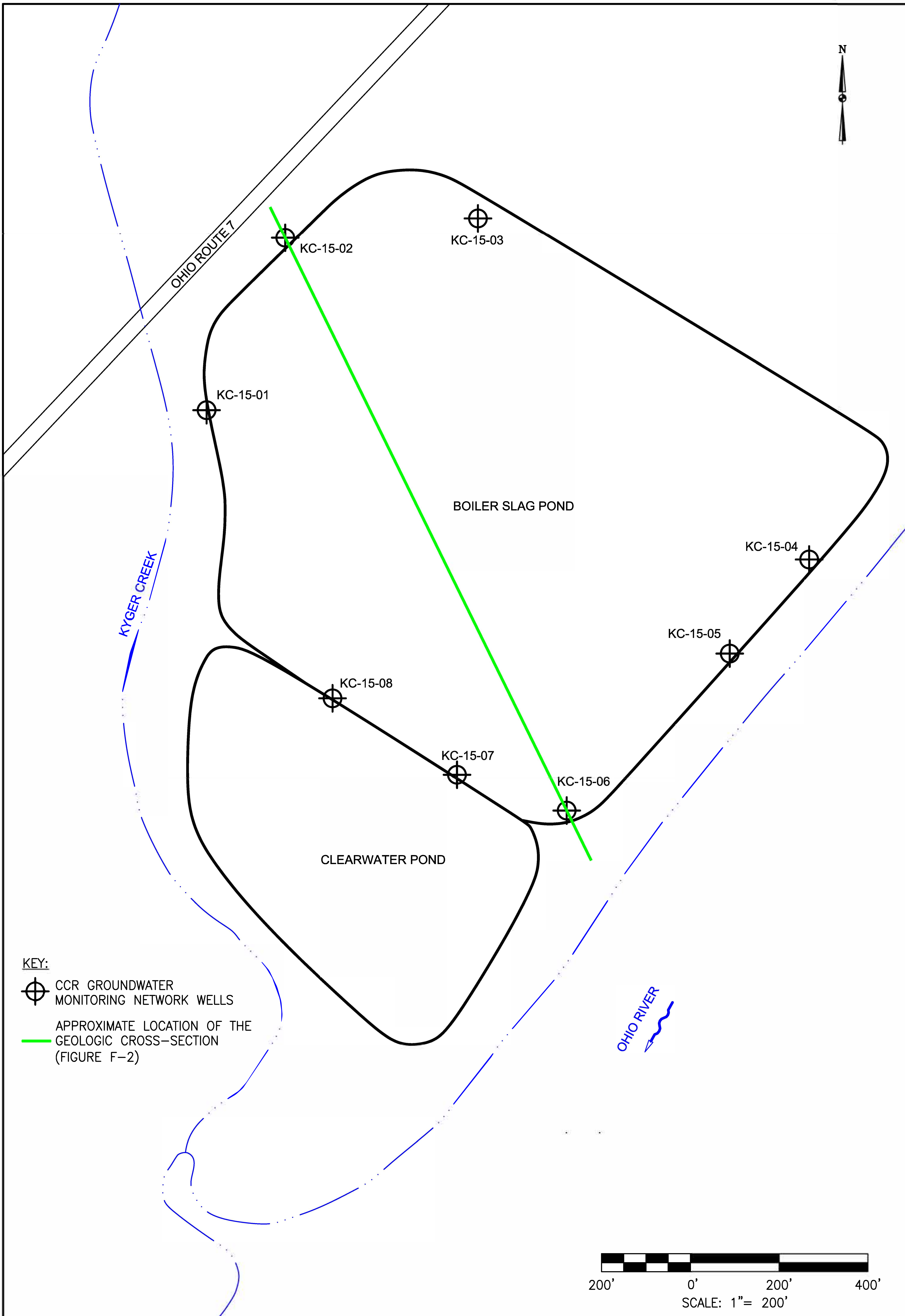
Applied Geology and Environmental Science, Inc. (AGES) 2018. Coal Combustion Residuals Regulation 2017 Groundwater Monitoring and Corrective Action Report. Ohio Valley Electric Corporation, Kyger Creek Station, Cheshire, Gallia County, Ohio. January 2018.

Applied Geology and Environmental Science, Inc. (AGES) 2019. Coal Combustion Residuals Regulation 2017 Assessment of Corrective Measures Report. Ohio Valley Electric Corporation, Kyger Creek Station, Cheshire, Gallia County, Ohio. September 2019.

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

# ATTACHMENT F

# FIGURES

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| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 4-1_BSP_MW LOCs.dwg |
| DRAWING SCALE | 1"=200' |

AGES
Applied Geology And Environmental Science, Inc.
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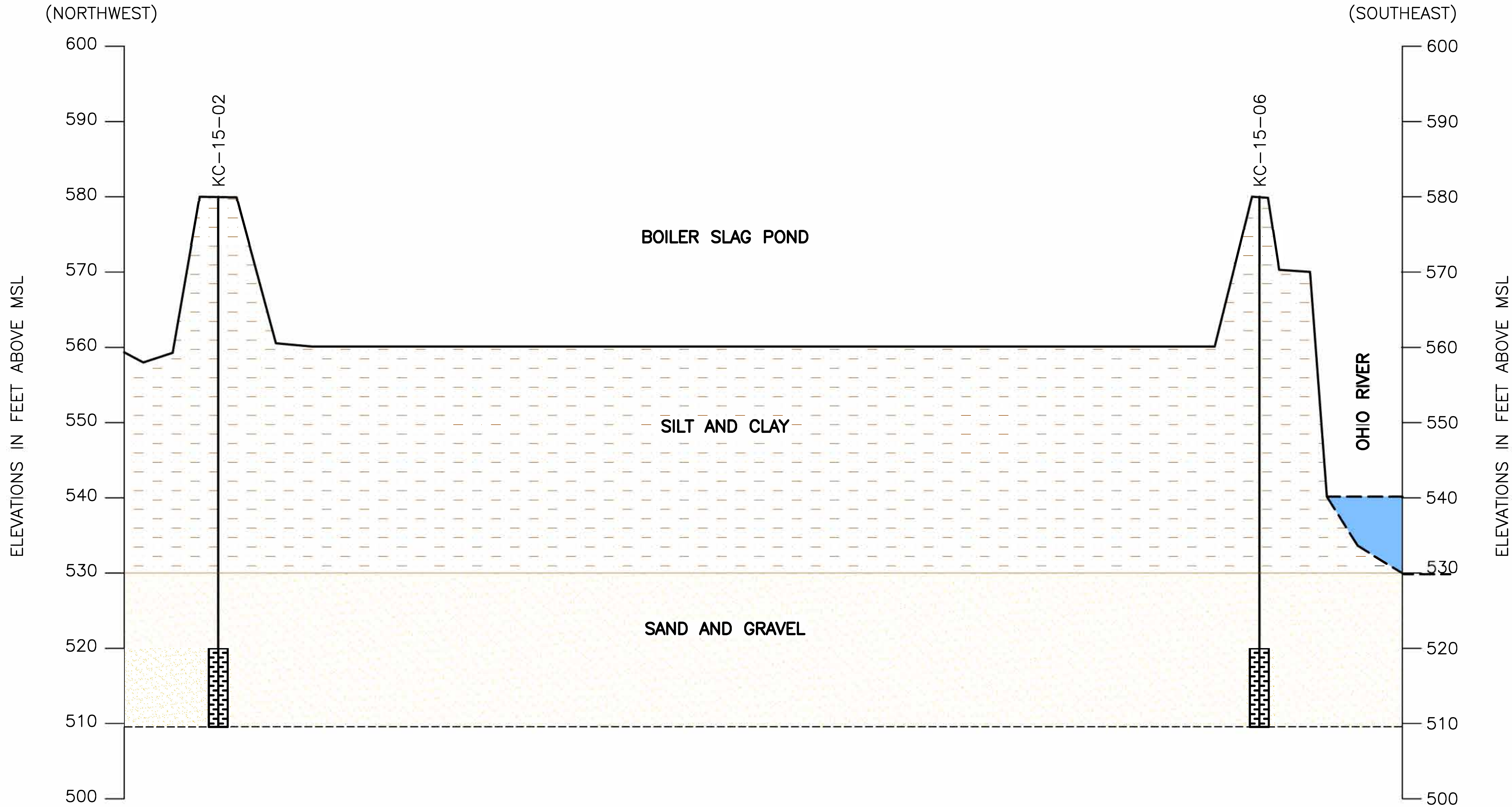
Clinton, PA 15026
412.264.6453

OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
EXISTING MONITORING WELL LOCATION MAP

| DRAWING NAME | REV. |
|---|---|
| FIGURE F-1 | 0 |

Plot: 12/25/2020 13:25 _PROGRAM-KYGER OVEC\Kyger Creek-CCR Program\CAD\2019 Assessment of Corrective Measures\2019 ACM_KYGER_Fig 4-1_BSP_MW LOCs.dwg




NOTE:
THE APPROXIMATE LOCATION OF THE CROSS-SECTION
IS ILLUSTRATED ON FIGURE F-1.

| | |
|---|---|
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| DATE | |
| CHECKED BY | |
| JOB NO. | 2019109-1-KYGER |
| DWG FILE | 2019 ACM_KYGER_Fig 3-1_BSP_Cross Sec.dwg |
| DRAWING SCALE | NOT TO SCALE |

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OHIO VALLEY ELECTRIC COMPANY
KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION
(NORTHWEST - SOUTHEAST)

DRAWING NAME: FIGURE F-2
REV. 0

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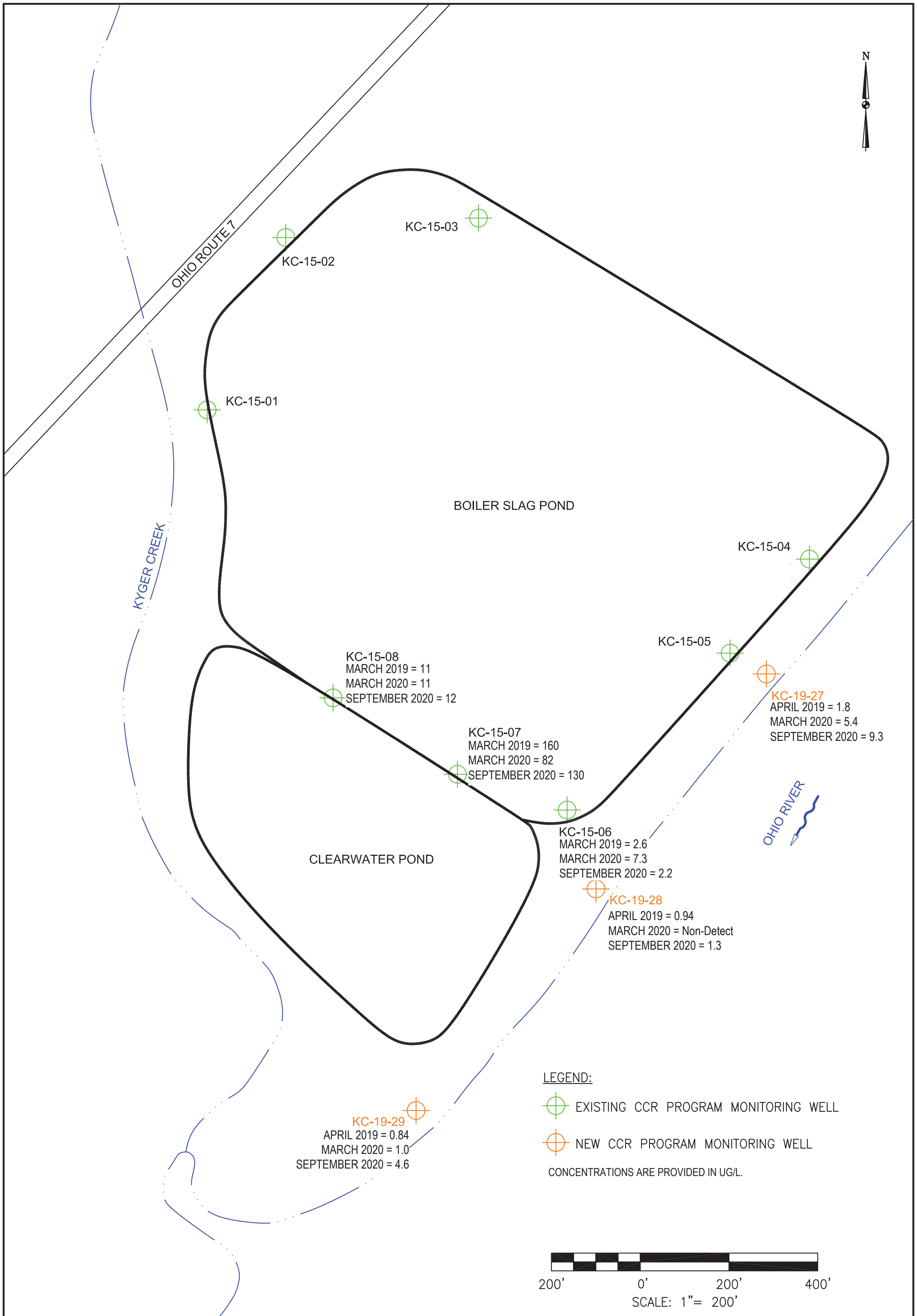


| | |
|---|---|
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| JOB NO. | 2019245–1–KYGER |
| DWG FILE | 2020 ACM_KYGER_Fig F–3_BSP_Arsenic.dwg |
| DRAWING SCALE | 1"=200' |

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OHIO VALLEY ELECTRIC COMPANY

KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
ARSENIC IN GROUNDWATER RESULTS
MARCH 2019 THROUGH SEPTEMBER 2020

DRAWING NAME: FIGURE F–3
REV. 0

Plot: 11/25/2020 13:03 _PROGRAMS–KYGER OVEC\Kyger Creek–CCR Program\CAD\2020 Assessment of Corrective Measures\2020 ACM_KYGER_Fig F–3_BSP_Arsenic.dwg

# ATTACHMENT F-1

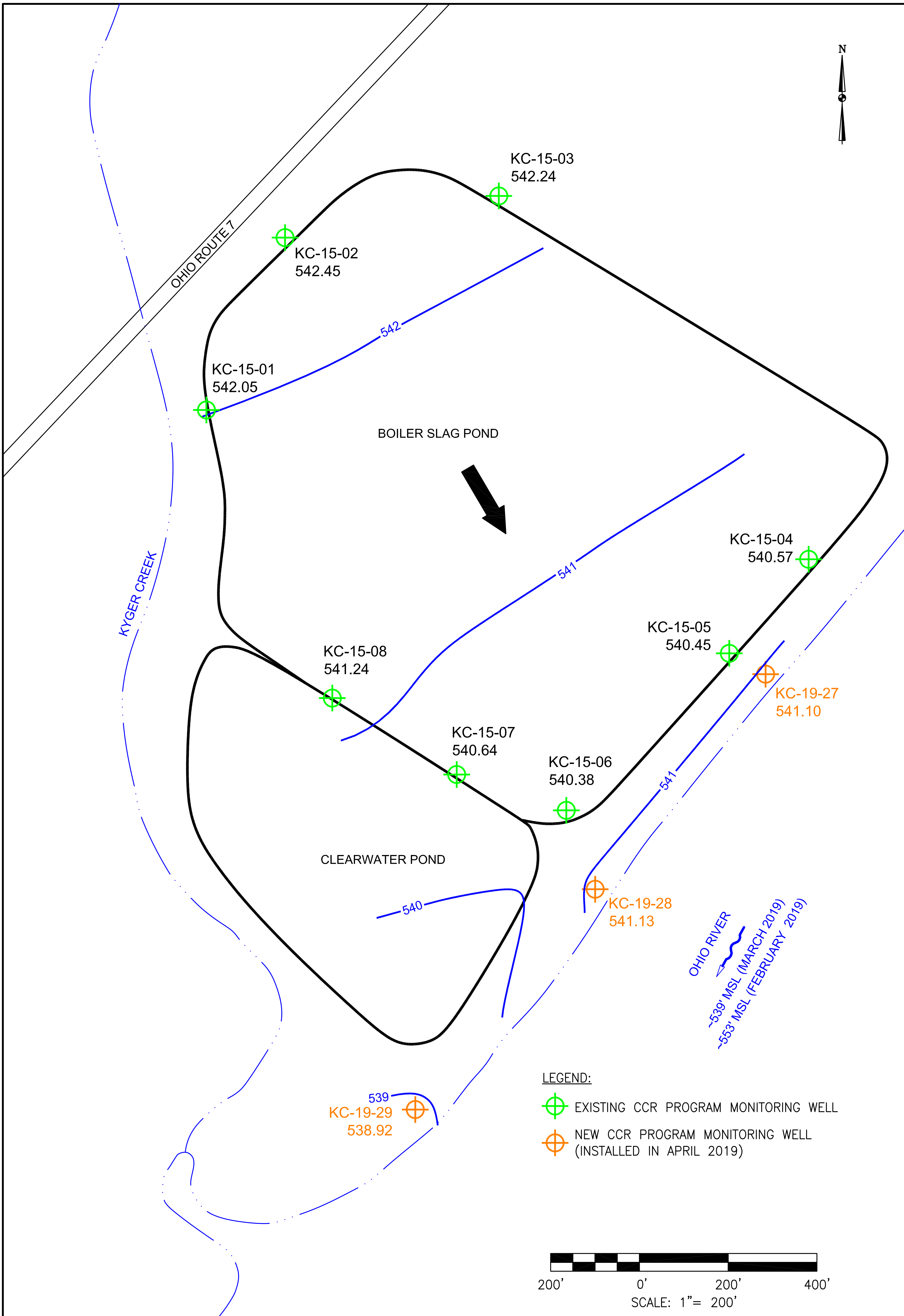
# GROUNDWATER ELEVATION DATA

**ATTACHMENT F-1**
**SUMMARY OF GROUNDWATER ELEVATION DATA**
**BOILER SLAG POND**
**CCR GROUNDWATER MONITORING PROGRAM**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID | Mar-19 | Mar-20 | Sep-20 |
|---|---|---|---|
| | Groundwater Elevation (ft) | Groundwater Elevation (ft) | Groundwater Elevation (ft) |
| **KC-15-01** | 542.05 | 540.85 | 541.10 |
| **KC-15-02** | 542.45 | 541.10 | 539.70 |
| **KC-15-03** | 542.24 | 543.35 | 539.35 |
| **KC-15-04** | 540.57 | 538.37 | 538.59 |
| **KC-15-05** | 540.45 | 539.26 | 537.97 |
| **KC-15-06** | 540.38 | 539.23 | 538.48 |
| **KC-15-07** | 540.64 | 539.54 | 538.54 |
| **KC-15-08** | 541.24 | 540.15 | 538.85 |
| **KC-19-27** | 541.10 | 539.30 | 538.75 |
| **KC-19-28** | 541.13 | 538.90 | 538.30 |
| **KC-19-29** | 538.92 | 539.17 | 538.37 |

# ATTACHMENT F-2

# GENERALIZED GROUNDWATER FLOW MAPS

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|---|---|
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| DATE | |
| CHECKED BY | |
| JOB NO. | 2020245–KYGER |
| DWG FILE | 2020 ACM_KYGER_Att F-2 Fig 1_BSP_GW Flow_MAR2019.dwg |
| DRAWING SCALE | 1"=200' |

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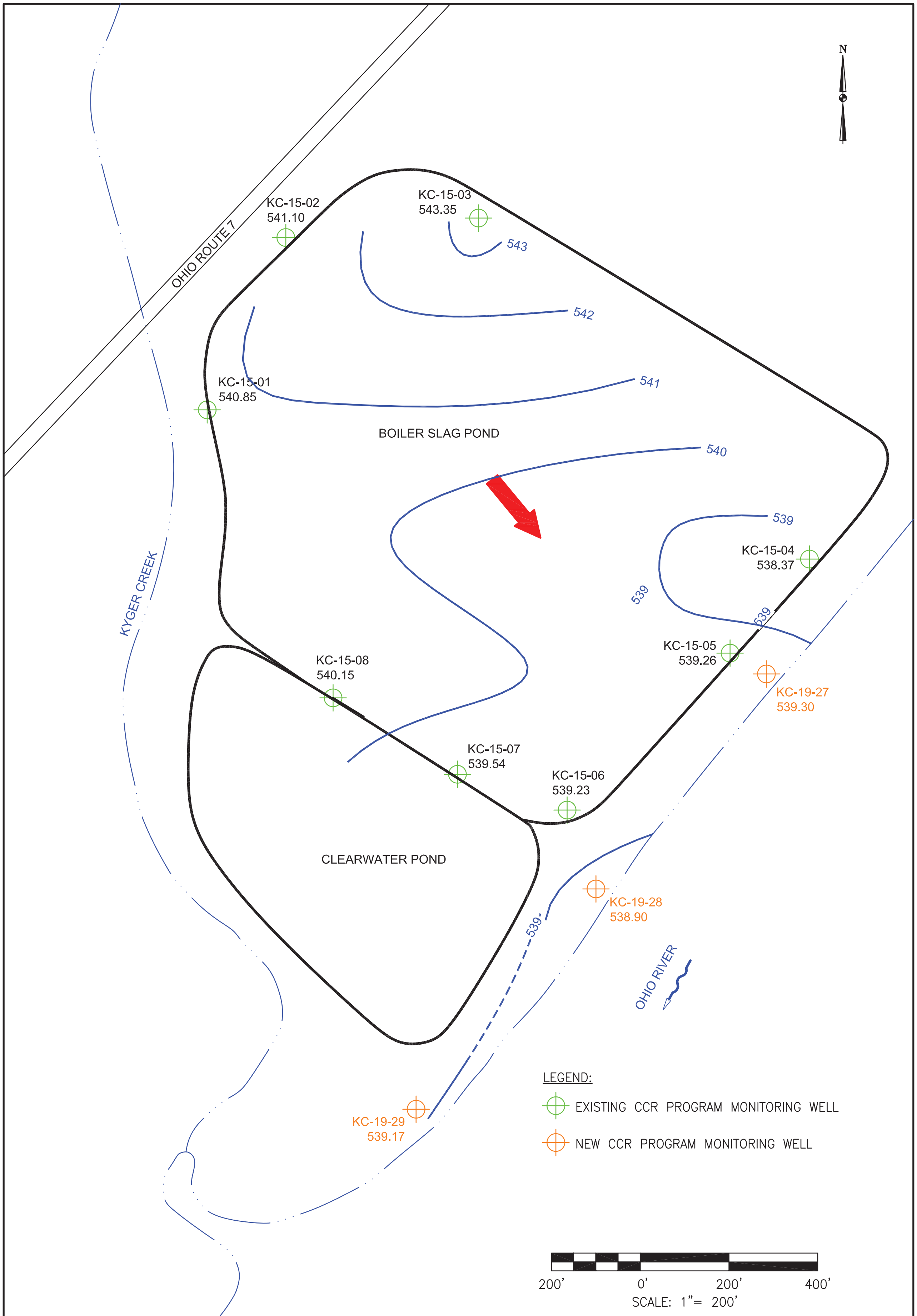
OHIO VALLEY ELECTRIC COMPANY
KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH/APRIL 2019

DRAWING NAME: ATTACHMENT F-2 FIGURE 1
REV. 0

Plot: 11/27/2020 12:45 \Kyger Creek-CCR Program\CAD\2020 Assessment of Corrective Measurest\2020 ACM_KYGER_Att F-2 Fig 1_BSP_GW Flow_MAR2019.dwg




| | |
|---|---|
| DRAWN BY | JM |
| DATE | |
| CHECKED BY | |
| JOB NO. | 2020245-1-KYGER |
| DWG FILE | March 2020 ACM_KYGER_Fig F-1_BSP_GW Contours.dwg |
| DRAWING SCALE | 1"=200' |

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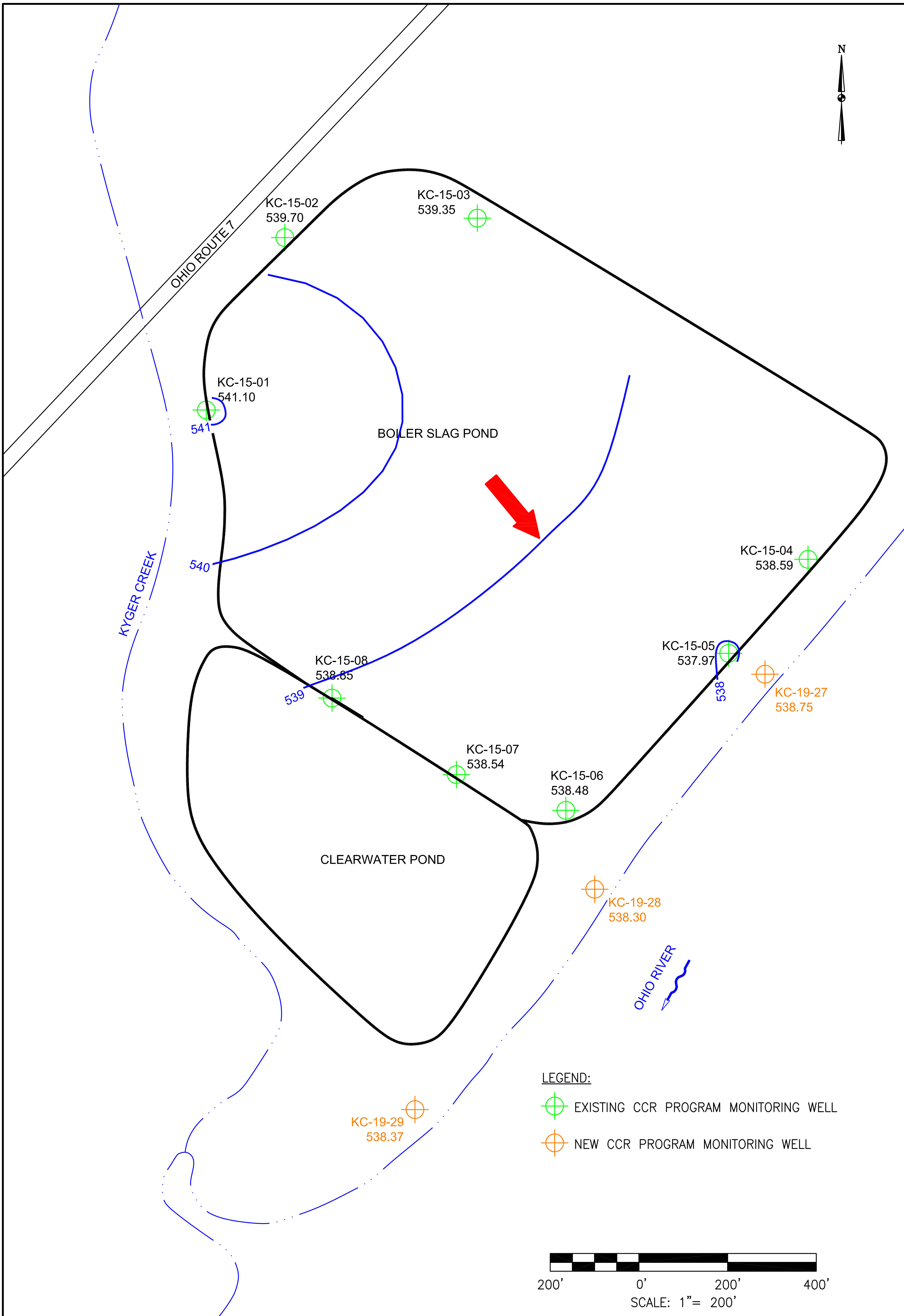
OHIO VALLEY ELECTRIC COMPANY
KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER ELEVATIONS AND FLOW MAP
MARCH 2020

DRAWING NAME: ATTACHMENT F-2 FIGURE 2
REV. 0




| | |
|---|---|
| DRAWN BY | JM |
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| DRAWING SCALE | 1"=200' |

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KYGER CREEK STATION
CHESHIRE, GALLIA COUNTY, OHIO
BOILER SLAG POND
GROUNDWATER ELEVATIONS AND FLOW MAP
SEPTEMBER 2020

DRAWING NAME: ATTACHMENT F-2 FIGURE 3
REV. 0

Plot: 11/25/2020 12:45 \Kyger Creek–CCR Program\CAD\2020 Assessment of Corrective Measures\Sept 2020 ACM_KYGER_Fig F–2_BSP_GW Contours.dwg

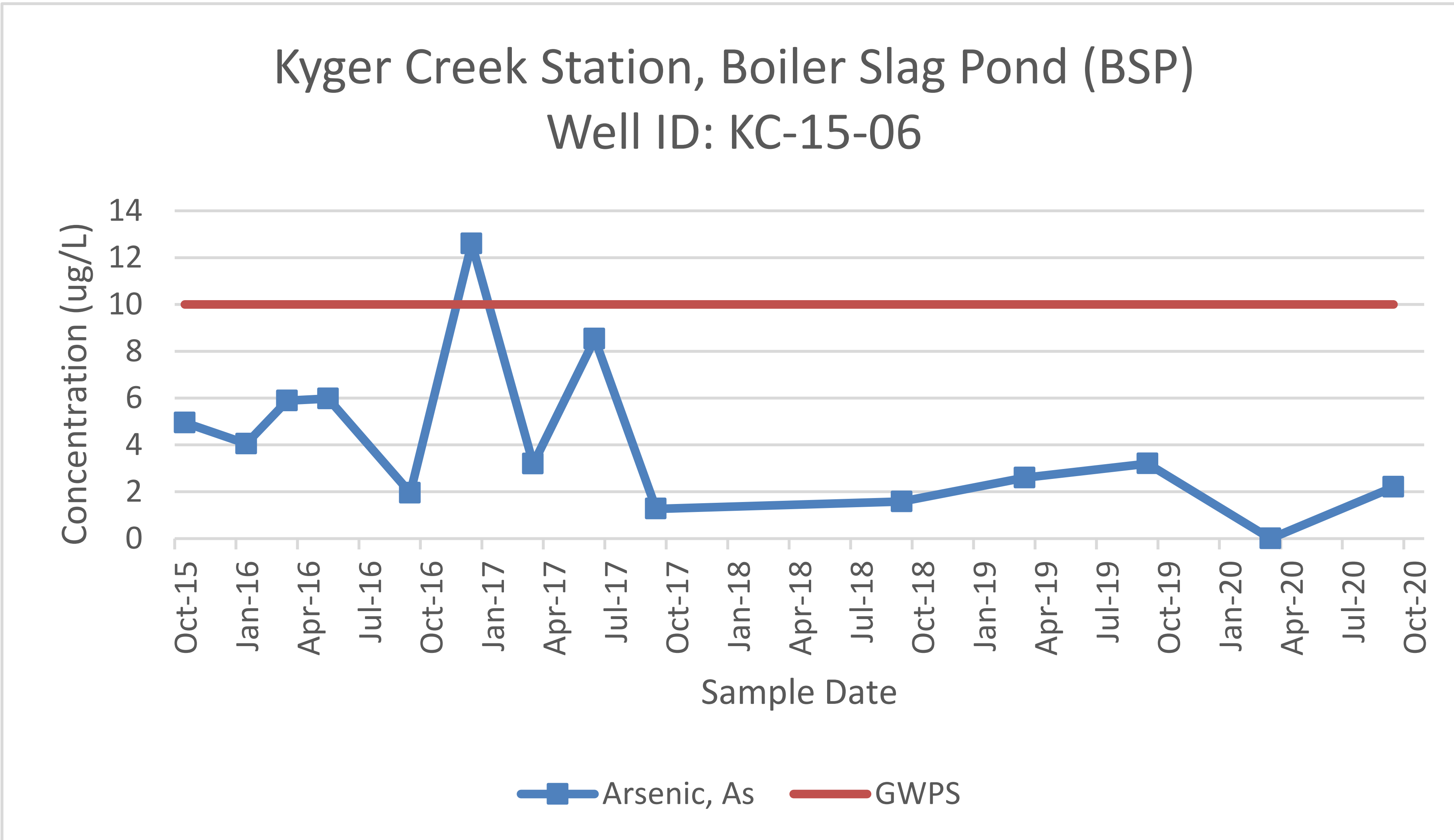
# ATTACHMENT F-3

# TIME-SERIES GRAPHS

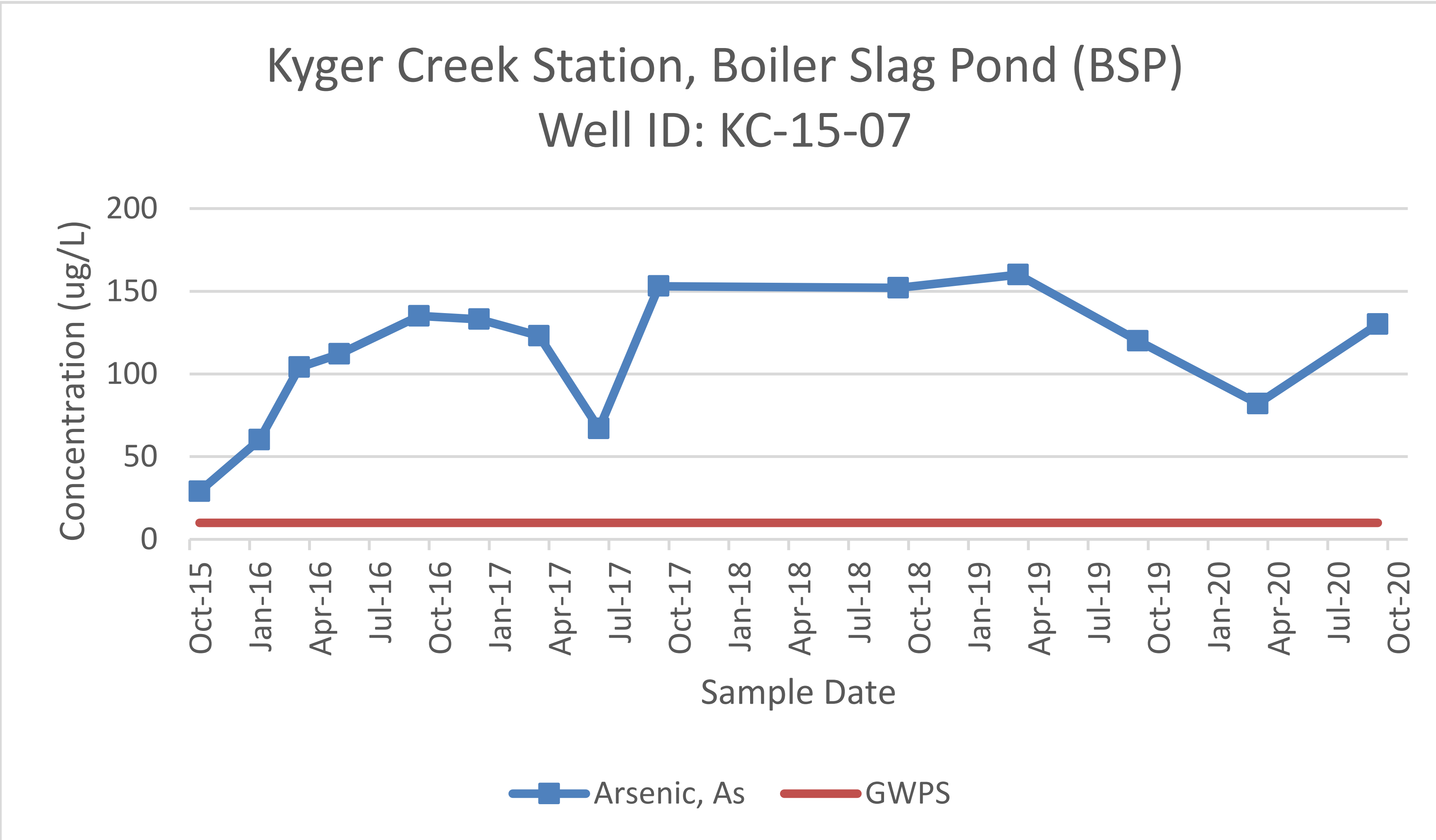
**ATTACHMENT F-3**
**SUMMARY OF ARSENIC CONCENTRATIONS IN GROUNDWATER**
**BOILER SLAG POND**
**CCR GROUNDWATER MONITORING PROGRAM**
**KYGER CREEK STATION**
**CHESHIRE, OHIO**

| Well ID / Sampling Event | KC-15-06 | KC-15-07 | KC-15-08 |
|---|---|---|---|
| **Oct-15** | 4.95 | 29 | 10.6 |
| **Jan-16** | 4.05 | 60.1 | 9.0 |
| **Mar-16** | 5.89 | 104 | 8.9 |
| **May-16** | 5.98 | 112 | 6.2 |
| **Sep-16** | 1.95 | 135 | 6.0 |
| **Dec-16** | 12.6 | 133 | 7.4 |
| **Mar-17** | 3.19 | 123 | 10.2 |
| **Jun-17** | 8.53 | 66.9 | 11.5 |
| **Sep-17** | 1.27 | 153 | 10.3 |
| **Sep-18** | 1.58 | 152 | 3.9 |
| **Mar-19** | 2.6 | 160 | 11 |
| **Sep-19** | 3.2 | 120 | 9.4 |
| **Mar-20** | 7.3 | 82 | 11 |
| **Sep-20** | 2.2 | 130 | 12 |

1. Concentrations are provided in ug/L.
2. The results from SSI resampling event are not included.



Kyger Creek Station, Boiler Slag Pond (BSP)
Well ID: KC-15-06
Concentration (ug/L)
0
2
4
6
8
10
12
14
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Sample Date
Arsenic, As
GWPS


Kyger Creek Station, Boiler Slag Pond (BSP)
Well ID: KC-15-07
Concentration (ug/L)
200
150
100
50
0
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
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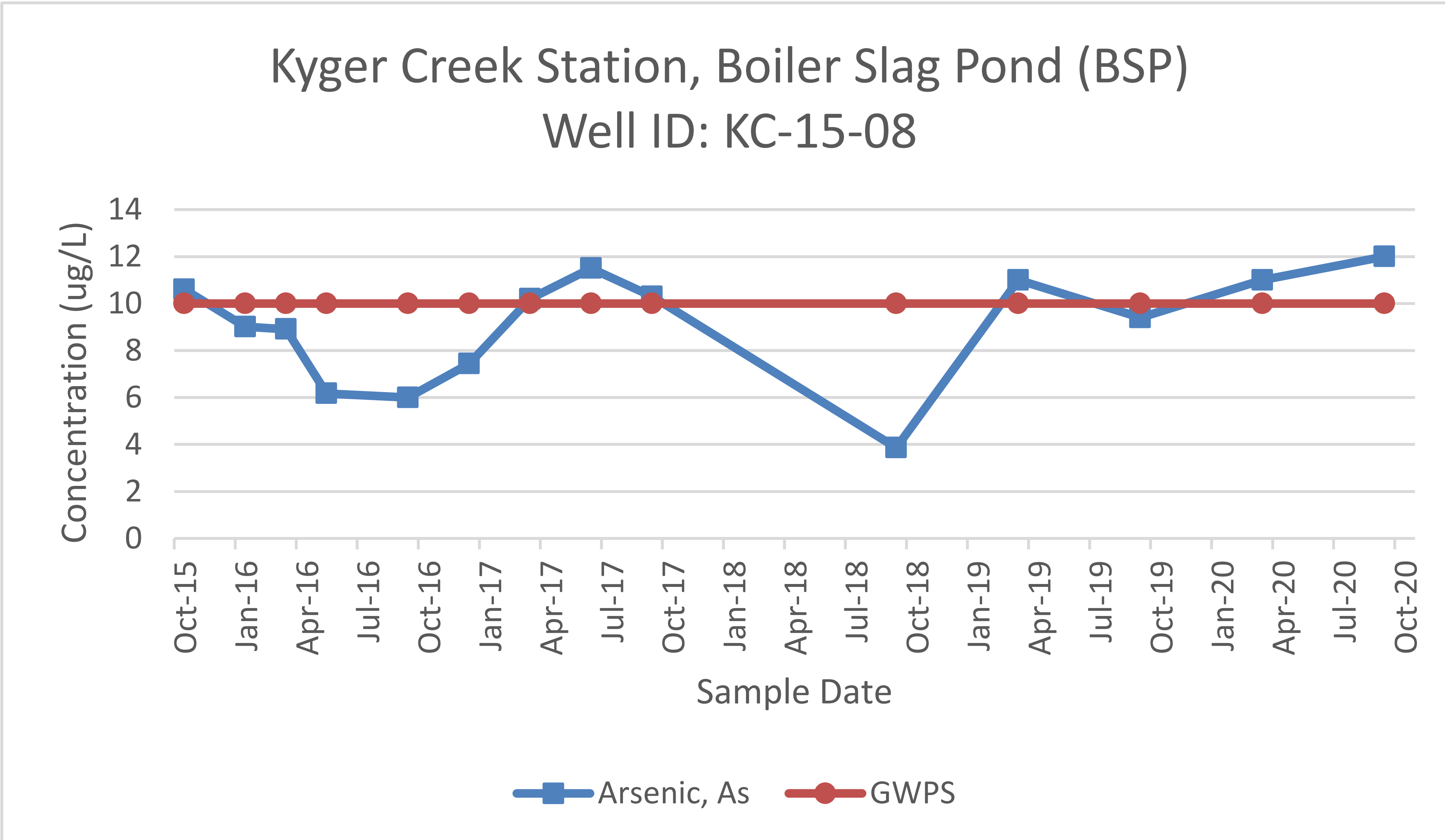
Sample Date
Arsenic, As
GWPS



Kyger Creek Station, Boiler Slag Pond (BSP)
Well ID: KC-15-08
Concentration (ug/L)
14
12
10
8
6
4
2
0
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Sample Date
Arsenic, As
GWPS