Assessment of Corrective Measures OGS Ash Pond Addendum No. 2 and OGS Zero Liquid Discharge Pond

Ottumwa Generating Station
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

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2830 Dairy Drive
Madison, WI 53718-6751
608-224-2830

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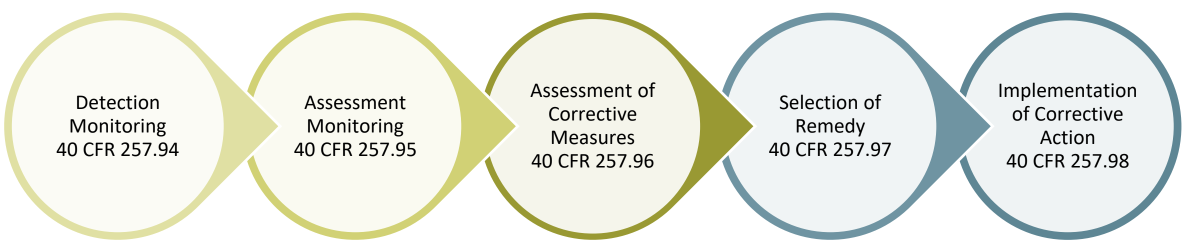
EXECUTIVE SUMMARY

Interstate Power and Light Company (IPL), an Alliant Energy company, operated two ash ponds at the Ottumwa Generating Station (OGS), including the Main Ash Pond (OGS Ash Pond) and the Zero Liquid Discharge Pond (OGS ZLD Pond). The ponds were used to manage coal combustion residuals (CCR) and wastewater from the power plant, which burns coal to generate electricity. The OGS ZLD Pond was removed by excavation and replaced with the lined Low Volume Wastewater Treatment Pond (LVWTP) in 2021. The Ash Pond is currently being drained in preparation for closure by consolidation and capping.

This report has been prepared to include the OGS ZLD Pond within the Assessment of Corrective Measures (ACM) process to satisfy requirements of the U.S. Environmental Protection Agency (U.S. EPA) standards for the Disposal of CCR from Electric Utilities, or the “CCR Rule” (Rule). This report includes updates since the November 25, 2020, ACM Addendum No. 1. These updates are consistent with the most recent semi-annual update from March 2022, as well as on-going work that will be captured in subsequent semi-annual progress reports. This Addendum No. 2 supersedes Addendum No. 1.

IPL samples and tests the groundwater in the area of the ponds to comply with the CCR Rule. Groundwater samples from two of the wells installed to monitor the OGS Ash Pond and one of the wells installed to monitor the OGS ZLD Pond contain cobalt at levels higher than the Groundwater Protection Standards (GPS) defined in the Rule. Cobalt occurs naturally and can be present in coal and CCR.

IPL prepared an ACM Report in September 2019 in response to the groundwater sampling results at the OGS facility. The ACM process is one step in a series of steps defined in the Rule and shown below.



To prepare the ACM, IPL worked to understand the following:

- Types of soil and rock deposits in the area of the OGS facility.
- Depth of groundwater.
- Direction that groundwater is moving.
- Potential sources of cobalt in groundwater.
- The area where cobalt levels are higher than the U.S. EPA standards.
- The people, plants, and animals that may be affected by levels of cobalt in groundwater that are above the GPS.

IPL has continued work since identification of the initial GPS exceedance to improve the understanding of the items listed above for both the OGS Ash Pond and OGS ZLD Pond. Using information obtained between September 2019 and September 2020, IPL selected a remedy and issued a Selection of Remedy Report on September 11, 2020. New information was received following issuance of the Selection of Remedy report, resulting in the November 25, 2020, Addendum No. 1 to the ACM. Addendum No. 1 included an update of available site data obtained since the initial ACM was completed and additional Corrective Measures. IPL held a public meeting on June 4, 2020, to discuss the contents of the September 2019 ACM. IPL held an additional public meeting with interested and affected parties to discuss the amended ACM on February 18, 2021.

This report, Addendum No. 2 to the ACM, was prepared to expand the ACM to include the OGS ZLD Pond. Cobalt has been detected at statistically significant levels (SSLs) in monitoring wells located downgradient from both Ponds and expanding the ACM to address both will support a holistic approach to addressing the cobalt concentrations in groundwater. IPL will hold an additional public meeting with interested and affected parties to discuss Addendum No. 2 and will issue a revised Selection of Remedy Report.

IPL has identified appropriate options, or Corrective Measures, to bring the levels of cobalt in groundwater below U.S. EPA standards. In addition to stopping the discharge of CCR and OGS wastewater to the OGS Ash Pond, these corrective measures include:

- Cap CCR in Place with Monitored Natural Attenuation (MNA).
- Consolidate CCR and Cap with MNA.
- Excavate and Dispose CCR on-site with MNA.
- Excavate and Dispose CCR in off-site Landfill with MNA.
- Consolidate and Cap with Chemical Amendment.
- Consolidate and Cap with Groundwater Collection.
- Consolidate and Cap with Barrier Wall.

IPL has also included a “No Action” alternative for comparison purposes only. This alternative will not be selected as a remedy.

Addendum No. 2 includes an updated evaluation that includes all eight options using factors identified in the Rule.

IPL provided a semiannual update in March 2020 on its progress in evaluating Corrective Measures to address the groundwater impacts at OGS. The initial Selection of Remedy report issued in September 2020 also describes progress in evaluating the Corrective Measures. Subsequent semiannual updates were provided in March 2021, September 2021, and March 2022.

For more information on Alliant Energy, view our Corporate Responsibility Report at https://poweringwhatsnext.alliantenergy.com/crr/.

1.0 INTRODUCTION AND PURPOSE

An Assessment of Corrective Measures (ACM) at the Interstate Power and Light Company (IPL) Ottumwa Generating Station (OGS) was prepared to comply with U.S. Environmental Protection Agency (U.S. EPA) regulations regarding the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities [40 CFR 257.50-107], or the "CCR Rule" (Rule). Specifically, the ACM was initiated and this report was prepared to fulfill the requirements of 40 CFR 257.96, including:

- Prevention of further releases.
- Remediation of release.
- Restoration of affected areas.

An ACM Report was issued in September 2019 to summarize the remedial alternatives for addressing the Groundwater Protection Standard (GPS) exceedances observed in the October 2018 sampling event for the OGS Ash Pond, and identified in the Notification of GPS Exceedance dated January 14, 2019. The September 2019 ACM identified additional information needed to inform the selection of a corrective measure (remedy) for OGS according to 40 CFR 257.97. Using information obtained between September 2019 and September 2020, IPL selected a remedy and issued a Selection of Remedy Report on September 11, 2020. New information was received following issuance of the Selection of Remedy report, resulting in an addendum to the ACM (Addendum No. 1). Addendum No. 1 included an update of available site data obtained since the initial ACM was completed and additional Corrective Measures. IPL held a public meeting on June 4, 2020, to discuss the contents of the September 2019 ACM. This Addendum No. 2 supersedes Addendum No. 1. IPL held another public meeting with interested and affected parties to discuss the amended ACM No. 1 on February 18, 2021.

Additional information was received following the issuance of Addendum No. 1 to the ACM resulting in this second addendum to the ACM (Addendum No. 2).

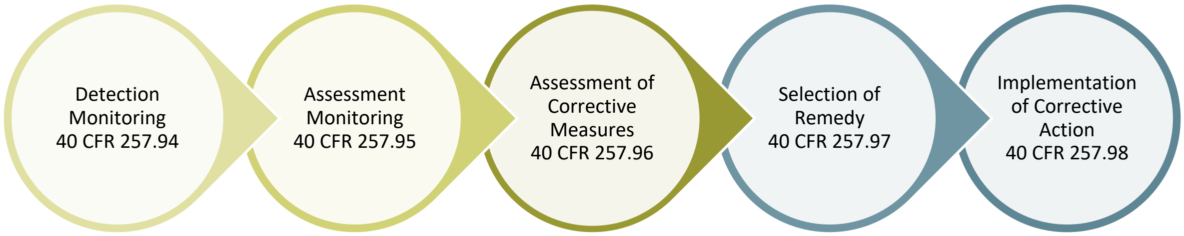
Based on the proximity of MW-305 and MW-307, the arrangement of the ponds, and the available flow path data, IPL believes the elevated cobalt concentrations are most likely attributable to the same source. Further, IPL anticipates that corrective measures to address this source are likely to address the concentrations in these wells that monitor the two ponds. Developing an updated ACM to compile all available information related to the elevated cobalt in these wells is the most comprehensive and appropriate approach for ensuring that the source(s) are effectively remediated.

In addition to other potential sources of cobalt, buried organic material discovered during closure of the Zero Liquid Discharge Pond (OGS ZLD Pond) could have created reducing conditions that would have enhanced the mobility of cobalt released from either the OGS Ash Pond or the OGS ZLD Pond.

Addendum No. 2 includes an update of available OGS Ash Pond data since Addendum No. 1 was completed and an assessment of corrective measures at the OGS ZLD Pond. IPL will hold an additional public meeting with interested and affected parties to discuss Addendum No. 2 and will issue a revised Selection of Remedy Report.

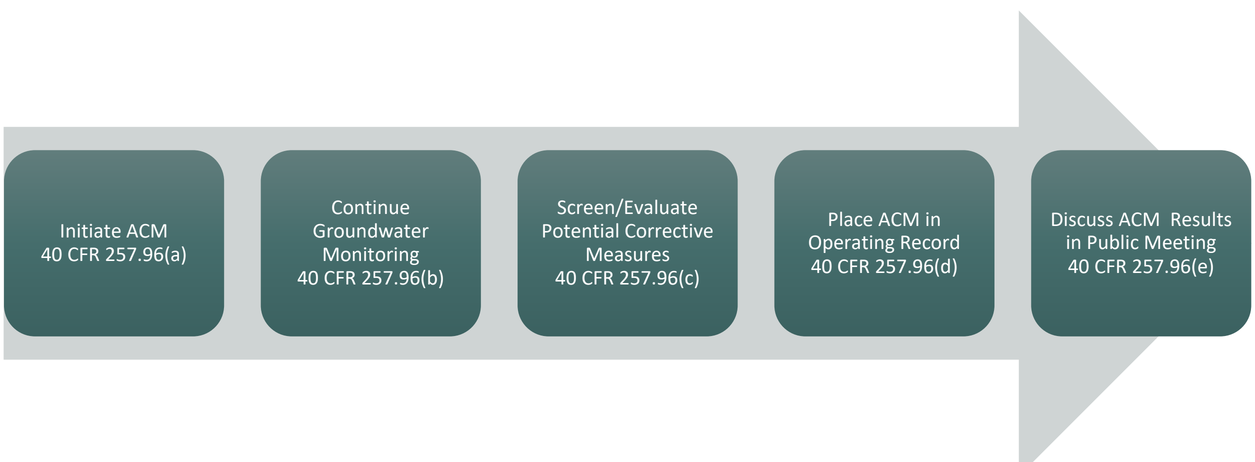
1.1 ASSESSMENT OF CORRECTIVE MEASURES REQUIREMENTS

As discussed above, Addendum No. 2 was prepared to incorporate the OGS ZLD Pond to update the ACM Report, and ACM Addendum No. 1 was developed in response to GPS exceedances observed in groundwater samples collected at the OGS facility. The ACM process is one step in a series of steps defined in the CCR Rule and depicted in the graphic below. To date, IPL has implemented a detection monitoring program per 40 CFR 257.94 and completed assessment monitoring at OGS per 40 CFR 257.95. The September 2019 ACM was required based on the groundwater monitoring results obtained through October 2018. With the ACM completed and now updated with new information, IPL is required to revisit the remedy selection process in 40 CFR 257.97. The remedy selection process must be completed as soon as feasible, and, once selected, IPL is required to start the corrective action process within 90 days.



The process for developing the ACM is defined in 40 CFR 257.96 and is shown in the graphic below. IPL held a public meeting on June 4, 2020, to discuss the September 2019 ACM with interested and affected parties. Additional corrective measure alternatives are identified in Addendum No. 1 that were not discussed at the June 4 meeting. Since IPL is required to discuss the ACM results in a public meeting at least 30 days before selecting a remedy, a second public meeting was held on in February 2021 to discuss the new alternatives. Further information and revisions to the corrective measures alternatives are presented in Addendum No. 2. Therefore, a third public meeting will be held to discuss the new information and updates to the ACM.

To facilitate the selection of a remedy for the GPS exceedances at OGS, IPL continues to investigate and assess the nature and extent of the groundwater impacts. Information about the site, the groundwater monitoring completed, the groundwater impacts as they are currently understood, and the ongoing assessment activities are discussed in the sections that follow.



1.2 SITE INFORMATION AND MAP

OGS is located southwest of the Des Moines River, approximately 8 miles northwest of the City of Ottumwa in Wapello County, Iowa (**Figure 1**). The address of the plant is 20775 Power Plant Road, Ottumwa, Iowa. In addition to the coal-fired generating station, the property also contains the OGS Ash Pond, the OGS ZLD Pond, a coal stockpile, and a hydrated fly ash stockpile.

The current groundwater monitoring networks are being evaluated and additional monitoring wells will be installed if needed. Both the OGS Ash Pond and the OGS ZLD Pond are the subjects of this ACM Report. A map showing the CCR units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program is provided as **Figure 2**.

IPL issued a Notification of Intent to Close for the OGS ZLD Pond in November 2020. The OGS ZLD Pond was dewatered and all CCR material was removed and relocated to the OGS Ash Pond (completed in October 2021). A new low-volume wastewater treatment pond was constructed in the former OGS ZLD Pond footprint, with a new geosynthetic pond liner. The new low-volume wastewater treatment pond is not a CCR unit. Excavation activities for the OGS ZLD Pond were completed in December 2021 and are documented in the April 14, 2022 Construction Documentation Report – ZLDP Closure and Low Volume Wastewater Treatment Pond (LVWTP) Construction (SCS Engineers, 2022).

The OGS Ash Pond is currently scheduled to close in 2022. The pending closure of the OGS Ash Pond was discussed in the IPL Notification of Intent to Close CCR Surface Impoundment, dated April 3, 2019. The closure notification for the OGS Ash Pond was updated on June 1, 2022. The OGS Ash Pond will be closed with CCR remaining within the footprint of the existing impoundment under a final cover system that meets the requirements of 40 CFR 257.102(d)(3).

2.0 BACKGROUND

2.1 REGIONAL GEOLOGIC INFORMATION

The uppermost geologic formation beneath OGS that meets the definition of the "uppermost aquifer," as defined under 40 CFR 257.53, is the Mississippian bedrock aquifer and hydraulically connected overlying unconsolidated sediments. The thickness and water-producing capacity of the unconsolidated material in the area is variable. A summary of the regional hydrogeologic stratigraphy is included in **Attachment A.**

2.2 SITE GEOLOGIC INFORMATION

Monitoring wells MW-301 through MW-314 and MW-305A, MW-310A, and MW-311A were installed to intersect the uppermost aquifer at the site. Due to variations in the unconsolidated material thickness and the bedrock surface, some wells are screened in unconsolidated material and some are in bedrock. The unconsolidated material at these well locations generally consists of a clay layer overlying clay and sand. Site-specific geologic information consistently shows the uppermost aquifer below unconsolidated clay and silt deposits. In addition to the site-specific data referenced in the support documents, additional site-specific soil borings show similar conditions along the downgradient boundary of the ZLDP. The total monitoring well boring depths are between 14 and 79 feet. The depth to bedrock at the site is variable, and the bedrock surface is highly weathered in some areas. Bedrock was encountered as shallow as 7 feet and as deep as 44 feet below ground surface (bgs) in the monitoring well borings. The boring logs for all of the site monitoring wells are included in **Appendix B**.

To evaluate the water table elevation in the clay unit surrounding the OGS Ash Pond, water table monitoring wells were installed adjacent to monitoring wells screened in the uppermost aquifer. The water table wells installed in May 2022 include MW-302WT, MW-304WT, MW-306WT, and MW-314WT. Piezometer MW-314 was also installed as a nested well with MW-314WT. These wells are used for water level monitoring only and are not sampled for water quality.

Shallow and deep groundwater at the site generally flows toward the Des Moines River. The groundwater flow patterns in April 2021, October 2021, and April 2022 are shown on **Figures 5** through **10**. A water table map for April 2022 is shown on **Figure 11**. The groundwater elevation data for the CCR monitoring wells are provided in **Table 1**. Based on a comparison of groundwater elevations to Des Moines River elevations, groundwater elevations in wells MW310 and MW311 have the strongest correlation to changes in the river levels. The correlation between groundwater and river level elevations decreases with the well's distance from the river.

Geologic cross section A-A' was prepared for the OGS Ash Pond. The cross section line runs through upgradient wells MW-301 and MW-314/MW-314WT, and downgradient monitoring wells MW-305/MW-305A, MW-312, MW-313, and MW-310/MW-310A, and crosses the OGS Ash Pond.

Geologic cross section B-B' was prepared for the OGS ZLD Pond. The cross section line runs through upgradient wells MW-301 and MW-314/MW-314WT, and downgradient monitoring wells MW-306/MW-306WT, MW-307, MW-312, MW-313, and MW-310/MW-310A, and crosses the OGS ZLD Pond. Cross section B-B' shows the design grade of the air heater wash basin (AHWB) and the LVWTP as well as the additional excavation to the base of, or below the design grades to create a stable subbase for the AHWB and the LVWTP.

Both cross sections show little to no contact between the remaining ash and the July 5, 2022 water table, or potentiometric surface of the uppermost aquifer.

The cross section locations are provided on **Figure 2**, and the geologic cross sections are provided on **Figures 3** and **4**. Geologic materials and estimated water table levels from July 5, 2022, are identified on the cross section.

2.3 CCR RULE MONITORING SYSTEM

The original OGS Ash Pond groundwater monitoring system established in accordance with the CCR Rule consists of one upgradient (background) monitoring well and five downgradient monitoring wells. The upgradient well is MW-301 and the downgradient wells, MW-302 through MW-306, were installed in November and December 2015. Two additional downgradient assessment wells, MW-310 and MW-311, were installed along the Des Moines River in August 2019 to evaluate the downgradient extent of groundwater impacts and groundwater flow direction. Three deeper piezometers, MW-305A, MW-310A, and MW-311A, were installed in February and March 2020 to evaluate the vertical components of groundwater impacts and flow. Additional downgradient piezometers, MW-312 and MW-313, were installed in December 2021 to evaluate the downgradient nature and extent of groundwater impacts.

The original OGS ZLD Pond groundwater monitoring system established in accordance with the CCR Rule consists of one upgradient (background) monitoring well and three downgradient monitoring wells. The upgradient well MW-301 was installed in November 2015 and the downgradient wells, MW-307 through MW-309, were installed in October 2016.

The CCR Rule wells are installed in the uppermost aquifer at the site. Well depths range from approximately 14 to 79 feet bgs.

Four additional water table wells and one additional piezometer were installed around the OGS Ash Pond in May 2022 to evaluate groundwater elevations during the closure of the OGS Ash Pond. These additional wells are used only to monitor groundwater elevations and they are not sampled as part of the OGS Ash Pond groundwater monitoring system.

The addition of a compliance monitoring well between wells MW-308 and MW-309 is being evaluated and will be installed if needed. The purpose of the well would be to provide additional groundwater quality information downgradient of the ZLDP. Additional delineation well installations near the Des Moines River, north of monitoring well nest MW-310/310A, are also being evaluated. The purpose for these additional wells would be to further identify the nature and extent of groundwater impacts downgradient of the CCR Units.

3.0 NATURE AND EXTENT OF GROUNDWATER IMPACTS

3.1 POTENTIAL SOURCES

The potential sources of groundwater impacts detected in the OGS Ash Pond and OGS ZLD Pond monitoring systems are currently under evaluation. The Closure Plan for CCR Surface Impoundments at OGS issued in September 2016 and amended in November 2020 details the steps to be undertaken to close the OGS ZLD Pond by removing CCR and the OGS Ash Pond by leaving the CCR in place. Based on documents posted on Alliant's CCR Rule Compliance Data and Information website, potential sources of groundwater impacts from the CCR units during their operation include the following:

CCR Unit	Potential Sources	Description	Quantity
OGS Ash Pond	CCR	Bottom ash, economizer ash, precipitator fly ash, hydrated fly ash, and pyrites. See the paragraph following this table for new information regarding cobalt in OGS Ash Pond sediment samples collected in the open water area near MW-305.	322,000 CY (Amended 11/2020). Discharge of CCR to the Ash Pond ceased in September 2020, with the exception of material consolidated during closure of the ZLD Pond.
	Storm water	Annual precipitation, runoff from surrounding areas prior to closure.	83 AC-FT. Watershed of 72 acres with 18 acres of open water and 40 acres of contributing area (See Note 1).
	Low-volume plant wastewater	Discharge from the oil water separator, SCU blowdown, plant drains, cooling tower blowdown, and contact water/leachate from OML.	1.62 million gallons per day (MGD). These discharges have ceased since Addendum No. 1 was issued.
OGS ZLD Pond	CCR	Fly ash from storage area runoff, potential CCR in discharges from OGS Ash Pond to OGS ZLD Pond (See Note 2).	97,300 CY (Amended 11/2020). The ZLD Pond has not received CCR since prior to 2015.
	Storm water	Annual precipitation, runoff from surrounding areas prior to closure.	68 AC-FT. Watershed of 36 acres with 18 acres of open water and 18 acres of contributing area (See Note 1).

Notes: (1) Storm water volume is calculated based on the watershed area for the OGS Ash Pond and former OGS ZLD Pond from the May 5, 2021, Inflow Design Flood Control Plan prepared by Hard Hat Services and the annual average precipitation for Ottumwa, Iowa, of 37 inches per year. For example, the volume of annual runoff from the surrounding areas that are not open water (40 acres), which are part of the OGS Ash Pond watershed, is estimated using Figure 1. Average Annual Runoff, 1951-1980 from USGS publication Average Annual Runoff in the United States, 1951-80 (Gebert 1987). Figure 1 shows approximately 8.0 inches of runoff from the 40 acres for an estimated 27 acre-feet of storm water annually. The quantity provided for plant wastewater was the average discharge from the ash pond (Outfall 001).

(2) The discharge of water from the Ash Pond to the ZLD Pond was physically possible until the connection between the two ponds was abandoned. Actual discharges from the OGS Ash Pond to the OGS ZLD Pond and the timing of the abandonment are undocumented.

During April 2022 six sediment samples were obtained from the OGS Ash Pond. A synthetic precipitation leaching procedure (SPLP) test was run on each of the sediment samples. The cobalt results ranged from non-detect to an estimated concentration of 1.8 μg/L. All of the results were below the cobalt GPS. The laboratory report for the SPLP test is located in **Appendix D.**

The OGS ZLD Pond was historically monitored separately from the OGS Ash Pond and was not considered a potential source for the groundwater impacts detected in the Ash Pond and OGS ZLD Pond monitoring systems. The historical use of the OGS ZLD Pond was to collect storm water runoff from hydrated fly ash stored on the west side of the OGS ZLD Pond, north of the plant, as well as storm water from the surrounding embankments. Based on the location of the former fly ash storage along the northern portion of the OGS ZLD Pond, impacts from the fly ash storage or runoff would be expected to be similar in the three downgradient OGS ZLD Pond wells (MW-307, MW-308, and MW-309) rather than the southern well (MW-307), if wastes historically discharged to the pond was determined to be the cobalt source.

As described in **Section 1.2**, the OGS ZLD Pond was dewatered and CCR material was removed and relocated to the OGS Ash Pond (completed in October 2021). A new low-volume wastewater treatment pond was constructed in the former OGS ZLD Pond footprint, with a new geosynthetic pond liner (completed December 2021).

During excavation of CCR as part of the closure of the OGS ZLD Pond in 2021, organic material such as buried tree trunks, tree branches, and other vegetation was observed below the excavated pond sediment in the vicinity of MW-307. This material could have created reducing conditions that would have enhanced the mobility of cobalt released from either the OGS Ash Pond or the OGS ZLD Pond. Although the OGS Ash Pond still appears to be the most likely source of cobalt in groundwater at both MW-305 and MW-307, IPL has elected to evaluate potential sources of cobalt from both CCR Units and address groundwater impacts holistically for the site.

3.2 GROUNDWATER ASSESSMENT

3.2.1 Groundwater Depth and Flow Direction

Depth to groundwater as measured in the site CCR monitoring wells varies from approximately 1 to 40 feet bgs due to topographic variations across the facility and seasonal variations in water levels. Groundwater flow at the site is generally to the east-northeast, and the groundwater flow direction and water levels fluctuate seasonally due to the proximity to the river. The groundwater elevations in wells MW-310 and MW-311 show a close correlation to the river elevation. Groundwater elevations and flow directions in the uppermost aquifer are shown on the April and October 2021, and April 2022 potentiometric surface maps (**Figures 5** through **10**).

3.2.2 Groundwater Protection Standard Exceedances Identified

The ACM process was triggered by the detection of cobalt at SSLs exceeding the GPS in samples from MW-305 and MW-307. For comparison of assessment monitoring data to fixed GPS values, the U.S. EPA's Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at Resource Conservation and Recovery Act (RCRA) Facilities (EPA 530-R-09-007, March 2009) recommends the use of confidence intervals. Specifically, the suggested approach for comparing assessment groundwater monitoring data to GPS values based on long-term chronic health risks, such as drinking water Maximum Contaminant Levels (MCLs), is to compare to a lower confidence limit around the arithmetic mean with the fixed GPS.

The calculated lower confidence limit for the means were compared to the cobalt GPS for wells with individual results exceeding the GPS, which included MW-305, MW-306, and MW-307. Based on these comparisons, a statistically significant exceedance has not occurred for cobalt at MW-306. Monitoring well MW-306 had individual results exceeding the GPS for cobalt, but the exceedances were not determined to be at SSLs.

For MW-305, cobalt was initially determined to be at an SSL above the GPS based on the first four sampling events for the Appendix IV assessment monitoring parameters, including complete sampling events in April, August, and October 2018, and a resampling event for cobalt at selected wells in January 2019. The list of samples collected are included in **Tables 2A** and **2B**, and complete results for these sampling events are summarized in **Tables 3**, **4**, and **5**.

For MW-307, cobalt was initially determined to be at an SSL above the GPS at MW-307 in the initial evaluation of assessment monitoring results for the OGS ZLD Pond, dated July 13, 2020. Cobalt concentrations exceeding the GPS were observed in all subsequent samples collected, with SSLs above the GPS in February, April, July, and October of 2021. ASD reports were submitted on October 12, 2020, for the initial assessment monitoring results and on August 30, 2021, to discuss monitoring results for February, April, and July 2021. The ASD reports concluded the most likely source of the GPS exceedance for cobalt at MW-307 was the adjacent OGS Ash Pond, and not the OGS ZLD Pond, based on the history of waste disposal in these units and the absence of cobalt exceedances in monitoring wells MW-308 and MW-309. As discussed above in Section 3.1, although the OGS Ash Pond still appears to be the most likely source of cobalt in groundwater at MW-307, additional information was discovered during excavation of the OGS ZLDP in 2021 resulted in a decision not to prepare an ASD for the October 2021 monitoring results. IPL initiated this ACM for the OGS ZLD Pond was initiated, which also represents an update to the OGS Ash Pond ACM to evaluate potential sources of cobalt from both CCR Units and address groundwater impacts holistically for the site.

Lithium was detected above the GPS at new delineation monitoring wells MW-310, MW-310A, and MW-311A. Fluoride was also detected in the deep piezometer MW-311A at a concentration above the GPS in two of the four sampling events. There were no lithium or fluoride GPS exceedances in any of the compliance wells located at the waste boundary.

Based on the results of assessment monitoring conducted through the April 2022 sampling event, SSLs exceeding the GPSs have been identified for the following wells and parameters:

Assessment Monitoring Appendix IV Parameter	Location of GPS Exceedance(s)	Historic Range of Detections at Wells with SSL Above GPS	Groundwater Protection Standard (GPS)
Cobalt (µg/L)	MW-305	14.4-21.0	6
Cobalt (µg/L)	MW-307	1.3 - 64	6

µg/L = micrograms per liter

Note: Historic range includes results from assessment monitoring from April 2018 through April 2022.

3.2.3 Expanding the Groundwater Monitoring Network

Monitoring wells MW-310 and MW-311 were installed during August 2019 in the area between the current downgradient wells and the Des Moines River to fulfill the requirements of 40 CFR 257.95(g)(1), which requires additional characterization to support a complete and accurate assessment of corrective measures. The installation of these wells was originally scheduled for spring 2019, but due to state and federal permitting requirements and persistent flooding along the Des Moines River, the installation was delayed. Three deeper piezometers, MW-305A, MW-310A, and MW-311A were installed in February and March 2020 to evaluate the vertical components of groundwater impacts and flow.

Monitoring wells MW-312 and MW-313 were installed in December 2021 as additional delineation wells to assess groundwater conditions between the compliance well network and delineation well MW-310. MW-312 is screened in weathered Mississippian Dolomite, and MW-313 is screened in alluvial sand. The total boring depths were 27.5 feet at MW-312 and 22.5 feet at MW-313.

Four water table wells and one piezometer were installed around the Ash Pond in May 2022 to evaluate groundwater elevations during the closure of the Ash Pond. The wells are intended for water level measurement only, and will not be sampled for water quality.

3.2.4 Monitored Natural Attenuation Data Collection and Evaluation

An evaluation of the potential for OGS to utilize monitored natural attenuation (MNA) as a corrective action alternative began with the initiation of an ACM at OGS. The tiered analysis approach in the U.S. EPA guidance, "Monitored Natural Attenuation of Inorganic Contaminants in Groundwater, Volume 1 – Technical Basis for Assessment" (U.S. EPA, 2007), is being used as a guide for evaluating MNA as a potential corrective action alternative at OGS.

There are four tiers of analysis to be addressed in evaluating the site for MNA:

1. Demonstrate active contaminant removal from groundwater.
2. Determine mechanism and rate of attenuation.
3. Determine system capacity and stability of attenuation.
4. Design a performance monitoring program and identify an alternative remedy.

Data collection activities during the assessment monitoring and ACM process that begins to address the objectives of tiers 1 and 2 include:

- Installation of downgradient assessment wells MW-310, MW-311, MW-312, and MW-313 and deeper downgradient piezometers MW-305A, MW-310A, and MW311A to evaluate groundwater flow direction and horizontal and vertical hydraulic gradients.
- Additional groundwater sampling events and analysis of data from all site wells to evaluate contaminant distribution in groundwater and stability of groundwater concentrations over time.
- Analysis of general groundwater chemistry and field parameters in addition to the App III and IV constituents to provide further characterization of groundwater chemistry.
- Analysis of both total and dissolved constituents for selected parameters.

A hydrogeochemical conceptual model and summary of preliminary evaluation of cobalt attenuation in the aquifer at OGS is included in **Appendix C**. Preliminary findings include:

- Cobalt has likely been released from the OGS Ash Pond to the alluvial aquifer beneath the site.
- Immobilization within the saturated sand is the mechanism that drives natural attenuation of cobalt.
- If cobalt were not attenuated, the 40-year groundwater travel time from the OGS Ash Pond to well MW-310 suggests that cobalt would have already arrived in the approximate 40-year time frame since the OGS Ash Pond was commissioned if it was not attenuated.
- The cobalt concentration from MW-305 located at the downgradient edge of the primary pond to MW-310, located near the Des Moines River, appears to decrease by a factor of about 60.
- Cobalt precipitation, coprecipitation, or adsorption likely account for the decrease in cobalt concentrations beyond the MW-305 location along with a component of dilution by mixing with upward flowing deep groundwater at MW-310.
- The groundwater becomes more toxic from the OGS Ash Pond perimeter to MW-310 at the Des Moines River. As the ORP increases, iron precipitates from the water and provides adsorption sites on iron oxyhydroxides for cobalt, which is then also removed from the groundwater.
- The iron oxyhydroxides on the aquifer matrix provide potential adsorption sites for the sequestration of cobalt.
- The mass of cobalt in the groundwater where the GPS may be exceeded between MW-305 and MW-310 is estimated at 0.60 kilograms.

Based on the investigations completed prior to ACM Addendum No. 1, evidence of cobalt attenuation by precipitation, coprecipitation, and adsorption was observed making MNA a viable alternative for site remediation. Additional investigation was warranted to increase the understanding of contributing factors to attenuation and to provide the basis for a long-term corrective action monitoring program. The following additional investigation was performed since the submittal of ACM Addendum No.1:

- Installed two additional monitoring wells in December 2021 between MW-305 and MW-310 (at approximately 400-foot spacing) to better define aqueous geochemical trends from the OGS Ash Pond to the Des Moines River. The new wells are MW-312 and MW-313. The data from the new wells were used to refine the estimate of cobalt mass in the groundwater downgradient of the OGS Ash Pond.
- Performed additional rounds of groundwater monitoring at the new and existing monitoring wells. In addition to the existing parameters, the following were added or continued:

- In-field measurement of pH, Oxidation Reduction Potential (ORP), Dissolved Oxygen (DO), temperature, specific electrical conductance, turbidity, ferrous iron, and sulfide; and laboratory analyses of dissolved (0.45 µm filtered) Ca, Mg, Na, K, Fe, Mn, alkalinity (as $CaCO_3$), Cl, SO_4, and Total Dissolved Solids (TDS) to better define the groundwater chemistry and evolution with flow.

- Laboratory analyses of dissolved (0.45 µm filtered) cobalt to better define the aqueous or "mobile" plume.

- Laboratory analyses of 0.20 µm filtered cobalt and iron to assess potential adsorption of cobalt to "colloidal" iron.

- Filtration of turbid groundwater produced by the monitoring wells and analysis of the solid filtrate for aluminum, iron, and cobalt to determine the degree to which the cobalt is associated with suspended solids.

- Continued monitoring of cobalt concentrations over time to evaluate if cobalt migration is attenuated.

- Laboratory analyses of the degree of iron precipitation and cobalt coprecipitation and adsorption from MW-305 groundwater with aeration (i.e. redox increase) to better understand the degree to which cobalt adsorption and coprecipitation are contributing to attenuation.

- Desorption trials were completed to assess the degree to which the absorbed cobalt is permanently bound to the site sediment. Two samples selected for desorption included MW-305 at the 10 to 1 liquid to solids ratio and MW-313 at the 10 to 1 liquid to solids ratio. The filtered solids were combined with upgradient groundwater from MW-301 at 5 to 1 and 10 to 1 liquid to solids ratios, and reacted for 10 days. After reaction, the water was filtered at 0.45 µm, preserved, and shipped to an analytical laboratory for analysis. The cobalt desorption results are summarized in Table 9 in **Appendix C** of this report. The soil samples absorbed from 0.905 to 0.950 µg of cobalt per g of soil. Most of the cobalt was retained on the soil during the desorption trials. The desorption trials at the 5 to 1 liquid to solids ratio released only 2.5 to 5.4 percent of the adsorbed cobalt. Increasing the liquid to solids ratio to 10 did not change the fraction of cobalt released from the MW-313 sample. The cobalt release increased to 14 percent at MW-305.

• Collected samples of the saturated sand from the two new well locations, MW-312 and MW-313, and from the area adjacent to MW-305 and MW-310. Analyses of sand included:

  - Iron and manganese concentrations to assess potential for adsorption.

  - Cobalt concentrations to assess the degree to which cobalt has adsorbed or coprecipitated onto the sand matrix (i.e. defining the "immobile plume").

  - Cobalt adsorption isotherms to assess capacity of the sand to absorb cobalt and determine maximum adsorption capacity.

The results of the additional investigation described above indicated that cobalt precipitation was occurring in the groundwater downgradient of wells MW-305 and MW-307. Also, desorption trials indicated that approximately 96 percent of the cobalt remained adsorbed to the aquifer media, supporting MNA as a viable remedial alternative for cobalt.

3.3 CONCEPTUAL SITE MODEL

The following conceptual site model describes the compound and nature of the constituent above the GPS, discusses potential exposure pathways affecting human health and the environment, and presents a cursory review of their potential impacts. The conceptual site model for OGS has been prepared in general conformance with the Standard Guide for Developing Conceptual Site Models for Contaminated Sites (ASTM E1689-95). This conceptual site model is the basis for assessing the efficacy of likely corrective measures to address the source, release mechanisms, and exposure routes.

3.3.1 Nature of Constituents Above Groundwater Protection Standards

The constituent in groundwater at OGS that is present at a statistically significant concentration greater than the GPS (Cobalt) is described in the September 2019 ACM.

Lithium was detected above the GPS in the new wells MW-310, MW-310A, and MW-311A. Fluoride was detected above the GPS in MW-311A. These constituents have not been observed at the waste boundary of the CCR units and are believed to be unrelated to historic disposal activities.

3.3.2 Potential Receptors and Pathways

As described in **Section 3.3**, ASTM E1689-95 provides a framework for identifying potential receptors (people or other organisms potentially affected by the groundwater impacts at OGS) and pathways (the ways groundwater impacts might reach receptors). In accordance with ASTM E1689-95, we have considered potential human and ecological exposures to groundwater impacted by the constituents identified in **Section 3.2.2**:

Human Health

In general, human health exposure routes to contaminants in the environment include ingestion, inhalation, and dermal contact with the following environmental media:

- Groundwater
- Surface Water and Sediments
- Air
- Soil
- Biota/Food

If people might be exposed to the impacts described in **Section 3.0** via one of the environmental medias listed above, a potential exposure route exists and is evaluated further. For the groundwater impacts at OGS, the following potential exposure pathways have been identified with respect to human health:

- Groundwater – Ingestion and Dermal Contact: The potential for ingestion of, or dermal contact with, impacted groundwater from OGS exists if water supply wells are present in the area of impacted groundwater and are used as a potable water supply. Based on a review of the Iowa Department of Natural Resources (IDNR) GeoSam well database, and information provided by OGS:

  – No off-site water supply wells have been identified as downgradient or sidegradient in the vicinity of the CCR units.

  – Potable water is not supplied from on-site wells. Potable water at OGS is provided by the Wapello Rural Water Association.

- Surface Water and Sediments – Ingestion and Dermal Contact: The potential for ingestion of or dermal contact with impacted surface water and sediments exists if impacted groundwater from the OGS facility has interacted with adjacent surface water and sediments, to the extent that cobalt is present in these media at concentrations that represent a risk to human health.

  – No more surface water is present within the CCR units are OGS.

  – Cobalt is not present at concentrations above the GPS at wells closest to the Des Moines River (MW-310 and MW-311).

  – Cobalt is not present at concentrations above the GPS at wells between the OGS Ash Pond and Middle Avery Creek.

- Biota/Food – Ingestion: The potential for ingestion of impacted food exists if impacted groundwater from the OGS facility has interacted with elements of the human food chain. Elements of the food chain may also be exposed indirectly through groundwater-to-surface water interactions.

  – Based on groundwater monitoring conducted to date, cobalt-impacted groundwater does not appear to reach nearby surface waters.

  – Based on available soil boring logs for wells immediately adjacent to farm fields and the latest shallow piezometric surface map, cobalt-impacted groundwater in the uppermost aquifer is separated by approximately 10, or more, feet of clayey soil. Clay soil appears to provide a separation from impacted groundwater for even deep-rooted crops such as corn.

Based on the lack of groundwater exposure, only the surface water, sediment, and biota/food exposure pathways were retained for further consideration in the September 2019 ACM. Groundwater samples collected from the piezometer nests installed downgradient of the OGS Ash Pond and adjacent to the Des Moines River do not contain cobalt at a concentration above the GPS. None of the additional information obtained since the September 2019 ACM suggests that cobalt is reaching the well nests. Therefore, cobalt does not appear to be migrating to a location where it can impact human health or the environment. In other words, there is no pathway for exposure to cobalt. Implementation of potential corrective measures may introduce secondary exposure pathways that are discussed in **Section 6.0** and will be evaluated further as a corrective measure is selected for OGS.

Ecological Health

In addition to human exposures to impacted groundwater, potential ecological exposures are also considered. If ecological receptors might be exposed to impacted groundwater, the potential exposure routes are evaluated further. Ecological receptors include living organisms, other than humans, the habitat supporting those organisms, or natural resources potentially adversely affected by CCR impacts. This includes:

- Transfer from an environmental media to animal and plant life. This can occur by bioaccumulation, bioconcentration, and biomagnification.
  - Bioaccumulation is the general term describing a process by which chemicals are taken up by a plant or animal either directly from exposure to impacted media (soil, sediment, water) or by eating food containing the chemical.
  - Bioconcentration is a process in which chemicals are absorbed by an animal or plant to levels higher than the surrounding environment.
  - Biomagnification is a process in which chemical levels in plants or animals increase from transfer through the food web (e.g., predators have greater concentrations of a particular chemical than their prey).
- Benthic invertebrates within adjacent waters.

Based on the information available and presented in the September 2019 ACM, both of these ecological exposure routes required additional evaluation at the time.

Both potential ecological exposure pathways require groundwater-to-surface water interactions for the exposure pathway to be complete. As discussed above, none of the additional information obtained since the September 2019 ACM suggests that cobalt is reaching the new wells, and samples indicate that elevated concentrations of cobalt are only present near the pond. Therefore, cobalt does not appear to be migrating to a location where it can impact ecological health.

The surface water/sediment, biota/food, and ecological exposure assessment is incomplete as the extent of groundwater impacts are still being evaluated. If groundwater impacts extend to the river, then these exposure pathways will be evaluated further.

4.0 POTENTIAL CORRECTIVE MEASURES

In this section, we identify potential corrective measures to meet the ACM goals identified in 40 CFR 257.96(a), which are to:

- Prevent further releases
- Remediate releases
- Restore affected areas to original conditions

The development of corrective measure alternatives is described further in the following sections. Corrective measure alternatives developed to address the groundwater impacts at OGS are described in **Section 5.0**. The alternatives selected are qualitatively evaluated in **Section 6.0**.

4.1 IDENTIFICATION OF CORRECTIVE MEASURES

As described in the U.S. EPA Solid Waste Disposal Facility Criteria Technical Manual (U.S. EPA 1998), corrective measures generally include up to three components:

- Source Control
- Containment
- Restoration

Within each component, there are alternative measures that may be used to accomplish the component objectives. The measures from one or more components are then combined to form corrective measure alternatives (discussed in **Section 5.0**) intended to address the observed groundwater impacts. Potential corrective measures were identified based on site information available during development of the ACM for the purpose of meeting the goals described in **Section 4.0**.

Each component and associated corrective measures are further identified in subsequent paragraphs. The corrective measures are evaluated for feasibility and combined to create the corrective action alternatives identified in this section, and further evaluated in **Section 5.0**. We continue to evaluate site conditions and may identify additional corrective measures based on new information regarding the nature and extent of the impacts.

4.1.1 Source Control

The source control component of a corrective measure is intended to identify and locate the source of impacts and provide a mechanism to prevent further releases from the source. For the OGS site, the sources to be controlled are the CCR materials in the OGS Ash Pond, OGS ZLD Pond, and the associated process water. Each of the source control measures described in this section requires closure of the impoundments, and for wastewater to be re-directed from the CCR unit to eliminate the flows that may mobilize constituents from the CCR and transport them to groundwater. IPL has ended all CCR waste placement and non-CCR wastewater discharges to the OGS Ash Pond and OGS ZLD Pond. Furthermore, CCR has been removed from the OGS ZLD Pond for closure pursuant to 40 CFR 257.102(c). The dates for these key events are provided below:

- September 2020 – End of bottom ash discharges to the OGS Ash Pond.
- October 2021 – Completion of CCR removal from the OGS ZLD Pond.
- May 2022 – End of non-CCR wastewater discharges to the OGS Ash Pond.

The date when CCR discharges to the OGS ZLD Pond ended coincides with the abandonment of the piped connection between the OGS Ash Pond and the OGS ZLD Pond. The exact date of this event is uncertain, but it precedes the 2015 effective date of the CCR Rule by many years. The sealing of these pipes is described in the September 2016 History of Construction Report issued by Hard Hat Services (HHS 2016).

Based on the activities completed by IPL to advance the closure of the CCR units at OGS and develop the new low-volume wastewater treatment pond and air heater wash basin, we have updated the potential source control measures:

- **Close and cap in place.** Close the OGS Ash Pond and OGS ZLD Pond and cap the CCR in place to significantly reduce the infiltration of rain water into the impoundment, prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and minimize the potential for CCR to interface with groundwater. Since CCR has been removed from the OGS ZLD Pond and IPL has constructed a new lined low-volume wastewater pond (not a CCR unit) in the same location, this source control approach is not feasible and will no longer be considered.

- **Consolidate and cap.** Consolidate CCR from the OGS Ash Pond and OGS ZLD Pond into one or two areas to reduce the cap area exposed to infiltration, reduce the potential source footprint, prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and reduce the potential for CCR to interface with groundwater.

- **Consolidate and cap with chemical stabilization.** Consolidate CCR into one or two areas to reduce the cap area exposed to infiltration, reduce the potential source footprint, prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and minimize the potential for CCR to interface with groundwater. Mix a chemical amendment into CCR in-situ prior to placing additional CCR for consolidation and mix the amendment into CCR as it is excavated and placed for consolidation to reduce the mobility of select CCR constituents in the environment. Chemical stabilization may include the use of one or multiple admixtures that serve to physically and/or chemically stabilize the constituents of concern within the CCR. Physically, this may include solidification with cementitious or polymeric materials. Chemically, this may include precipitation or alteration to render cobalt less mobile in the environment. Evaluation of an appropriate high organic carbon commodity amendment, that may include activated carbon, biochar, locally available aged mulch, and/or proprietary chemicals such as PlumeStop, will occur during the remedy selection process.

- **Excavate and create on-site disposal area.** Excavate and place CCR in a newly lined landfill area on site to prevent further releases from the OGS Ash Pond and OGS ZLD Pond, and isolate the CCR from potential groundwater interactions. Cap the new landfill with final cover to prevent the transport of CCR constituents from unsaturated CCR.

- **Excavate and dispose at a licensed off-site disposal area.** Remove all CCR from the OGS Ash Pond and OGS ZLD Pond, and haul it to a licensed landfill.

Water movement through the CCR materials is the mechanism for CCR impacts to groundwater, including surface water that moves vertically through the CCR materials via infiltration of precipitation and surface water runoff. Based on the available information for this site, all the source control measures have potential to prevent further releases caused by infiltration, and thus are retained for incorporation into alternatives for further evaluation.

In conjunction with the ongoing evaluation of MNA mechanisms and site attenuation capacity, chemical stabilization has been added as a source control alternative. Additional source control may be needed to address CCR that could be in contact with groundwater after closure is in place, or if further investigation indicates that MNA mechanisms are not sufficient for reaching the groundwater quality objectives at OGS or the site does not have the attenuation capacity to reduce groundwater concentrations of cobalt below the GPS.

4.1.2 Containment

The objective of containment is to limit the spread of the impacts beyond the source. The need for containment depends on the nature and extent of impacts, exposure pathways, and risks to receptors. Containment may also be implemented in combination with restoration as described in **Section 4.1.3**.

Containment may be a recommended element of a corrective measure if needed to:

- Prevent off-site migration of groundwater impacts.
- Cease completion of an exposure pathway (e.g., water supply well).

Containment may also be used in lieu of active restoration if an active approach is needed but treatment is not warranted by the aquifer characteristics including:

- Water in the affected aquifer is naturally unsuited for human consumption.
- Contaminants present in low concentration with low mobility.
- Low potential for exposure to contaminants and low risk associated with exposure.
- Low transmissivity and low future user demand.

The aquifer characteristics above are identified as favorable to plume containment in the U.S. EPA Solid Waste Disposal Facility Criteria Technical Manual (U.S. EPA, 1998).

The following measures have potential to limit the spread of continued or remaining groundwater impacts:

- **Gradient Control with Pumping.** Gradient control includes a measure to alter the groundwater velocity and direction to slow or isolate impacts. This can be accomplished with pumping wells and/or a trench/sump collection system. If groundwater pumping is considered for capturing an impacted groundwater plume, the impacted groundwater must be managed in conformance with all applicable Federal and State requirements.

- **Gradient Control with Phytotechnology**. Gradient control with phytotechnology relies on the ability of vegetation to evapotranspire sources of surface water and groundwater. Water interception capacity by the aboveground canopy and subsequent evapotranspiration through the root system can limit vertical migration of water from the surface downward. The horizontal migration of groundwater can be controlled or contained using deep-rooted species, such as prairie plants and trees, to intercept, take up, and transpire the water. Trees classified as phreatophytes are deep-rooted, high-transpiring, water-loving organisms that send their roots into regions of high moisture and can survive in conditions of temporary saturation.

- **Chemical Stabilization.** Stabilization refers to processes that involve chemical reactions that reduce the leachability of cobalt. Stabilization chemically immobilizes impacts or reduces their solubility through a chemical reaction. The desired results of stabilization methods include converting metals into a less soluble, mobile, or toxic form.

- **Containment Walls.** Containment walls can be applied in two ways. First, a wall that creates a physical barrier to the flow of groundwater to limit the movement of constituents of concern in groundwater. Second, a passive barrier is installed to intercept the flow of groundwater and constructed with a reactive media designed to adsorb, precipitate, or degrade groundwater constituents to limit their movement in the environment (FRTR 2020).

Based on the currently available information for this site, active MNA mechanisms including precipitation, coprecipitation, and adsorption of cobalt are observed. The assessment of the site's capacity to attenuate the cobalt impacts to groundwater is ongoing. Active containment may be needed if CCR is in contact with groundwater after closure is in place, or if further investigation indicates that MNA mechanisms are not sufficient for reaching the groundwater quality objectives at OGS or the site does not have the attenuation capacity to reduce groundwater concentrations of cobalt below the GPS.

4.1.3 Restoration

Restoration is the process through which groundwater quality is restored to meet GPSs. This can be accomplished by way of MNA or intensively addressed by groundwater treatment with or without extraction.

MNA can be a viable remedy or component of a remedial alternative for groundwater impacted with metals. MNA requires ongoing involvement and potentially intense characterization of the geochemical environment to understand the attenuation processes involved, and to justify reliance on them and regular, long-term monitoring to ensure the attenuation processes are meeting remedial goals.

MNA is not a "do-nothing" alternative; rather it is an effective knowledge-based remedy where a thorough engineering analysis provides the basis for understanding, monitoring, predicting, and documenting natural processes. To properly employ this remedy, there needs to be a strong scientific basis supported by appropriate research and site-specific monitoring implemented in accordance with quality controls. The compelling evidence needed to support proper evaluation of the remedy requires that the processes that lower metal concentrations in groundwater be well understood. MNA is considered viable with a demonstration of permanence such that sorption and/or precipitation of the constituents can be safely held in place on aquifer materials.

If active treatment is implemented, water may be treated in-situ, on-site, or off-site. The need for active treatment depends on the nature and extent of impacts, potential exposure pathways, and current and anticipated future risks to receptors. If there are no receptors or if the risks are acceptably low, then MNA is an appropriate option. If existing or future risks require a more rapid restoration of groundwater quality, then active restoration may be needed.

Treated groundwater may be re-injected, sent to a local publicly owned treatment works (POTW), or discharged to a local body of surface water, depending on local, state, and federal requirements. Typical on-site treatment practices for metals include coagulation and precipitation, ion exchange, or reverse osmosis. Off-site wastewater treatment may include sending the impacted groundwater that is extracted to a local POTW or to a facility designed to treat the contaminants of concern.

The removal rate of groundwater constituents such as cobalt will depend on the rate of groundwater extraction, the cation exchange capacity of the soil, and partition coefficients of the constituents adsorbed to the soil. As the concentration of metals in groundwater is reduced, the rate at which constituents become partitioned from the soil to the aqueous phase may also be reduced. The amount of flushing of the aquifer material required to remove the metals and reduce their concentration in groundwater below the GPS will generally determine the time frame required for restoration. This time frame is site-specific.

In-situ methods may be appropriate, particularly where pump and treat technologies may present adverse effects. In-situ methods may include the introduction of a chemical amendment to adsorb, precipitate, or degrade a contaminant or biological restoration requiring pH control, addition of specific micro-organisms, and/or addition of nutrients and substrate to augment and encourage degradation by indigenous microbial populations. Bioremediation requires laboratory treatability studies and pilot field studies to determine the feasibility and the reliability of full-scale treatment.

Based on current available information, active MNA mechanisms at OGS have been identified, but are still being refined along with the capacity of the site to attenuate the cobalt impacts to groundwater. Other restoration measures have been included in this addendum to increase the breadth of alternatives evaluated and available for consideration during the remedy selection process. These additional alternatives are discussed in Section 5.0.

5.0 CORRECTIVE MEASURE ALTERNATIVES

We have preliminarily identified the following corrective measure alternatives for the groundwater impacts at OGS:

- Alternative 1 – No Action
- Alternative 2 – Close and Cap in Place and MNA
- Alternative 3 – Consolidate On-Site and Cap with MNA
- Alternative 4 – Excavate and Dispose On-Site with MNA
- Alternative 5 – Excavate and Dispose Off-Site with MNA
- Alternative 6 – Consolidate and Cap with Chemical Amendment and Groundwater Collection
- Alternative 7 – Consolidate and Cap with Groundwater Collection
- Alternative 8 – Consolidate and Cap with Barrier Wall and Groundwater Collection

These alternatives were developed by selecting components from the reasonable and appropriate corrective measures components discussed above. With the exception of the No Action alternative, each of the corrective measure alternatives meet the requirements in 40 CFR 257.97(b)(1) through (5) based on the information available at the current time. We may identify additional alternatives or otherwise modify the alternatives based on the continued evaluation of site conditions.

5.1 ALTERNATIVE 1 – NO ACTION

IPL is committed to implementing corrective measures as required under the Rule, and the No-Action alternative is included as a baseline condition and a point of comparison for the other alternatives. The consideration of this alternative assumes the monitoring of groundwater continues under this action.

5.2 ALTERNATIVE 2 – CLOSE AND CAP IN PLACE WITH MONITORED NATURAL ATTENUATION

Alternative 2 includes closing the OGS Ash Pond (no further discharge) and OGS ZLD Pond, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). Based on work that has already been completed, including excavation of the OGS ZLD Pond to make room for the new low-volume wastewater pond, and excavation within the OGS Ash Pond to make room for the new air heater wash basin, this alternative is no longer viable and will not be considered further.

5.3 ALTERNATIVE 3 – CONSOLIDATE ON-SITE AND CAP WITH MONITORED NATURAL ATTENUATION

Alternative 3 includes closing the OGS Ash Pond and OGS ZLD Pond, relocating and consolidating CCR currently located within the OGS Ash Pond into a smaller footprint within the OGS Ash Pond, covering the CCR materials with a cap, establishing vegetation, and meeting all requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in **Section 4.1.1**. The consolidated and capped areas will be subject to enhanced groundwater monitoring via MNA.

This alternative relies on the elimination of CCR sluicing/plant process water discharges, which have already occurred, and consolidation of the CCR footprint and the installation of a cap will reduce infiltration through the CCR. This is expected to address a significant contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces or eliminates the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.4 ALTERNATIVE 4 – EXCAVATE AND DISPOSE ON-SITE WITH MONITORED NATURAL ATTENUATION

Alternative 4 includes closing the OGS Ash Pond, excavation of CCR from the OGS Ash Pond, including the CCR consolidated from the OGS ZLD Pond, and creation of a new on-site disposal area with a liner and cap system. This alternative will serve to entomb the CCR from the OGS Ash Pond and OGS ZLD Pond and allow for the collection and management of liquids generated from the disposal area which would be considered a new CCR landfill. Further releases from the CCR at OGS will be prevented by the use of engineering controls constructed/installed to meet the design criteria for new CCR landfills required under 40 CFR 257.70. The new CCR landfill would be required to meet the Location Restrictions described in 40 CFR 257.60-64.

This alternative relies on the elimination of CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a new on-site disposal area liner and cap, will reduce infiltration through the CCR. This is expected to address a significant contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.5 ALTERNATIVE 5 – EXCAVATE AND DISPOSE OFF-SITE WITH MONITORED NATURAL ATTENUATION

Alternative 5 includes closing the OGS Ash Pond, excavation of all CCR from the OGS Ash Pond, including the CCR consolidated from the OGS ZLD Pond, and transport to an approved off-site landfill. Further on-site releases from the CCR at OGS will be prevented by removing the source material from the site, which eliminates the potential for ongoing leaching of constituents into groundwater at OGS.

This alternative relies on the elimination of CCR sluicing/plant process water discharges and, with the removal of CCR from the site, will eliminate infiltration through the CCR. This is expected to address a potential major contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.6 ALTERNATIVE 6 – CONSOLIDATE AND CAP WITH CHEMICAL AMENDMENT AND GROUNDWATER COLLECTION

Alternative 6 includes closing the OGS Ash Pond, adding a chemical amendment to in-place CCR, and relocated CCR, to reduce the mobilization of cobalt prior to relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, establishing vegetation, and meeting all requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR and the reduced contaminant mobilization achieved by chemical amendment as described in Section 4.1.1. Impacted groundwater will be collected using pumps and treated prior to discharge according to state and federal requirements as described in Section 4.1.2.

This alternative relies on the elimination of CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address a significant contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces or eliminates the volume of potential source materials that could come into contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced by fixation using a chemical amendment. Cobalt-impacted groundwater will be collected to restore cobalt concentrations in groundwater to levels below the GPS.

5.7 ALTERNATIVE 7 – CONSOLIDATE AND CAP WITH GROUNDWATER COLLECTION

Alternative 7 includes consolidating and covering the CCR materials currently located within the OGS Ash Pond with a cap, establishing vegetation, and meeting all requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in Section 4.1.1. Impacted groundwater will be collected using pumps and treated prior to discharge according to state and federal requirements as described in Section 4.1.2.

This alternative relies on the elimination of CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the

CCR. This is expected to address a significant contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces or eliminates the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated over time as impacted groundwater is collected to contain and restore cobalt concentrations in groundwater to levels below the GPS.

5.8 ALTERNATIVE 8 – CONSOLIDATE AND CAP WITH BARRIER WALL AND GROUNDWATER COLLECTION

Alternative 8 includes consolidating and covering the CCR materials with a cap, establishing vegetation, and meeting all requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in **Section 4.1.1**. Impacted groundwater will be intercepted with a barrier wall to minimize the migration of cobalt as described in **Section 4.1.2**. Impacted groundwater beyond the barrier wall will be collected using pumps and treated prior to discharge according to state and federal requirements as described in **Section 4.1.2**.

This alternative relies on the elimination of CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address a significant contributor to groundwater impacts from surface impoundments, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces or eliminates the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated as impacted groundwater is intercepted with a barrier wall to minimize the spread of cobalt in groundwater and/or groundwater is prevented from interacting with the disposal area. Cobalt-impacted groundwater will be collected to restore cobalt concentrations in groundwater to levels below the GPS.

6.0 EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

As required by 40 CFR 257.96(c), the following sections provide an evaluation of the effectiveness of corrective measure alternatives in meeting the requirements and objectives outlined in 40 CFR 257.97. The evaluation addresses the requirements and objectives identified in 40 CFR 257.96(c)(1) through (3), which include:

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to residual contamination;
- The time required to begin and complete the remedy; and
- 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.

In addition to the discussion of the items listed above, **Table 6** provides a summary of the initial evaluation of the alternatives including each of the criteria listed in 40 CFR 257.97. This evaluation will be updated as part of the remedy selection process as additional site information is obtained and further evaluation of remedial alternatives such as MNA is completed.

6.1 ALTERNATIVE 1 – NO ACTION

As described in **Section 5.1**, the No Action alternative is only included as a baseline condition and a point of comparison for the other alternatives. This alternative does not satisfy all five criteria in 40 CFR 257.97(b)(1) through (5), so it is not an acceptable corrective measure under the CCR Rule. For comparison only, Alternative 1 is evaluated with regard to the criteria in 40 CFR 257.96(c) below:

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – The ability to attain the GPS for cobalt without any additional action is unlikely.
  - Reliability – Alternative 1 does not provide any reduction in existing risk.
  - Implementation – Nothing is required to implement Alternative 1.
  - Impacts – No additional safety or cross-media impacts are expected with Alternative 1. This alternative does not control current suspected routes of exposure to residual contamination.
- **Timing.** No time is required to begin. However, the time required to attain the GPS for cobalt under Alternative 1 is unknown.
- **Institutional Requirements.** No institutional requirements beyond maintaining current regulatory approvals exist for Alternative 1.

6.2 ALTERNATIVE 2 – CLOSE AND CAP IN PLACE WITH MONITORED NATURAL ATTENUATION

As described in **Section 5.2**, Alternative 2 is no longer viable as the OGS ZLD Pond has been fully excavated and portions of the OGS Ash Pond have been excavated to make room for additional infrastructure to meet the future needs of OGS. It will not be considered further.

6.3 ALTERNATIVE 3 – CONSOLIDATE ON-SITE AND CAP WITH MONITORED NATURAL ATTENUATION

As described in **Section 5.3**, Alternative 3 includes relocating and consolidating CCR into a smaller footprint within the OGS Ash Pond, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d).

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is believed to be a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint will reduce or eliminate CCR contact with groundwater and reduce the area exposed to limited post-construction infiltration through the cap. The smaller closure footprint also reduces or eliminates the potential for ongoing CCR contact with groundwater. MNA

monitoring will identify, if active, the natural attenuation processes that reduce mass, toxicity, mobility, volume, or concentrations of the constituents of concern in groundwater. As discussed in **Section 3.2.4**, based on the investigations completed prior to ACM Addendum No. 1, evidence of cobalt attenuation by precipitation, coprecipitation, and adsorption was observed making MNA a viable alternative for site remediation. Alternative 3 is capable of and expected to attain the GPS for cobalt.

- Reliability – The expected reliability of capping is good. The final cover system will meet the performance standards in 40 CFR 257.102(d)(3), and those standards are intended to minimize or eliminate post-closure infiltration. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. In addition, as discussed in **Section 3.2.4**, desorption trials indicated that approximately 96 percent of the cobalt remained adsorbed to the aquifer media, supporting MNA as a viable remedial alternative for cobalt.

- Implementation – The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. Alternative 3 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 3 are not specialized and are generally readily available.

- Impacts – Safety impacts associated with the implementation of Alternative 3 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on-site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR. Although the risk to surface water receptors is already low and ending wastewater discharges and capping the impoundment minimizes infiltration (a potentially significant source of water and CCR interaction), the consolidation of CCR prior to capping under Alternative 3 reduces or eliminates the potential for CCR and groundwater interaction after closure. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. An insufficient MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Installation of a cap over the CCR located within can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 3 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 3:
  – IDNR Closure Permit.
  – State and local erosion control/construction storm water management permits.

6.4 ALTERNATIVE 4 – EXCAVATE AND DISPOSE ON-SITE WITH MONITORED NATURAL ATTENUATION

As described in **Section 5.4**, Alternative 4 includes, excavation of CCR from the source area, creation of a new on-site disposal area that meets the design criteria for new CCR landfills required under 40 CFR 257.70, and subsequent closure of the new disposal area.

- **Performance, Reliability, Implementation, and Impacts.**
  – Performance – Ceasing wastewater discharges and closing the OGS Ash Pond and OGS ZLD Pond by removing and re-disposing CCR in a new lined/capped disposal area is expected to address infiltration, which is believed to be a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint will reduce or eliminate CCR contact with groundwater and reduce the area exposed to limited post-construction infiltration through the cap. The separation from groundwater and other location criteria for the new on-site disposal facility may enhance the performance of this alternative if location criteria can be met on site. MNA monitoring to date has identified evidence of cobalt attenuation by precipitation, coprecipitation, and adsorption making MNA a viable alternative. Alternative 4 is capable of and expected to attain the GPS for cobalt.

  – Reliability – The expected reliability of on-site re-disposal with a composite liner and cap is good. Disposal facilities that meet the requirements in 40 CFR 257.70 or other similar requirements have been used for solid waste disposal including municipal and industrial waste for numerous years. There is significant industry experience with the design and construction of similar disposal facilities. The composite liner and cover, combined with a consolidated disposal footprint, may enhance reliability by reducing infiltration and the scale of post-closure maintenance. At the same time, post-closure maintenance is likely more complex due to maintenance of a leachate collection system and geosynthetic repairs requiring specialized personnel, material, and equipment. In addition, desorption trials have shown that MNA can be a reliable alternative for cobalt remediation.

  – Implementation – The complexity of constructing the new liner and cap is moderate due to the composite design. The limited area available at the facility for developing an on-site disposal facility makes this alternative logistically complex. Significant volumes of CCR will be excavated and stored on site while the disposal facility is constructed. Significant dewatering will be required to excavate and relocate CCR to a temporary storage area. Conditioning (e.g., drying) of relocated CCR is expected to facilitate temporary storage and on-site re-disposal. Alternative 4 can likely be achieved through standard dewatering and conditioning methods, but may be impacted by the space available for these activities. Although the post-closure CCR footprint will be minimized, composite liner and cap construction may put a high demand on the local supply of suitable cap materials. The local availability of liner and cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 4 are not specialized and are generally readily available, with the exception of the resources needed to install the geosynthetic portions of the composite liner and cover, which are not locally available.

- Impacts – Safety impacts associated with the implementation of Alternative 4 are not significantly different than other heavy civil construction projects. However, the level of disturbance required to excavate, store, and re-dispose CCR on site and the traffic required to import composite liner and cap material are not typical and likely represent an increase in safety risk due to site conditions, on-site construction traffic, and incoming/outgoing off-site construction traffic. A risk of cross-media impacts is possible due to the large volume of CCR to be excavated, stored, and relocated on site. Although the risk to surface water receptors is already low, Alternative 4 reduces the potential interaction between CCR and water after closure. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. An insufficient MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Installation of a cap over the CCR located within the OGS Ash Pond can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. However, the time required to permit and develop the on-site disposal facility may extend this schedule. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a new on-site disposal facility with a composite liner and cap may decrease the time to reach GPS. Alternative 4 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 4:
  - IDNR Closure Permit.
  - IDNR Disposal Facility (Landfill) Permit.
  - State and local erosion control/construction storm water management permits.

6.5 ALTERNATIVE 5 – EXCAVATE AND DISPOSE OFF SITE WITH MONITORED NATURAL ATTENUATION

As described in **Section 5.5**, Alternative 5 includes excavation of CCR from the source area and transporting the CCR off-site for disposal.

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – Ceasing wastewater discharges and closing the OGS Ash Pond and OGS ZLD Pond by removing and re-disposing CCR off-site will eliminate a potential source material that is exposed to infiltration, which is believed to be a key contributor to groundwater impacts. The off-site disposal of CCR prevents further releases at OGS, but introduces the possibility of releases at the receiving facility. MNA monitoring to date has identified evidence of cobalt attenuation by precipitation, coprecipitation, and adsorption was observed making MNA a viable alternative. Alternative 5 is capable of and expected to attain the GPS for cobalt.

  - Reliability – The expected reliability of excavation and off-site disposal is good. Off-site disposal facilities are required to meet the requirements in 40 CFR 257.70 or other similar requirements, which have been used for solid waste disposal including municipal and industrial waste for numerous years. There is significant industry experience with the design and construction of these disposal facilities. In addition, desorption trials have shown that MNA can be a reliable alternative for cobalt remediation.

  - Implementation – The complexity of excavating CCR for off-site disposal is low. The scale of CCR excavation (expected to exceed 450,000 cy), off-site transportation, and the permitting/development of off-site disposal facility airspace makes this alternative logistically complex. Significant dewatering will be required to excavate CCR. Conditioning (e.g., drying) of excavated CCR is expected to facilitate off-site transportation and re-disposal. Alternative 5 can likely be achieved through standard dewatering and conditioning methods, but may be impacted by the space available for these activities. Although the source area at OGS is eliminated, the development of off-site disposal airspace will put a high demand on the receiving disposal facility, which may not have the current physical or logistical capacity to receive large volumes of CCR in a short period of time. The equipment and personnel required to implement on-site and off-site aspects of Alternative 5 are not specialized and are generally readily available, with the exception of the resources needed to install the geosynthetic portions of the off-site composite liner and cover, which are not locally available.

  - Impacts – Safety impacts associated with the implementation of Alternative 5 are not significantly different than other heavy civil construction projects. However, the level of disturbance required to excavate, transport, and re-dispose CCR and the traffic required to import composite liner and cap material at the receiving disposal facility are not typical and likely represent an increase in safety risk due to large volumes of incoming/outgoing off-site construction traffic at both sites. A risk of cross-media impacts is possible due to the large volume of CCR to be excavated and transported from the site. Although the risk to surface water receptors is already low, Alternative 5 nearly eliminates the potential interaction between CCR and water after closure at OGS. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. An insufficient MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination on-site is very low since CCR will be removed; however, the off-site potential for exposure to CCR is increased due to the relocation of the source material.

- **Timing.** Installation of a cap over the CCR located within the OGS Ash Pond can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. However, the time required to secure the off-site disposal airspace required to complete this alternative, including potential procurement, permitting, and construction, may extend this schedule significantly. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The removal of CCR from OGS may decrease the time to reach GPS. Alternative 5 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 5:

  - IDNR Closure Permit.
  - Depending on the off-site disposal facility, approval of off-site disposal facility owner or landfill permit for new off-site facility.
  - State and local erosion control/construction storm water management permits.
  - Transportation agreements and permits (local roads and railroads).

  Depending on the off-site disposal facility, state solid waste comprehensive planning approvals may also be required.

6.6 ALTERNATIVE 6 – CONSOLIDATE AND CAP WITH CHEMICAL AMENDMENT AND GROUNDWATER COLLECTION

As described in **Section 5.6**, Alternative 6 includes, relocating and consolidating CCR into a smaller footprint within the OGS Ash Pond, adding a chemical amendment to the CCR to reduce the mobilization of cobalt prior to relocating, covering the CCR materials with a cap, establishing vegetation, meeting all requirements for closure in place in 40 CFR 257.102(d), and installing a groundwater pump and treat system to prevent the migration of and/or recover groundwater with cobalt concentrations greater than the GPS.

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – Ceasing wastewater discharges and closing the impoundment by capping is expected to address infiltration, which is believed to be a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint will reduce or eliminate CCR contact with groundwater and reduce the area exposed to limited post-construction infiltration through the cap. The application of a chemical amendment to the CCR that will remain on-site may further reduce the potential for ongoing groundwater impacts after closure. Although the risk to surface water

receptors is already low, the potential for CCR to interact with groundwater will remain after closure. Alternative 6 further reduces the potential for ongoing groundwater impacts from that interaction between CCR and water. If needed to address changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water, the initial application of a chemical amendment during closure can be supplemented with additional applications in the future outside of capped area. The groundwater pump and treat system may further reduce the potential for down-gradient migration of groundwater impacts after closure. Alternative 6 further reduces the risk of potential ongoing groundwater impacts from that interaction between CCR and water. The groundwater pump and treat system offers additional flexibility to address changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water. Alternative 6 is capable of and expected to attain the GPS for cobalt.

– Reliability – The expected reliability of capping is good. The final cover system will meet the performance standards in 40 CFR 257.102(d)(3), and those standards are intended to minimize or eliminate post-closure infiltration. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. Based on a review of information in the Federal Remediation Technologies Roundtable (FRTR) Technology Screening Matrix, amending source material using site-specific chemistries can be an effective means of sequestering metals to limit the future release to groundwater from residual source material. The technology can be applied to source material and groundwater plumes. The approach has been used at full scale to remediate inorganics (FRTR 2020). Similar to capping, groundwater pump and treat is a common method used to limit the migration of impacted groundwater or remove impacted groundwater to restore groundwater concentrations to levels below the GPS. If shown to be effective at OGS, groundwater pump and treat may be a reliable solution. However, the reliability of a groundwater pump and treat system requires proper maintenance, if groundwater pumping and treatment is required for long periods of time, maintenance must be considered in the alternative selection.

– Implementation – The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative compared to closure without consolidation. CCR dewatering will be required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. So long as an appropriate amendment chemistry can be identified for OGS, the technology and equipment used for the in-situ application or mixing as part of excavation/consolidation activities are commercially available. The complexity of the groundwater pump and treat system is also low. Alternative 6 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement the consolidation and capping portion of Alternative 6 are not specialized and are generally readily available. However, the equipment for the in-situ chemical amendment application is more specialized and may be in high demand.

- Impacts – Safety impacts associated with the implementation of Alternative 6 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the use of and application of amendment chemistry, but can likely be addressed with additional worker protective measures. Some elevated risk may exist due to the additional construction involved with the groundwater pump and treat system and the higher complexity of the long-term maintenance required. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on-site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of offsite transportation of CCR. Although the risk to surface water receptors is already low based on available data, the additional source control and active groundwater collection provided by Alternative 6 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contamination is low since the CCR will be chemically stabilized, capped, and the footprint of the cap minimized.

- **Timing.** Installation of a cap over the CCR located within the OGS Ash Pond can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 6 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 6:
  - IDNR Closure Permit.
  - Federal, state, and local floodplain permits.
  - Injection permits.
  - NPDES permitting for post-treatment groundwater discharges.
  - State and local erosion control/construction stormwater management permits.
  - Federal and state wetland permitting may also be required.

6.7 ALTERNATIVE 7 – CONSOLIDATE AND CAP WITH GROUNDWATER COLLECTION

As described in **Section 5.7**, Alternative 7 includes relocating and consolidating CCR into a smaller footprint within the OGS Ash Pond, covering the CCR materials with a cap, establishing vegetation, meeting all requirements for closure in place in 40 CFR 257.102(d), and installing a groundwater pump and treat system to prevent the migration of and/or recover groundwater with cobalt concentrations greater than the GPS.

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – Ceasing wastewater discharges and closing the impoundment by capping is expected to address infiltration, which is believed to be a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint will reduce

or eliminate CCR contact with groundwater and reduce the area exposed to limited post-construction infiltration through the cap. The groundwater pump and treat system may further reduce the potential for down-gradient migration of groundwater impacts after closure. The groundwater pump and treat system offers additional flexibility to address changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water. Alternative 7 is capable of and expected to attain the GPS for cobalt.

- Reliability – The expected reliability of capping is good. The final cover system will meet the performance standards in 40 CFR 257.102(d)(3), and those standards are intended to minimize or eliminate post-closure infiltration. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. Similar to capping, groundwater pump and treat is a common method used to limit the migration of impacted groundwater or remove impacted groundwater to restore groundwater concentrations to levels below the GPS. If shown to be effective at OGS, groundwater pump and treat may be a reliable solution. However, the reliability of a groundwater pump and treat system requires proper maintenance, if groundwater pumping and treatment is required for long periods of time, maintenance must be considered in the alternative selection.

- Implementation – The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. The complexity of the groundwater pump and treat system is also low. Alternative 7 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 7 are not specialized and are generally readily available. The permitting, development, operation, maintenance, and monitoring of adequate treatment for large volumes of groundwater with relatively low concentrations of cobalt likely increases the complexity of implementing this alternative.

- Impacts – Safety impacts associated with the implementation of Alternative 7 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the additional construction involved with the groundwater pump and treat system and the higher complexity of the long-term maintenance required. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on-site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of offsite transportation of CCR. Although the risk to surface water receptors is already low based on available data, the active nature of the groundwater plume containment provided by Alternative 7 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contaminated source material is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Installation of a cap over the CCR located within the OGS Ash Pond can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The additional time required to design and install the groundwater pump and treat system is unlikely to have a significant impact on the implementation timing but may reduce the time required to attain the GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 7 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 7:
  - IDNR Closure Permit.
  - Federal, state, and local floodplain permits.
  - State and local well installation permits.
  - NPDES permitting for post-treatment groundwater discharges.
  - State and local erosion control/construction stormwater management permits.
  - Federal and state wetland permitting may also be required.

6.8 ALTERNATIVE 8 – CONSOLIDATE AND CAP WITH BARRIER WALL WITH GROUNDWATER COLLECTION

As described in **Section 5.8**, Alternative 8 includes relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, establishing vegetation, meeting all requirements for closure in place in 40 CFR 257.102(d), installing a barrier wall to prevent the migration of groundwater with cobalt concentrations greater than the GPS, and installing a groundwater pump and treat system to prevent the migration of and/or recover groundwater with cobalt concentrations greater than the GPS.

- **Performance, Reliability, Implementation, and Impacts.**
  - Performance – Ceasing wastewater discharges and closing the impoundment by capping is expected to address infiltration, which is believed to be a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint will reduce or eliminate CCR contact with groundwater and reduce the area exposed to limited post-construction infiltration through the cap. The barrier wall may further reduce the potential for groundwater impacts after closure. Although it acts passively, the barrier wall reduces the risk from a more passive groundwater restoration approach such as MNA if MNA mechanisms are not active, the site has insufficient site attenuation capacity, or groundwater conditions change in a way that increases the potential for cross-media impacts between groundwater and surface water. The groundwater pump and treat system may further reduce the potential for down-gradient migration of groundwater impacts after closure. Alternative 6 further reduces the risk of potential ongoing groundwater impacts from that interaction between CCR and water. The groundwater pump and treat system offers additional flexibility to address

changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water. Alternative 8 is capable of and expected to attain the GPS for cobalt.

- Reliability – The expected reliability of capping is good. The final cover system will meet the performance standards in 40 CFR 257.102(d)(3), and those standards are intended to minimize or eliminate post-closure infiltration. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. A barrier wall at OGS will likely have to consist of a permeable reactive barrier (PRB) due to the lack of an impermeable layer to key a low permeability barrier wall into. In general, the reliability of PRBs for containment of inorganics is favorable based on information available in the FRTR Technology Screening Matrix (FRTR 2020). The reliability of a PRB requires the identification of a suitable reactive media for the conditions at OGS and the ability to effectively locate the barrier, which are both likely but require additional evaluations. PRB performance can diminish over time as consumptive media is exhausted or hydraulic conditions change due to chemical precipitation or biofouling. Long-term monitoring and maintenance is required to ensure continued performance. Similar to capping, groundwater pump and treat is a common method used to limit the migration of impacted groundwater or remove impacted groundwater to restore groundwater concentrations to levels below the GPS. If shown to be effective at OGS, groundwater pump and treat may be a reliable solution. However, the reliability of a groundwater pump and treat system requires proper maintenance, if groundwater pumping and treatment is required for long periods of time, maintenance must be considered in the alternative selection.

- Implementation – The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. The complexity of the PRB wall significantly increases the level of complexity for implementing this alternative. PRB installation contractors and equipment have lengthy procurement timelines. The complexity of the groundwater pump and treat system is also low. Alternative 8 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The equipment and personnel required to implement the consolidation and capping portion of Alternative 8 are not specialized and are generally readily available. However, the equipment for the barrier wall is more specialized and may be in high demand.

- Impacts – Safety impacts associated with the implementation of Alternative 8 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the additional construction involved with the barrier wall construction and the higher complexity of the long-term barrier wall performance monitoring. Some elevated risk may exist due to the additional construction involved with the groundwater pump and treat system and the higher complexity of the long-term maintenance required. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on-site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of offsite transportation of CCR. Although the risk to surface water receptors is already low based on available data, the enhanced nature of the passive groundwater plume containment and active groundwater collection provided by Alternative 8 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contaminated source material is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Installation of a cap over the CCR located within the OGS Ash Pond can be completed within 1 to 2 years of remedy selection. At OGS, the consolidation and installation of a cap is currently expected to be complete by the end of 2022. The time required to attain the GPS for cobalt will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The additional time required to design and install the barrier wall is unlikely to have a significant impact on the implementation timing but may reduce the time required to attain the GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 8 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 8:
  - IDNR Closure Permit.
  - Federal, state, and local floodplain permits.
  - State and local well installation permits.
  - NPDES permitting for post-treatment groundwater discharges.
  - State and local erosion control/construction stormwater management permits.
  - Federal and state wetland permitting may also be required.

7.0 SUMMARY OF ASSESSMENT

An initial qualitative assessment of the advantages and disadvantages of each Corrective Measure Alternative presented in **Section 4.0** is provided in **Table 6**. Each of the identified Corrective Measure Alternatives exhibits both favorable and unfavorable outcomes with respect to the assessment criteria. In accordance with 40 CFR 257.97(c), the facility must consider all of the evaluation factors and select a remedy that meets the standards of 257.97(b) as soon as feasible.

We continue to advance additional data collection efforts to identify the appropriate corrective action measure for the Site. We will continue to update **Table 6** and develop a quantitative scoring matrix to identify a preferred corrective action.

8.0 REFERENCES

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Tables

Table 1. Groundwater Elevations - CCR Rule Monitoring Well Networks
IPL - Ottumwa Generating Station / SCS Engineers Project #25222072.00

Depth to Water in feet below top of well casing/reference elevation																						
Raw Data	**MW-301**	**MW-302**	**MW-302WT**	**MW-303**	**MW-304**	**MW-304WT**	**MW-305**	**MW-305A**	**MW-306**	**MW-306WT**	**MW-307**	**MW-308**	**MW-309**	**MW-310**	**MW-310A**	**MW-311**	**MW-311A**	**MW-312**	**MW-313**	**MW-314**	**MW-314WT**	**River at Intake**
Measurement Date																						
April 26, 2016	3.83	18.27	NI	8.65	27.47	NI	22.24	NI	12.61	NI				NI	NI	NI	NI	NI	NI	NI	NI	NI
June 23, 2016	4.05	18.25	NI	8.18	26.31	NI	21.55	NI	12.83	NI				NI	NI	NI	NI	NI	NI	NI	NI	NI
August 9, 2016	4.36	18.38	NI	9.31	29.05	NI	23.13	NI	13.12	NI				NI	NI	NI	NI	NI	NI	NI	NI	NI
October 26-27, 2016	4.59	18.23	NI	8.90	27.81	NI	22.54	NI	13.26	NI				NI	NI	NI	NI	NI	NI	NI	NI	NI
January 18-19, 2017	4.96	18.44	NI	9.33	28.34	NI	23.04	NI	13.58	NI	8.75	7.97	8.28	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 19-20, 2017	4.48	17.55	NI	6.50	25.36	NI	20.64	NI	12.78	NI	3.94	4.30	4.78	NI	NI	NI	NI	NI	NI	NI	NI	NI
June 20-21, 2017	4.72	18.25	NI	8.65	28.09	NI	22.65	NI	13.53	NI	7.71	7.13	7.34	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 21-23, 2017	5.35	18.77	NI	10.49	30.45	NI	24.91	NI	14.70	NI	11.78	12.27	13.12	NI	NI	NI	NI	NI	NI	NI	NI	NI
November 8, 2017	5.09	18.50	NI	9.73	29.81	NI	24.15	NI	14.43	NI	10.19	10.40	10.74	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 18, 2018	5.10	18.19	NI	8.60	27.29	NI	22.92	NI	14.55	NI	7.90	7.48	7.29	NI	NI	NI	NI	NI	NI	NI	NI	NI
May 30, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	5.11	4.34	3.96	NI	NI	NI	NI	NI	NI	NI	NI	NI
June 28, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	4.69	3.96	3.47	NI	NI	NI	NI	NI	NI	NI	NI	NI
July 18, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	5.29	4.72	4.25	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 14-15, 2018	5.72	17.85	NI	8.50	26.49	NI	22.35	NI	14.81	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 29, 2018	5.54	18.01	NI	6.00	25.02	NI	NM	NI	NM	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
October 16, 2018	4.13	16.99	NI	4.90	24.64	NI	20.54	NI	13.23	NI	3.43	NM	3.33	NI	NI	NI	NI	NI	NI	NI	NI	NI
January 8, 2019	4.41	17.87	NI	6.42	26.56	NI	21.78	NI	13.63	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 8, 2019	3.94	16.67	NI	5.52	23.51	NI	19.90	NI	12.51	NI	2.66	1.69	1.39	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 28, 2019	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	NM	NM	NM	17.65	NI	12.08	NI	NI	NI	NI	NI	NI
October 23-24, 2019	3.56	13.76	NI	7.21	25.13	NI	20.70	NI	12.19	NI	5.67	4.08	3.66	9.32	NI	6.38	NI	NI	NI	NI	NI	NI
December 11, 2019	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	7.97	8.00	7.70	NM	NI	NM	NI	NI	NI	NI	NI	NI
February 5, 2020	3.33	NM	NI	NM	NM	NI	NM	NI	NM	NI	7.68	5.27	6.60	13.92	NI	9.18	NI	NI	NI	NI	NI	NI
March 12-13, 2020	3.81	NM	NI	NM	NM	NI	22.50	32.39	NM	NI	NM	NM	NM	13.18	40.09	10.00	29.43	NI	NI	NI	NI	NI
April 1, 2020	3.36	16.9	NI	5.18	24.27	NI	23.32	28.98	12.34	NI	3.8	3.51	3.71	7.54	8.77	4.83	5.27	NI	NI	NI	NI	6.6
April 13-14, 2020	3.38	17.45	NI	6.99	26.42	NI	21.47	30.34	12.76	NI	6.90	5.30	5.75	12.72	10.43	7.39	5.12	NI	NI	NI	NI	10.6
May 4, 2020	NM	NM	NI	NM	NM	NI	NM	NM	NM	NI	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NM
June 30, 2020	NM	NM	NI	NM	NM	NI	NM	NM	NM	NI	NM	NM	NM	NM	NM	NM	5.81	NI	NI	NI	NI	NM
October 5-12, 2020	4.29	18.10	NI	10.70	29.89	NI	24.10	36.02	13.29	NI	11.38	12.54	13.44	20.17	17.73	15.45	12.45	NI	NI	NI	NI	18.15
February 23, 2021	NM	NM	NI	NM	NM	NI	NM	NM	13.61	NI	10.76	NM	NM	19.86	NM	NM	12.38	NI	NI	NI	NI	NM
April 12 - 16, 2021	3.69	17.85	NI	7.25	28.50	NI	22.76	32.87	13.20	NI	8.03	7.73	8.48	15.93	13.05	11.16	9.38	NI	NI	NI	NI	15.40
July 6, 2021	NM	NM	NI	NM	NM	NI	NM	NM	21.60	NI	10.53	NM	NM	19.31	NM	NM	11.16	NI	NI	NI	NI	NM
October 6-8, 2021	4.68	19.04	NI	11.27	33.31	NI	29.08	38.46	21.20	NI	13.07	13.58	14.23	20.44	18.36	Dry	12.96	NI	NI	NI	NI	NM
January 11-12, 2022	5.05	NM	NI	NM	NM	NI	27.36	NM	NM	NI	11.32	NM	NM	NM	NM	NM	NM	13.19	14.62	NI	NI	NM
January 31, 2022	5.07	19.34	NI	11.00	32.33	NI	27.24	37.02	19.33	NI	11.51	11.95	12.52	18.94	17.30	14.71	11.75	13.69	15.45	NI	NI	13.35
February 14-15, 2022	5.20	19.48	NI	11.04	32.42	NI	27.56	37.19	19.81	NI	11.74	12.14	12.62	18.99	17.25	below pum	12.04	13.50	15.26	NI	NI	14.30
April 11-14, 2022	4.55	19.13	NI	8.12	30.70	NI	26.29	34.79	18.86	NI	9.16	9.64	10.62	17.84	17.10	12.74	10.31	10.74	13.78	NI	NI	13.10
May 3, 2022	4.36	19.39	DRY	8.93	29.33	36.82	26.21	33.99	19.87	DRY	8.42	7.98	7.87	13.80	12.69	11.20	9.60	8.02	10.01	17.30	17.03	9.15
May 5, 2022	4.56	19.12	18.50	8.59	28.38	36.40	25.84	33.56	19.70	DRY	7.70	7.23	6.48	10.52	11.42	10.16	9.41	6.59	7.60	17.14	17.11	NM
May 10, 2022	NM	19.20	18.82	NM	28.75	35.35	NM	NM	19.76	DRY	NM	NM	NM	NM	NM	NM	NM	NM	NM	17.70	17.56	NM
May 17, 2022	4.88	19.34	18.84	8.60	29.24	34.04	26.13	33.26	20.02	DRY	7.86	7.33	7.49	13.96	7.86	9.96	8.41	7.79	9.76	17.64	17.42	NM
May 20, 2022	NM	19.27	18.87	NM	29.34	33.52	NM	NM	19.98	DRY	NM	NM	NM	NM	NM	NM	NM	NM	NM	17.27	17.15	NM
May 23, 2022	NM	NM	NM	NM	30.18	33.80	NM	NM	NM	DRY	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
June 2, 2022	4.94	19.68	18.85	9.54	30.47	31.82	27.73	34.50	22.05	DRY	9.23	8.71	8.56	14.02	12.70	10.82	8.61	8.93	10.36	18.56	18.40	NM
June 9, 2022	4.83	19.66	18.83	9.63	28.66	31.31	27.57	34.23	22.22	DRY	8.66	8.34	7.62	10.40	11.73	10.04	8.93	7.58	7.19	18.89	18.70	NM
June 10, 2022	NM	NM	NM	NM	29.87	31.23	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
June 21, 2022	5.03	19.61	18.84	9.72	29.95	30.72	27.66	33.51	22.60	DRY	8.02	6.92	6.60	12.34	10.30	9.30	7.94	7.49	8.67	19.10	18.93	NM
June 27, 2022	5.03	19.84	18.85	9.93	30.68	30.65	27.76	34.33	22.06	DRY	8.95	8.26	8.60	14.76	13.08	10.54	8.17	8.94	11.04	19.55	19.34	NM
July 5, 2022	5.16	19.98	18.85	10.37	31.81	30.47	28.58	35.52	22.61	DRY	10.22	9.98	10.80	17.05	15.02	10.02	9.24	10.86	13.40	19.57	19.37	NM

Table 1. Groundwater Elevations - CCR Rule Monitoring Well Networks
IPL - Ottumwa Generating Station / SCS Engineers Project #25222072.00

	Ground Water or Surface Water Elevation in feet above mean sea level (amsl)																					
Well Number	**MW-301**	**MW-302**	**MW-302WT**	**MW-303**	**MW-304**	**MW-304WT**	**MW-305**	**MW-305A**	**MW-306**	**MW-306WT**	**MW-307**	**MW-308**	**MW-309**	**MW-310**	**MW-310A**	**MW-311**	**MW-311A**	**MW-312**	**MW-313**	**MW-314**	**MW-314WT**	**River at Intake**
Top of Well Casing Elevation / Surface Water Reference Elevation (feet amsl)	686.63	673.90	674.53	661.07	682.84	682.20	683.91	684.03	683.47	684.05	657.56	655.39	654.94	658.63	657.93	654.18	653.54	655.36	655.84	684.71	684.61	656.31
Screen Length (ft)	10.0	5.0	10.0	5.0	5.0	10.0	5.0	5.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	NA
Total Depth (ft from top of casing)	17.0	25.8	19.23	17.5	52.3	37.7	51.5	81.91	36.6	24.05	28.0	25.0	27.5	25.9	55.55	17.9	47.68	29.87	23.82	33.24	24.81	NA
Top of Well Screen Elevation (ft)	679.63	653.10	665.3	648.57	635.54	654.5	637.41	607.12	651.87	670.0	634.56	635.39	632.44	637.76	607.38	641.24	610.86	NS	NS	656.47	669.8	NA
Measurement Date																						
April 26, 2016	682.80	655.63	NI	652.42	655.37	NI	661.67	NI	670.86	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
June 23, 2016	682.58	655.65	NI	652.89	656.53	NI	662.36	NI	670.64	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 9, 2016	682.27	655.52	NI	651.76	653.79	NI	660.78	NI	670.35	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
October 26-27, 2016	682.04	655.67	NI	652.17	655.03	NI	661.37	NI	670.21	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
January 18-19, 2017	681.67	655.46	NI	651.74	654.50	NI	660.87	NI	669.89	NI	648.81	647.42	646.66	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 19-20, 2017	682.15	656.35	NI	654.57	657.48	NI	663.27	NI	670.69	NI	653.62	651.09	650.16	NI	NI	NI	NI	NI	NI	NI	NI	NI
June 20-21, 2017	681.91	655.65	NI	652.42	654.75	NI	661.26	NI	669.94	NI	649.85	648.26	647.60	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 21-23, 2017	681.28	655.13	NI	650.58	652.39	NI	659.00	NI	668.77	NI	645.78	643.12	641.82	NI	NI	NI	NI	NI	NI	NI	NI	NI
November 8, 2017	681.54	655.40	NI	651.34	653.03	NI	659.76	NI	669.04	NI	647.37	644.99	644.20	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 18, 2018	681.53	655.71	NI	652.47	655.55	NI	660.99	NI	668.92	NI	649.66	647.91	647.65	NI	NI	NI	NI	NI	NI	NI	NI	NI
May 30, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	652.45	651.05	650.98	NI	NI	NI	NI	NI	NI	NI	NI	NI
June 28, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	652.87	651.43	651.47	NI	NI	NI	NI	NI	NI	NI	NI	NI
July 18, 2018	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	652.27	650.67	650.69	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 14-15, 2018	680.91	656.05	NI	652.57	656.35	NI	661.56	NI	668.66	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 29, 2018	681.09	655.89	NI	655.07	657.82	NI	NM	NI	NM	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
October 16, 2018	682.50	656.91	NI	656.17	658.20	NI	663.37	NI	670.24	NI	654.13	NM	651.61	NI	NI	NI	NI	NI	NI	NI	NI	NI
January 8, 2019	682.22	656.03	NI	654.65	656.28	NI	662.13	NI	669.84	NI	NM	NM	NM	NI	NI	NI	NI	NI	NI	NI	NI	NI
April 8, 2019	682.69	657.23	NI	655.55	659.33	NI	664.01	NI	670.96	NI	654.90	653.70	653.55	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 28, 2019	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	NM	NM	NM	640.98	NI	642.10	NI	NI	NI	NI	NI	NI
October 23-24, 2019	683.07	660.14	NI	653.86	657.71	NI	663.21	NI	671.28	NI	651.89	651.31	651.28	649.31	NI	647.80	NI	NI	NI	NI	NI	NI
December 11, 2019	NM	NM	NI	NM	NM	NI	NM	NI	NM	NI	649.59	647.39	647.24	NM	NI	NM	NI	NI	NI	NI	NI	NI
February 5, 2020	683.30	NM	NI	NM	NM	NI	NM	NI	NM	NI	649.88	650.12	648.34	644.71	NI	645.00	NI	NI	NI	NI	NI	NI
March 12-13, 2020	682.82	NM	NI	NM	NM	NI	661.41	651.64	NM	NI	NM	NM	NM	645.45	617.84	644.18	624.11	NI	NI	NI	NI	NI
April 1, 2020	683.27	657.00	NI	655.89	658.57	NI	660.59	655.05	671.13	NI	653.76	651.88	651.23	651.09	649.16	649.35	648.27	NI	NI	NI	NI	649.71
April 13-14, 2020	683.25	656.45	NI	654.08	656.42	NI	662.44	653.69	670.71	NI	650.66	650.09	649.19	645.91	647.50	646.79	648.42	NI	NI	NI	NI	645.71
May 4, 2020	NM	NM	NI	NM	NM	NI	NM	NM	NM	NI	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NM
June 30, 2020	NM	NM	NI	NM	NM	NI	NM	NM	NM	NI	NM	NM	NM	NM	NM	NM	647.73	NI	NI	NI	NI	NM
October 5-12, 2020	682.34	655.80	NI	650.37	652.95	NI	659.81	648.01	670.18	NI	646.18	642.85	641.50	638.46	640.20	638.73	641.09	NI	NI	NI	NI	638.16
February 23, 2021	NM	NM	NI	NM	NM	NI	NM	NM	669.86	NI	646.80	NM	NM	638.77	NM	NM	641.16	NI	NI	NI	NI	NM
April 12 - 16, 2021	682.94	656.05	NI	653.82	654.34	NI	661.15	651.16	670.27	NI	649.53	647.66	646.46	642.70	644.88	643.02	644.16	NI	NI	NI	NI	640.91
July 6, 2021	NM	NM	NI	NM	NM	NI	NM	NM	661.87	NI	647.03	NM	NM	639.32	NM	NM	642.38	NI	NI	NI	NI	NM
October 6-8, 2021	681.95	654.86	NI	649.80	649.53	NI	654.83	645.57	662.27	NI	644.49	641.81	640.71	638.19	639.57	Dry	640.58	NI	NI	NI	NI	NM
January 11-12, 2022	681.58	NM	NI	NM	NM	NI	656.55	NM	NM	NI	646.24	NM	NM	NM	NM	NM	NM	NS	NS	NI	NI	NM
January 31, 2022	681.56	654.56	NI	650.07	650.51	NI	656.67	647.01	664.14	NI	646.05	643.44	642.42	639.69	640.63	639.47	641.79	NS	NS	NI	NI	642.96
February 14-15, 2022	681.43	654.42	NI	650.03	650.42	NI	656.35	646.84	663.66	NI	645.82	643.25	642.32	639.64	640.68	below pump	641.50	NS	NS	NI	NI	642.01
April 11-14, 2022	682.08	654.77	NI	652.95	652.14	NI	657.62	649.24	664.61	NI	648.40	645.75	644.32	640.79	640.83	641.44	643.23	644.62	642.06	NI	NI	643.21
May 3, 2022	682.27	654.51	<655.3	652.14	653.51	645.38	657.70	650.04	663.60	<660	649.14	647.41	647.07	644.83	645.24	642.98	643.94	647.34	645.83	667.41	667.58	647.16
May 5, 2022	682.07	654.78	656.03	652.48	654.46	645.80	658.07	650.47	663.77	<660	649.86	648.16	648.46	648.11	646.51	644.02	644.13	648.77	648.24	667.57	667.50	NM
May 10, 2022	NM	654.70	655.71	NM	654.09	646.85	NM	NM	663.71	<660	NM	NM	NM	NM	NM	NM	NM	NM	NM	667.01	667.05	NM
May 17, 2022	681.75	654.56	655.69	652.47	653.60	648.16	657.78	650.77	663.45	<660	649.70	648.06	647.45	644.67	650.07	644.22	645.13	647.57	646.08	667.07	667.19	NM
May 20, 2022	NM	654.63	655.66	NM	653.50	648.68	NM	NM	663.49	<660	NM	NM	NM	NM	NM	NM	NM	NM	NM	667.44	667.46	NM
May 23, 2022	NM	NM	NM	NM	652.66	648.40	NM	NM	NM	<660	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
June 2, 2022	681.69	654.22	655.68	651.53	652.37	650.38	656.18	649.53	661.42	<660	648.33	646.68	646.38	644.61	645.23	643.36	644.93	646.43	645.48	666.15	666.21	NM
June 9, 2022	681.80	654.24	655.70	651.44	654.18	650.89	656.34	649.80	661.25	<660	648.90	647.05	647.32	648.23	646.20	644.14	644.61	647.78	648.65	665.82	665.91	NM
June 10, 2022	NM	NM	NM	NM	652.97	650.97	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
June 21, 2022	681.60	654.29	655.69	651.35	652.89	651.48	656.25	650.52	660.87	<660	649.54	648.47	648.34	646.29	647.63	644.88	645.60	647.87	647.17	665.61	665.68	NM
June 27, 2022	681.60	654.06	655.68	651.14	652.16	651.55	656.15	649.70	661.41	<660	648.61	647.13	646.34	643.87	644.85	643.64	645.37	646.42	644.80	665.16	665.27	NM
July 5, 2022	681.47	653.92	655.68	650.70	651.03	651.73	655.33	648.51	660.86	<660	647.34	645.41	644.14	641.58	642.91	644.16	644.30	644.50	642.44	665.14	665.24	NM
Bottom of Well Elevation (ft)	669.63	648.10	655.3	643.57	630.54	644.5	632.41	602.12	646.87	660.0	629.56	630.39	627.44	632.76	602.38	636.24	605.86	NS	NS	651.5	659.8	--

Notes:
NM = not measured
NI = not installed
ND = Not surveyed

Created by: NDK Date: 1/15/20218
Last rev. by: LMH Date: 7/5/2022
Checked by: REO Date: 7/5/2022
Proj Mgr QA/QC: TK Date: 7/15/2022

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Table 2A. CCR Rule Ash Pond Groundwater Samples Summary
Ottumwa Generating Station / SCS Engineers Project #25220083.00

Sample Dates	Downgradient Wells												Background Well
	MW-302	MW-303	MW-304	MW-305	MW-305A	MW-306	MW-310	MW-310A	MW-311	MW-311A	MW-312	MW-313	MW-301
4/26/2016	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
6/23/2016	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
8/10-11/2016	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
10/26-27/2016	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
1/18/2017	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
4/19/2017	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
6/20-21/2017	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
8/22-23/2017	B	B	B	B	NI	B	NI	NI	NI	NI	NI	NI	B
11/8/2017	D	D	D	D	NI	D	NI	NI	NI	NI	NI	NI	D
4/18/2018	A	A	A	A	NI	A	NI	NI	NI	NI	NI	NI	A
8/14-15/2018	A	A	A	A	NI	A	NI	NI	NI	NI	NI	NI	A
8/29/2018	A-R	A-R	A-R	--	NI	--	NI	NI	NI	NI	NI	NI	A-R
10/16/2018	A	A	A	A	NI	A	NI	NI	NI	NI	NI	NI	A
1/8/2019	A-R	A-R	A-R	A-R	NI	A-R	NI	NI	NI	NI	NI	NI	A-R
4/8/2019	A	A	A	A	NI	A	NI	NI	NI	NI	NI	NI	A
10/24/2019	A	A	A	A	NI	A	A	NI	A	NI	NI	NI	A
2/5/2020	--	--	--	--	NI	--	A	NI	A	NI	NI	NI	A
3/13/2020	--	--	--	A-R	A	--	A-R	A	A-R	A	NI	NI	A
4/14/2020	A	A	A	A	A	A	A	A	A	A	NI	NI	A
6/30/2020	--	--	--	--	--	--	--	--	--	A-R	NI	NI	--
10/8/2020	A	A	A	A	A	A	A	A	A	A	NI	NI	A
2/23/2021	--	--	--	--	--	Add.	Add.	--	--	Add.	NI	NI	--
4/13-16/2021	A	A	A	A	A	A	A	A	A	A	NI	NI	A
7/6-7/2021	--	--	--	--	--	Add.	Add.	--	--	Add.	NI	NI	--
10/6-8/2021	A	A	A	A	A	A	A	A	--	A	NI	NI	A
1/12/2022	--	--	--	--	--	--	--	--	--	--	Add.	Add.	--
2/14/2022	--	--	--	Add.	--	Add.	--	--	--	--	Add.	Add.	--
4/11-12/2022	A	A	A	A	A	A	A	A	A	A	A	A	A
Total Samples	21	21	21	22	6	23	10	6	7	9	3	3	23

Abbreviations:
B = Background Sample Event
D = Detection Monitoring Sampling Event
-- = Not Applicable
A = Assessment Monitoring Sampling Event
A-R = Assessment Monitoring Resampling Event
NI - Not Installed
Add. = Additional sampling event for selected parameters

Created by: NDK Date: 1/8/2018
Last revision by: NDK Date: 7/14/2022
Checked by: JR Date: 7/14/2022

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Table 2B. CCR Rule ZLDP Groundwater Samples Summary
Ottumwa Generating Station / SCS Engineers Project #25220083.00

Sample Dates	Downgradient Wells			Background Well
	MW-307	MW-308	MW-309	MW-301
4/26/2016	NI	NI	NI	B
6/23/2016	NI	NI	NI	B
8/9/2016	NI	NI	NI	B
10/26/2016	NI	NI	NI	B
1/18-19/2017	B	B	B	B
4/19-20/2017	B	B	B	B
6/20-21/2017	B	B	B	B
8/21-23/2017	B	B	B	B
11/8/2017	B	B	B	D
4/16-18/2018	B	B	B	A
5/30/2018	B-R	B-R	B-R	--
6/28/2018	B	B	B	--
7/18/2018	B-R	B-R	B-R	--
10/16/2018	B	B	B	A
4/8/2019	D	D	D	D
10/23-24/2019	D	D	D	D
12/11/2019	A	A	A	A
2/5/2020	A	A	A	A
4/13-14/2020	A	A	A	A
10/7-8/2020	A	A	A	A
2/23/2021	A-R	--	--	--
4/14/2021	A	A	A	A
7/6/2021	A-R	--	--	--
10/7/2021	A	A	A	A
2/14/2022	Add.	--	--	--
4/11-14/2022	A	A	A	A
Total Samples	22	19	19	24

Abbreviations:
D = Detection Monitoring Sampling Event
A= Assessment Monitoring Event
-- = Not Applicable
B = Background Sampling Event
B-R = Background Resampling event
NI - Not Installed
Add. = Additional Assessment monitoring sampling event
A-R = Assessment Monitoring Resampling Event

Created by: JAO Date: 7/8/2022
Last revision by: NDK Date: 7/14/2022
Checked by: JR Date: 7/14/2022

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Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

Background Well MW-301

Parameter Name	UPL Method	UPL	GPS	11/8/2017	4/18/2018	8/14/2018, 8/29/2018 ^	10/16/2018, 1/8/2019 ^^	4/8/2019	10/24/2019	2/5/2020	3/12/2020	4/14/2020	10/8/2020	4/14/2021	10/7/2021
Appendix III															
Boron, ug/L	P	820		488	480	735	410	380	680	540	--	700	650 F1	690	800
Calcium, mg/L	P	78.7		65.2	63.0	72.5	47.2	43	78	68	--	84	94	96	100
Chloride, mg/L	P	86.8		59.8	63.4	63.1	33.9	50	110	120	--	140	170	150	180
Fluoride, mg/L	P	0.484		0.27	0.22	0.27	0.3	0.44 J	<0.23	--	--	<0.23	<0.23	<0.28	<0.28
Field pH, Std. Units	P	6.87		6.41	6.41	6.26	6.27	6.61	6.33	6.39	6.48	6.58	6.22	6.26	6.26
Sulfate, mg/L	P	199		178	186	181	164	81	130	130	--	140	140	140	180
Total Dissolved Solids, mg/L	P	628		448	514	532	392	340	510	570	--	550	660	620	670
Appendix IV		**UPL**	**GPS**												
Antimony, ug/L	P*	0.22	6	--	<0.026	0.20 J	<0.078	<0.53	<0.53	--	--	<0.58	<0.51	<1.1	<1.1
Arsenic, ug/L	P*	0.53	10	--	0.074 J	0.29 J	0.16 J	<0.75	<0.75	<0.88	--	<0.88	<0.88	<0.75	<0.75
Barium, ug/L	P	68.8	2,000	--	31.6	44.5	28.1	25	56	43	--	54	58	52	61
Beryllium, ug/L	DQ	DQ	4	--	<0.012	0.14 J	<0.089	<0.27	<0.27	--	--	<0.27	--	<0.27	<0.27
Cadmium, ug/L	NP*	0.12	5	--	0.023 J	0.16 J	<0.033	<0.077	0.040	<0.039	--	<0.039	0.0075 J	<0.051	0.057 J
Chromium, ug/L	P	1.07	100	--	<0.054	0.25 J	0.11 J,B	<0.98	<0.98	<1.1	--	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	NP	4.1	6	--	0.46 J	1.4	0.36 J,B	0.44 J	0.60	1.1	0.43 J	0.52	0.41 J	0.29 J	0.48 J
Fluoride, mg/L	P	0.48	4	--	0.22	0.27	0.3	0.44 J	<0.23	--	--	<0.23	<0.23	<0.28	<0.28
Lead, ug/L	NP*	0.10	15	--	0.041 J	0.18 J	<0.13	<0.27	<0.27	<0.27	--	<0.27	<0.11	<0.21	<0.21
Lithium, ug/L	P	34.2	40	--	19.1	26.5	19.4	15	24	17	21	24	23	23	26
Mercury, ug/L	DQ	DQ	2	--	<0.090	<0.083	<0.090	<0.10	<0.10	--	--	<0.10	--	<0.15	<0.15
Molybdenum, ug/L	P	1.74	100	--	0.67 J	1.3	0.72 J	<1.1	1.1	--	--	1.2 J	<1.1	<1.3	<1.3
Selenium, ug/L	P	8.55	50	--	4.3	6.3	3.4	3.1 J	6.2	--	--	6.8	7.7	6.5	7.5
Thallium, ug/L	NP*	0.14	2	--	<0.036	0.16 J	<0.099	<0.27	<0.27	--	--	<0.26	<0.26	<0.26	<0.26
Radium 226/228 Combined, pCI/L	P	2.15	5	--	0.513	1.19	1.7	0.0956	0.956	0.228	--	0.315	0.407	0.598	1.04
Additonal Parameters - Selection of Remedy															
Aluminum, ug/L	UPL or GPS not applicable														
Cobalt - dissolved, ug/L				--	--	--	--	--	--	--	0.32 J	0.44 J	--	--	--
Lithium - dissolved, ug/L				--	--	--	--	--	--	--	22	--	--	--	--
Iron, dissolved, ug/L				--	--	--	--	--	--	--	<50	<50	<50	<36	<36
Iron, ug/L				--	--	--	--	--	--	--	<50	50 J	<50	49 J	<36
Magnesium											--	33,000	38,000	34,000	36,000
Manganese, dissolved, ug/L				--	--	--	--	--	--	--	17	16	13	10	15
Manganese, ug/L				--	--	--	--	--	--	--	16	19	14	14	18
Potassium, ug/L				--	--	--	--	--	--	--	--	1,500	1,500	1,200	1,300
Sodium, ug/L				--	--	--	--	--	--	--	--	77,000	87,000	78,000	88,000
Total Alkalinity, mg/L				--	--	--	--	--	--	--	--	150	160	170	210
Cabonate Alkalinity, mg/L				--	--	--	--	--	--	--	--	<1.9	<3.8	<4.6	<4.6
Bicarbonate Alkalinity, mg/L				--	--	--	--	--	--	--	--	150	160	170	210

Compliance Well MW-302

Parameter Name	11/8/2017	4/18/2018	8/14/2018, 8/29/2018 ^	10/16/2018, 1/8/2019 ^^	4/8/2019	10/24/2019	4/14/2020	10/8/2020	4/13/2021	10/7/2021
Appendix III										
Boron, ug/L	1,320	1,200	1,240	1,100	1,340	1,200	1,200	1,300	1,300	1,200
Calcium, mg/L	183	177	185	146	199	180	180	180	180	170
Chloride, mg/L	254	246	259	214	240	220	220	230	190	200
Fluoride, mg/L	0.20 J	0.26	0.26	0.24	<0.23	<0.23	<0.23	<0.23 ^	0.33 J	<0.28
Field pH, Std. Units	6.55	6.47	6.76	6.37	6.61	6.55	6.7	7.00	6.44	6.49
Sulfate, mg/L	786	899	847	785	840	810	790	840	360	850
Total Dissolved Solids, mg/L	1,620	1,690	1,840	1,400	1,600	1,600	1,500	1,700	1,500	1,300
Appendix IV										
Antimony, ug/L	--	<0.026	<0.15	0.26 J,B	<0.53	<0.53	<0.58	<0.51	<1.1	<1.1
Arsenic, ug/L	--	0.16 J	0.30 J	1.9	<0.75	<0.75	<0.88	<0.88	<0.75	<0.75
Barium, ug/L	--	17.7	18.3	28.9	19	21	23	18	22	18
Beryllium, ug/L	--	<0.012	<0.12	0.22 J	<0.27	<0.27	<0.27	--	<0.27	<0.27
Cadmium, ug/L	--	0.22 J	0.21 J	0.67	0.21 J	0.20	0.23	0.20	0.26	0.23
Chromium, ug/L	--	0.46 J	0.48 J	1.6	<0.98	<0.98	1.4 J	<1.1	3.0 J	1.3 J
Cobalt, ug/L	--	0.90 J	1.50	4.0	1.2	2.7	5.3	1.5	5.5	2.2
Fluoride, mg/L	--	0.26	0.26	0.24	<0.23	<0.23	<0.23	<0.23 ^	0.33 J	<0.28
Lead, ug/L	--	0.098 J	0.12 J	3.9	<0.27	0.29 J	1.0	<0.11	0.59	0.22 J
Lithium, ug/L	--	7.5 J	6.9 J	8.6 J	10	10	11	9.6 J	10	11
Mercury, ug/L	--	0.096 J	<0.083	<0.090	<0.10	<0.10	<0.10	--	<0.15	<0.15
Molybdenum, ug/L	--	0.59 J	0.54 J	<0.57	<1.1	<1.1	<1.1	<1.1	<1.3	1.7 J
Selenium, ug/L	--	<0.086	<0.16	0.84 J,B	<1.0	<1.0	<1.0	<1.0	<0.96	1.2 J
Thallium, ug/L	--	<0.036	<0.14	0.16 J	<0.27	<0.27	<0.26	<0.26	<0.26	0.56 J
Radium 226/228 Combined, pCI/L	--	0.746	1.12	1.7	0.116	0.79	1.26	0.447	0.901	1.45
Additonal Parameters - Selection of Remedy										
Aluminum, ug/L										
Cobalt - dissolved, ug/L	--	--	--	--	--	--	0.81	--	--	--
Lithium - dissolved, ug/L	--	--	--	--	--	--	--	--	--	--
Iron, dissolved, ug/L	--	--	--	--	--	--	<50	<50	<36	<36
Iron, ug/L	--	--	--	--	--	--	500	100	350	65 J
Magnesium							50,000	57,000	50,000	46,000
Manganese, dissolved, ug/L	--	--	--	--	--	--	110	130	110	110
Manganese, ug/L	--	--	--	--	--	--	200	140	200	120
Potassium, ug/L	--	--	--	--	--	--	1,500	1,900	1,500	1,400
Sodium, ug/L	--	--	--	--	--	--	250,000	280,000	240,000	220,000
Total Alkalinity, mg/L	--	--	--	--	--	--	61	72	72	120
Cabonate Alkalinity, mg/L	--	--	--	--	--	--	<1.9	<1.9	<3.2	<4.6
Bicarbonate Alkalinity, mg/L	--	--	--	--	--	--	61	72	72	120

Legend	Description
4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Yellow highlighted cell with bold text indicates the compliance well result exceeds the GPS and the result was determined to be statistically significant[(1)].
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of MNA.

Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

Parameter Name	UPL Method	UPL	GPS	Compliance Wells																			
				MW-303										MW-304									
				11/8/2017	4/18/2018	8/14/2018, 8/29/2018 ^	10/16/2018, 1/8/2019 ^^	4/8/2019	10/24/2019	4/14/2020	10/8/2020	4/13/2021	10/7/2021	11/8/2017	4/18/2018	8/14/2018, 8/29/2018 ^	10/16/2018, 1/8/2019 ^^	4/8/2019	10/23/2019	4/13/2020	10/8/2020	4/14/2021	10/8/2021
Appendix III																							
Boron, ug/L	P	820		1,070	987	1,010	549	290	440	420	1,100	420	860	1,040	991	1,000	930	1,110	970	1,000	1,000	990	990
Calcium, mg/L	P	78.7		234	212	213	195	172	170	170	210	160	190	136	131	138	123	130	120	130	120	120	120
Chloride, mg/L	P	86.8		185	198	64.8	57	22	35	47	210	29	140	417	400	375	410	320	280	250	250	240	260
Fluoride, mg/L	P	0.484		0.19 J	0.22	0.31	0.24	<0.23	<0.23	<0.23	0.26 J^	<0.28	<0.28	0.96	0.92	1.00	1.0	1.3	0.74	1.1	1.1	1.1	<0.28
Field pH, Std. Units	P	6.87		6.60	6.63	6.83	6.66	7.00	6.83	6.98	8.28	6.67	6.7	7.00	6.9	7.34	6.86	7.17	7.05	7.12	7.88	6.94	6.97
Sulfate, mg/L	P	199		348	328	164	389	260	180	180	190	140	170	194	198	185	184	180	190	220	230	200	230
Total Dissolved Solids, mg/L	P	628		1,290	1,300	832	1,150	890	810	810	1,100	720	720	1,270	1,300	3,680	1,180	1,100	1,100	1,000	1,200	1,000	760
Appendix IV		**UPL**	**GPS**																				
Antimony, ug/L	P*	0.22	6	--	0.098 J	0.16 J	0.2 J,B	<0.53	<0.53	<0.58	<0.51	<1.1	<1.1	--	<0.026	0.19 J	<0.078	<0.53	<0.53	<0.58	<0.51	<1.1	<1.1
Arsenic, ug/L	P*	0.53	10	--	0.43 J	0.60 J	0.55 J	<0.75	<0.75	<0.88	<0.88	<0.75	<0.75	--	0.68 J	1.3	0.96 J	<0.75	0.83 J	0.96 J	<0.88	<0.75	0.88 J
Barium, ug/L	P	68.8	2,000	--	69.5	77.3	95.2	54	77	64	94	63	80	--	88.5	87.4	91	80	80	80	74	80	79
Beryllium, ug/L	DQ	DQ	4	--	0.017 J	<0.12	<0.089	<0.27	<0.27	<0.27	--	<0.27	<0.27	--	0.026 J	0.21 J	<0.089	<0.27	<0.27	<0.27	--	<0.27	<0.27
Cadmium, ug/L	NP*	0.12	5	--	0.44 J	0.36 J	0.24 J	0.092 J	0.21	0.18	0.46	0.12	0.28	--	<0.018	0.17 J	0.07 J	<0.077	<0.039	<0.039	<0.049	<0.051	<0.051
Chromium, ug/L	P	1.07	100	--	0.12 J	0.19 J	0.15 J,B	<0.098	<0.98	<1.1	<1.1	<1.1	<1.1	--	2.0	5.9	1.4	1.6 J	2 J	3.5 J	<1.1	<1.1	<1.1
Cobalt, ug/L	NP	4.1	6	--	2.1	2.2	1.7 B	0.42 J	1.2	0.87	2.4	0.43 J	4.0	--	0.39 J	0.92 J	0.45 J,B	0.40 J	0.5	0.57	0.41 J	0.43 J	0.42 J
Fluoride, mg/L	P	0.48	4	--	0.22	0.31	0.24	<0.23		<0.23	0.26 J^	<0.28	<0.28	--	0.92	1.00	1.0	1.3	0.74	1.1	1.1	1.1	<0.28
Lead, ug/L	NP*	0.10	15	--	0.069 J	0.13 J	<0.13	<0.27	<0.27	<0.27	<0.11	<0.21	<0.21	--	0.37 J	0.81 J	0.66 J	<0.27	0.27 J	0.5	<0.11	<0.21	<0.21
Lithium, ug/L	P	34.2	40	--	<4.6	6.9 J	<4.6	<2.7	<2.7	4.7 J	5.6 J	4.1 J	5.8 J	--	<4.6	<4.6	<4.6	3.3 J	2.8 J	4.8 J	3.1 J	3.3 J	4.0 J
Mercury, ug/L	DQ	DQ	2	--	<0.090	<0.083	<0.090	<0.10	<0.10	<0.10	--	<0.15	<0.15	--	<0.090	<0.083	<0.090	<0.10	<0.10	<0.10	--	<0.15	<0.15
Molybdenum, ug/L	P	1.74	100	--	0.61 J	0.98 J	5.5	7.5	5.2	3.6	<1.1	2.9	1.4 J	--	2.0	2.4	1.9	1.5 J	2.3	2.0	1.5 J	1.7 J	2.0
Selenium, ug/L	P	8.55	50	--	0.23 J	0.35 J	0.37 J,B	2.1 J	<1.0	5.0	<1.0	5.1	<0.96	--	<0.086	0.50 J	0.26 J,B	<1.0	<1.0	<1.0	<1.0	<0.96	<0.96
Thallium, ug/L	NP*	0.14	2	--	<0.036	<0.14	<0.099	<0.27	<0.27	<0.26	<0.26	<0.26	<0.26	--	<0.036	0.15 J	<0.099	<0.27	<0.27	<0.26	<0.26	<0.26	<0.26
Radium 226/228 Combined, pCI/L	P	2.15	5	--	0.529	1.82	1.68	0.391	0.336	0.229	0.654	0.510	0.916	--	2.08	3.74	1.25	2.42	3.03	2.46	2.41	2.49	3.49
Additonal Parameters - Selection of Remedy																							
Aluminum, ug/L																							
Cobalt - dissolved, ug/L				--	--	--	--	--	--	0.37 J	--	--	--	--	--	--	--	--	--	0.37 J	--	--	--
Lithium - dissolved, ug/L				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, dissolved, ug/L				--	--	--	--	--	--	<50	<50	<36	100	--	--	--	--	--	--	4,600	4,200	4,500	3,900
Iron, ug/L				--	--	--	--	--	--	280	310	44 J	120	--	--	--	--	--	--	5,200	4,200	4,500	3,700
Magnesium										23,000	31,000	22,000	26,000							43,000	40,000	40,000	36,000
Manganese, dissolved, ug/L	UPL or GPS not applicable			--	--	--	--	--	--	220	1,600	340	1,800 ^2	--	--	--	--	--	--	3,700	3,800	3,800	3,400 ^2
Manganese, ug/L				--	--	--	--	--	--	260	1,600	330	1,900	--	--	--	--	--	--	3,700	3,800	3,600	3,000
Potassium, ug/L				--	--	--	--	--	--	960	1,100	800	800	--	--	--	--	--	--	7,700	7,800	8,200	6,800
Sodium, ug/L				--	--	--	--	--	--	100,000	150,000	89,000	94,000	--	--	--	--	--	--	210,000	210,000	210,000	190,000
Total Alkalinity, mg/L				--	--	--	--	--	--	440	470	440	490	--	--	--	--	--	--	370	380	360	470
Cabonate Alkalinity, mg/L				--	--	--	--	--	--	<1.9	<3.8	<4.6	<4.6	--	--	--	--	--	--	<1.9	<3.8	<4.6	<4.6
Bicarbonate Alkalinity, mg/L				--	--	--	--	--	--	440	470	440	490	--	--	--	--	--	--	370	380	360	470

Legend	Description
4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Yellow highlighted cell with bold text indicates the compliance well result exceeds the GPS and the result was determined to be statistically significant[1].
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of MNA.

Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

				Compliance Well												Delineation Well					
				MW-305												MW-305A					
Parameter Name	**UPL Method**	**UPL**	**GPS**	11/8/2017	4/18/2018	8/15/2018	10/16/2018, 1/8/2019 ^^	4/8/2019	10/23/2019	3/13/2020	4/13/2020	10/8/2020	4/16/2021	10/6/2021	2/14/2022	3/13/2020	4/14/2020	10/8/2020	4/15/2021	10/8/2021	4/12/2022
Appendix III																					
Boron, ug/L	P	820		925	886	911	835	1,000	880	--	920	900	860	880	--	250	280	180	190	200	210
Calcium, mg/L	P	78.7		99.5	97.6	102.0	96.2	110	100	--	100	110	110	110	--	100	130	150	150	150	180
Chloride, mg/L	P	86.8		282	289	265	281	250	280	--	270	290	240	230	--	40	89	120	140	130	160
Fluoride, mg/L	P	0.484		0.40	0.40	0.44	0.40	0.75	<0.23	--	0.35 J	0.38 J^	0.37 J	<0.28	--	0.77	0.73	0.73	0.56	<0.28	<0.22
Field pH, Std. Units	P	6.87		7.01	6.9	7.21	6.86	7.06	6.91	7.02	7.0	7.44	6.92	6.94	7.2	8.09	7.63	7.46	7.05	6.90	7.19
Sulfate, mg/L	P	199		138	147	139	129	110	76	--	63	93	120	150	--	40	93	130	150	140	160
Total Dissolved Solids, mg/L	P	628		1,040	1,070	1,060	1,070	1,000	1,000	--	960	1,100	900	680	--	400	570	660	780	730	700
Appendix IV		**UPL**	**GPS**																		
Antimony, ug/L	P*	0.22	6	--	0.089 J	<0.15	0.096 J,B	<0.53	<0.53	--	<0.58	<0.51	<1.1	<1.1	--	1.3	0.88 J	<0.51	<1.1	<1.1	<0.69
Arsenic, ug/L	P*	0.53	10	--	0.51 J	0.72 J	0.66 J	<0.75	<0.75	--	<0.88	<0.88	<0.75	0.75 J	--	<0.88	<0.88	<0.88	<0.75	<0.75	<0.75
Barium, ug/L	P	68.8	2,000	--	116	118	125	120	110	--	110	120	130	120	--	70	80	75	80	84	91
Beryllium, ug/L	DQ	DQ	4	--	<0.012	<0.12	<0.089	<0.27	<0.27	--	<0.27	--	<0.27	<0.27	--	<0.27	<0.27	--	<0.27	<0.27	<0.27
Cadmium, ug/L	NP*	0.12	5	--	0.054 J	0.086 J	0.044 J	<0.077	0.087 J	--	0.14	0.097 J	0.12	<0.051	--	<0.039	<0.039	<0.049	<0.051	<0.051	<0.055
Chromium, ug/L	P	1.07	100	--	0.26 J	0.41 J	0.30 J,B	<0.98	<0.98	--	<1.1	<1.1	<1.1	<1.1	--	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	NP	4.1	6	--	14.5	15.6	17.2	17	**17**	**18**	**16**	**17**	**18**	**18**	**20**	2.4	2.7	1.5	0.50	0.94	1.7
Fluoride, mg/L	P	0.48	4	--	0.40	0.44	0.40	0.75	<0.23	--	0.35 J	0.38 J^	0.37 J	<0.28	--	0.77	0.73	0.73	0.56	<0.28	<0.22
Lead, ug/L	NP*	0.10	15	--	0.12 J	0.31 J	<0.13	<0.27	<0.27	-	0.27 J	<0.11	<0.21	0.29 J	--	0.68	<0.27	<0.11	<0.21	<0.21	<0.24
Lithium, ug/L	P	34.2	40	--	<4.6	<4.6	<4.6	<2.7	<2.7	2.3 J	3.2 J	<2.5	2.6 J	3.1 J	--	14	16	13	17	17	17
Mercury, ug/L	DQ	DQ	2	--	<0.090	<0.090	<0.090	<0.10	<0.10	--	<0.10	--	<0.15	<0.15	--	<0.10	<0.10	--	<0.15	<0.15	<0.11
Molybdenum, ug/L	P	1.74	100	--	7.1	6.5	7.3	7.2	7.2	--	6.9	7.9	8.2	8.1	--	9.0	17	6.4	5.5	4.2	4.5
Selenium, ug/L	P	8.55	50	--	0.12 J	0.36 J	0.33 J,B	<1.0	<1.0	--	<1.0	<1.0	<0.96	<0.96	--	2.3 J	1.7 J	<1.0	<0.96	<0.96	<0.96
Thallium, ug/L	NP*	0.14	2	--	0.32 J	0.33 J	0.33 J	0.33 J	0.38 J	--	0.35 J	0.35 J	0.36 J	0.37 J	--	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
Radium 226/228 Combined, pCI/L	P	2.15	5	--	0.676	1.33	1.32	0.685	0.46	--	0.909	0.483	0.327	1.66	--	1.97	1.26	2.05	2.67	2.96	3.44
Additonal Parameters - Selection of Remedy																					
Aluminum, ug/L																					
Cobalt - dissolved, ug/L				--	--	--	--	--	--	16	16	17	20	17	--	2.1	2.8	--	--	--	--
Lithium - dissolved, ug/L				--	--	--	--	--	--	<2.3	--	--	--	--	--	15	--	--	--	--	--
Iron, dissolved, ug/L				--	--	--	--	--	--	51 J	66 J	63 J	85 J	150	--	<50	<50	<50	<36	<36	<36
Iron, ug/L				--	--	--	--	--	--	390	330	200	170	75 J	--	720	64 J	64 J	<36	<36	<36
Magnesium											47,000	48,000	47,000	44,000	--	--	28,000	31,000	29,000	26,000	32,000
Manganese, dissolved, ug/L	UPL or GPS not applicable			--	--	--	--	--	--	3,100	3,400	3,600	3,800	3,300 ^2	--	150	240	160	87	120	120
Manganese, ug/L				--	--	--	--	--	--	3,200	3,300	3,600	3,500	3,200	--	180	260	150	78	100	140
Potassium, ug/L				--	--	--	--	--	--	--	7,600	8,300	7,900	7,000	--	--	3,800	4,200	3,600	3,400	4,200
Sodium, ug/L				--	--	--	--	--	--	--	210,000	210,000	200,000	180,000	--	--	46,000	64,000	68,000	52,000	60,000
Total Alkalinity, mg/L				--	--	--	--	--	--	--	460	300	470	500	--	--	270	340	300	300	320
Cabonate Alkalinity, mg/L				--	--	--	--	--	--	--	<1.9	<3.8	<4.6	<4.6	--	--	<1.9	<3.8	<4.2	<4.6	<4.6
Bicarbonate Alkalinity, mg/L				--	--	--	--	--	--	--	460	300	470	500	--	--	270	340	300	300	320

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Yellow highlighted cell with bold text indicates the compliance well result exceeds the GPS and the result was determined to be statistically significant[(1)].
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of MNA.

Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

				Compliance Wells																							
Parameter Name	UPL Method	UPL	GPS	MW-306													MW-307										
				11/8/2017	4/18/2018	8/15/2018	10/16/2018, 1/8/2019 ^^	4/8/2019	10/23/2019	4/14/2020	10/8/2020	2/23/2021	4/13/2021	7/6/2021	10/8/2021	2/14/2022	4/8/2019	10/23/2019	12/11/2019	2/5/2020	4/14/2020	10/7/2020	2/23/2021	4/14/2021	7/6/2021	10/7/2021	2/14/2022
Appendix III																											
Boron, ug/L	P	820		881	919	915	862	1,100	980	1,000	1,100	--	1,000	--	730	--	240	200	190 J	200	240	260	--	200	--	230	--
Calcium, mg/L	P	78.7		73.1	74.1	78.9	80.0	95	77	73	80	--	74	--	130	--	240	230	230	210	240	240	--	250	--	240	--
Chloride, mg/L	P	86.8		50.4	54.4	58.2	83.3	98	47	41	43	--	35	--	180	--	220	220	200	220	230	230	--	210	--	240	--
Fluoride, mg/L	P	0.484		0.11 J	0.11 J	0.13 J	<0.19	0.27 J	<0.23	<0.23	<0.23 ^	--	<0.28	--	<0.28	--	0.28 J	<0.23	<0.23	--	<0.23	<0.23	--	<0.28	--	<0.28	--
Field pH, Std. Units	P	6.87		6.49	6.42	6.74	6.42	6.66	6.74	6.68	6.54	6.34	6.42	7.44	6.66	7.07	6.76	6.68	6.37	6.67	6.76	6.97	6.50	6.59	7.05	6.71	7.03
Sulfate, mg/L	P	199		274	289	275	285	270	280	310	360	--	370	--	460	--	100	95	92	100	99	100	--	92 F1	--	110	--
Total Dissolved Solids, mg/L	P	628		773	805	840	884	930	870	820	900	--	880	--	1,100	--	1,000	1,000	1,000	970	980	1,000 H	--	1,000	--	1,000	--
Appendix IV		UPL	GPS																								
Antimony, ug/L	P*	0.22	6	--	0.094 J	<0.15	0.10 J,B	<0.53	<0.53	<0.58	<0.51	--	<1.1	--	<1.1	--	--	--	<0.53	--	<0.58	--	--	<1.1	--	<1.1	--
Arsenic, ug/L	P*	0.53	10	--	0.38 J	0.65 J	0.60 J	<0.75	0.78 J	<0.88	<0.88	--	<0.75	--	<0.75	--	--	--	<0.75	<0.88	<0.88	<0.88	--	<0.75	--	<0.75	--
Barium, ug/L	P	68.8	2,000	--	48.2	51.6	56.0	58	51	48	49	--	49	--	71	--	--	--	140	130	140	140	--	160	--	140	--
Beryllium, ug/L	DQ	DQ	4	--	<0.012	<0.12	<0.089	<0.27	<0.27	<0.27	--	--	<0.27	--	<0.27	--	--	--	<0.27	--	<0.27	--	--	<0.27	--	<0.27	--
Cadmium, ug/L	NP*	0.12	5	--	0.88	0.76	0.96	1.1	0.89	0.83	0.92	--	0.95	--	1.7	--	--	--	<0.039	<0.039	<0.039	--	--	<0.051	--	<0.051	--
Chromium, ug/L	P	1.07	100	--	0.37 J	0.70 J	0.46 J,B	<0.98	1.0 J	<1.1	<1.1	--	<1.1	--	<1.1	--	--	--	<0.98	<1.1	<1.1	<1.1	--	<1.1	--	<1.1	--
Cobalt, ug/L	NP	4.1	6	--	4.8	5.5	6.4	6.9	6.2	5.5	5.9	5.6	5.6	5.8	11	8.8	--	--	11	13	20	18	64	46	60	48	24
Fluoride, mg/L	P	0.48	4	--	0.11 J	0.13 J	<0.19	0.27 J	<0.23	<0.23	<0.23 ^	--	<0.28	--	<0.28	--	--	<0.23	<0.23	--	<0.23	<0.23	--	<0.28	--	<0.28	--
Lead, ug/L	NP*	0.10	15	--	0.040 J	0.20 J	<0.13	<0.27	0.34 J	0.37 J	<0.11	--	<0.21	--	<0.21	--	--	--	0.71	<0.27	0.31 J	<0.11	--	<0.21	--	<0.21	--
Lithium, ug/L	P	34.2	40	--	<4.6	<4.6	<4.6	<2.7	<2.7	<2.3	<2.5	--	<2.5	--	<2.5	--	--	--	12	9.1 J	13	11	--	14	--	14	--
Mercury, ug/L	DQ	DQ	2	--	<0.090	<0.083	<0.090	<0.10	<0.10	<0.10	--	--	<0.15	--	<0.15	--	--	--	<0.10	--	<0.10	--	--	<0.15	--	<0.15	--
Molybdenum, ug/L	P	1.74	100	--	5.7	4.7	5.1	4.3	4.9	4.4	5.6	--	5.1	--	6.1	--	--	--	<1.1	--	<1.1	<1.1	--	<1.3	--	<1.3	--
Selenium, ug/L	P	8.55	50	--	<0.086	0.21 J	0.22 J,B	<1.0	<1.0	<1.0	<1.0	--	<0.96	--	<0.96	--	--	--	<1.0	--	<1.0	<1.0	--	<0.96	--	<0.96	--
Thallium, ug/L	NP*	0.14	2	--	0.083 J	<0.14	0.12 J	<0.27	<0.27	<0.26	<0.26	--	<0.26	--	<0.26	--	--	--	<0.27	--	<0.26	--	--	<0.26	--	<0.26	--
Radium 226/228 Combined, pCI/L	P	2.15	5	--	0.305	0.985	1.34	0.155	0.624	0.0738	0.889	--	0.334	--	0.794	--	--	--	2.46	2.23	2.06	2.36	--	3.08	--	3.90	--
Additonal Parameters - Selection of Remedy																											
Aluminum, ug/L	UPL or GPS not applicable																										
Cobalt - dissolved, ug/L				--	--	--	--	--	--	5.4	5.1	--	6.1	--	9.9	--				--	19	19	--	49	--	59	--
Lithium - dissolved, ug/L				--	--	--	--	--	--	--	--	--	--	--	--	--				--	--	--	--	--	--	--	--
Iron, dissolved, ug/L				--	--	--	--	--	--	140	100	--	110	--	100	--				--	3,100	3,600	--	3,400	--	3,400	--
Iron, ug/L				--	--	--	--	--	--	590	340	--	220	--	<360	--				--	3,800	3,500	--	3,700	--	3,900	--
Magnesium										26,000	23,000	--	25,000	--	43,000	--				--	28,000	27,000	--	30,000	--	28,000	--
Manganese, dissolved, ug/L				--	--	--	--	--	--	16,000	15,000	--	15,000	--	31,000	--				--	290	350	--	360	--	410	--
Manganese, ug/L				--	--	--	--	--	--	16,000	16,000	--	15,000	--	30,000	--				--	310	290 F1	--	330	--	440	--
Potassium, ug/L				--	--	--	--	--	--	3,700	3,800	--	3,500	--	3,700 J	--				--	1,900	1,900	--	2,000	--	2,000	--
Sodium, ug/L				--	--	--	--	--	--	160,000	170,000	--	170,000	--	170,000	--				--	97,000	100,000	--	98,000	--	100,000	--
Total Alkalinity, mg/L				--	--	--	--	--	--	280	160	--	270	--	270	--				--	520	480	--	490	--	550	--
Cabonate Alkalinity, mg/L				--	--	--	--	--	--	<1.9	<3.8	--	<4.6	--	<4.6	--				--	<1.9	<3.8	--	<4.6	--	<4.6	--
Bicarbonate Alkalinity, mg/L				--	--	--	--	--	--	280	160	--	270	--	270	--				--	520	480	--	490	--	550	--

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
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Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

Parameter Name	UPL Method	UPL	GPS	Compliance wells																Delineation Wells								
				MW-308								MW-309								MW-310								
				4/8/2019	10/23/20219	12/11/2019	2/5/2020	4/14/2020	10/7/2020	4/14/2021	10/21/2021	4/8/2019	10/23/20219	12/11/2019	2/5/2020	4/14/2020	10/7/2020	4/14/2021	10/21/2021	10/24/2019	2/5/2020	3/13/2020	4/13/2020	10/8/2020	2/23/2021	4/13/2021	7/6/2021	10/6/2021
Appendix III																												
Boron, ug/L	P	820		190 J	220	160 J	220	210	270	220	200	1,500	1,300	1,100	1,300	1,400	1,200	1,400	1,300	720	620	--	550	800	--	360	--	520
Calcium, mg/L	P	78.7		240	240	220	210	240	220	230	230	160	150	150	130	150	120	130	120	230	160	--	200	180	--	210	--	130
Chloride, mg/L	P	86.8		160	160	150	160	170	160	150	170	72	74	66	68	69	68	57	67	150	120	--	130	150	--	250	--	120
Fluoride, mg/L	P	0.484		<0.23	<0.23	<0.23	--	<0.23	<0.23	<0.28	<0.28	0.27 J	<0.23	<0.23	--	0.36 J	<0.23	<0.28	<0.28	0.31 J	0.85	--	1.1	1.0	--	1.3	--	<0.28
Field pH, Std. Units	P	6.87		6.90	6.78	6.55	6.78	6.90	7.24	6.70	6.83	7.18	6.98	6.67	7.09	7.21	7.57	7.00	7.18	7.15	7.08	6.89	7.0	7.07	7.11	7.07	8.23	7.20
Sulfate, mg/L	P	199		300	300	280	300	290	290	270	290	410	400	370	370	390	380	360	400	610	530	--	590	570	--	720	--	470
Total Dissolved Solids, mg/L	P	628		1,200	1,100	1,100	1,100	1,000	1,000 H	1,100	1,000	1,100	1,100	980	990	1,000	930 H	940	950	260	1,200	--	1,300	1,200	--	1,600	--	930
Appendix IV		**UPL**	**GPS**																									
Antimony, ug/L	P*	0.22	6	--	--	<0.53	--	<0.58	--	<1.1	<1.1	--	--	<0.53	--	<0.58	--	<1.1	<1.1	<0.53	<0.58	--	<0.58	0.61 J	--	<1.1	--	<1.1
Arsenic, ug/L	P*	0.53	10	--	--	<0.75	<0.88	<0.88	<0.88	<0.75	<0.75	--	--	1.1 J	<0.88	0.88 J	<0.88	<0.75	<0.75	0.78 J	<0.88	--	<0.88	0.94 J	--	0.97 J	--	1.1 J
Barium, ug/L	P	68.8	2,000	--	--	130	130	140	130	140	130	--	--	54	46	50	42	52	47	76	53	--	62	55	--	92	--	53
Beryllium, ug/L	DQ	DQ	4	--	--	<0.27	--	<0.27	--	<0.27	<0.27	--	--	<0.27	--	<0.27	--	<0.27	<0.27	<0.27	<0.27	--	<0.27	--	--	<0.27	--	<0.27
Cadmium, ug/L	NP*	0.12	5	--	--	<0.039	<0.039	<0.039	--	<0.051	<0.051	--	--	0.09 J	<0.039	<0.039	--	<0.051	<0.051	0.22	0.12	--	0.16	0.29	--	0.51	--	0.21
Chromium, ug/L	P	1.07	100	--	--	5.9	<1.1	<1.1	<1.1	<1.1	<1.1	--	--	1.7 J	<1.1	1.3 J	<1.1	<1.1	1.3 J	<0.98	<1.1	--	<1.1	<1.1	--	<1.1	--	<1.1
Cobalt, ug/L	NP	4.1	6	--	--	0.26 J	0.14 J	0.14 J	0.14 J	0.16 J	0.22 J	--	--	3.7	2.3	3.2	2.0	2.3	2.0	0.57	0.32 J	0.32 J	0.24 J	0.38 J	--	0.75	--	0.72
Fluoride, mg/L	P	0.48	4	--	<0.23	<0.23	--	<0.23	<0.23	<0.28	<0.28	--	<0.23	<0.23	--	0.36 J	<0.23	<0.28	<0.28	0.31 J	0.85	--	1.1	1.0	--	1.3	--	<0.28
Lead, ug/L	NP*	0.10	15	--	--	0.52	<0.27	<0.27	<0.11	<0.21	<0.21	--	--	2.8	0.63	1.6	<0.11	<0.21	<0.21	<0.27	<0.27	--	<0.27	<0.11	--	<0.21	--	<0.21
Lithium, ug/L	P	34.2	40	--	--	16	12	17	14	16	16	--	--	8.2 J	6.3 J	9.6 J	6.9 J	8.9 J	7.5 J	35	42	46	48	42	37	58	52	52
Mercury, ug/L	DQ	DQ	2	--	--	<0.10	--	<0.10	--	<0.15	<0.15	--	--	<0.10	--	<0.10	--	<0.15	<0.15	<0.10	<0.10	--	<0.10	--	--	<0.15	--	<0.15
Molybdenum, ug/L	P	1.74	100	--	--	<1.1	--	<1.1	<1.1	<1.3	<1.3	--	--	<1.1	--	<1.1	<1.1	<1.3	<1.3	26	29	--	31	39	--	83	--	70
Selenium, ug/L	P	8.55	50	--	--	<1.0	--	<1.0	<1.0	<0.96	<0.96	--	--	<1.0	--	<1.0	<1.0	<0.96	<0.96	5.0	3.3 J	--	4.5 J	2.4 J	--	2.4 J	--	2.3 J
Thallium, ug/L	NP*	0.14	2	--	--	<0.27	--	<0.26	--	<0.26	<0.26	--	--	<0.27	--	<0.26	--	<0.26	<0.26	<0.27	<0.26	--	<0.26	<0.26	--	<0.26	--	<0.26
Radium 226/228 Combined, pCI/L	P	2.15	5	--	--	2.73	2.13	1.69	2.67	2.87	3.22	--	--	1.77	1.02	0.957	1.77	1.05	1.60	0.411	0.0344	--	0.271	0.429	--	0.00	--	0.539
Additonal Parameters - Selection of Remedy																												
Aluminum, ug/L	UPL or GPS not applicable																											
Cobalt - dissolved, ug/L				--	--	--	--	0.11 J	--	--	--	--	--	--	--	2.2	--	--	--	--	--	0.31 J	0.23 J	--	--	--	--	--
Lithium - dissolved, ug/L				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	45	--	44	--	63	--	45
Iron, dissolved, ug/L				--	--	--	--	4,400	4,000	3,900	300	--	--	--	--	590	690	660	680	--	--	<50	<50	<50	--	<36	--	<36
Iron, ug/L				--	--	--	--	5,100	3,800	3,900	4,700	--	--	--	--	1,900	890	900	950	--	--	<50	<50	<50	--	<36	--	<36
Magnesium				--	--	--	--	25,000	23,000	26,000	24,000	--	--	--	--	19,000	18,000	19,000	18,000				86,000	76,000	--	100,000	--	55,000
Manganese, dissolved, ug/L				--	--	--	--	770	1,400	1,300	950	--	--	--	--	660	660	640	600	--	--	250	280	350	--	330	--	830 ^2
Manganese, ug/L				--	--	--	--	800	1,200	1,300	1,100	--	--	--	--	740	620	630	650	--	--	260	280	390	--	290	--	350
Potassium, ug/L				--	--	--	--	3,900	4,000	4,400	4,300	--	--	--	--	670	670	750	740	--	--	--	12,000	12,000	--	17,000	--	9,900
Sodium, ug/L				--	--	--	--	110,000	100,000	100,000	110,000	--	--	--	--	170,000	180,000	180,000	180,000	--	--	--	100,000	100,000	--	150,000	--	110,000
Total Alkalinity, mg/L				--	--	--	--	380	390	370	410	--	--	--	--	290	290	280	300	--	--	--	190	410	--	130	--	250
Cabonate Alkalinity, mg/L				--	--	--	--	<1.9	<3.8	<4.6	<4.6	--	--	--	--	<1.9	<1.9	<4.6	<4.6	--	--	--	<1.9	<3.8	--	<4.6	--	<4.6
Bicarbonate Alkalinity, mg/L				--	--	--	--	380	390	370	410	--	--	--	--	290	290	280	300	--	--	--	190	410	--	130	--	250

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Yellow highlighted cell with bold text indicates the compliance well result exceeds the GPS and the result was determined to be statistically significant[(1)].
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of MNA.

Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

				Delineation Wells																							
Parameter Name	UPL Method	UPL	GPS	MW-310A					MW-311							MW-311A								MW-312		MW-313	
				3/13/2020	4/14/2020	10/8/2020	4/15/2021	10/8/2021	10/24/2019	2/5/2020	3/13/2020	4/13/2020	10/8/2020	4/14/2021	10/8/2021**	3/13/2020	4/13/2020	6/30/2020	10/8/2020	2/23/2021	4/16/2021	7/7/2021	10/8/2021	1/12/2022	2/15/2022	1/12/2022	2/15/2022
Appendix III																											
Boron, ug/L	P	820		1,500	1,600	1,700	1,500	1,500	<110	<100	--	<100	<80	64 J	--	1,400	1,500	--	1,600	--	1,500	--	1,400	380	420	530	510
Calcium, mg/L	P	78.7		82	87	94	82	80	170	130	--	170	160	160	--	44	48	--	51	--	42	--	40	180	180	190	200
Chloride, mg/L	P	86.8		140	130	130	120	130	13	14	--	13	14	11	--	130	140	--	150	--	130	--	140	150	150	180	170
Fluoride, mg/L	P	0.484		1.7	1.8	2.0	1.9	0.28 J	<0.23	<0.23	--	<0.23	<0.23 ^	<0.28	--	3.4	4.1	3.7	4.4	3.9	4.0	3.8	2.0	<0.28	0.37 J	<0.28	<0.22
Field pH, Std. Units	P	6.87		7.73	7.85	7.48	7.47	7.65	6.95	6.72	7.11	6.86	6.93	6.66	--	7.85	8.4	7.64	8.33	7.55	7.76	8.19	8.12	7.18	7.24	7.00	7.01
Sulfate, mg/L	P	199		1,200	1,100	1,100	1,100	1,200	47	54	--	54	70	75	--	1200	1,200	--	1200	--	1,100	--	1,100	620	570	620	570
Total Dissolved Solids, mg/L	P	628		2,300	2,300	2,200	2,300	1,800	530	520	--	570	640	590	--	2,300	2,400	--	2,400	--	2,200	--	2,000	1,200	930	1,300	1,100
Appendix IV		**UPL**	**GPS**																								
Antimony, ug/L	P*	0.22	6	<0.58	<0.58	<0.51	<1.1	<1.1	<0.53	<0.58	--	<0.58	<0.51	<1.1	--	<0.58	<0.58	--	<0.51	--	<1.1	--	<1.1	<1.1	<0.69	<1.1	<0.69
Arsenic, ug/L	P*	0.53	10	<0.88	<0.88	<0.88	<0.75	<0.75	<0.75	<0.88	--	<0.88	1.7 J	<0.75	--	<0.88	<0.88	--	<0.88	--	<0.75	--	<0.75	3.4	4.1	1.2 J	1.0 J
Barium, ug/L	P	68.8	2,000	16	16	16	14	12	200	160	--	180	220	180	--	20	20	--	15	--	12	--	8.7	87	63	48	44
Beryllium, ug/L	DQ	DQ	4	<0.27	<0.27	--	<0.27	<0.27	<0.27	<0.27	--	<0.27	--	<0.27	--	<0.27	<0.27	--	--	--	<0.27	--	<0.27	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NP*	0.12	5	<0.039	<0.039	<0.049	<0.051	<0.051	0.04 J	<0.039	--	<0.039	0.12	<0.051	--	<0.039	<0.039	--	<0.049	--	<0.051	--	<0.051	0.053 J	<0.055	<0.051	<0.055
Chromium, ug/L	P	1.07	100	<1.1	<1.1	<1.1	<1.1	<1.1	<0.98	<1.1	--	<1.1	<1.1	<1.1	--	<1.1	<1.1	--	<1.1	--	<1.1	--	<1.1	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	NP	4.1	6	0.63	0.39 J	0.43 J	0.48 J	0.45 J	0.78	0.11 J	<0.091	<0.091	2.2	<0.091	--	0.19 J	0.13 J	--	0.12 J	--	0.13 J	--	<0.19	4.9	6.1	5.9	5.7
Fluoride, mg/L	P	0.48	4	1.7	1.8	2.0	1.9	0.28 J	<0.23	<0.23	--	<0.23	<0.23 ^	<0.28	--	3.4	4.1	3.7	4.4	--	4.0	3.8	2.0	<0.28	0.37 J	<0.28	<0.22
Lead, ug/L	NP*	0.10	15	<0.27	<0.27	<0.11	<0.21	<0.21	<0.27	<0.27	--	<0.27	1.8	<0.21	--	<0.27	<0.27	--	<0.11	--	<0.21	--	<0.21	<0.21	<0.24	<0.21	<0.24
Lithium, ug/L	P	34.2	40	250	290	240	270	280	4.7 J	2.9 J	4.7 J	6.2 J	4.6 J	5.9 J	--	260	310	--	240	--	290	--	290	41	31	33	26
Mercury, ug/L	DQ	DQ	2	<0.10	<0.10	--	<0.15	<0.15	<0.10 F1	<0.10	--	<0.10	--	<0.15	--	<0.10	<0.10	--	--	--	<0.15	--	<0.15	<0.15	<0.11	<0.15	<0.11
Molybdenum, ug/L	P	1.74	100	2.6	2.7	3.0	5.0	1.9 J	<1.1	<1.1	--	<1.1	<1.1	<1.3	--	1.2 J	2.8	--	3.1	--	<1.3	--	<1.3	2.7	1.6 J	6.1	5.3
Selenium, ug/L	P	8.55	50	<1.0	<1.0	<1.0	<0.96	<0.96	<1.0	1.2 J	--	<1.0	<1.0	2.1 J	--	<1.0	<1.0	--	<1.0	--	<0.96	--	<0.96	<0.96	<0.96	<0.96	<0.96
Thallium, ug/L	NP*	0.14	2	<0.26	<0.26	<0.26	<0.26	<0.26	<0.27	<0.26	--	<0.26	<0.26	<0.26	--	<0.26	<0.26	--	<0.26	--	<0.26	--	<0.26	<0.26	<0.26	<0.26	<0.26
Radium 226/228 Combined, pCI/L	P	2.15	5	3.43	3.90	4.46	4.44	5.41	0.411	0.108	--	0.17	0.738	0.194	--	1.47	2.31	--	3.1	--	3.85	--	4.44	1.25	0.888	1.29	1.25
Additonal Parameters - Selection of Remedy																											
Aluminum, ug/L	UPL or GPS not applicable																							<17		<17	
Cobalt - dissolved, ug/L				0.67	0.40 J	--	--	--	--	--	0.11 J	<0.091	--	--	--	0.36 J	0.12 J	--	--	--	--	--	--	3.4	5.6	5.9	5.2
Lithium - dissolved, ug/L				250	--	230	300	240	--	--	8.0 J	--	--	--	--	250	--	--	230	--	330	--	250	--	31	--	26
Iron, dissolved, ug/L				<50	220	<50	<36	38 J	--	--	<50	<50	<50	<36	--	<50	<50	--	<50	--	<36	--	<36	--	380	--	290
Iron, ug/L				99 J	230	280	<36	<140	--	--	<50	<50	630	<36	--	<50	<50	--	<50	--	<36	--	<140	180	440	240	380
Magnesium				--	41,000	45,000	37,000	36,000			--	40,000	40,000	36000	--	--	23,000	--	25,000 J	--	21,000	--	20,000	52,000	54,000	58,000	58,000
Manganese, dissolved, ug/L				53	39	29	39	30	--	--	21	39	75	<4.4	--	20	22	--	5.8 J	--	6.2 J	--	5.5 J	--	1,100	--	3,200
Manganese, ug/L				51	38	31	34	26 J	--	--	20	41	180	<4.4	--	20	13	--	8.3	--	6.1 J	--	<18	1,300	1,300	3,600	3,700
Potassium, ug/L				--	9,900	11,000	9,200	8,900	--	--	--	620	810	650	--	--	9,000	--	10,000	--	8,300	--	7,700	4,300	4,300	5,700	5,900
Sodium, ug/L				--	630,000	620,000	600,000	570,000	--	--	--	5,000	5,100	5,200	--	--	710,000	--	700,000	--	720,000	--	670,000	120,000	130,000	110,000	120,000
Total Alkalinity, mg/L				--	320	260	340	370	--	--	--	460	290	450	--	--	360	--	400	--	370	--	380	220	230	230	250
Cabonate Alkalinity, mg/L				--	<1.9	<3.8	<4.6	<4.6	--	--	--	<1.9	<3.8	<4.6	--	--	<1.9	--	<3.8	--	<4.6	--	<4.6	<4.6	<4.6	<4.6	<4.6
Bicarbonate Alkalinity, mg/L				--	320	260	340	370	--	--	--	460	290	450	--	--	360	--	400	--	370	--	380	220	230	230	250

Key	Description
4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Yellow highlighted cell with bold text indicates the compliance well result exceeds the GPS and the result was determined to be statistically significant[(1)].
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of MNA.

Table 3. Groundwater Analytical Results Summary - CCR Program - Assessment Monitoring
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

Abbreviations:

-- = Not Analyzed
mg/L = milligrams per liter
ug/L = micrograms per liter
J = Estimated concentration at or above the LOD and below the LOQ.
B = Analyte was detected in the associated Method Blank.
F1 = MS and/or MSD Recovery is outside acceptance limits.
H=Sample was prepared or analyzed beyond the specific holding time
LOD = Limit of Detection
LOQ = Limit of Quantitation
GPS = Groundwater Protection Standard
UPL = Upper Prediction Limit
^ = ICV, CCV, ICB, ISA, ISB, CRI, CRA, DLCK, OR MRL standard: Instrument related QC is outside acceptance limits
^2 = Calibration Blank (ICB and/or CCB) is outside acceptance limits.
P = Parametric UPL with 1-of-2 retesting
DQ = Double Quantification Rule (not detected in background)
NP = Nonparametric UPL (highest background value)
* = UPL is below the LOQ for background sampling. For compliance wells, only results confirmed above the LOQ are evaluated as potential SSIs above background.
**= Sufficient water for sample collection was not present in MW-311 during the October 2021 sampling event.

Notes:

1. An individual result above the UPL or GPS does not constitute a statistically significant increase (SSI) above background or statistically significant level above the GPS. The cobalt GPS exceedances at MW-305 have been determined to be statistically significant. The cobalt GPS exceedance at MW-306 has been determined not to be statistically significant. Lithium and fluoride GPS exceedances have either been determined not to be statistically significant or the determination is ongoing. See the accompanying reporttext for additional information regarding determinations of statistical significance.
2. GPS is the United States Environmental Protection Agency (US EPA) Maximum Contamination Level (MCL), if established; otherwise, the values are from 40 CFR 257.95(h)(2)
3. Interwell UPLs calculated based on results from background well MW-301.

Created by:	NDK	Date:	5/1/2018
Last revision by:	NDK	Date:	7/11/2022
Checked by:	JR	Date:	7/11/2022
Proj Mgr QA/QC:	TK	Date:	7/15/2022

Table 4. Groundwater Analytical April 2022 Results Summary
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

				Background Well	Compliance Wells				Delineation Well	Compliance Well				Delineation Wells					
Parameter Name	UPL Method	UPL	GPS	MW-301	MW-302	MW-303	MW-304	MW-305	MW-305A	MW-306	MW-307	MW-308	MW-309	MW-310	MW-310A	MW-311	MW-311A	MW-312	MW-313
				4/12/2022	4/12/2022	4/12/2022	4/12/2022	4/11/2022	4/12/2022	4/12/2022	4/14/2022	4/14/2022	4/14/2022	4/11/2022	4/12/2022	4/11/2022	4/14/2022	4/11/2022	4/11/2022
Appendix III																			
Boron, ug/L	P	839		640	1,300	620	940	850	210	760	200	220	1400	640	1,500	79 J	1500	560	570
Calcium, mg/L	P	103		92	170	190	130	120	180	110	250	230	130	190	99	150	54	200	200
Chloride, mg/L	P	210		140	170	58	270	200	160	260	210	150	57	200	120	17	140	170	170
Fluoride, mg/L	P	0.381		<0.22	<0.22	<0.22	1.7	<0.22	<0.22	<0.22	<0.28	<0.28	<0.28	<0.22	0.40 J	<0.22	2.4	<0.22	<0.22
Field pH, Std. Units	P	6.74		6.37	6.43	6.71	6.95	6.90	7.19	6.66	6.59	6.7	7	6.86	7.43	6.74	7.53	7.07	6.94
Sulfate, mg/L	P	208		160	750	200	260	150	160	70	92 F1	270	360	630	1,200	78	1,200	550	500
Total Dissolved Solids, mg/L	P	697		610	1,100	630	1,700	950	700	710	1,000	1100	940	1,400	2,100	480	2,200	1,100	3,200
Appendix IV		**UTL**	**GPS**																
Antimony, ug/L	NP	1.10	6	<0.69	<0.69	<0.69	<0.69	<0.69	<0.69	<0.69	<1.1	<1.1	<1.1	0.89 J	0.85 J	<0.69	<0.69	<0.69	<0.69
Arsenic, ug/L	NP	0.88	10	<0.75	<0.75	<0.75	0.76 J	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	1.0 J	<0.75	<0.75	<0.75	4.4	1.2 J
Barium, ug/L	P	71.0	2,000	40	17	64	78	120	91	94	160	140	52	75	14	170	10	50	44
Beryllium, ug/L	NP	0.270	4	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	P	0.149	5	<0.055	0.21	0.15	<0.055	<0.055	<0.055	1.3	<0.051	<0.051	<0.051	0.23	<0.055	<0.055	<0.055	<0.055	<0.055
Chromium, ug/L	NP	1.10	100	<1.1	1.4 J	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	P	5.26	6	0.23 J	1.3	1.6	0.41 J	21	1.7	9.1	46	0.16 J	2.3	0.93	0.41 J	<0.19	0.32 J	9.1	5.7
Fluoride, mg/L	P	0.417	4	<0.22	<0.22	<0.22	1.7	<0.22	<0.22	<0.22	<0.28	<0.28	<0.28	<0.22	0.40 J	<0.22	2.4	<0.22	<0.22
Lead, ug/L	NP	0.270	15	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.21	<0.21	<0.21	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24
Lithium, ug/L	P	31.8	40	19	9.1 J	4.0 J	3.4 J	<2.5	17	<2.5	14	16	8.9 J	54	260	6.3 J	280	40	28
Mercury, ug/L	DQ	DQ	2	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.15	<0.15	<0.15	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
Molybdenum, ug/L	NP	1.3	100	<1.2	2.6	2.7	1.9 J	7.8	4.5	14	<1.3	<1.3	<1.3	47	4.4	<1.2	1.6 J	1.3 J	4.8
Selenium, ug/L	P	9.01	50	6.0	2.4 J	8.3	1.3 J	1.1 J	<0.96	<0.96	<0.96	<0.96	<0.96	2.3 J	1.4 J	2.0 J	1.3 J	<0.96	<0.96
Thallium, ug/L	NP	0.500	2	<0.26	<0.26	0.26 J	<0.26	0.42 J	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
Radium 226/228 Combined, pCI/L	P	1.71	5	0.378	0.294	0.619	2.87	1.03	3.44	2.03	3.08	2.87	1.05	0.316	4.61	0.224	3.99	0.357	0.543
Additional Parameters Collected for Selection of Remedy																			
Cobalt, dissolved, ug/L	UPL or GPS not applicable			--	--	--	--	17	--	7.6	49	--	--	--	--	--	--	--	--
Lithium, dissolved, ug/L				--	--	--	--	--	--	--	--	--	--	52	260	--	310	37	26
Iron, dissolved, ug/L				<36	<36	<36	3,800	55 J	<36	<250	3,400	3,900	660	<36	<140	<36	<140	510	630
Iron, ug/L				<36	45 J	<36	4,800	76 J	<36	68 J	3,700	3,900	900	<36	56 J	<36	<36	350	920
Magnesium, ug/L				36,000	49,000	26,000	45,000	53,000	32,000	44,000	30,000	26,000	19,000	90,000	42,000	37,000	25,000	65,000	68,000
Manganese, dissolved, ug/L				5.0 J	91	410	3,500	3,200	120	23,000	360	1,300	640	400	20 J	<3.6	<14	1,200	3,200
Manganese, ug/L				8.1 J	110	490	4,200	4,000	140	26,000	330	1,300	630	520	26	4.6 J	3.7 J	1,400	3,800
Potassium, ug/L				1,100	1,600	930	8,700	8,700	4,200	6,000	2,000	4,400	750	16,000	11,000	860	10,000	4,800	6,100
Sodium, ug/L				89,000	240,000	110,000	240,000	210,000	60,000	180,000	98,000	100,000	180,000	170,000	650,000	6,300	800,000	170,000	140,000
Bicarbonate Alkalinity, mg/L				190	100	520	380	520	320	470	490	370	280	260	360	440	370	240	300
Carbonate Alkalinity, mg/L				<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6
Total Alkalinity, mg/L				190	100	520	380	520	320	470	490	370	280	260	360	440	370	240	300

4.4	Blue highlighted cell indicates the compliance or delineation well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance or delineation well result exceeds the GPS.

Table 4. Groundwater Analytical April 2022 Results Summary
Ottumwa Generating Station Ash Pond / SCS Engineers Project #25220083.00

Abbreviations:

UPL = Upper Prediction Limit	LOD = Limit of Detection	ug/L = micrograms per liter	UTL= Upper Tolerance Limits
NA = Not Analyzed	LOQ = Limit of Quantitation	DQ = Double Quantification Rule (not detected in background)	
GPS = Groundwater Protection Standard	-- = Not Analyzed	NP = Nonparametric UPL (highest background value)	
MNA = Monitorized Natural Attenuation	mg/L = milligrams per liter	P = Parametric UPL with 1-of-2 retesting	

Lab Notes:
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1 = MS and/or MSD Recovery is outside acceptance limits.

Notes:
1. An individual result above the UPL or GPS does not constitute an SSI above background or statistically significant level above the GPS. See the accompanying text for identification of statistically significant results.
2. GPS is the United States Environmental Protection Agency (USEPA) Maximum Contamination Level (MCLs), if established; otherwise, the values from 40 CFR 257.95(h)(2).
3. Interwell UPLs and UTLs calculated based on results from background well MW-301. UPLs and UTLs were upated in April 2022.
4. Compliance wells represent the groundwater monitoring network at the boundary of the CCR unit. The delineation wells were installed during the selection of remedy process to evaluate an extension of the downgradient groundwater monitoring network.

Created by:	NDK	Date:	5/1/2018
Last revision by:	NDK	Date:	7/11/2022
Checked by:	JAO	Date:	7/11/2022
Sci./PM QA/QC:	TK	Date:	7/15/2022

I:\25220083.00\Deliverables\ACM Addendum No 2\Tables\[4_CCR GW April 2022 Screening Summary_OGS.xlsx]Current Event Table

Table 5. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Ottumwa Generating Station / SCS Project # 25220083.00
November 2017 - June 2022

Well	Sample Date	Groundwater Elevation (feet)	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Field Oxidation Potential (mV)	Turbidity (NTU)
MW-301	11/8/2017	681.54	13.9	6.41	4.16	743	201	1.03
	4/18/2018	681.53	7.2	6.41	6.52	770	106	0.66
	8/14/2018	680.91	20.4	6.26	3.18	867	-56	0.52
	8/29/2018	681.09	20.6	6.31	4.71	781	--	0.63
	10/16/2018	682.50	16.6	6.27	4.12	599	120	2.91
	1/8/2019	682.22	7.9	5.68	5.68	310	118	0.77
	4/8/2019	682.69	7.3	6.61	8.32	501	38	1.87
	10/24/2019	683.07	13.7	6.33	4.94	902	10	1.6
	2/5/2020	683.30	5.4	6.39	7.28	966	68	1.43
	3/12/2020	682.82	6.9	6.48	5.3	962	258.5	1.33
	4/14/2020	683.25	8.7	6.58	5.1	939	176.3	0.87
	10/8/2020	682.34	15.4	6.22	4.2	1,035	163.6	0.02
	4/14/2021	682.94	9.1	6.26	5.99	1,062	232.5	1.61
	10/7/2021	681.95	17.9	6.26	4.17	1,062	207.3	8.90
	4/12/2022	682.08	7.4	6.37	3.26	976	117.6	5.03
MW-302	11/8/2017	655.40	13.8	6.55	0.4	2,274	191.7	1.63
	4/18/2018	655.71	10.7	6.47	0.2	2,248	82.6	2.41
	8/14/2018	656.05	14.3	6.76	0.17	2,304	-336.6	4.01
	8/29/2018	655.89	14.6	6.77	0.23	2,357	--	1.42
	10/16/2018	656.91	14.1	6.37	0.26	1,912	114.2	88.24
	1/8/2019	656.03	12.2	6.58	6.4	1,473	70.2	4.39
	4/8/2019	657.23	12.3	6.61	0.86	2,159	68.3	26.9
	10/24/2019	660.14	12.9	6.55	0.35	2,184	-0.5	11.9
	4/14/2020	656.45	10.5	6.70	0.22	1,971	135.6	31.1
	10/8/2020	655.80	14.4	7.00	0.14	2,100	34.5	18.7
	4/13/2021	656.05	11.9	6.44	0.37	2,087	198.2	22.9
	10/7/2021	654.86	14.9	6.49	0.30	1,920	211.5	15.6
	4/12/2022	654.77	11.4	6.43	0.41	1,741	145.2	5.13
MW-303	11/8/2017	651.34	15.2	6.60	0.5	1,896	176.8	3.67
	4/18/2018	652.47	8.2	6.63	0.17	1,862	3.2	3.69
	8/14/2018	652.57	17.2	6.83	0.19	1,833	-307.9	1.51
	8/29/2018	655.07	18.7	7.03	1.92	1,161	--	10.13
	10/16/2018	656.17	17.1	6.66	0.29	1,573	32.8	5.99
	1/8/2019	654.65	9.1	6.83	3.19	750	73.7	14.2
	4/8/2019	655.55	8.5	7.00	2.29	1,181	51.7	3.49
	10/24/2019	653.86	15.3	6.83	0.28	1,287	-5.1	4.24
	4/14/2020	654.08	8.9	6.98	1.94	1,097	104.3	12.1
	10/8/2020	650.37	17.0	8.28	0.13	1,602	-0.4	30.2
	4/13/2021	653.82	9.7	6.67	2.83	1,118	184.7	4.31
	10/7/2021	649.80	17.6	6.70	0.32	1,343	66.5	11.1
	4/12/2022	652.95	9.0	6.71	1.19	1,245	158.2	6.2
MW-304	11/8/2017	653.03	13.3	7.00	0.25	2,205	162.7	3.88
	4/18/2018	655.55	12.8	6.90	0.15	2,141	137.5	39.29
	8/15/2018	656.35	15.1	7.34	0.21	2,085	35.5	81.42
	8/29/2018	657.82	13.7	7.22	0.16	2,123	--	55.94
	10/16/2018	658.20	13.5	6.86	0.11	2,058	-114.5	17.12
	1/8/2019	656.28	12.8	7.16	0.72	1,368	-62.1	4.38
	4/8/2019	659.33	13.8	7.17	0.41	1,876	-58.3	57.9
	10/23/2019	657.71	13.6	7.05	0.44	1,871	-57.5	18.9
	4/13/2020	656.42	11.9	7.12	0.24	1,764	-119.8	54.1
	10/8/2020	652.95	13.6	7.88	0.18	1,675	-113	11.1
	4/14/2021	654.34	13.1	6.94	0.20	1,797	-97.5	16.9
	10/8/2021	649.53	13.8	6.97	0.32	1,617	-78.7	7.3
	4/12/2022	652.14	13.3	6.95	0.13	1,772	-56.9	3.7
MW-305	11/8/2017	659.76	13.2	7.01	0.2	1,738	146.1	2.68
	4/18/2018	660.99	12.8	6.90	0.15	1,840	-32.7	7.37
	8/15/2018	661.56	14.8	7.21	0.18	1,832	31	14.9
	10/16/2018	663.37	13.9	6.86	0.09	1,836	-26.8	6.96
	1/8/2019	662.13	12.4	6.99	0.81	1,235	36.4	4.76
	4/8/2019	664.01	13.8	7.06	0.59	1,728	32.6	21.7
	10/23/2019	663.21	13.2	6.91	0.42	1,794	-6.7	6.21
	3/13/2020	661.41	12.4	7.02	0.2	1,788	192.6	42.68
	4/13/2020	662.44	9.1	7.00	0.28	1,772	6.6	21.7
	10/9/2020	659.81	14.0	7.44	0.13	1,810	-13	12.9
	4/16/2021	661.15	12.9	6.92	0.16	1,799	43.6	8.17
	10/6/2021	654.83	13.7	6.94	0.44	1,629	46.9	3.8
	2/14/2022	656.35	12.4	7.20	4.8	1,500	50	0.0
	4/11/2022	657.62	12.8	6.90	0.23	1,742	134.8	4.97

Table 5. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Ottumwa Generating Station / SCS Project # 25220083.00
November 2017 - June 2022

Well	Sample Date	Groundwater Elevation (feet)	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Field Oxidation Potential (mV)	Turbidity (NTU)
MW-305A	3/13/2020	651.64	11.8	8.09	3.79	745	204.2	63.2
	4/14/2020	653.69	11.2	7.63	2.26	807	106.7	4.91
	10/5/2020	648.01	14.2	7.46	0.19	1,102	11	NM
	4/15/2021	651.16	12.4	7.05	0.88	1,224	158.3	1.02
	10/8/2021	645.57	14.7	6.90	2.02	1,145	147.8	14.3
	4/12/2022	649.24	21.6	7.19	4.85	1,242	79.7	12.5
MW-306	11/8/2017	669.04	13.6	6.49	0.18	1,186	174.1	0.82
	4/18/2018	668.92	13.1	6.42	0.14	1,228	14.2	0.59
	8/15/2018	668.66	14.6	6.74	0.15	1,271	22.8	3.95
	10/16/2018	670.24	13.4	6.42	0.08	1,340	13.3	7.07
	1/8/2019	669.84	13.3	6.65	0.47	965	59.5	0.89
	4/8/2019	670.96	13.6	6.66	0.92	1,350	49.1	28.5
	10/23/2019	671.28	13.1	6.74	0.29	1,266	-0.5	12.3
	4/14/2020	670.71	11.7	6.68	0.21	1,158	49.7	15.7
	10/9/2020	670.18	13.4	6.54	0.12	1,294	41.4	14
	2/23/2021	669.86	13.4	6.34	0.50	1,277	64.2	2.86
	4/13/2021	670.27	12.7	6.42	0.14	1,339	92	8.99
	7/6/2021	661.87	14.3	7.44	0.33	1,357	119.2	1.37
	10/8/2021	662.27	14.7	6.66	0.40	1,506	86	6.7
	2/14/2022	663.66	13.6	7.07	1.05	1,770	39	0.0
	4/12/2022	664.61	13.8	6.66	0.24	1,579	17.1	2.64
MW-307	11/8/2017	647.37	13.2	6.61	0.17	1,656	176.7	11.16
	4/16/2018	649.66	11.6	7.04	0.29	1,674	-105.9	11.93
	5/30/2018	652.45	12.7	6.44	0.18	1,710	-45.8	18.58
	6/28/2018	652.87	13.4	6.87	0.21	1,686	-43.4	53.34
	7/18/2018	652.27	12.9	6.62	0.21	1,718	-416.3	14.94
	10/16/2018	654.13	14.3	6.54	0.08	1,697	-65.7	14.08
	4/8/2019	654.90	12.5	6.76	0.51	1,599	-3.7	26
	10/23/2019	651.89	13.4	6.68	0.25	1,684	-24.8	12.5
	12/11/2019	649.59	11.5	6.37	0.18	1,576	-45.8	43.13
	2/5/2020	649.88	11.7	6.67	0.9	1,681	-15.6	9.74
	4/14/2020	650.66	10.6	6.76	0.69	1,554	-52.9	28.9
	10/7/2020	646.18	13.2	6.97	0.08	1,637	-62.2	4.56
	2/23/2021	646.80	12.2	6.50	0.20	1,632	0.8	2.41
	4/14/2021	649.53	11.5	6.59	0.41	1,675	-39.9	21.2
	7/6/2021	647.03	13.2	7.05	0.21	1,705	14.7	17.91
	10/7/2021	644.49	14.4	6.71	0.19	1,552	-23.8	10.0
	2/14/2022	645.82	12.3	7.03	0.97	1,810	-51	0.0
	4/11/2022	648.40	11.8	6.63	0.13	1,718	46.3	4.09
MW-308	11/8/2017	644.99	13.0	6.76	0.12	1,577	169.7	0.73
	4/16/2018	647.91	11.8	7.14	0.35	1,577	-47.2	0.93
	5/30/2018	651.05	12.1	6.61	0.14	1,611	-48.2	3.34
	6/28/2018	651.43	13.1	7.08	0.19	1,584	-60.3	5.87
	7/18/2018	650.67	12.6	6.73	0.13	1,628	-415.4	1.54
	10/16/2018	NM	13.1	6.68	0.08	1,594	-80.8	5.49
	4/8/2019	653.70	12.5	6.90	0.66	1,539	-23	6.87
	10/23/2019	651.31	13.2	6.78	4.42	1,637	-38.7	7.42
	12/11/2019	647.39	10.5	6.55	0.43	1,532	-56.6	15.72
	2/5/2020	650.12	11.4	6.78	1.48	1,630	-35.9	3.49
	4/14/2020	650.09	10.9	6.90	0.28	1,502	-69.1	5.12
	10/7/2020	642.85	13.2	7.24	0.11	1,575	-56.5	1.15
	4/15/2021	647.66	11.5	6.70	0.44	1,598	-49.3	4.47
	10/7/2021	641.81	13.0	6.83	0.17	1,453	-26.1	12.80
	4/12/2022	645.75	12.7	6.70	0.26	1,491	-30.9	6.0
MW-309	11/8/2017	644.20	13.1	7.11	0.13	1,431	149.7	3.71
	4/16/2018	647.65	11.2	7.52	0.37	1,445	-58.5	36.7
	5/30/2018	650.98	12.4	6.92	0.12	1,484	-38	40.55
	6/28/2018	651.47	13.8	7.36	0.17	1,477	-45.5	241.4
	7/18/2018	650.69	12.6	7.02	0.11	1,501	-432.6	40.38
	10/16/2018	651.61	13.5	6.95	0.03	1,464	-81.6	28.27
	4/8/2019	653.55	12.4	7.18	0.66	1,396	-3.3	72.1
	10/23/2019	651.28	12.8	6.98	0.36	1,461	-27.5	42.6
	12/11/2019	647.24	11.5	6.67	0.26	1,350	-37.8	413.6
	2/5/2020	648.34	11.4	7.09	1.07	1,433	-7.8	18.1
	4/14/2020	649.19	11.2	7.21	0.16	1,322	-51.5	100.1
	10/7/2020	641.50	13.3	7.57	0.09	1,371	-71.1	7.7
	4/14/2021	646.46	11.7	7.00	0.36	1,411	-40.6	9.32
	10/7/2021	640.71	13.1	7.18	0.21	1,297	-8.1	19.60
	4/14/2022	644.32	11.7	7.16	0.70	1,305	28.1	14

Table 5. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Ottumwa Generating Station / SCS Project # 25220083.00
November 2017 - June 2022

Well	Sample Date	Groundwater Elevation (feet)	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Field Oxidation Potential (mV)	Turbidity (NTU)
MW-310	10/24/2019	649.31	13.7	7.15	0.41	1,906	-9.3	2.29
	2/5/2020	644.71	12.5	7.08	0.68	1,723	42.2	0.9
	3/12/2020	645.45	12.8	6.89	0.3	1,902	252.2	2.77
	4/13/2020	645.91	10.3	7.00	0.22	1,823	179.4	0.87
	10/12/2020	638.46	13.9	7.07	0.16	1,709	146.5	0.02
	2/23/2021	638.77	13.6	7.11	0.09	962	91.3	0.02
	4/13/2021	642.70	12.6	7.07	0.46	2,362	161	2.38
	7/6/72021	639.32	13.0	8.23	0.21	1,852	88.6	0.0
	10/6/2021	638.19	15.4	7.20	0.48	1,425	96.8	1.0
	4/11/2022	640.79	12.6	6.86	0.30	2,007	161.1	4.0
MW-310A	3/13/2020	645.45	12.5	7.73	6.28	3,160	178.9	109
	4/14/2020	645.91	8.8	7.85	6.39	2,915	146.1	--
	10/5/2020	640.20	13.1	7.48	0.48	3,122	89.7	NM
	4/15/2021	644.88	12.5	7.47	0.98	3,106	160.2	2.25
	10/8/2021	639.57	15.6	7.65	6.21	2,808	143.1	15
	4/12/2022	640.83	17.2	7.43	4.72	2,920	26.7	14.2
MW-311	10/24/2019	647.80	13.9	6.95	0.29	926	-24.7	3.88
	2/5/2020	645.00	10.2	6.72	2.11	891	21	1.89
	3/13/2020	644.18	10.0	7.11	0.23	877	222.6	3.44
	4/13/2020	646.79	8.8	6.86	0.29	912	103.4	0.44
	10/12/2020	638.73	14.4	6.93	7.12	1024	-53	NM
	4/14/2021	643.02	9.3	6.66	1.18	945	179.8	0.78
	7/7/2021	642.38	14.2	8.19	0.42	3381	80.8	0.0
	10/6/2021	Dry	NM	NM	NM	NM	NM	NM
	4/11/2022	641.44	10.1	6.74	0.51	880	125.4	3.57
MW-311A	3/13/2020	624.11	12.1	7.85	2.29	3,336	206	7.74
	4/13/2020	648.42	7.9	8.40	3.87	3,027	115.8	3.19
	6/30/2020	647.73	12.6	7.64	1.51	3,391	23.4	1.43
	10/6/2020	641.09	12.7	8.33	0.44	3,177	39.6	NM
	2/25/2021	641.16	11.5	7.55	3.23	3,243	129.7	0.02
	4/16/2021	644.16	12.3	7.76	0.77	3,332	146.9	0.02
	10/8/2021	640.58	15.1	8.12	1.68	2,930	140.7	9.6
	4/14/2022	643.23	14.1	7.53	4.66	3,211	54.6	9.61
MW-312	2/15/2022	641.86	13.0	7.24	1.34	1,800	-67.00	0.0
	4/11/2022	644.62	12.3	7.07	0.15	1,855	112.1	8.39
MW-313	2/15/2022	640.58	13.9	7.01	1.22	925	-29.00	0.0
	4/11/2022	642.06	13.2	6.94	0.09	1,788	126.5	7.44

Created: NDK Date: 7/13/2022
Updated: NDK Date: 7/13/2022
QC Checked: JR Date: 7/13/2022

Table 6. Preliminary Evaluation of Corrective Measure Alternatives
Ottumwa Generating Station / SCS Engineers Project #25220083.00

	Alternative #1 No Action	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-Site Landfill with MNA	Alternative #6 Consolidate and Cap with Chemical Amendment and Groundwater Collection	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall and Groundwater Collection
CORRECTIVE ACTION ASSESSMENT - 40 CFR 257.97(b)							
257.97(b)(1) Is remedy protective of human health and the environment?	No	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(2) Can the remedy attain the groundwater protection standard?	Unlikely	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(3) Can the remedy 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?	No	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(4) Can the remedy remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible?	No	Yes, if MNA is feasible or coupled with an alternative groundwater restoration method.	Yes, if MNA is feasible or coupled with an alternative groundwater restoration method.	Yes, if MNA is feasible or coupled with an alternative groundwater restoration method.	Yes, as updated to include groundwater restoration via groundwater collection. Alternatively, groundwater restoration via MNA is appropriate if feasible.	Yes	Yes, as updated to include groundwater restoration via groundwater collection. Alternatively, groundwater restoration via MNA is appropriate if feasible.
257.97(b)(5) Can the remedy comply with standards for management of wastes as specified in §257.98(d)?	Not Applicable	Yes	Yes	Yes	Yes	Yes	Yes
LONG- AND SHORT-TERM EFFECTIVENESS - 40 CFR 257.97(c)(1)							
257.97(c)(1)(i) Magnitude of reduction of existing risks	No reduction of existing risk	Existing risk reduced through consolidation of CCR into a smaller footprint thereby reducing or eliminating the volume of source material in contact with groundwater after closure. Risk is aslo reduced by achieving GPS.	Similar to Alternative #3 with potential increased reduction of risk due to CCR removal and elimination of groundwater interaction with CCR.	Similar to Alternative #3 with potential increased reduction of risk due to CCR removal and elimination of groundwater interaction with CCR.	Similar to Alternative #3. Long-term risk may be reduced with additional source control and in-situ stabilization/fixation of CCR that may be in contact with groundwater.	Similar to Alternative #3 with potential increased reduction of risk due to removal of contaminant from the aquifer.	Similar to Alternative #3. Long-term risk may be reduced with additional containment offered by barrier wall.
257.97(c)(1)(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy	No reduction of existing risk. Residual risk is limited for all alternatives due to limited extent of impacts and lack of receptors.	Magnitude of residual risk of further releases is lower than current conditions due to consolidation, reduction or elimination of CCR and groundwater interaction, and final cover eliminating infiltration through CCR	Reduced risk over Alternative #3 due to composite liner and cover	Reduced risk over Alternative #3 due to removal of CCR from site	Same as Alternative #3 with potential further reduction in release risk due to CCR material footprint; Residual risk is further reduced by way of chemical / physical alteration of the source of impacts.	Same as Alternative #3 with potential further reduction in release risk due to CCR material footprint; Residual risk is potentially reduced by way of the ability to respond to potential future/ongoing releases from CCR that might be in contact with groundwater following closure.	Same as Alternative #3 with potential further reduction in release risk due to CCR material footprint; Residual risk of source material in contact with groundwater is further reduced by the containment of groundwater impacts provided by barrier walls;
257.97(c)(1)(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance	Not Applicable	30-year post-closure groundwater monitoring; Groundwater monitoring network maintenance and as-needed repair/replacement Final cover maintenance (e.g., mowing and as-needed repair); Periodic final cover inspections; Additional corrective action as required based on post-closure groundwater monitoring	Same as Alternative #3	No on-site long-term management required; Limited on-site post-closure groundwater monitoring until GPS are achieved; Receiving disposal facility will have same/similar long-term monitoring, operation, and maintenance requirements as Alternative #3	Same as Alternative #3.	Same as Alternative #3 with additional effort for groundwater pump operation and maintenance (O&M), groundwater treatment system O&M, and treatment system discharge monitoring/reporting.	Same as Alternative #3 with additional monitoring of wall performance.

Table 6. Preliminary Evaluation of Corrective Measure Alternatives
Ottumwa Generating Station / SCS Engineers Project #25220083.00

	Alternative #1 No Action	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-Site Landfill with MNA	Alternative #6 Consolidate and Cap with Chemical Amendment and Groundwater Collection	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall and Groundwater Collection
LONG- AND SHORT-TERM EFFECTIVENESS - 40 CFR 257.97(c)(1) (continued)							
257.97(c)(1)(iv) Short-term risks - Implementation							
Excavation	None	Limited risk to community and environment due to limited amount of excavation(likely >200K cy but <420K cy) required to establish final cover subgrades. Risk to environment due to increased excavation volumes required for consolidation	Same as Alternative #3 with increased risk to environment due to increased excavation volumes (~420K cy) and temporary CCR storage during disposal site construction required for removal and on-site re-disposal	Same as Alternative #4 with reduced risk to environment from excavation due to limited on-site storage	Similar to Alternative #3 with some increased potential risk due to exposure during the application of the chemical amendment.	Similar to Alternative #3 with some increased construction risk due to drilling, trenching, and excavation for groundwater pumping and treatment system construction.	Similar to Alternative #3 with some increased construction risk due to excavation or installation of the barrier wall.
Transportation	None	No risk to community or environment from off-site CCR transportation; Typical risk due to construction traffic delivering final cover materials to site	Same as Alternative #3 with increased risk from construction traffic due to increased material import requirements (liner and cap construction required)	Highest level of community and environmental risk due to CCR volume export (~420K cy)	Similar to Alternative #3 with increased risk from importing chemical material for stabilization/treatment.	Similar to Alternative #3 with increased risk from importing groundwater pumping and treatment system materials.	Similar to Alternative #3 with increased risk from importing barrier wall system materials.
Re-Disposal	None	Limited risk to community and environment due to limited volume of CCR re-disposal due to increased volumes (likely >200K cy but <420K cy) required for consolidation	Same as Alternative #3 with increased risk to environment due to increased excavation volumes (~420K cy) and temporary CCR storage during disposal site construction required for removal and on-site re-disposal	Same as Alternative #4 with increased risk to community and environment due to re-disposal of large CCR volume (~420K cy) at another facility; Re-disposal risks are managed by the receiving disposal facility	Similar to Alternative #3 with some increased potential risk due to exposure during the application of the chemical amendment.	Same as Alternative #3	Same as Alternative #3
257.97(c)(1)(v) Time until full protection is achieved	Unknown	Closure and capping can be completed by end of 2023. Groundwater protection timeframe to reach GPS potentially 2 to 10 years following closure construction, achievable within 30-year post-closure monitoring period. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential for decrease in time to reach GPS due to consolidation of CCR. Scoring is based on balance between potential increase or decrease due to factors listed.	Increased time required to implement remedy in comparison to Alternative #3. Anticipated increase in time required to identify, site and develop onsite disposal capacity if located outside of existing impoundment footprint. Increased time required for closure construction due CCR excavation, temporary storage, liner construction, and redisposal if completed within impoundment footprint. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential decrease in time to reach GPS due to source isolation within liner/cover system.	Increased time required to implement remedy in comparison to Alternative #3, and potentially the longest required time to implement closure. Implementation schedule extends the time required to achieve full protection. Extended implementation timeframe is driven by the time required to identifying and secure off-site disposal capacity, or develop the capacity at an existing Alliant-owned facility. If landfill capacity is not owned by Alliant, additional time may be required to permit and develop the necessary disposal capacity. Increased construction time likely required due to the capacity of the receiving site to unload and place material. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential decrease in time to reach GPS due to impounded CCR source removal.	Similar to Alternative #3. Potential for reduction in time to reach GPS due to chemical/physical stability of CCR.	Similar to Alternative #3. Potential decrease in time to reach GPS from implementation of groundwater pumping.	Similar to Alternative #3. Potential decrease in time to reach GPS upon implementation of barrier wall.
257.97(c)(1)(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment	No change in potential exposure	Potential for exposure is low. Remaining waste is capped with risk to construction workers during consolidation of CCR.	Similar to Alternative #3 with increased risk to construction workers during excavation and re-disposal. Increased risk due to higher material management volumes.	No potential for on-site exposure to remaining waste since no waste remains on site; Risk of potential exposure is transferred to receiving disposal facility and is likely similar to Alternative #3 Highest level of risk due to excavation, transportation, and re-disposal for construction workers removing CCR and solid waste workers at receiving facility.	Same as Alternative #3.	Similar to Alternative #3 with potential for secondary impacts from releases of extracted groundwater or disruption in treatment.	Same as Alternative #3
257.97(c)(1)(vii) Long-term reliability of the engineering and institutional controls	Not Applicable	Long-term reliability of cap is good; Significant industry experience with methods/controls; Capping is common practice/industry standard for closure in place for remediation and solid waste management	Same as Alternative #3	Success of remedy at OGS does not rely on long-term reliability of engineering or institutional controls; Overall success relies on reliability of the engineering and institutional controls at the receiving facility	Same as Alternative #3.	Same as Alternative #3. Remedy relies upon active equipment that will require additonal operations and maintenance.	Same as Alternative #3. Remedy relies on continued hydraulic conductivity of the selected barrier. Breaches or short circuiting can develop and must be monitored.
257.97(c)(1)(viii) Potential need for replacement of the remedy	Not Applicable	Limited potential for remedy replacement if maintained; Some potential for remedy enhancement due to residual groundwater impacts following source control	Same as Alternative #3 with further reduction in potential need for remedy enhancement composite with liner	No potential for remedy replacement; Limited potential for remedy enhancement due to residual groundwater impacts following source control	Similar to Alternative #3, with further reduction in potential need for remedy enhancement due to stabilized/solidified CCR material.	Similar to Alternative #3, with reduced potential of remedy replacement, but added expectation for pump, conveyance system and treatment system replacement.	Similar to Alternative #3, with reduced potential of remedy replacement, but added expectation for potential replenishment of consumptive barrier product.

Table 6. Preliminary Evaluation of Corrective Measure Alternatives
Ottumwa Generating Station / SCS Engineers Project #25220083.00

	Alternative #1 No Action	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-Site Landfill with MNA	Alternative #6 Consolidate and Cap with Chemical Amendment and Groundwater Collection	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall and Groundwater Collection
SOURCE CONTROL TO MITIGATE FUTURE RELEASES - 40 CFR 257.97(c)(2)							
257.97(c)(2)(i) The extent to which containment practices will reduce further releases	No reduction in further releases	Cap will reduce further releases by minimizing infiltration through CCR	Same as Alternative #3 with further reduction due to composite liner and 5-foot groundwater separation required by CCR Rule	Removal of CCR prevents further releases at OGS; Receiving disposal site risk similar to Alternative #3	Similar to Alternative #3 with further reduction due to lower mobility of contaminants in residual source material as a result of chemical amendment.	Similar to Alternative #3 with the added ability to contain or restore groundwater impacts if MNA mechanisms are not active or site attenuation capacity is not adequate.	Similar to Alternative #3 with the added ability to contain groundwater impacts if MNA mechanisms are not active or site attenuation capacity is not adequate.
257.97(c)(2)(ii) The extent to which treatment technologies may be used	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative relies on the indentification and availability of a suitable chemical amendment. Implementation of and contact with physical/chemical stabilizing agent will require specialized field implementation methods and health and safety measures.	This alternative relies on conventional pump and treat remediation.	Alternative relies on the indentification and availability of a suitable barrier wall technology (e.g., permeable reactive barrier material or slurry wall). Implementation of and contact with barrier wall materials will require specialized field implementation methods and health and safety measures.
IMPLEMENTATION - 40 CFR 257.97(c)(3)							
257.97(c)(3)(i) Degree of difficulty associated with constructing the technology	Not Applicable	Low complexity construction; Moderate degree of logistical complexity; Moderate level of dewatering effort - dewatering required for material excavation/placement and capping	Moderately complex construction due to composite liner and cover; High degree of logistical complexity due to excavation and on-site storage of ~420K cy of CCR while new lined disposal area is constructed; High level of dewatering effort - dewatering required for excavation of full CCR volume	Low complexity construction; High degree of logistical complexity including the excavation and off-site transport of ~420K cy of CCR and permitting/development of off-site disposal facility airspace; High level of dewatering effort - dewatering required for excavation of full CCR volume	Moderate complexity construction due to the equipment required to apply the selected amendment; requirements to ensure consistent contact and dosing of amendment; Medium degree of logistical complexity involving the import of specialty chemicals; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping	Low complexity construction; Moderate degree of logistical complexity; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping. Moderate complexity contruction for the installation of extraction wells and conveyance to a site-specific groundwater treatment plant.	High complexity construction; Barrier walls require specialty installation equipment and knowledge. Highly specialized and experience contractors required to achieve proper installation. Moderate degree of logistical complexity; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping.
257.97(c)(3)(ii) Expected operational reliability of the technologies	Not Applicable	High reliability based on historic use of capping as corrective measure	Same as Alternative #3	Success at OGS does not rely on operational reliability of technologies; Overall success relies on off-site disposal facility, which is likely same/similar to Alternative #3, but may not be controlled by the Owner.	Similar to Alternative #3; however, success at OGS relies on the successful application of specialty chemicals.	Similar to Alternative #3; however, success of this remedy relies on the successful operation of a site-specific groundwater treatment plant.	Similar to Alternative #3; however, success this remedy relies on continued hydraulic conductivity of the selected barrier. Breaches or short circuiting can develop and must be monitored.
257.97(c)(3)(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies	Not Applicable	Need is low in comparison to other alternatives; State Closure Permit required	Need is high in comparison to other alternatives State Closure Permit required; State Landfill Permit may be required	Need is highest in comparison to other alternatives; State Closure Permit required; Approval of off-site disposal site owner required; May require State solid waste comprehensive planning approval; Local road use permits likely required	Need is moderate in comparison to other alternatives; State Closure Permit required; Underground Injection Control Permit may be required if chemical materials placed within groundwater. State and local erosion control/construction stormwater management permits required; Federal/State/Local Floodplain permitting likely required.	Need is moderate in comparison to other alternatives; State Closure Permit required; Well permitting for extraction well installation; NPDES Permit for groundwater treatment and discharge; State and local erosion control/construction stormwater management permits required; Federal/State/Local Floodplain permitting likely required.	Need is moderate in comparison to other alternatives State Closure Permit required; Well permitting for barrier wall monitoring; Federal/State/Local Floodplain permitting required; State and local erosion control/construction stormwater management permits required
257.97(c)(3)(iv) Availability of necessary equipment and specialists	Not Applicable	Necessary equipment and specialists are highly available. cap construction materials are readily available and accessible in the area. Requires dewatering, treatment and conditioning of CCR.	Same as Alternative #3; Similar level of demand for liner and cap construction material. Increase in demand for specialty materials and services due to composite liner construction.	Availability of necessary equipment to develop necessary off-site disposal facility airspace and transport ~420K cy of CCR to new disposal facility will be a limiting factor in the schedule for executing this alternative; No liner or cover material demands for on-site implementation of remedy	Similar to Alternative #3; Moderate level of demand for liner and cap construction material. Specialized mixing equipment likely required to apply chemical amendment and achieve required dosing.	Similar to Alternative #3; Moderate level of demand for liner and cap construction material. A site-specific, trained employee will be required to operate the groundwater treatment system.	Similar to Alternative #3; Moderate level of demand for liner and cap construction material; Availability of the necessary specailized equipment and extensive experience required for barrier installation is potentially low or in high demand.
257.97(c)(3)(v) Available capacity and location of needed treatment, storage, and disposal services	Not Applicable	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Available temporary on-site storage capacity for ~420K cy of CCR while composite liner is constructed is significant limiting factor	Off-site disposal capacity, facility logistical capacity, or the time required to develop the necessary off-site disposal and logistical capacity is a significant limiting factor.	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative
COMMUNITY ACCEPTANCE - 40 CFR 257.97(c)(4)							
257.97(c)(4) The degree to which community concerns are addressed by a potential remedy (Anticipated)	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on June 4, 2020 or February 2021. Assume all alternatives are acceptable to interested/affected parties.

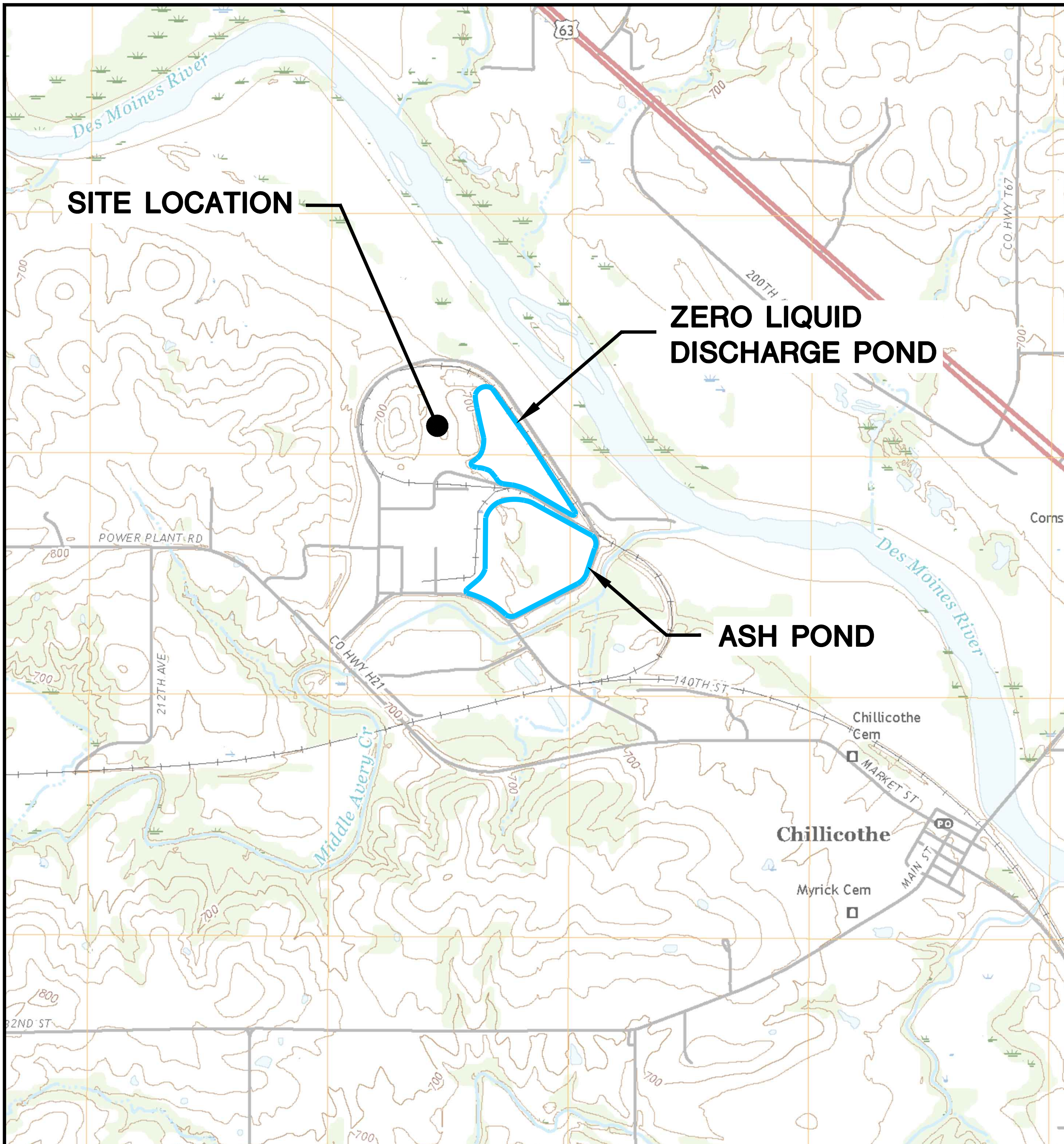
NOTES:

1) Alternatives #1 through #5 were developed and submitted within the Assessment of Correctvie Measures Report (ACM), dated September 2019
2) Alternatives #6 through #8 were added in November 2020 as part of Addendum #1 to the September 2020 ACM Report
3) Former Alternative #2 (Close and Cap in Place with MNA) is not viable due to the completed removal of the OGS ZLD Pond and contents. Alternative #2 has been eliminated from further evaluation.

Created by: LAB/SK Date: 6/20/2019
Last revision by: EJN Date: 8/1/2022
Checked by: TK Date: 8/1/2022

I:\25220083.00\Deliverables\ACM Addendum No 2\Tables\[Table 6_Evaluation of Assessment of Corrective Measure_OGS_Rev 01.xlsx]OGS_Evaluation Matrix

Figures



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CHILLICOTHE QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'

IOWA

CLIENT	SITE	
INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	ALLIANT ENERGY OTTUMWA GENERATING STATION OTTUMWA, IOWA	SITE LOCATION MAP

				ENGINEER	FIGURE
PROJECT NO.	25220083.00	DRAWN BY:	BSS/ZB	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	1
DRAWN:	09/16/2020	CHECKED BY:	NDK		
REVISED:	07/11/2022	APPROVED BY:	TK 7/15/2022		

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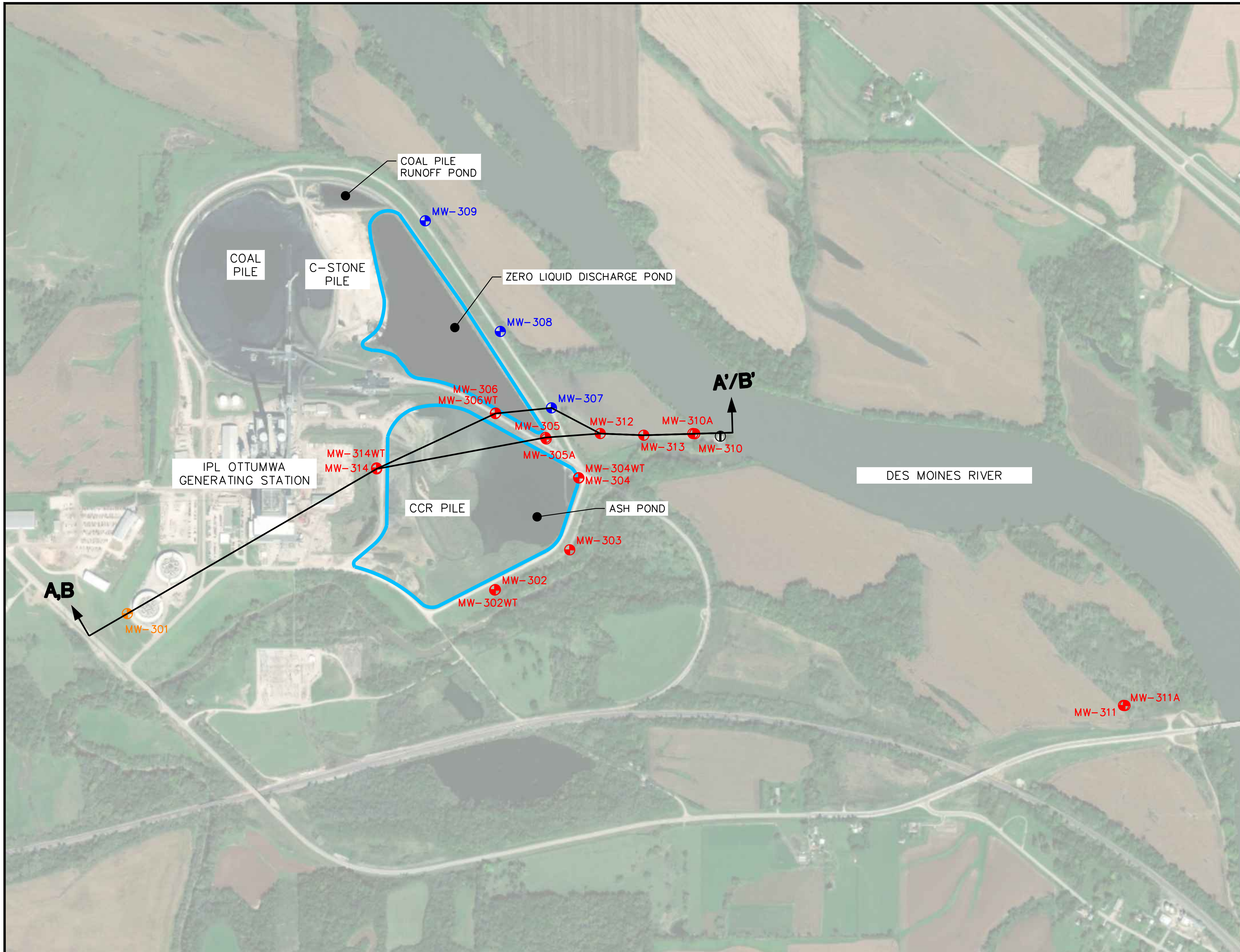

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- GEOLOGIC CROSS SECTION

NOTES:

1. 2014 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.
2. MONITORING WELLS MW-301, MW-302, AND MW-304, WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM NOVEMBER 11-12, 2015.
3. MONITORING WELLS MW-303 AND MW-305 WERE INSTALLED BY CASCADE DRILLING LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 7-8, 2015.
4. MONITORING WELLS MW-307, MW-308, AND MW-309 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM OCTOBER 25-27, 2016.
5. MONITORING WELLS MW-310 AND MW-311 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING ON AUGUST 27, 2019.
6. MONITORING WELLS MW-305A, MW-310A, AND MW-311A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING BETWEEN FEBRUARY 27, 2020 AND MARCH 3, 2020.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP	ENGINEER	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	CLIENT	INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE	ALLIANT ENERGY OTTUMWA GENERATING STATION OTTUMWA, IOWA
DRAWN:	07/07/2022	CHECKED BY:	TK						
REVISED:	07/07/2022	APPROVED BY:	TK 7/15/2022						

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

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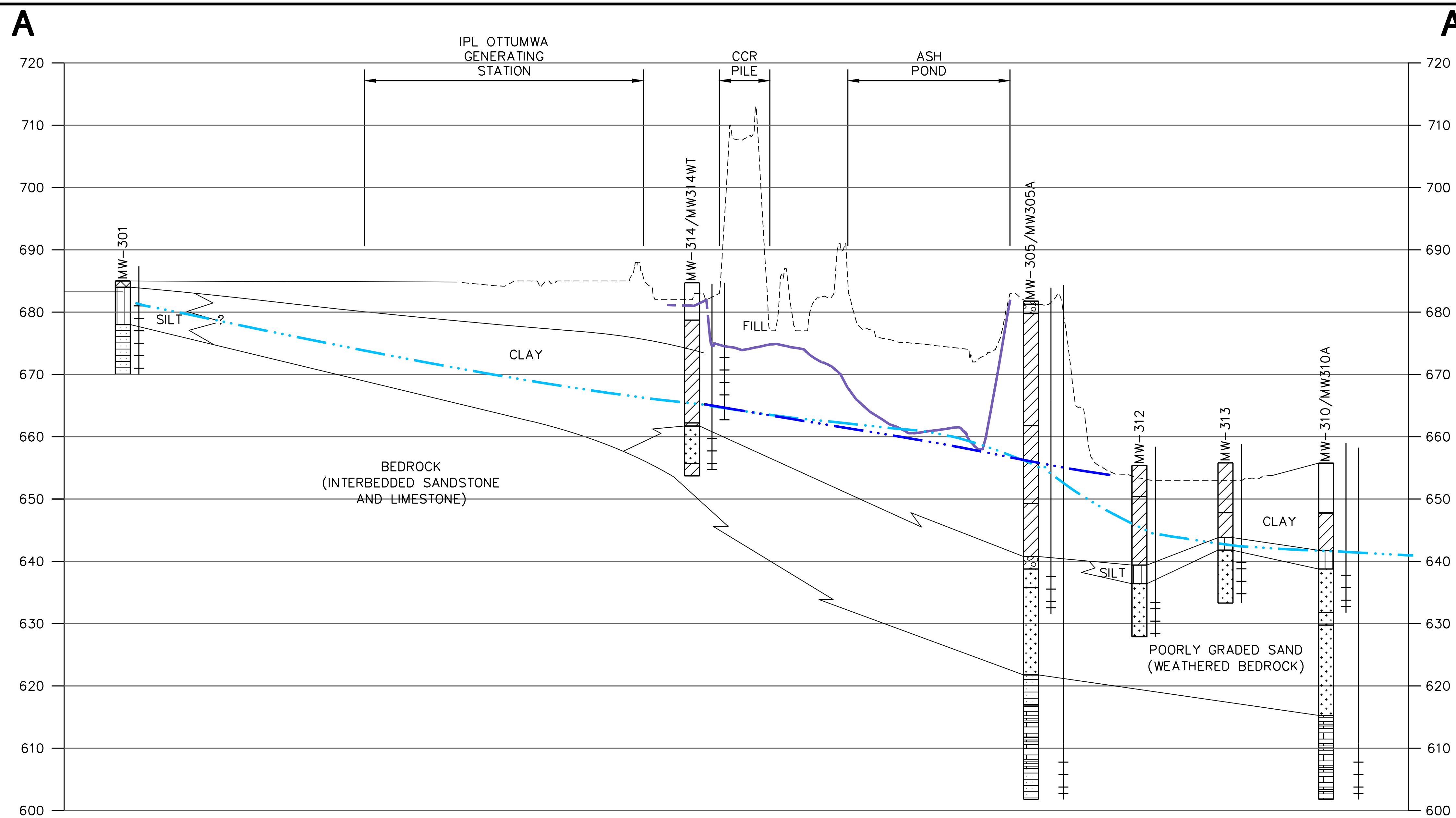
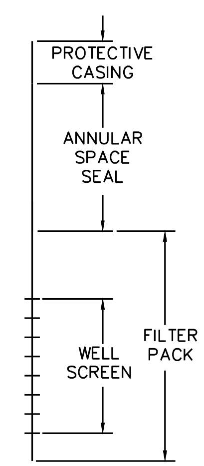


LEGEND

- TOPSOIL/FILL
- SAND, POORLY GRADED (SP)
- SILT, WITH SAND AND GRAVEL (ML)
- CLAY (CL)
- FAT CLAY (CH)
- GRAVEL, POORLY GRADED, LITTLE OR NO FINES (GP)
- SANDSTONE
- LIMESTONE
- WATER TABLE SURFACE MEASURED JULY 5, 2022
- SHALLOW POTENTIOMETRIC SURFACE MEASURED JULY 5, 2022
- ESTIMATED POND BOTTOM (FROM HARD HAT SERVICES BASED ON ALLIANT ENERGY DRAWING S1005)



WELL DETAIL

0 500

HORIZONTAL SCALE: 1" = 500'
VERTICAL SCALE: 1" = 20'
VERTICAL EXAGGERATION = 25X

NOTES:

1. MW-305 AND MW-305A WERE HYDROVACED TO APPROXIMATELY 8.5'. MW-310 AND MW-310A WERE HYDROVACED TO APPROXIMATELY 8.0'. HYDROVACING IS PERFORMED TO DETERMINE IF UNDERGROUND UTILITIES ARE PRESENT. HIGH PRESSURE WATER AND A VACUUM ARE USED TO CLEAR THE BOREHOLE AND GEOLOGIC SAMPLES ARE NOT COLLECTED. NATIVE SOIL IN THE VICINITY OF MW-307 IS CLAY.
2. ASH POND BOTTOM ELEVATION IS BASED ON THE EMBANKMENT CREST ELEVATION (681 FEET) AND INTERNAL STORAGE DEPTH (25 FEET) REPORTED IN THE HISTORY OF CONSTRUCTION REPORT ISSUED SEPTEMBER 29, 2016, BY HARD HAT SERVICES.

PROJECT NO.	25220083.00	DRAWN BY:	KP	ENGINEER	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	CLIENT: INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE: ALLIANT ENERGY OTTUMWA GENERATING STATION OTTUMWA, IOWA	GEOLOGIC CROSS SECTION A-A'	FIGURE 3
DRAWN:	07/07/2022	CHECKED BY:	TK						
REVISED:	07/07/2022	APPROVED BY:	TK 08/01/2022						

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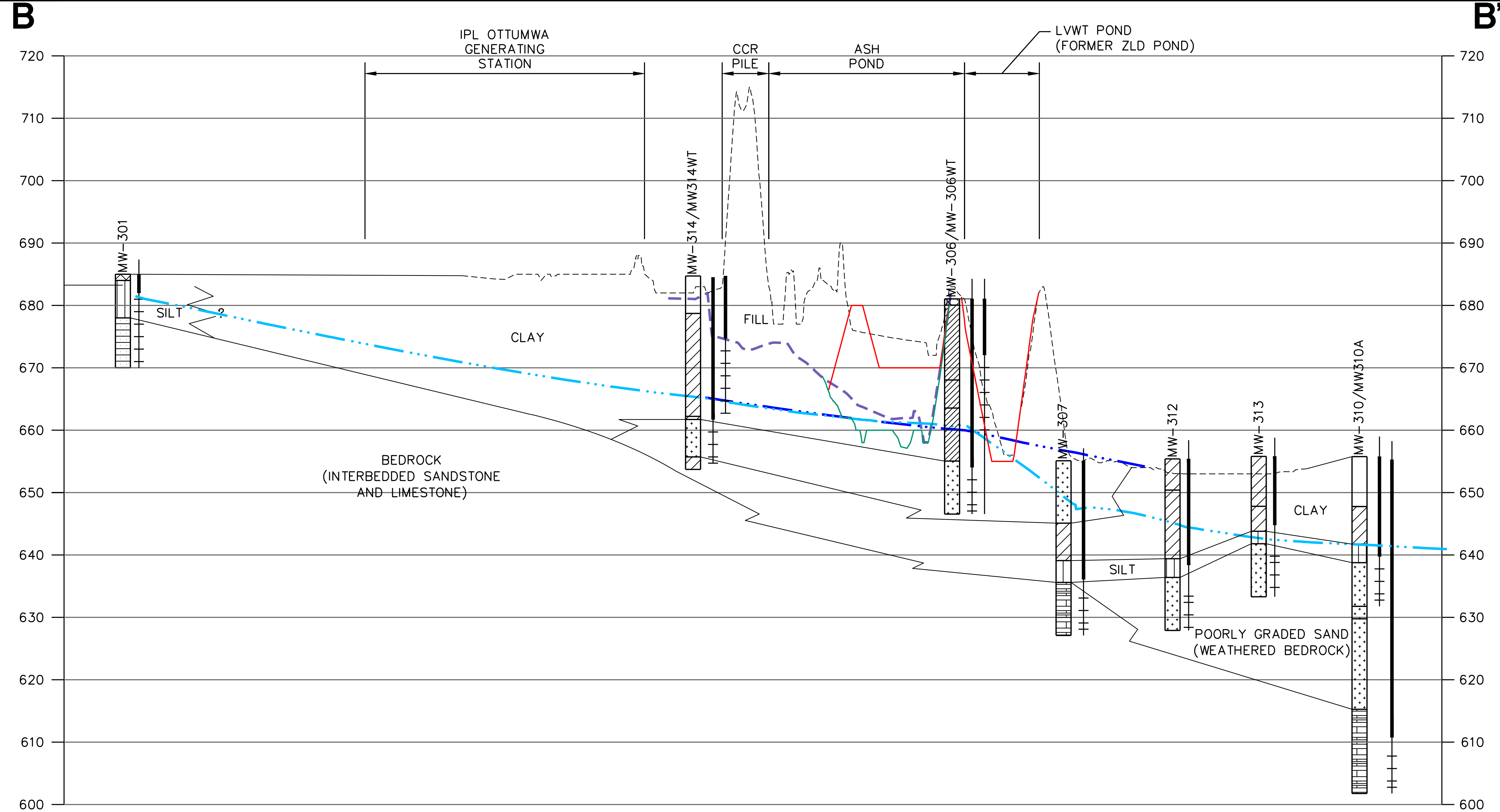
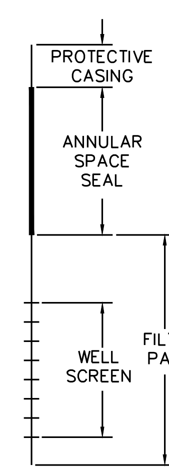


LEGEND

- TOPSOIL/FILL
- SAND, POORLY GRADED (SP)
- SILT, WITH SAND AND GRAVEL (ML)
- CLAY (CL)
- FAT CLAY (CH)
- GRAVEL, POORLY GRADED, LITTLE OR NO FINES (GP)
- SANDSTONE
- LIMESTONE
- WATER TABLE SURFACE MEASURED JULY 5, 2022
- SHALLOW POTENTIOMETRIC SURFACE MEASURED JULY 5, 2022
- ESTIMATED POND BOTTOM (FROM HARD HAT SERVICES BASED ON ALLIANT ENERGY DRAWING S1005)
- AIR HEATER WASH BASIN DESIGN GRADES
- AIR HEATER WASH BASIN EXCAVATION GRADES



WELL DETAIL

0 500

HORIZONTAL SCALE: 1" = 500'
VERTICAL SCALE: 1" = 20'
VERTICAL EXAGGERATION = 25X

NOTES:

1. MW-305 AND MW-305A WERE HYDROVACED TO APPROXIMATELY 8.5'. MW-310 AND MW-310A WERE HYDROVACED TO APPROXIMATELY 8.0'. HYDROVACING IS PERFORMED TO DETERMINE IF UNDERGROUND UTILITIES ARE PRESENT. HIGH PRESSURE WATER AND A VACUUM ARE USED TO CLEAR THE BOREHOLE AND GEOLOGIC SAMPLES ARE NOT COLLECTED. NATIVE SOIL IN THE VICINITY OF MW-307 IS CLAY.
2. ASH POND BOTTOM ELEVATION IS BASED ON THE EMBANKMENT CREST ELEVATION (681 FEET) AND INTERNAL STORAGE DEPTH (25 FEET) REPORTED IN THE HISTORY OF CONSTRUCTION REPORT ISSUED SEPTEMBER 29, 2016, BY HARD HAT SERVICES.

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	07/07/2022	CHECKED BY:	TK
REVISED:	07/07/2022	APPROVED BY:	TK 08/01/2022

ENGINEER: SCS ENGINEERS, 2830 DAIRY DRIVE MADISON, WI 53718-6751, PHONE: (608) 224-2830

CLIENT: INTERSTATE POWER AND LIGHT CO., 20775 POWER PLANT ROAD, OTTUMWA, IA 52501

SITE: ALLIANT ENERGY, OTTUMWA GENERATING STATION, OTTUMWA, IOWA

GEOLOGIC CROSS SECTION B-B'

FIGURE 4

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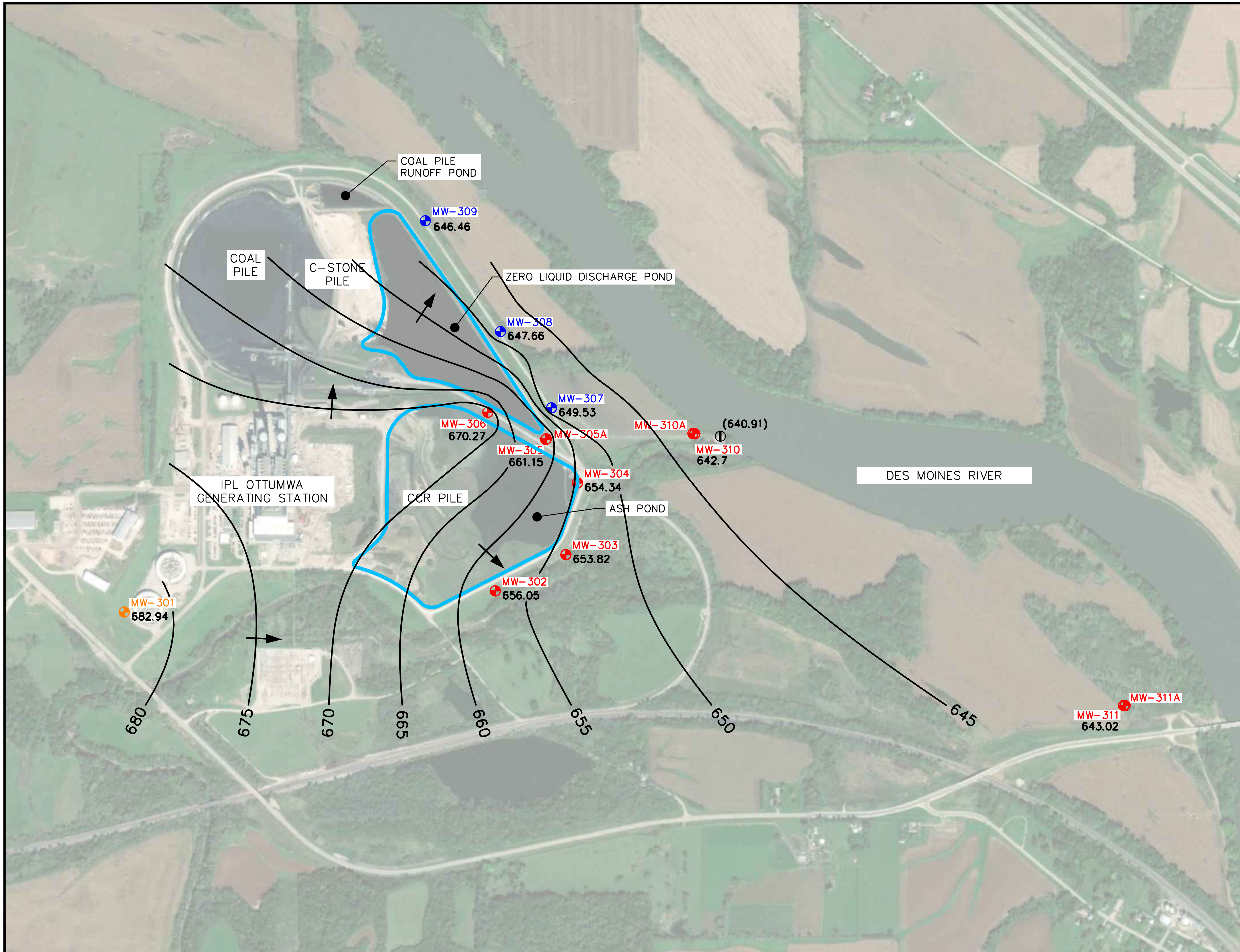


LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- (640.91) RIVER ELEVATION (APRIL 16, 2021)
- 651.09 POTENTIOMETRIC ELEVATION AT WELL (APRIL 12-16, 2021)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	05/26/2021	CHECKED BY:	NDK
REVISED:	08/11/2021	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

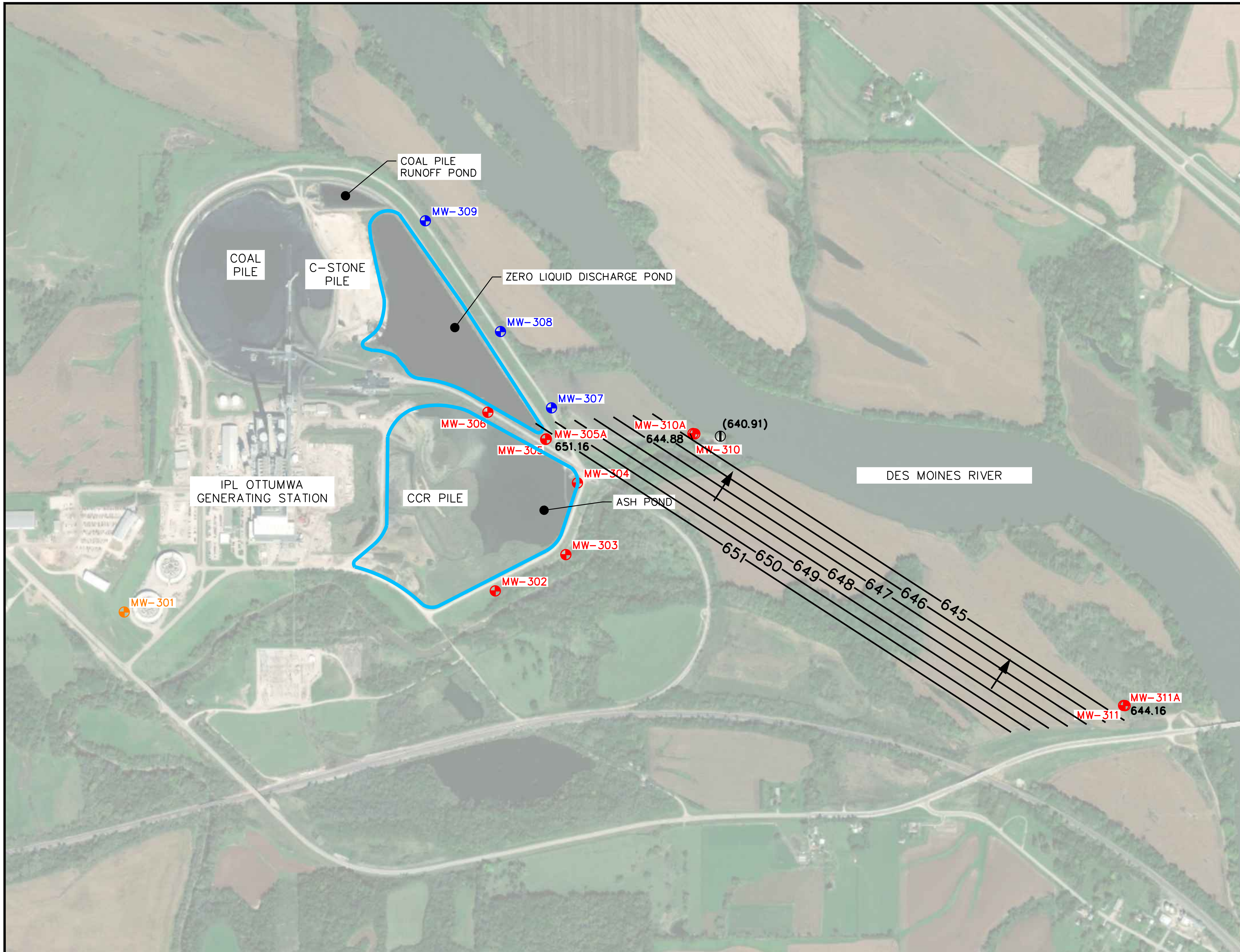
CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
APRIL 12-16, 2021

FIGURE 5

I:\25220083.00\Drawings\Potentiometric Surface 2021.dwg, 7/11/2022 4:50:10 PM



LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- (640.91) RIVER ELEVATION (APRIL 16, 2021)
- 651.09 POTENTIOMETRIC ELEVATION AT WELL (APRIL 12–16, 2021)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	05/26/2021	CHECKED BY:	NDK
REVISED:	08/11/2021	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

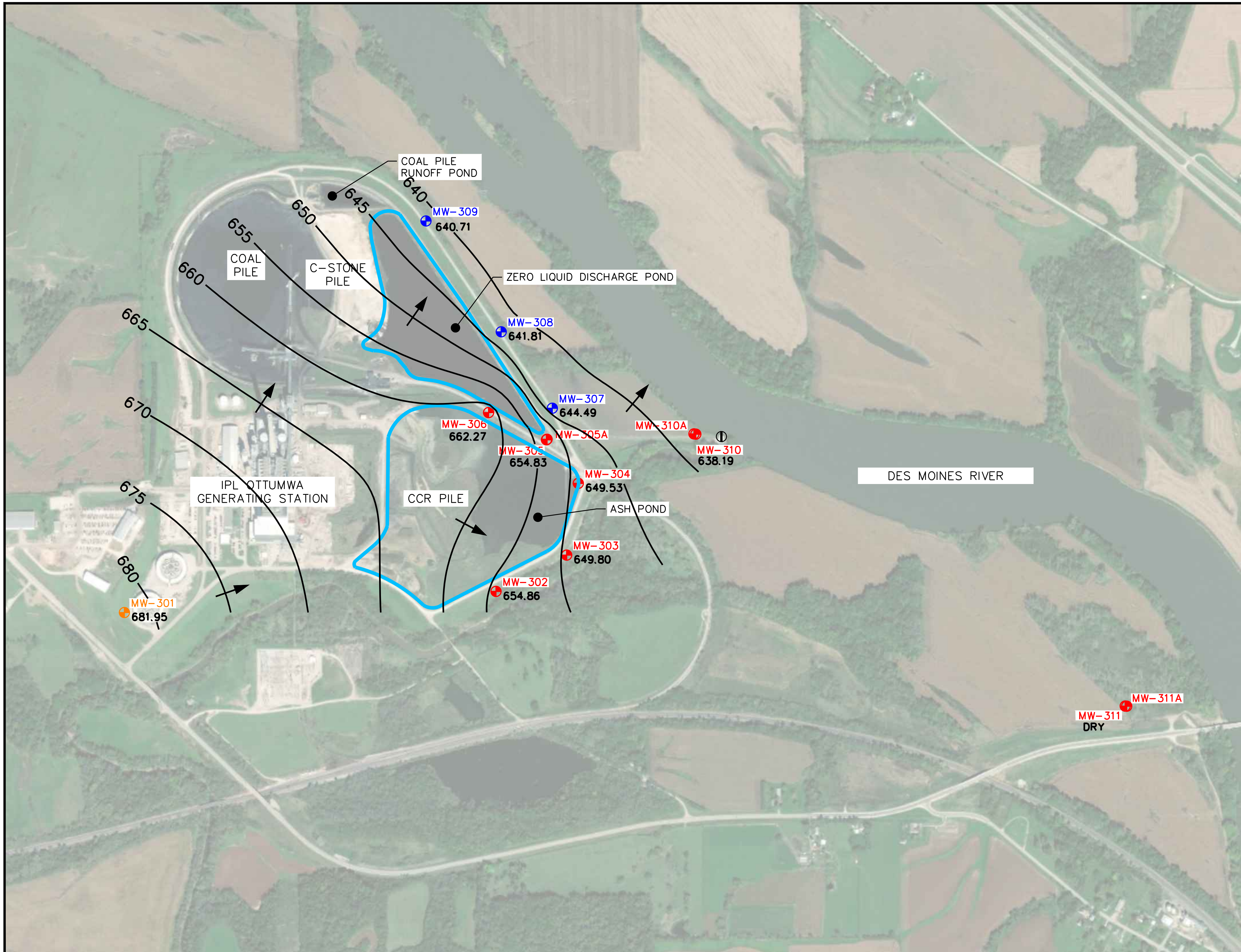
CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

DEEP POTENTIOMETRIC SURFACE
APRIL 12–16, 2021

FIGURE
6

I:\25220083.00\Drawings\Potentiometric Surface 2021.dwg, 7/11/2022 4:50:13 PM



LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- **651.09** POTENTIOMETRIC ELEVATION AT WELL (OCTOBER 6-8, 2021)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	10/28/2021	CHECKED BY:	NDK
REVISED:	01/05/2022	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
OCTOBER 6-8, 2021

FIGURE 7

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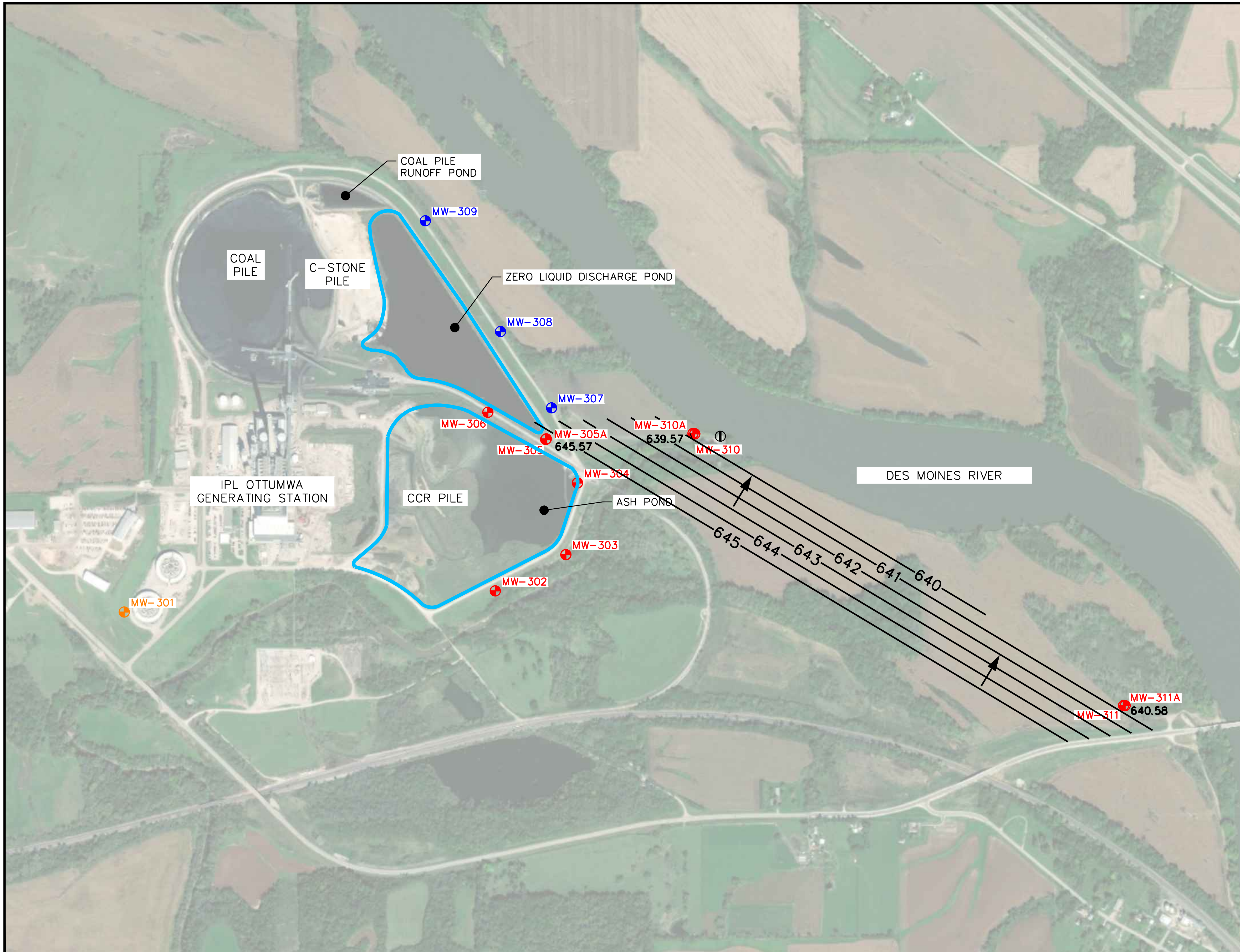


LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- **651.09** POTENTIOMETRIC ELEVATION AT WELL (OCTOBER 6-8, 2021)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	10/28/2021	CHECKED BY:	NDK
REVISED:	10/28/2021	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

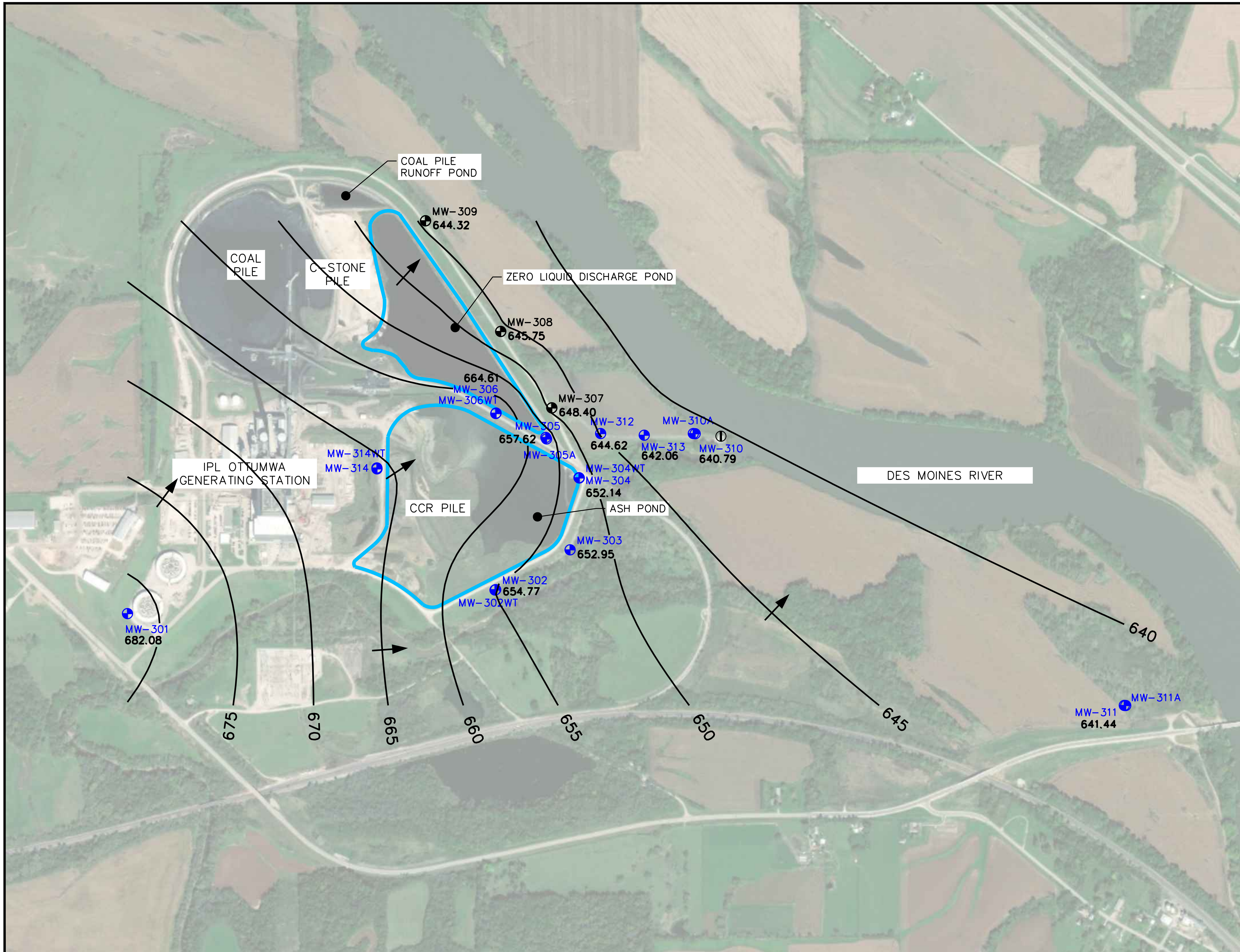
CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

DEEP POTENTIOMETRIC SURFACE
OCTOBER 6-8, 2021

FIGURE
8

I:\25220083.00\Drawings\Potentiometric Surface 2021.dwg, 7/11/2022 4:50:24 PM



LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- **651.09** POTENTIOMETRIC ELEVATION AT WELL (APRIL 11–14, 2022)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2014 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.
2. MONITORING WELLS MW-301, MW-302, AND MW-304, WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM NOVEMBER 11–12, 2015.
3. MONITORING WELLS MW-303 AND MW-305 WERE INSTALLED BY CASCADE DRILLING LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 7–8, 2015.
4. MONITORING WELLS MW-307, MW-308, AND MW-309 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM OCTOBER 25–27, 2016.
5. MONITORING WELLS MW-310 AND MW-311 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING ON AUGUST 27, 2019.
6. MONITORING WELLS MW-305A, MW-310A, AND MW-311A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING BETWEEN FEBRUARY 27, 2020 AND MARCH 3, 2020.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	07/11/2022	CHECKED BY:	NDK
REVISED:	07/11/2022	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

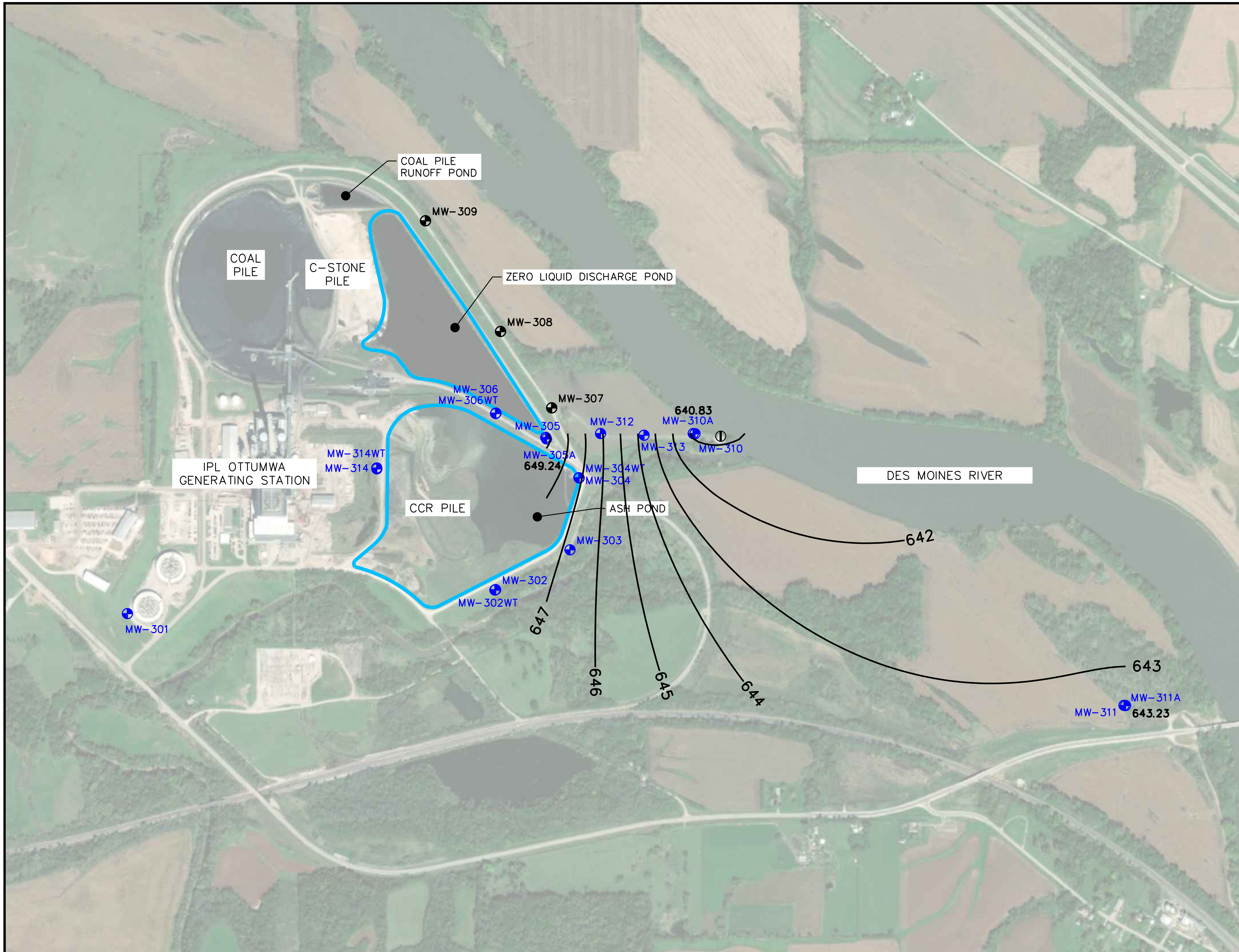
CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
APRIL 11–14, 2022

FIGURE
9

I:\25220083.00\Drawings\Potentiometric Surface 2022.dwg, 7/11/2022 4:47:10 PM



LEGEND

(blue line)	CCR UNIT
(symbol)	CCR ZLDP MONITORING WELL
(symbol)	CCR ASH POND MONITORING WELL
(symbol)	CCR BACKGROUND MONITORING WELL
(symbol)	RIVER ELEVATION MEASUREMENT LOCATION
651.09	POTENTIOMETRIC ELEVATION AT WELL (APRIL 11–14, 2022)
(line)	POTENTIOMETRIC SURFACE CONTOUR
(arrow)	APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2014 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.
2. MONITORING WELLS MW-301, MW-302, AND MW-304, WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM NOVEMBER 11–12, 2015.
3. MONITORING WELLS MW-303 AND MW-305 WERE INSTALLED BY CASCADE DRILLING LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 7–8, 2015.
4. MONITORING WELLS MW-307, MW-308, AND MW-309 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM OCTOBER 25–27, 2016.
5. MONITORING WELLS MW-310 AND MW-311 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING ON AUGUST 27, 2019.
6. MONITORING WELLS MW-305A, MW-310A, AND MW-311A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING BETWEEN FEBRUARY 27, 2020 AND MARCH 3, 2020.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP
DRAWN:	07/07/2022	CHECKED BY:	TK
REVISED:	07/07/2022	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS, 2830 DAIRY DRIVE MADISON, WI 53718-6751, PHONE: (608) 224-2830

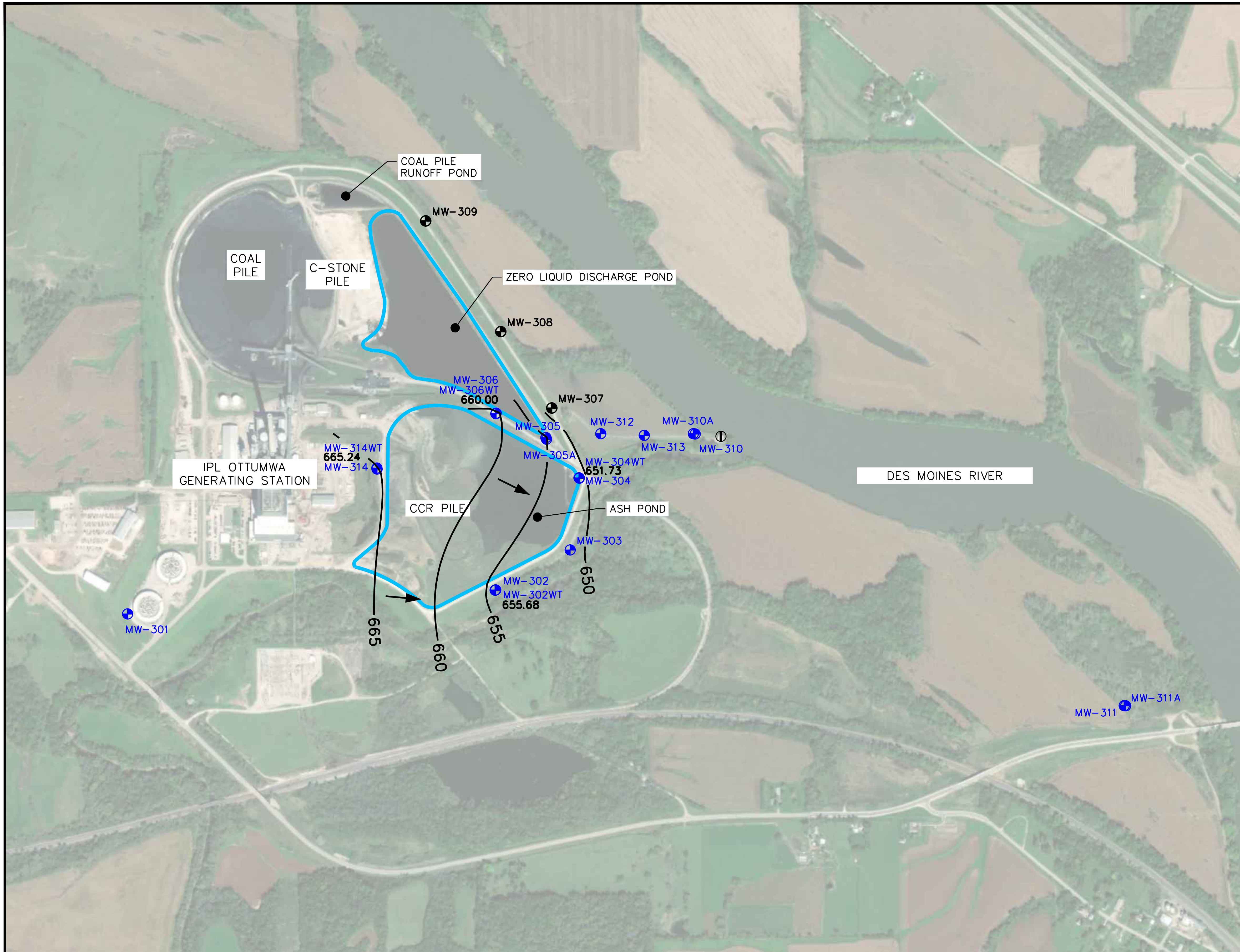
CLIENT: INTERSTATE POWER AND LIGHT CO., 20775 POWER PLANT ROAD, OTTUMWA, IA 52501

SITE: ALLIANT ENERGY, OTTUMWA GENERATING STATION, OTTUMWA, IOWA

DEEP POTENTIOMETRIC SURFACE
APRIL 11–14, 2022

FIGURE 10

I:\25220083.00\Drawings\Potentiometric Surface 2022.dwg, 7/11/2022 4:47:12 PM



LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- **651.73** WATER TABLE ELEVATION AT WELL (JULY 05, 2022)
- WATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2014 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.
2. MONITORING WELLS MW-301, MW-302, AND MW-304, WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM NOVEMBER 11-12, 2015.
3. MONITORING WELLS MW-303 AND MW-305 WERE INSTALLED BY CASCADE DRILLING LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 7-8, 2015.
4. MONITORING WELLS MW-307, MW-308, AND MW-309 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM OCTOBER 25-27, 2016.
5. MONITORING WELLS MW-310 AND MW-311 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING ON AUGUST 27, 2019.
6. MONITORING WELLS MW-305A, MW-310A, AND MW-311A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING BETWEEN FEBRUARY 27, 2020 AND MARCH 3, 2020.
7. MONITORING WELLS MW-302WT, MW-304WT, MW-306WT, MW-314, AND MW-314WT WERE INSTALLED BY DIRECT PUSH ANALYTICAL DRILLING ON APRIL 27 AND APRIL 28, 2022.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25220083.00	DRAWN BY:	KP/BWM
DRAWN:	07/13/2022	CHECKED BY:	NDK
REVISED:	07/13/2022	APPROVED BY:	TK 7/15/2022

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

WATER TABLE MAP
JULY 05, 2022

FIGURE
11

\\10.2.18.8\data\Projects\25220083.00\Drawings\WaterTable-2022-07.dwg, 7/15/2022 9:05:47 AM

Appendix A

Regional Geological and Hydrogeological Information

Regional Hydrogeologic Stratigraphy
Ottumwa Generating Station / SCS Engineers Project #25215053.01

Age of Rocks	Hydrogeologic Unit	General Thickness (feet)	Name of Rock Unit*	Type of Rock
Quaternary (0-1 million years old)	Surficial Aquifers • Alluvial • Buried-Channel • Drift	0 to 320	Undifferentiated	• Sand, gravel, silt, and clay • Sand, gravel, silt, and clay • Till (sandy, pebbly clay), sand, and silt
Pennsylvanian (180 to 310 million years old)	Aquiclude	0 to 370	Undifferentiated	• Shale, sandstone, limestone, and coal
Mississippian (310 to 345 million years old	Mississippian Aquifer • Upper	0 to 600	St. Louis Spergen	• Limestone and sandstone • Limestone
	• Lower		Warsaw Keokuk Burlington Hampton Starrs Cave	• Shale and dolomite • Dolomite, limestone, and shale • Dolomite and limestone • Limestone and dolomite • Limestone
	Aquiclude	0 to 425	Prospect Hill McCraney	• Siltstone • Limestone
Devonian (345 to 400 million years old)			Yellow Spring Lime Creek	• Shale, dolomite, and siltstone • Dolomite and shale
	Devonian Aquifer	110 to 420	Cedar Valley Wapsipinicon	• Limestone and dolomite • Dolomite, limestone, shale, and gypsum
Silurian (400 to 425 million years old)		0 to 105	Undifferentiated	• Dolomite
Ordovician (425 to 500 million years old)	Aquiclude	150 to 600	Maquoketa Galena Decorah Platteville	• Dolomite and shale • Dolomite and chert • Limestone and shale • Limestone, shale, and sandstone
	Cambrian-Ordovician aquifer	750 to 1,110	St. Peter Prairie du Chien	• Sandstone • Dolomite and sandstone
Cambrian (500 to 600 million years old)			Jordan St. Lawrence	• Sandstone • Dolomite
	Not considered an aquifer in southeast Iowa	450 to 750+	Franconia Galesville Eau Claire Mt. Simon	• Shale, siltstone, and sandstone • Sandstone • Sandstone, shale, and dolomite • Sandstone
Precambrian (600 million to 2 billion + years old)				• Sandstone, igneous rocks, and metamorphic rocks

*This nomenclature and classification of rock units in this report are those of the Iowa Geological Survey and do not necessarily coincide with those accepted by the U.S. Geological Survey.

Source: "Water Resources of Southeast Iowa," Iowa Geologic Survey Water Atlas No. 4.

Appendix B

Boring Logs

SCS ENGINEERS **SOIL BORING LOG INFORMATION**

Environmental Consultants and Contractors

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40			MW-301

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/10/2015	11/10/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-301	Feet	684.3 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,077 N, 1,899,709 E S/C/N
NW 1/4 of SW 1/4 of Section 26, T 73 N, R 15 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location: ☐ N ☐ S Feet; ☐ E ☐ W Feet

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	TOPSOIL.	TOPSOIL									
			1	SANDY SILT WITH GRAVEL, gray (7.5YR 6/1), gravel is fine.	ML									
S1	10	woh 1 3 9	5–6							W				
			7	WEATHERED SANDSTONE, very weak, light gray matrix (10YR 7/1), scondary color very dark gray 910YR 3/1), massive.	SANDSTONE									
S2	13	24 50	8							W				
S3	5	50	10–11							W				
S4	6	50	13							W				
S5	4	50	15							W				
			15	Endo of Boring at 15 feet bgs.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature] for Kyle Kramer	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: (608) 224-2830 Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Remediation/Redevelopment ☐ Waste Management ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-302

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/10/2015	11/10/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-302	Feet	671.6 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,267 N, 1,902,625 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–1	TOPSOIL.	TOPSOIL									
			1–14	LEAN CLAY WITH SAND, dark gray (10YR 4/1).	CL									
S1	19	1 4 5 7	10–12							M				
S2	19	2 4 7 11	12–14							M				
			14–16	LEAN CLAY WITH SAND, very dark gray (5Y 3/1).	CL									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature] for Kyle Kramer	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: (608) 224-2830 Fax:

Boring Number MW-302

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	24	2 3 9 9	17	POORLY GRADED SAND, olive yellow (2.5Y 6/6).	SP					M				
			18	LEAN CLAY, dark grayish brown (10YR 4/2).	CL									
S4	24	4 4 4 4	19	POORLY GRADED GRAVEL, fine.	GP					W				saturation @ 18 ft bgs.
			20	LEAN CLAY, brownish yellow (10YR 6/8).	CL									
S5	15	2 3 3 6	21, 22	POORLY GRADED GRAVEL WITH CLAY, gray (10YR 5/1), fine.	GP-GC					W				
S6	24	3 4 8 9	23, 24							W				
			25	POORLY GRADED SAND, gray (10YR 5/1), medium grained.	SP									
S7	24	4 3 6 8	26, 27							W				
			28	Same as above, but brown (10YR 5/3).										
S8	24	7 8 11 9	29	POORLY GRADED SAND, gray (10YR 5/1), fine grained, (weathered bedrock?).	SP					W				
			30	Medium grained.										
S9	23	5 14 33 50/.4	31, 32							W				
S10	12	2 50/.3	33							W				
			34, 35	POORLY GRADED SAND, olive yellow (2.5Y 7/1), fine grained, (weathered bedrock?).	SP									
S11	3	50/.3	36							W				
			37	End of Boring at 37 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Remediation/Redevelopment ☐ Waste Management ☐ Other ☐

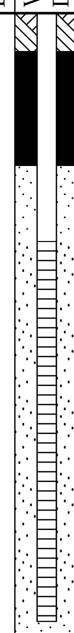
Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220083.00		MW-302WT

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Brian Kinzer Direct Push Analytical	4/27/2022	4/27/2022	hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-302WT	Feet MSL	671.54 Feet MSL	8.25 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,264 N, 1,902,620 E S / C / N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 16 W
Lat 41 ° 5 ' 40.9 "
Long -92 ° 32 ' 55.2 "
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–16.5	Hydrovaced to 8 feet below ground surface (bgs) and blind drilled to 16.5 feet bgs. See boring log MW-302 for lithology.										
			16.5	End of boring at 16.5 feet below ground surface.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature]	SCS Engineers 2830 Dairy Drive, Madison, WI 608-224-2830 Tel: Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

Facility/Project Name: IPL- Ottumwa Generating Station SCS#: 25215135.40	License/Permit/Monitoring Number:		Boring Number: MW-303	
Boring Drilled By: Name of crew chief (first, last) and Firm: Todd Schmalfeld, Cascade Drilling	Date Drilling Started: 12/8/2015	Date Drilling Completed: 12/8/2015		Drilling Method: 4-1/4 hollow stem auger
Unique Well No. / DNR Well ID No. / Common Well Name: MW-303	Final Static Water Level: Feet	Surface Elevation: 659.0 Feet		Borehole Diameter: 8.5 in
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 400,583 N, 1,903,215 E S/C/N; NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W	Lat ° ' " Long ° ' "	Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W		
Facility ID / County: Wapello	Civil Town/City/ or Village: Ottumwa			

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–9	FILL, boring location was cleared to 9' bgs by hydrovac, then back filled.	FILL									
			9	WEATHERED SANDSTONE, medium grained, brown (10YR 5/4).	SANDSTONE									
S1	1	50	11							W				
S2	NR		13.5											
			14.5	End of Boring at 14.5 ft bgs.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] for Kyle Kramer

Firm: SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Remediation/Redevelopment ☐ Waste Management ☐ Other ☐

Facility/Project Name: IPL- Ottumwa Generating Station SCS#: 25215135.40	License/Permit/Monitoring Number:	Boring Number: MW-304	
Boring Drilled By: Name of crew chief (first, last) and Firm: Todd Schmalfeld, Cascade Drilling	Date Drilling Started: 11/11/2015	Date Drilling Completed: 11/11/2015	Drilling Method: 4-1/4 hollow stem auger
Unique Well No.: / DNR Well ID No.: / Common Well Name: MW-304	Final Static Water Level: Feet	Surface Elevation: 680.1 Feet	Borehole Diameter: 8.5 in
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 401,152 N, 1,903,287 E S/C/N; SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W	Lat ° ' " / Long ° ' "	Local Grid Location: Feet ☐ N ☐ S	Feet ☐ E ☐ W
Facility ID: / County: Wapello	Civil Town/City/ or Village: Ottumwa		

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–1	TOPSOIL.	TOPSOIL									
			1–13	FAT CLAY, black (10YR 2/1).	CH									
S1	23	4 5 4 5	10–12							M				
S2	19.5	4 4 5 5	12.5–14.5	FAT CLAY, yellowish brown (10YR 5/4).	CH					M				
			15–16	FAT CLAY, yellowish brown (10YR 3/4).	CH									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] for Kyle Kramer

Firm: SCS Engineers, 2830 Dairy Drive Madison, WI 53718 Tel: (608) 224-2830 Fax:

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	12	3 3 4 5		FAT CLAY, yellowish brown (10YR 3/4). *(continued)*						M				
			17											
			18											
S4	22	4 3 7 12	19							M				
			20											
S5	23	2 7 8 9	21							M				
			22											
			23											
S6	23	3 4 8 6	24							M				
			25		CH									
S7	23	5 11 15 11	26							M				
			27											
			28											
S8	15	4 4 5 6	29							M				
			30											
S9	18	4 6 9 9	31							M				
			32											
			33											
S10	24	4 6 7 6	34							M				
			35	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3).										
S11	16	2 2 4 6	36							M				
			37											
			38											
S12	24	4 3 5 5	39		CH					M				
			40											
S13	18	2 3 3 3	41							M				
			42											

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			43	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3). *(continued)*	CH									
S14	24	3 4 9 14	44	SANDY SILT, very dark gray.	ML					W				
			45	POORLY GRADED SAND, medium grained, gray (5Y 6/1), (weathered bedrock).										
S16	15	30 50/.4	46							W				
			47											
			48		SP									
S17	5	33 50/.2	49							W				
			50											
S18		50/.4	51							W				
			52	End of Boring at 52 feet bgs.										

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SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220083.00		MW-304WT

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Brian Kinzer Direct Push Analytical	4/27/2022	4/27/2022	hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-304WT	645.38 Feet MSL	679.69 Feet MSL	8.25 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,154 N, 1,903,286 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W

Lat 41° 5' 49.6"
Long -92° 32' 46.4"

Local Grid Location: ☐ N ☐ E Feet ☐ S Feet ☐ W

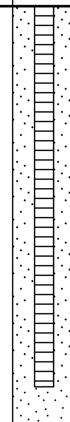
Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	Hydrovaced to 8 feet below ground surface (bgs) and blind drilled to 36 feet bgs. See boring log MW-304 for lithology.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive, Madison, WI 608-224-2830	Tel: Fax:

Boring Number MW-304WT

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			26											
			28											
			30											
			32											
			34											
			36	End of boring at 36 feet below ground surface.										

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SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number		Boring Number	
IPL- Ottumwa Generating Station SCS#: 25215135.40				MW-305	
Boring Drilled By: Name of crew chief (first, last) and Firm		Date Drilling Started	Date Drilling Completed		Drilling Method
Todd Schmalfeld Cascade Drilling		12/7/2015	12/8/2015		4-1/4 hollow stem auger
Unique Well No.	DNR Well ID No. / Common Well Name	Final Static Water Level	Surface Elevation		Borehole Diameter
	MW-305	Feet	681.5 Feet		8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,473 N, 1,903,023 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' " Long ° ' "
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID | County: Wapello | Civil Town/City/ or Village: Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				TOPSOIL	TOPSOIL									
			1	GRAVEL	GP									
			2–9	FAT CLAY	CH									
			10	FAT CLAY, very dark grayish brown (10YR 3/2).										
S1	18	3 6 9 11	11							W				
			13	same as above except, brown (10YR 4/3).										
S2	22	3 7 14 22	14							W				
			15–16											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] for Kyle Kramer

Firm: SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

Boring Number MW-305

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S3	22	5 15 14 15	17	FAT CLAY *(continued)*										
S4	20	3 5 13 15	18, 19		CH									
S5	24	4 5 7 11	20, 21, 22	FAT CLAY WITH SILT, dark gray (10YR 4/1).						M				
S6	20	7 11 15 20	23, 24	same as above except, very dark brown (10YR 2/2).						M				
S7	24	4 8 11 12	25, 26, 27	same as above except, very dark gray (10YR 3/1).	CH					M				
S8	24	8 12 16 21	28, 29							M				
S9	13	4 4 7 12	30, 31, 32							M				
S10	24	5 6 9	33, 34	LEAN CLAY, very dark brown (10YR 2/2).						W				
S11	24	4 4 5 7	35, 36, 37		CL					W				
S12	22	2 2 3 5	38, 39, 40	same as above except, very dark grayish brown (10YR 3/2).						W				
S13	6	3 9 11	41, 42	POORLY GRADED SANDY GRAVEL, fine, brown (10YR 4/3).	GPS					W				water @ 41.0 ft bgs.

Boring Number MW-305

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			43	POORLY GRADED SAND, medium grained, yellowish brown (10YR 5/4), (weathered bedrock). *(continued)*	SP									
S14	22	23 50								S				
			44											
			45											
S15	6	5 10 50	46		SP					S				
			47											
			48											
S16	6	50								S				
			49											
			50	End of Boring at 50 ft bgs.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220056.00		MW-305A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	2/25/2020	2/27/2020	6 1/4" HSA and air/mud rotary

	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-305A	32.7 Feet	681.76 Feet	10" and 6" in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,461 N, 1,903,028 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W

Lat ___° ___' ___"
Long ___° ___' ___"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Wapello		Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–9.5	Hydrovaced to 9.5 feet for utility clearance.										Drilled using hollow stem augers to 55 feet
			9.5–15	Blind drilled to 46 feet. See boring log MW-305 for lithology.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature]	scs engineers Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-305A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16											
			17											
			18											
			19											
			20											
			21											
			22											
			23											
			24											
			25											
			26											
			27											
			28											
			29											
			30											
			31											
			32											
			33											
			34											
			35											
			36											
			37											
			38											
			39											
			40											

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-305A   Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			40–45											Bagged auger samples to ~40 feet
			45											Swithched to mud rotary drilling at 45 feet
S1	5	50/5	46	POORLY GRADED SAND, fine, light brown, (weathered sandstone bedrock).	SP					W				
			55	Same as above but very fine, light brown to light gray, with pieces of rock.										Switched to air rotary drilling at 55 feet
			59											Driller noted rock became more compitant at 59' bgs.
			60–65	SANDSTONE, fine to medium, light brown, trace gravel and light gray to gray limestone, (bedrock).										

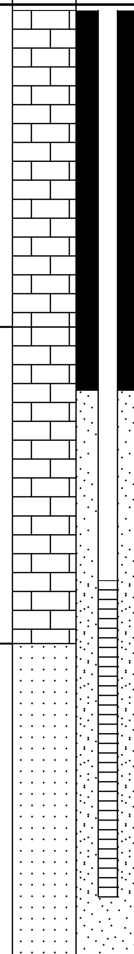
State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-305A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			65–70	LIMESTONE, light gray, with fine, light brown sandstone, (bedrock).										At 68 feet, driller noted a fracture in the bedrock.
			70–75	LIMESTONE, gray, with dark brownish gray shale, (bedrock).										
			75–80	SANDSTONE, fine, light grayish white, with gray limestone, (bedrock).										
			80	End of boring at 80 feet below ground surface.										



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Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40			MW-306

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/12/2015	11/12/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-306	Feet	681.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,666 N, 1,902,629 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–1	TOPSOIL.	TOPSOIL									
			1–13	FAT CLAY, dark olive brown (2.5Y 3/3).	CH									
S1	18	3 6 9 11	11							M				
S2	22	5 6 7 9	13–16	FAT CLAY, gray (10YR 5/1).	CH					M				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] for Kyle Kramer
Firm: SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

Boring Number MW-306

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	22	5 10 10 14	17	FAT CLAY, gray (10YR 5/1). *(continued)* FAT CLAY, gray (10YR 5/1).	CH					M				
			18	FAT CLAY, dark olive brown (2.5Y 3/3).	CH									
S4	13	5 8 14 17	19							M				
			20											
S5	15	5 6 13 16	21							W				
			22											
			23											
S6	15	3 5 7 9	24							W				
			25											
S7	22	2 5 7 11	26	POORLY GRADED SAND, very dark grayish brown (10YR 3/2), medium to coarse grained, (weathered bedrock?).	SP					W				
			27											
			28											
S8	NR	7 3 4 3	29							W				
			30											
S9	18	1 1 2 2	31							W				
			32											
			33											
S10	13	WOR	34							W				
				End of Boring at 34.5 feet bgs.										

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Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220083.00		MW-306WT

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Brian Kinzer Direct Push Analytical	4/27/2022	4/27/2022	hollow stem auger

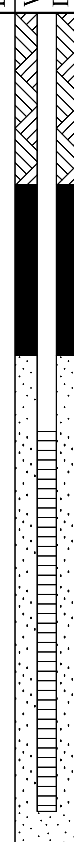
Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-306WT	655.25 Feet MSL	681.34 Feet MSL	8.25 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,662 N, 1,902,626 E S / C / N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W

Lat 41 ° 5 ' 54.7 "
Long -92 ° 32 ' 55.0 "

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–22	Hydrovaced to 8 feet below ground surface (bgs) and blind drilled to 22 feet bgs. See boring log MW-306 for lithology.										
			22	End of boring at 22 feet below ground surface.										

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive, Madison, WI 608-224-2830	Tel: Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		MW-307

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/25/2016	10/25/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-307	Feet	655.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,707 N, 1,903,070 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S, Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	POORLY GRADED SAND WITH GRAVEL, tan, fine to coarse sand and gravel, (construction fill sand to fill in hydrovac hole cleared to 8.5 ft bgs).	SP									water level 6.5 ft bgs.
S1	24	2 2 3 2								W				
			10–15	LEAN CLAY, dark yellowish brown (10YR 4/4), slightly dense.	CL									
S2	14	4 1 4 4								W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53711	Tel: (608) 224-2830 Fax:

Boring Number MW-307

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				LEAN CLAY, dark yellowish brown (10YR 4/4), slightly dense. *(continued)*	CL									
S3	24	1 2 2 4	16	SILT, dark yellowish brown (10YR 3/4), fine to medium sand.	ML					W				
S4	17	3 3 3	18–19							W				Bedrock @19.5 ft bgs.
S5	5	50/0.5	20	SANDSTONE, dark brown (10YR 3/3),						W				More competent @20.5' -24.5' bgs.
			25	more weathered.										
S6	1	100	28	Same as above except, gray (10YR 6/1).										
				End of boring at 28 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00			MW-308

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/25/2016	10/25/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-308	Feet	652.9 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 402,312 N, 1,902,665 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S, Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–9.5	POORLY GRADED SAND WITH GRAVEL, tan, fine to coarse sand and gravel, (construction fill sand to fill in hydrovac hole cleared to 9.5 ft bgs).	SP									water @ 6.5 ft bgs.
S1	24	19 4 2 2	9.5–13	LEAN CLAY, brown (10YR 4/3), dense.	CL					W				
S2	13	1 2 2 2	13–15	SILT, brown (10YR 4/3), some clay.	ML					W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711
Tel: (608) 224-2830
Fax:

Boring Number MW-308

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				SILT, brown (10YR 4/3), some clay. *(continued)*	ML									
S3	18	1 2 1 3	16	SILTY SAND, brown (10YR 4/3).	SM					W				
			17	POORLY GRADED SAND, brown (10YR 4/3), fine grained.	SP									
			18											
S4	13	4 12 13 3		WELL GRADED SAND AND GRAVEL, dark grayish brown (10YR 3/2), fine to coarse grained, (weathered bedrock).	SW					W				
			19	SANDSTONE, dark grayish brown (10YR 4/2), weathered bedrock.										
S5	6	12 26 50/0.4	20	Same as above except, brown (10YR 4/3).						W				
			21											
			22											
			23											
			24	Same as above except, dark grayish brown (10YR 4/2).										
S6	4	50/0.4	25							W				
				End of boring at 25 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		MW-309

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/27/2016	10/27/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-309	Feet	652.5 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 403,189 N, 1,902,070 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' " Long ° ' "
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	Hydrovac borehole to 10 ft bgs.										
			10	LEAN CLAY, very dark grayish brown (10YR 3/2), trace sand.	CL									
S1		3 3 6 7	11							W				
S2		2 2 2 2	13.5							W				
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711
Tel: (608) 224-2830
Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-309

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				SILTY SAND, very dark grayish brown (10YR 3/2), fine to medium grained.										
S3		1 1 1 1	16							W				
			17		SM									
			18											
S4		3 5 4 6	19							W				
				POORLY GRADED SAND, yellowish brown (10YR 5/4), coarse grained.										
			20		SP									
S5		2 3 7 50	21							W				
				WEATHERED SANDSTONE.										
			22											
			23											
			24											
S6			25							W				
			26											
			27											
				End of boring at 27.5 ft bgs.										

State of Wisconsin
Department of Natural Resources

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Field	Value
Facility/Project Name	IPL - Ottumwa Generating Station SCS#: 25219028.00
License/Permit/Monitoring Number	
Boring Number	MW-310
Boring Drilled By: Name of crew chief (first, last) and Firm	Eric Wetzel, Roberts Environmental Drilling, Inc.
Date Drilling Started	8/27/2019
Date Drilling Completed	8/27/2019
Drilling Method	4 1/4 hollow stem auger
WI Unique Well No.	
DNR Well ID No.	
Common Well Name	MW-310
Final Static Water Level	Feet MSL
Surface Elevation	655.76 Feet MSL
Borehole Diameter	8.5 in.
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒	State Plane 401,502 N, 1,904,206 E S/C/N; 1/4 of 1/4 of Section , T N, R
Lat / Long	Lat ° ' " ; Long ° ' "
Local Grid Location	Feet ☐ N ☐ S; Feet ☐ E ☐ W
Facility ID	
County	Wapello
County Code	
Civil Town/City/ or Village	Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Sample: Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			0	Hydrovac through clay for utility clearances										
			8	LEAN CLAY, brown, massive										
S1	11	WOR-10 3 10	9							M				
				Some reddish brown and grey mottling, some silt.										
S2	15	2 2 3 2	11		CL					M				
S3	20	1 1 1 9	13							M/W				
			14	SILT, brown, with clay	ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: SCS Engineers, 2830 Dairy Drive Madison, WI 53718 Tel: 608-224-2830 Fax

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-310 Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Sample: Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S4	24	WOR								M/W				
			16		ML									
S5	18	1 3 2 3	17	POORLY GRADED SAND, fine to medium, 1/2" coarse sand seam at 17 75'						W				
			18											
S6	14	WOR WOR 2 3	19							W				
			20		SP									
S7	10	WOR 2 4 2	21							W				
			22	Trace small rounded gravel										
S8	24	6 6 11 20	23							W				
			24	End of boring at 24'										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220056.00		MW-310A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	2/27/2020	3/2/2020	6 1/4" HSA & air rotary

	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-310A	12.0 Feet	655.26 Feet	10" and 6" in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,504 N, 1,904,191 E S/C/N
SW 1/4 of NW 1/4 of Section 25, T 73 N, R 15 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Wapello		Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–8	Hydrovaced to 8 feet for utility clearance.										Drilled using hollow stem augers to 40 feet
			8–15	Blind drilled to 24 feet. See boring log MW-310 for lithology.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature]	scs engineers Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-310A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16											
			17											
			18											
			19											
			20											
			21											
			22											
			23											
			24	POORLY GRADED SAND, fine to coarse, brown, trace gravel and lenses of lean clay.	SP									
S1	14	7 20 23 21	25							W				Began collecting split spoon samples at 24 feet
			26	POORLY GRADED SAND, fine, light gray, trace lean clay, (weathered sandstone bedrock).										
S2	17	9 11 12 13	27							W				
			28	Same as above but brown with small gravel.										
S3	13	14 36 50/5	29							W				
			30	Same as above but fine to medium and brown to light gray.										
S4	5	50/5	31							W				
			32	Same as above but fine and light gray.	SP									
S5	5	50/5	33							W				
			34											
S6	5	50/5	35							W				
			36											
S7	5	50/5	37							W				
			38											
S8	4	50/4	39							W				Auger refusal at 39 fet
			40	Same as above but much more competent.										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-310A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
					SP									
			41	LIMESTONE, light brownish gray, with fine to medium light gray sandstone, (bedrock).										
S9			42							W				Switching to air rotary drilling at 40 feet
			43	Same as above but with gravel and very little sand.										Intermittent gravel between 43 to 54 feet
			44											
			45											
			46											
			47											
			48											
			49											
			50											
			51											
			52											
			53											
			54	End of boring at 54 feet below ground surface.										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL - Ottumwa Generating Station SCS#: 25219028.00		MW-311

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Eric Wetzel Roberts Environmental Drilling, Inc.	8/27/2019	8/27/2019	4 1/4 hollow stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-311	Feet MSL	651.24 Feet MSL	8.5 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 399,350 N, 1,907,603 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Wapello		Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S1	14	2 3 4 6	0–2	LEAN CLAY, brown, massive, trace fine to medium sand, roots, 1" sand seam at 1.5'.	CL					M				
S2	14	3 3 4 6	4							M				
S3	6	2 3 4 6	6	SILT, brown, massive.	ML					M				
			7	LEAN CLAY, brown, massive.	CL									
S4	20	2 3 4 3	8	POORLY GRADED SAND, fine to medium, brown, massive.	SP					M/W				
S5	12	2 3 4 5	10	2" clay seam at 10.5'.						W				
S6	14	1 2 4 2	12							W				
S7	14	1 2 3 3	14							W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: 608-224-2830
Fax:

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-311 Use only as an attachment to Form 4400-122.

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
					SP									
			16	End of boring at 16'										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220056.00		MW-311A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	3/2/2020	3/3/2020	6 1/4" auger & air rotary

	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-311A	8.9 Feet	651.16 Feet	10" and 6" in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 399,349 N, 1,907,615 E S/C/N
SW 1/4 of SE 1/4 of Section 25, T 73 N, R 15 W

Lat ___° ___' ___"
Long ___° ___' ___"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Wapello		Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–15	Blind drilled to 16 feet. See boring log MW-311 for lithology.										Drilled using hollow stem augers to 28 feet

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
[signature]	scs engineers	Tel: Fax:

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-311A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	POORLY GRADED SAND, fine to coarse, brown, with trace gravel and silt.										
S1	2		17							W				Began collecting split spoon samples at 16 feet
			18											
S2	11	4 5 6 7	19							W				
			20											
S3	12	5 5 6 7	21		SP					W				
			22											
S4		7 8 9 8	23							W				No return
			24											
S5		3 3 5 10	25							W				No return
			26											
S6	14	5 9 50/5	27							W				Driller noted bedrock at 27.5 feet
			28	POORLY GRADED SAND, very fine, white, with pieces of competent rock, (weatherd sandstone bedrock).	SP									Switched to air rotary drilling at 28 feet
			29	LIMESTONE, gray with fine, light gray to white sandstone, (bedrock).										
			30											
			31	POORLY GRADED SAND, fine to medium, brown, with trace brown limestone, (bedrock).										
			32											
			33											
			34		SP									
			35											
			36											
			37	LIMESTONE, gray, with fine to medium browinsh gray sandstone, (bedrock).										
			38											
			39											
			40											

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-311A Use only as an attachment to Form 4400-122.

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			41											
			42											
			43											
			44											
			45											
			46	End of boring at 46 feet below ground surface.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Ottumwa Generating Station SCS#: 25221162.00		MW-312

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/14/2021	12/14/2021	Roto-Sonic

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-312	642.2 Feet	655.4 Feet	6.0 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,504 N, 1,903,457 E (S)/C/N
SE 1/4 of NE 1/4 of Section 26, T 72 N, R 15 W
Lat 41 ° 5 ' 53.1 "
Long -92 ° 32 ' 44.1 "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello, Iowa	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–8	Hydrovaced to 8' below ground surface through clay.										
			8	LEAN CLAY, dark grayish brown (10YR 4/2) with trace roots, medium stiff.	CL									
S1	21		9						1.0	M				
			10	Same as above but stiff to medium stiff with brown and black mottling.										
S2	46		12.5						0.75-1.25	M/W				Water is at 11.5' bgs.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] | Firm SCS Engineers 2830 Dairy Drive, Madison, WI 53718 608-224-2830 Tel: Fax:

Boring Number MW-312

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				Same as above but dark gray.	CL									
			16	SILT, dark graysish brown (10YR 4/2) to gray - dark gray (2.5Y 3/1), soft to medium stiff.										
			17											
S3	60				ML			0.5/0.25-0.5		W				
			18											
			19											
				POORLY GRADED SAND, fine to coarse grained, orange brown to white with trace gravel.										
			20	Same as above but fine grained, white to light gray (5Y 7/1) with pieces of rock and trace cobbles (Weathered Bedrock).										
			21											
			22											
S4	60									M				Hard drilling from 20-27.5' bgs.
			23		SP									
			24											
			25	Same as above										
			26											
S5	28									M				Sampled S4 and S5.
			27											
				End of boring at 27.5' below ground surface.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Ottumwa Generating Station SCS#: 25221162.00		MW-313

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/14/2021	12/14/2021	Roto-Sonic

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-313	641.2 Feet	655.8 Feet	6.0 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,491 N, 1,903,802 E (S)/C/N
SW 1/4 of NW 1/4 of Section 25, T 73 N, R 15 W

Lat 41° 5' 52.9"
Long -92° 32' 39.6"

Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello, Iowa	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–8	Hydrovaced to 8' below ground surface through clay.	CL									
S1	12		8–12	LEAN CLAY, dark grayish brown (10YR 4/2) with trace roots, stiff.	CL				1.25	M				
S2	55		12–14.25	SILT, dark grayish brown (10YR 4/2), with trace sand, soft.	ML				0.75/0.25	W				Water at 13' bgs.
			14.25–15	POORLY GRADED SAND, fine to coarse grained, brown (10YR 4/2) with trace fine gravel.	SP									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm		
[signature]	SCS Engineers	2830 Dairy Drive, Madison, WI 53718 608-224-2830	Tel: Fax:

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Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-313

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	85		16 17 18 19 20 21 22	Same as above but ranging from dark grayish brown to red brown, gray, and tan. Same as above but with layer of cobbles at 21' bgs. Trace silt at bottom of sample.	SP					W				Sampled S3
				End of boring at 22.5' below ground surface.										

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SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220083.00		MW-314

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Brian Kinzer Direct Push Analytical	4/28/2022	4/28/2022	Geoprobe/HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-314	667.67 Feet MSL	681.89 Feet MSL	8.25 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,224 N, 1,901,685 E S / C / N
SW 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat 41° 5' 50.5"
Long -92° 33' 7.3"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–6	Hydrovaced to 8 feet below ground surface (bgs).										
S1	20		6–8	LEAN CLAY, gray to dark gray with orange mottling, trace sand (backfill), medium stiff.	CL					M				Hydrovaced hole collapsed in from 6 to 8 feet bgs
S2	44		8–12	Same as above but gray to brownish gray with trace organics, medium stiff.						M				
S3	33		12–16	Same as above but soft to medium stiff.						M				
S4	48		16–20							M				
S5	48		20–23	Same as above but stiff to very stiff.						M/W				
			23–25	POORLY GRADED SAND, fine to coarse grained, brown to orangish brown, with trace clay.	SP									

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Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive, Madison, WI 608-224-2830	Tel: Fax:

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Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-314

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S6	29		26, 28	Same as above but with trace fine gravel.	SP					W				
S7	24		30	SANDY LEAN CLAY, fine to coarse grained, brown to orangish brown, brownish gray, and trace white, with trace gravel and organics. White clay appears to be thixotropic in composition.	CL					W				
				End of boring at 31 feet below ground surface.										

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SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

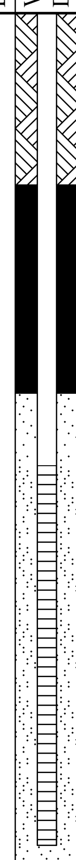
Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25220083.00		MW-314WT

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Brian Kinzer Direct Push Analytical	4/28/2022	4/28/2022	hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-314WT	667.85 Feet MSL	681.74 Feet MSL	8.25 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,232 N, 1,901,685 E S / C / N
SW 1/4 of NE 1/4 of Section 76, T 73 N, R 15 W
Lat 41 ° 5 ' 50.6 "
Long -92 ° 33 ' 7.3 "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			2 4 6 8 10 12 14 16 18 20 22	Hydrovaced to 8 feet below ground surface (bgs) and blind drilled to 22.5 feet bgs. See boring log MW-314 for lithology.										
				End of boring at 22.5 feet below ground surface.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature]	SCS Engineers 2830 Dairy Drive, Madison, WI 608-224-2830 Tel: Fax:

Appendix C

Hydrogeochemical Conceptual Model and Preliminary Summary of Groundwater Contaminant Attenuation

ReSolution Partners, LLC

Subject: Cobalt assessment and Treatability Study

From: Bernd W. Rehm Date: 11 July 2022

Project: SCS – Alliant OGS Ash Pond CCR Evaluations 158-002a

Conclusion

Concentrations of cobalt downgradient of the Ottumwa Generating Station (OGS) Ash Pond exceed the groundwater protection standard of 6 µg/L. Hydrogeochemical from the site suggest that the presence of the cobalt may be due to the adsorption to suspended sediment that is released when groundwater samples are acidified. The adsorption process also drives the natural of attenuation of cobalt with groundwater flow from the Ash Pond. Additional laboratory studies confirmed the adsorption of cobalt by iron minerals (presumably iron oxyhydroxides) in the aquifer solids and the suspended sediment in the groundwater samples and found that the adsorption was nearly irreversible.

1. Introduction.

This document focuses the application of monitored natural attenuation with respect to cobalt for the Ottumwa Generating Station Ash Pond. Two of the five shallow monitoring wells on the downgradient perimeter of the Ash Pond consistently show total (dissolved + suspended) cobalt concentrations exceed one or both of either the cobalt background upper prediction limit (UPL = 4.1 µg/L) or the groundwater protection standard (GPS = 6.0 µg/L):

	MW-305	MW-306
Mean	16.3	6.6
Median	16.0	6.1
Range	13.7 to 21.0	4.8 to 11.0
Number	21	22

Two of 18 observations from April 2016 through April 2022 at MW-302 exceeded the UPL but not the GPS with concentrations of 5.3 and 5.5 µg/L. The final two monitoring wells, MW-303 and MW-304, did not exceed the cobalt UPL with 18 observations.

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2. Conceptual Site Model.

2.1 Hydrogeology. Four of the five monitoring wells downgradient of the Ash Pond are completed in saturated poorly graded sand (weathered sandstone) between elevations of approximately 655 to 625 feet above mean sea level. The fifth location (MW-303) encountered sandstone at an elevation of about 650 feet. Clay of variable thickness is generally found above the sand. The degree to which clay separates the Ash Pond from the saturated sand in uncertain. The saturated sand forms a permeable pathway from beneath the Ash Pond to well MW-310 and presumably to the Des Moines River immediately east of MW-310. The horizontal hydraulic gradient of ~0.01 beneath the Ash Pond decreases to ~0.006 from the Ash Pond to the river. The hydraulic conductivity of the sand was observed to range from 3.5 E-4 to 3.2 E-3 cm/s (median 2.8 E-3 cm/s, n=5). Assuming a porosity of 0.3 yields estimated groundwater flow rates on the order of 100 ft/yr below the Ash Pond, to on the order of 60 ft/yr from the pond to the river. The groundwater travel time from the pond to the river is estimated on the order of 30 years. The Ash Ponds were first commissioned in 1981, approximately 40 years ago.

2.2 General Geochemistry. The groundwater chemistry of the cobalt-bearing monitoring wells and the downgradient monitoring well within the potential groundwater flow path as observed in March, April and October 2020 are used to evaluate the site groundwater chemistry. The wells include MW-301 and MW-302. Table 1 summarizes the overall groundwater chemistry and Table 2 summarizes the data used in the preparation of the figures in Section 2 of this report.

The groundwater has near-neutral pH, with a slight increase east of the Ash Pond with no clear trend over time.

The ORP shows decreasing trends at the background well and MW-306 and increasing trend at MW-305 from April 2020 to April 2022. The three locations downgradient of the Ash Pond have no clear trend with time but suggest an increase to the east.

Samples from MW-301, -303, -305A and -310A show a weak positive correlation between ORP and dissolved oxygen above an ORP of about 0 mV (circled data, Figure 1). The remaining samples have little to no dissolved oxygen over a broad range of ORP. The DO measurements indicate the groundwater becomes less oxic as it travels beneath the Ash Pond from an upgradient mean of +200 mV. The ORP values at the downgradient edge of the Ash Pond range from means of -90 mV at MW-304 to about +60 mV at MW-305 and -306. There is no consistent trend with time. Further downgradient of the Ash Pond the ORP is variable at MW-311 and -312, averaging about 30 mV while the DO decreases to <0.3 mg/L. Near the Des Moines River, the ORP rises sharply to +190 mV while the dissolved oxygen remains below 0.5 mg/L.

There is no measurable total or dissolved iron in the upgradient well consistent with the pH and ORP. At the Ash Pond perimeter, the total iron (including dissolved iron and iron associated with suspended sediment) increases to about 4,800 µg/L at MW-304 (Figure 2). Total iron concentrations are also high sometimes high at MW-302, -303, -305 and -306 (blue circle, Figure 2) and at downgradient locations MW-312 and -312 (red circle, Figure 2). Except for the blue circled data there is a general 1 to 1 correlation between the dissolved and total iron concentrations.

There is little correlation between the iron concentrations and pH. However, both dissolved and total iron are correlated with ORP (Figure 3). This is expected as reduced ferrous iron is more soluble that oxidized ferric iron.

As might be expected, the suspended sediment is also positively correlated with total iron concentrations (Figure 4, with one outlier from MW-304 and one from MW-310A).

Only dissolved manganese was consistently measured in the groundwater. The lowest concentrations are found at MW-301 and -310 (14 to 53 µg/L). At MW-304, -305 and -306 the concentrations range from 3,100 to 16,000 µg/L. There is a general negative correlation between dissolved manganese and ORP.

Sulfate concentrations increase from MW-301 to MW-306 with the possible seepage from the Ash Pond, and then decreased with continued downgradient migration to MW-305. This may suggest very limited and localized sulfate reduction is occurring or dilution (note the sulfate concentrations in the pond are not know). The subsequent increase in sulfate at MW-312, -313 and -310 is attributed to upward flowing deep groundwater mixing with the shallow groundwater as described elsewhere by SCS. The mixing is supported by the trends in boron and lithium concentrations that show sharp decreases and increases, respectively, as the deeper groundwater mixes with the shallower groundwater.

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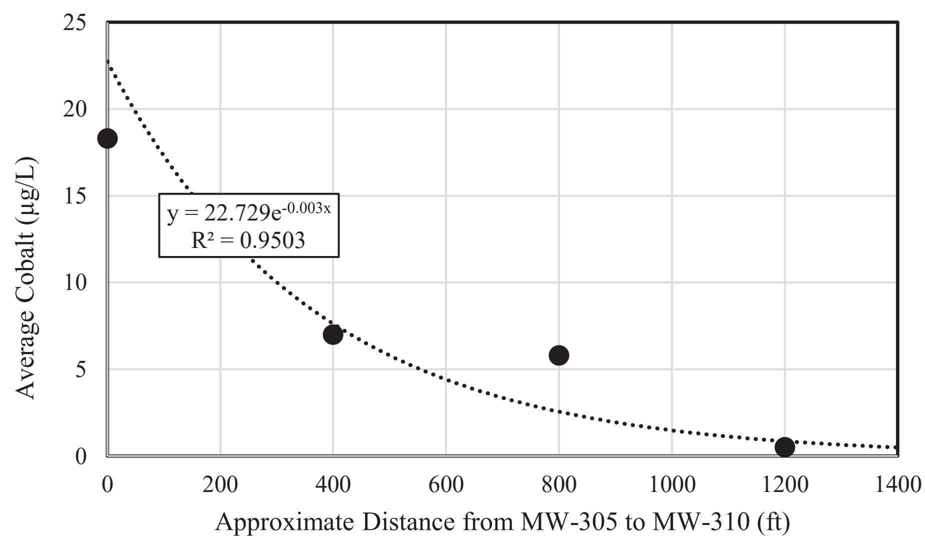
ReSolution Partners, LLC

2.3 Cobalt Geochemistry. Cobalt is present as a 2+ cation (Co^{2+}) and is the dominant species found in natural environments. Its valance state is not affected by the oxidation reduction potential in which it is found, but the ORP can affect ligands with which cobalt may complex, precipitate or absorb to. Assuming an ORP on the order of -100 to -400 mV (Eh on the order of 100 to -200 mV), and a pH on the order of 6 to 7 SU suggests cobalt could occur as aqueous Co^{2+} or precipitate as CoS. In many settings the aqueous concentrations are a function of adsorption to, or coprecipitation with iron, manganese or aluminum oxyhydroxides. Iron and manganese oxyhydroxide formation are controlled by pH and ORP. Aluminum oxyhydroxide is controlled by pH with maximum precipitation between pH of 6 to 7 SU.

Total and dissolved iron concentrations are less than 1 µg/L at the upgradient well (MW-301). Cobalt concentrations are also less than 1 µg/L at MW-303 and -304. Perimeter wells MW-302, and -305A yield total and dissolved cobalt concentrations between 1 and 6 µg/L. MW-305 and -306 produced mean concentrations of 17 and 7 µg/L cobalt, respectively. The concentrations at MW-305 were relatively constant while the concentrations at MW-306 increased from 2021 to 2022. In 2022, MW-312 averaged 7.0 and MW-313 averaged 5.8 µg/L. The downgradient-most wells (MW-310 and -310A) produced <1 µg/L of cobalt over 2 years of monitoring (March 2020 through April 2022). The concentration trend suggests an exponential concentration decrease with distance along the assumed flow path.



In the absence of natural attenuation, the estimated 60 ft/yr groundwater flow rate and the 40 years since the Ash Pond was commissioned there has been adequate time for cobalt present near the Ash Pond to have reached MW-310. The trend demonstrates natural attenuation is occurring.

The total cobalt concentrations (which includes cobalt associated with suspended sediment) shows positive correlations with suspended sediment loads as measured by turbidity at the time of sample collection (Figure 5). Two possible outliers on Figure 5 include one sample each from MW-304, and -305 for April 2020. The remaining data appear to fall into two groups. The data from MW-305, -305A within the solid blue outline suggest the total cobalt concentration increases with the amount of suspended sediment. All the remaining data suggest a similar correlation but offset by about 10 times lower total cobalt. The correlation between dissolved cobalt and turbidity is nearly identical to the total cobalt plot because dissolved and total cobalt are well correlated (Figure 6). This suggests the possibility that there is an absorption equilibrium between the aqueous dissolved cobalt and the cobalt associated with the iron-bearing suspended sediment.

While cobalt's valence state would not be affected by ORP, there is a general correlation between ORP and dissolved or total cobalt in the groundwater (Figure 7, except for possible outliers from MW-304 and -305). When reviewing all the data there was no correlation evident between ORP and iron. However, plotting dissolved iron (which is expected to increase with decreasing ORP) against dissolved cobalt (Figure 8) there is a positive correlation for MW-305, -305A and -306 where dissolved cobalt is present above 1 µg/L (one sample from each of MW-304 and MW-310A are potential outliers with high iron concentrations). This suggests the cobalt that passes a 0.45 µm filter may be absorbed to iron that passes a 0.45 µm filter (i.e. "colloidal" particulate iron).

The mass of cobalt in the groundwater where the GPS may be exceeded between MW-305 and MW-310 is estimated at 0.67 kg assuming:

- Approximate plume dimensions of 120 m wide (assuming ~ half the distance between MW-305 and adjacent wells that do not exceed the GPS) by 320 m long and 6 m thick,
- Total porosity of 0.3,
- Cobalt concentration of 9.7 ug/L (average of MW-305, -312, -313 and -310).

3. Potential for Site-Specific Cobalt Natural Attenuation.

Immobilization within the saturated sand is the mechanism that drives natural attenuation of cobalt. If cobalt were not attenuated, the 30-year groundwater travel time from the Ash Pond to MW-310 suggests that cobalt should have arrived at MW-310 in the ~40 years since the Ash Pond was commissioned if it was not attenuated. The cobalt concentration from MW-305 to MW-310 appears to decrease by a factor of ~60. Dilution by mixing with upward flowing deep groundwater at MW-310 may be a factor in the decrease. Assuming lithium is a conservative constituent in the deep groundwater at 270 µg/L, its concentration is reduced to 48 µg/L by mixing with the 3.2 µg/L from MW-305. The potential mixing does not appear to be sufficient to account for the cobalt concentration reduction. Precipitation, coprecipitation or adsorption likely account for the remaining decrease.

The groundwater becomes more oxic from the Ash Pond perimeter to MW-310 at the Des Moines River. As the ORP increases, iron precipitates from the water and provides adsorption sites on iron oxyhydroxides for cobalt which is then also removed from the groundwater.

In addition, the sand at MW-305 is described as yellow-brown suggesting that some of the iron may be in an oxidized form on the surfaces of the sand. The color of the sand at MW-310 was not recorded. The iron oxyhydroxides on the aquifer matrix provide potential adsorption sites for the sequestration of cobalt.

4. Additional Assessment of Site-Specific Cobalt Monitored Natural Attenuation.

4.1 Introduction. Immobilization within the saturated sand is the mechanism that drives natural attenuation of cobalt. If cobalt were not attenuated, the 30-year groundwater travel time from the Ash Pond to MW-310 suggests that cobalt should have arrived at MW-310 in the ~40 years since the Ash Pond was commissioned if cobalt was not attenuated. The cobalt concentration from MW-305 to MW-310 appears to decrease by a factor of ~60. Dilution by mixing with upward flowing deep groundwater at MW-310 may be a factor in the decrease. Assuming lithium is a conservative constituent in the deep groundwater at 270 µg/L, its concentration is reduced to 48 µg/L by mixing with the 3.2 µg/L from MW-305. The potential mixing does not appear to be sufficient to account for the cobalt concentration reduction. Precipitation, coprecipitation or adsorption likely account for the remaining decrease.

The groundwater becomes more oxic from the Ash Pond perimeter to MW-310 at the Des Moines River. As the ORP increases, iron precipitates from the water and provides adsorption sites on iron oxyhydroxides for cobalt which is then also removed from the groundwater.

In addition, the sand at MW-305 is described as yellow-brown suggesting that some of the iron may be in an oxidized form on the surfaces of the sand. The color of the sand at MW-310 was not recorded. The iron oxyhydroxides on the aquifer matrix provide potential adsorption sites for the sequestration of cobalt.

Groundwater sampling completed in February 2021 found 64 µg/L of total (unfiltered) cobalt in MW-307, downgradient of the zero liquid discharge pond. The cobalt concentration from MW-307 was higher than MW-305, which historically had the highest cobalt concentrations. SCS therefore added MW-307 to the assessment.

4.2 Treatability Study. ReSolution Partners (RP) completed bench-scale treatability studies (TS) to assess the following:

- The degree of iron precipitation and cobalt coprecipitation and adsorption from MW-305 groundwater with aeration (i.e. redox increase) to better understand the degree to which cobalt adsorption and coprecipitation contributes to attenuation.

- Samples of suspended sediment from MW-305 and -307 were analyses to assess the degree to which cobalt is associated with the suspended sediment.

- Samples of the saturated sand collected by SCS from the two new well locations, MW-312 and -313, and from the adjacent area to MW-305 (labeled as MW-305X) and MW-307 (MW-307X) was analyzed for:
    - iron and manganese concentrations to assess potential for adsorption,
    - cobalt concentrations to assess the degree to which cobalt has adsorbed or coprecipitated on to the sand matrix (i.e. defining the "immobile plume"),
    - cobalt adsorption isotherms to assess capacity of the sand to absorb cobalt and determine maximum adsorption capacity.

4.3 Sample Collection. SCS collected four (4) samples representative of the aquifer solids through which the cobalt is migrating from the locations noted above. Each sample filled a 1-L plastic bottle and was saturated with groundwater from the well at each sampling location to as close as practical to zero-head-space to minimize atmospheric exposure and oxidation. The samples were placed on ice and delivered to RP on 17 December 2021. Each sample was mechanically homogenized, re-saturated and returned to their respective sample containers. The samples were placed in refrigerated storage until used in the treatability study.

Recent groundwater sampling found 5.6 µg/L of cobalt in MW-305 and 64 µg/L in MW-307. SCS therefore collected 9.5 L of groundwater from both MW-305 and MW-307 in nitrogen-purged stainless-steel sample collection vessels using low-flow pumping methods to minimize exposure to the atmosphere and potential iron precipitation prior to receipt by RP. In-field stabilization parameters (including pH, DO and ORP) were collected by SCS at the time of sample collection. The samples were delivered to RP on 13 January 2022. RP measured groundwater pH, DO, ORP and SEC upon receipt, transferred the groundwater to multi-layer (Nylon-PE-Al foil-PE) bags to minimize contact with atmospheric oxygen and place the samples in refrigerated storage until used in the TS.

Once the 9.5-L samples were collected, SCS filtered 4 litres of groundwater from each of MW-305, -307, -312 and -313 through 0.45 µm and 0.20 µm filters provided by RP. The filters were folded in half to protect the retained sediment and placed in plastic bags with the respective well numbers. The filter samples were packaged in plastic bags and delivered to RP on13 January 2022.

SCS also collected 1-L of groundwater from upgradient well MW-301 to zero-headspace in a glass bottle provided by RP. The samples were placed on ice and delivered to RP on 13 January 2022. In-field stabilization parameters (including pH, DO and ORP) was collected at the time of sample collection. Water samples and filters were delivered to RP on 13 January 2022.

4.4 Baseline Analyses. A summary of the soil samples provided for the treatability study is provided in Table 3. The soil sample from MW-307X contained <90 % by mass fine gravel to pebbles in the order of 2 to 3 cm in size. This coarse fraction does not provide the main portion of reactive solids in the soil. Sediment less than 4 mm in size was therefore separated from the sample. A representative aliquot of each soil sample

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was submitted to CTL for analyses of cobalt, iron and manganese content by USEPA Method 6010 with the results provided in Table 4. Laboratory reports for the treatability study are provided in Appendix A.

MW-305X and -307X located near the CCR management units contained iron from 1,290 to 32,900 mg/kg. This iron likely represents iron oxyhydroxides coating the sediment grains in the samples. The iron oxyhydroxides provide sites for the adsorption of cobalt. This correlation is demonstrated on Figure 9.

An aliquot of each groundwater from the multilayer bag was measured by RP for pH, ORP, DO and SEC upon receipt. One aliquot of each groundwater was submitted to CT Laboratories (CTL) in Baraboo, Wisconsin for analyses of cobalt, iron and manganese content by USEPA Method 6010 with the results provided in Table 5. The MW-305 cobalt concentrations in January 2022 were comparable to historical results. The pH and DO are also comparable. However, the ORP continues to show a downward trend from 190 mV in March 2020 to -72 mV in January 2022 as do total iron concentrations (from 390 to 28.4 ug/L) and turbidity (43 to 0 NTU). MW-307 also had comparable cobalt concentrations from April 2020 to January 2022 and iron concentrations and turbidity also decreased. Cobalt concentrations at MW-312 and -313 were intermediate between concentrations near the CCR units and the most downgradient well, MW-310; consistent with the conceptual model of cobalt attenuation.

The previous RP November 2020 cobalt assessments identified positive correlations between total or dissolved cobalt concentrations and turbidity. This trend generally continued with the most recent sample results as illustrated on Figure 10. The two samples circled by the green dashed line are from MW-305 and-307 sampled in 2022. The low turbidity would suggest that the cobalt concentration would also be low. The unusual response of MW-305 is further highlighted on Figure 11 when the results only from Table 5 are plotted. Figure 12 illustrates the unusually low ORP results observed in the treatability study samples. The large decrease in ORP suggests that iron oxyhydroxides in the sediment that would have been able to sequester cobalt are being dissolved at the low ORP and releasing cobalt. However, the iron concentration increases that would be expected are not evident. Why there is no increase cannot be explained with the existing data.

4.5 Suspended Sediment Analyses. Aluminum and iron are expected to be part of suspended sediments in the form of clay or oxyhydroxide minerals that were retained on the filter. Both clay minerals and iron oxyhydroxide can be expected to provide adsorption sites for cobalt. It is common practice to define "dissolved" species as those passing a 0.45 microns (µm) filter; however, there are mineral oxide and hydroxide minerals that can present as suspended particulates on the order of 0.10 µm in size[1]. Filters of 0.45 and 0.20 µm were used to define potential suspended material in the OGS groundwater.

There was too little sediment on the filters to allow for sediment removal and testing. Therefore, the entire filters were cut up and digested with heated aqua regia by RP. A clean filter was also digested as a control. The digestate was shipped to CTL for analyses of aluminum, iron and cobalt by Method 6010. The results are summarized in Table 6 and on Figure 13.

The aluminum and iron concentrations have been normalized to present the amount of each element that was measured in the sediment retained by the filters for one litre of groundwater (*"mg/L"*). The 0.45 µm filter retained most of the suspended aluminum and iron. Except for MW-307 samples, the 0.45 µm filters retained from 74 to 81 percent of the aluminum and the from 76 to 87 percent of the iron. The MW-307 samples found the two elements were more equally divided between the two filters.

From 6 to 27 *"mg/L"* of aluminum and from 7 to 58 *"mg/L"* were retained by both filters. The mineralogy of the aluminum- and iron-bearing particulates is not known. Assuming the aluminum is in the form of kaolinite clay [$Al_2Si_2O_5(OH)_4$], the measured aluminum concentrations would represent about 29 to 130 mg/L of clay; and assuming the iron is in the form of iron oxyhydroxide (FeOOH), the measured iron concentrations would represent about 11 to 93 mg/L of iron oxyhydroxide.

Most of the results suggest two generally linear trends indicated by the ovals shown on Figure 13. As expected, at low turbidity (indicative of low suspended sediment concentration) the aluminum and iron concentrations are low, less than 10 *"mg/L"*. As the amount of suspended sediment increases, the aluminum concentrations increased slightly to 10 to 15 *"mg/L"* while the iron concentration increases by about a factor of 10 as the turbidity reached 13 NTU. The results from MW-313 do not follow this trend because the reported turbidity was 0 NTU. The results suggest, but do not prove, that the

[1] J. D. Hem. 1970. Study and interpretation of the chemical characteristics of natural water. USGS Water-Supply Paper 1473, 363 pp.

turbidity results may be in error. MW-305 and -313 also show much wider differences between the elemental retentions for the two filter sizes.

Unfortunately, the cobalt reporting limits in the presence of the aluminum and iron concentrations were raised to the point at which the cobalt content could not be quantified. Assuming suspended particulates that pass the 0.45 µm filter as dissolved when a groundwater sample is preserved with nitric acid, the results suggest from 7 to 9 µg/L could be added to the "dissolved" phase from the particulates.

4.6 Cobalt and Iron Precipitation. The multi-layer bag of the selected groundwater was gently agitated to suspend any solids in the sample. A 50 mL subsample was withdrawn and preserved with nitric acid to determine dissolved and suspended cobalt and iron concentrations; immediately followed by a 50 mL subsample that was filtered at 0.45 µm and preserved with nitric acid to determine dissolved cobalt and iron concentrations. A 200 mL subsample was transferred to a beaker, a porous stone connected to a pump was placed in the beaker of groundwater, and air was pumped into the sample for 60 minutes. Following aeration, the pH and ORP of the groundwater was measured. The sample was stirred vigorously to suspend any solids in the sample. A 50 mL subsample was withdrawn and preserved with nitric acid to determine dissolved and suspended cobalt and iron concentrations; immediately followed by a 50 mL sample that was filtered at 0.45 µm and preserved with nitric acid to determine dissolved cobalt and iron concentrations. Analyses of cobalt and iron were completed by CTL. The results are presented in Table 7.

The pH of the samples increased with aeration by about 1.5 SU for both samples as a result of hydroxide loss with the precipitation of iron oxyhydroxide minerals. As expected, aeration increased the ORP of the water samples; however, the change was much greater for MW-307 (+240 mV) than MW-305 (+53 mV). The greater change in MW-307 may be due to the greater loss of reduced iron compared to MW-305.

Cobalt concentrations decreased less for MW-305 (about -8%) than for MW-307 (about -57%). The difference is due to amount of iron that was precipitated as illustrated on Figure 14. MW-307 lost ~300 µg/L of iron with aeration resulting in the loss of almost 8 µg/L of cobalt (1 µg Co per 38 µg Fe) while MW-305 lost about 16 µg/L of iron with a loss of 1.5 µg of cobalt (about 1 µg Co per 10 µg Fe). The presence of particulate iron minerals clearly reduces the dissolved cobalt concentrations.

4.7 Aquifer Sediment Adsorption Trials. Cobalt, typical of divalent metal ions in water, have variable degrees of adsorption to soil materials in competition with other ions that are present in the water. Adsorption is an equilibrium process such that the aqueous concentration reaches a stable concentration that is in equilibrium with the adsorbed concentration. Once adsorbed, the ions may desorb as the chemistry of the water in contact with the soil changes. Changes may include reductions in the aqueous concentrations of the metal ions. The correlation between the aqueous concentrations and the adsorbed concentrations is defined by adsorption isotherms that can be tested in batch trials. The following trials evaluated the degree to which cobalt adsorbed to site soils from site groundwater and potentially desorbed using adsorption isotherms.

Six trials were prepared for each soil samples MW-305X, MW-307X, MW-312 and MW-313, with 200 mL of MW-305 groundwater containing ~17 µg/L of cobalt. The site groundwater provided only ~3 µg of cobalt for adsorption using 200 mL trials. Given the analytical reporting limit of 0.6 µg/L, this is too little cobalt to adequately define adsorption isotherms of the aquifer solids. The MW-305 groundwater was therefore spiked with $CoCl_2$ to increase the cobalt concentration to 137 µg/L based on analyses by CTL. The pH and ORP immediately following spiking were 7.08 SU and -22 mV, respectively. The spiked groundwater was placed in a multi-layered bag to minimize exposure to the atmosphere.

Aquifer solids were combined with the spiked MW-305 groundwater as follows:

Groundwater (mL)	Approx. Aqueous Cobalt		Aquifer Solids (g, dry weight)	Liquid to Solids Ratio
	Concentration (µg/L)	Mass (µg)		
200	137	27.4	1	200
			2	100
			4	50
			8	25
			20	10
			40	5

In addition to the 24 adsorption trials, duplicate controls consisting of groundwater without aquifer solids were also be prepared. The trials were allowed to react for 10 days to approach an adsorption equilibrium. The trials were inverted each business day to uniformly expose the soil particles to the groundwater.

Iron and manganese precipitation as oxyhydroxides, common points for metals adsorption, are very sensitive to the presence of dissolved oxygen. Therefore, the trial preparation was completed in a glove box purged with nitrogen and the trials during the adsorption period were stored in a nitrogen-purged desiccator box.

At the end of the 10-day equilibration period, the trials were removed from the box and an aqueous aliquot was removed and immediately filtered at 0.45 µm, preserved with nitric acid and shipped to CTL for analyses of cobalt. The pH and ORP of the samples were measured by RP. The pH, ORP and adsorbed cobalt was determined by calculation from the reduction in aqueous concentrations as presented in Table 8.

The cobalt concentrations of the controls were just slightly less than the spiked concentrations, demonstrating that precipitation of cobalt from solution of cobalt adsorption to the bottles used in the trials were not significant mechanism of cobalt loss.

All the trials showed a pH decrease from the controls of ~0.3 SU with the addition of soil, and a continued slight decrease in pH (≤0.2 SU) as the liquid to solids ratio increased. As the liquid to solids ratio increased the ORP stayed relatively constant and near the starting spiked water level with MW-307X and MW-312 soil. The water from the ORP at MW-305X increased to 31 mV, approaching the control ORP as the liquid to about 4% of the cobalt was desorbed. One trial released 14 % of the adsorbed solids ratio increased. MW-313 saw a decrease in ORP to -66 mV. What drove the redox changes is not evident from the testing done.

A series of adsorption isotherms produced from the measured aqueous concentration (C_{aq}) and calculated absorbed concentration (C_{abs}) are presented on Figure 15.

Soil samples collected near the CCR units, MW-305 X and MW-307X (<4 mm fraction) had comparable near linear isotherms (r^2 = 0.95 and 0.90) with K_d values of 16.5 and 21.2 L/kg, respectively. MW-313 also provided a linear isotherm (r^2 = 0.98) with a higher K_d, 28.0 L/kg. The results for MW-312 soil had the lowest apparent K_d at 9.4 L/kg, but the results also reflected the least linearity (r^2 = 0.14). The MW-312 low K_d is likely due to the predominantly sand content of the samples where the other samples contained a much greater fraction of fine sediment.

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Allison and Allison (2005)[2] found the mean K_d of 11 studies was 130 L/kg (range of 0.06 to 13,000 L/kg). Krupka and Serne (2002)[3] noted commonly reported K_d values ranged from 1,000 to 100,000 L/kg. They also note that cobalt studies completed at the Hanford attributed K_d values <100 L/kg to aqueous complexation of cobalt. At the OGS the adsorption of cobalt to suspended sediment may have lower K_d values much as complexation lowered the Hanford K_d values.

Adsorption tells only part of the story since the adsorbed cobalt may desorb is the aqueous concentrations of cobalt decrease. Desorption trials were therefore completed to assess the degree to which the absorbed cobalt is permanently bound to the site sediment. Two samples selected for desorption included MW-305 at the 10 to1 liquid to solids ratio and MW-313 at the 10 to 1 liquid to solids ratio. The solids were vacuum filtered to quickly remove as much groundwater as practical without air-drying the solids. The filtered solids were combined with upgradient groundwater from MW-301 at 5 to 1 and 10 to 1 liquid to solids ratios and reacted for 10 days. After reaction, the water was filtered at 0.45 µm, preserved and shipped to CTL for analyses of cobalt while RP measure pH and ORP. The cobalt desorption results are summarized in Table 9.

The pH of both samples decreased slightly with increasing liquid to solids ratio (means of 6.95 to 6.75 SU) while the ORP increased slightly (means of 70 to 80 mV). The soil samples absorbed from 0.905 to 0.950 µg of cobalt per g of soil. Most of the cobalt was retained on the soil during the desorption trials. The desorption trials at the 5 to 1 liquid to solids ratio released only 2.5 to 5.4 percent of the adsorbed cobalt. Increasing the liquid to solids ratio to 10 did not change the fraction of cobalt released from the MW-313 sample. The cobalt release increased to 14% at MW-305.

4.8 Summary of Findings.

1. Cobalt concentrations in groundwater used for the treatability study were comparable to the historical results from MW-305 and MW-317.
2. In general, the samples for the treatability study reflected the previously identified positive correlations between total or dissolved cobalt concentrations and turbidity. However, the trend was confounded by significant decreases in ORP

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[2] Allison, J. and T. L. Allison. 2005. Partition coefficients for metals in surface water soil and sediment. USEPA, EPA/600/R-05/074.
[3] Krupka, K. M. and R. J. Serme. 2002. Geochemical factors affecting the behavior of antinomy, cobalt, europium, technetium and uranium in vadose soils. PNNL-14126, Pacific Northwest National Laboratory, Richland, WA, 95 pp.

reported at MW-305 and -307. The large decrease in ORP suggests that iron oxyhydroxides in the sediment that would have been able to sequester cobalt are being dissolved at the low ORP and releasing cobalt. However, the iron concentration increases that would be expected are not evident. Why there is no increase cannot be explained with the existing data.

3. Suspended sediment in the groundwater would likely be a result of clay minerals (identified by elevated total aluminum concentrations in groundwater) or by iron oxyhydroxide minerals (identified by elevated total iron concentrations in groundwater). Both aluminum and iron show a positive correlation with turbidity, supporting the identification of clay and iron oxyhydroxides as potential absorbents of cobalt.
4. Aeration of groundwater samples resulted in the precipitation of dissolved iron in the groundwater which in turn reduced the concentrations of dissolved cobalt.
5. Adsorption trials produced linear cobalt isotherms with K_d values 16.5 to 28.0 L/kg for three of four samples. The fourth sample showed the poorest linearity and lowest K_d (9.4 L/kg); probably as a result of having the highest sand and lowest fines content of the four samples.
6. Three of four desorption trials of two soil samples at multiple liquid to solids ratios found that >95% of the cobalt was irreversibly adsorbed with the fourth 85% irreversibly sorbed.

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Table 1. Groundwater chemistry summary for Section 2 of the evaluation.

Parameter	Units	Location (from up to down gradient, left to right)												
		MW-301		MW-306			MW-305			MW-312	MW-313	MW-310		
		April 2020	April 2022	April 2020	April 2021	April 2022	April 2020	April 2021	April 2022	April 2022	April 2022	April 2020	April 2021	April 2022
pH	SU	6.6	6.4	6.7	6.4	6.7	7.0	6.9	6.9	7.1	6.9	7.0	7.1	6.9
ORP	mV	180	120	50	92	17	7	44	130	110	130	180	160	160
Dissolved Oxygen	mg/L	5.1	3.3	0.2	9.0	0.2	0.3	0.2	0.2	0.2	0.1	0.2	0.5	0.3
Specific Conductance	µS/cm	940	980	1,160	1,340	1,580	1,770	1,800	1,740	1,860	1,790	1,820	2,360	2,010
Temperature	ºC	8.7	7.4	12.0	12.7	13.8	9.1	12.9	12.8	12.3	13.2	10.0	12.6	12.6
Turbidity	NTU	0.9	5	16	9	3	22	8	5	8	7	0.9	7	4
Cobalt (T)	µg/L	0.42	0.23	5.5	5.6	9.1	16	18	21	9.1	5.7	0.24	0.75	0.93
Cobalt (D)	µg/L	NA	NA	5.4	6.1	7.6	16	20	17	NA	NA	0.23	NA	NA
Lithium (T)	µg/L	24	19	<2.3	<2.5	<2.5	3.2	2.6	<2.5	40	28	48	58	54
Calcium (T)	mg/L	84	92	73	74	110	100	110	120	200	200	200	210	190
Magnesium (T)	mg/L	33	36	26	25	44	47	47	53	200	68	86	100	190
Sodium (T)	mg/L	77	89	160	170	180	210	200	210	65	140	100	150	170
Potassium(T)	mg/L	1.5	1.1	3.7	3.5	6.0	7.6	7.9	8.7	4.8	6.1	12	17	16
Iron (T)	µg/L	50	<36	590	220	68	330	170	76	350	920	<50	<36	<36
Iron (D)	µg/L	<50	<36	140	110	<250	66	85	55	510	630	<50	<36	<36
Manganese (D)	µg/L	16	5	16,000	15,000	23,000	3,400	3.500	3,200	1,200	3,200	280	330	400
Alkalinity (T,as CaCO3)	mg/L	150	190	280	270	470	460	470	520	240	300	190	130	260
Chloride (T)	mg/L	140	140	41	35	260	270	240	200	170	170	130	250	200
Sulfate (T)	mg/L	140	160	310	370	70	63	120	150	570	500	590	720	630
Total Dissolved Solids	mg/L	550	610	820	880	710	960	900	950	1,100	3,200	1,300	1,600	1.400

(D) Dissolved concentration filtered at 0.45 µm. (T) Total concentration, unfiltered.
Ferrous iron measured in the field by Hach colorimetric kit. NA – not analyzed.

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Table 2. Selected groundwater chemistry for MNA assessment (Section 2 of the report). Monitoring wells listed left to right from upgradient to downgradient locations

Measure-ment	Units	MW-301				MW-302			MW-303			MW-304			MW-305			MW-305A			
		Mar-20	Apr-20	Apr -21	Apr 22	Apr-20	Apr-21	Apr 22	Apr-20	Apr-21	Apr 22	Apr-20	Apr-21	Apr-22	Apr-20	Apr-21	Apr-22	Mar-20	Apr-20	Apr-21	Apr-22
Iron-T	µg/L	25	50	49	18	500	350	45	280	44	18	5200	4500	4800	330	170	76	720	64	18	18
Iron-D		25	25	18	18	25	18	18	25	18	18	4600	4500	3800	66	85	55	25	25	18	18
Cobalt-T		0.43	0.52	0.29	0.23	5.3	5.5	1.3	0.87	0.43	0.16	0.57	0.43	0.41	18	16	21	2.4	2.7	0.5	1.7
Cobalt-D		0.32	0.44	NA	NA	0.81	NA	NA	0.37	NA	NA	0.37	NA	NA	16	20	17	2.1	2.8	NA	NA
Turbidity	NTU	1	0.9	2	5	31	23	5	12	4	6	54	17	NA	22	8	5	63	5	1	13
pH	SU	6.48	6.58	6.5	6.6	6.7	6.4	6.4	6.98	6.67	6.71	7.12	6.94	6.95	7	6.92	6.9	8.09	7.63	7.05	7.19
ORP	mV	260	180	230	120	140	200	150	100	190	160	-120	-98	-57	190	6.6	-13	200	110	160	80
DO	mg/L	5.3	5.1	6	3.3	0.2	0	0.4	1.9	2.8	1.2	0.2	0.2	0.1	0.3	0.2	0.2	3.8	2.3	0.9	4.9

Measure-ment	Units	MW-306					MW-312		MW-313		MW-310				MW-310A			
		Apr-20	Oct-20	Apr-21	Oct-21	Apr-22	Jan-22	Apr-22	Jan-22	Apr-22	Mar-20	Apr-20	Apr-21	Apr-22	Mar-20	Apr-20	Apr-21	Apr-22
Iron-T	µg/L	590	340	220	180	68	NA	350	NA	920	NA	25	18	18	99	230	18	56
Iron-D		140	100	110	100	125	180	510	240	360	25	25	18	18	25	220	18	70
Cobalt-T		5.5	5.9	5.6	11	9.1	4.9	9.1	5.9	5.7	0.32	0.24	0.75	0.93	0.63	0.39	0.48	0.41
Cobalt-D		5.4	5.1	6.1	9.9	7.6	3.4	NA	6	NA	0.31	0.23	NA	NA	0.67	0.4	NA	NA
Turbidity	NTU	16	14	9	7	3	0	8	0	7	3	0.9	2	4	110		2	14
pH	SU	6.68	6.54	6.42	6.66	6.66	7.18	7.07	7	6.9	6.89	7	7.1	6.9	7.73	7.85	7.47	7.43
ORP	mV	50	41	92	86	17	-53	110	-51	130	250	180	160	160	180	150	160	27
DO	mg/L	0.2	0.1	0.1	0.4	0.2	0.3	0.2	0.2	0.1	0.3	0.2	0.5	0.3	6.3	6.4	1	4.7

Notes: T – total, result unfiltered with suspended solids. D – Dissolved, result filtered at 0.45 um. NA – Not analyzed. Charts use ½ of the laboratory reporting limits (green shading) for plotting purposes.

Table 3. Description of soil samples.

Sample Id.	Soil Description	Mass Received (kg)
MW-305X S8/S9	Sandy SILT, fine to medium sand with silt, trace clay, occasional pebbles. Non-plastic, odorless, light grey (2.5Y 7/1) and pale yellow (2.5Y 7/3)	4.08
MW-307X S5	Well-graded GRAVEL, fine to coarse gravel (up to 3 cm), trace fine to coarse sand, trace silt. Non-plastic, odorless, grey (10YR 5/1)	3.59
MW-310X S3	Well-graded SAND, fine to coarse sand, trace silt, trace fine to coarse rounded gravel. Non-plastic, odorless, brown (10YR 4/3)	4.37
MW-312 S4/S5	SILT with sand, fine sand, trace clay, trace fine gravel. Non-plastic, odorless, grey (2.5YR 6/1)	4.33
MW-313 S3	Well-graded SAND, fine to coarse sand, trace silt, trace fine gravel. Non-plastic, odorless, brown (10YR 5/3)	4.10

Table 4. Baseline soil chemistry.

Analytes	Units	MW-305X	MW-307X	MW-307X (<4 mm)	MW312	MW-313
Iron Manganese	mg/kg	1,410 142	11,500 529	32,900 419	1,290 88.9	2,960 180
Cobalt	mg/kg	0.78	4.3	3.7	1.4	2.7
Solids Content	wt.%	85	95	83	85	86

Table 5. Baseline groundwater analyses.

Analytes	Units	Sample Filtration	MW-305[a]	MW-305[b]	MW-307[c]	MW-307[d]	MW-312[d]	MW-313[d]	MW-310[a]
			Oct. 2020	Jan. 2022	Apr. 2020	Jan. 2022	Jan. 2022	Jan. 2022	Oct. 2020
pH	SU	none	7.44	6.96	6.76	6.69	7.18	7.00	7.07
ORP	mV	none	-13	-72	-53	-190	-53	-51	150
DO	mg/L	none	0.1	2.6	0.7	2.4	0.3	0.2	0.2
T	^0C	none	14	18.8	10.6	18.2	12.6	14.6	13.9
SEC	µS/cm	none	1,810	1,530	1,550	1,450	1,760	1,860	1,710
Turbidity	NTU	none	13	0	29	8.8	0	0	0
Iron	µg/L	0.45 µm	63	<27	3,100	<27	180	240	---
		none	200	28.4	3,800	330	---	---	64.0
Cobalt	µg/L	0.45 µm	17.0	18.3	19.0	15.7	3.4	5.9	---
		none	17.0	19.8	19.0	16.5	4.9	5.9	0.38

Notes: a.) SCS sampling and analysis
b.) RP sampling and analysis
c.) SCS sampling and analysis
d.) SCS sampling and analysis

Table 6. Suspended sediment analyses.

Groundwater	Filter Blank		MW-305		MW-307		MW-312		MW-313	
Turbidity[1] (NTU)	NA		13		9		0		0	
Total Aqueous Cobalt[1] (µg/L)	NA		17		16.5		4.9		5.9	
Dissolved Cobalt at 0.45 um Filtration (µg/L)	NA		17		15.7		3.4		5.9	
Dissolved Cobalt at 0.20 um Filtration (µg/L)	NA		----		----		5.1		6.0	
Filter for Sediment Capture (µm)	0.45	0.20	0.45	0.20	0.45	0.20	0.45	0.20	0.45	0.20
Concentrations as reported in sediment on filters										
Aluminum (mg/kg)	24.9	18.6	85.7	39.3	69.5	63.0	43.5	31.6	109	49.6
Iron	73.1	61.5	258	101	168	209	93.6	79.4	252	109
Cobalt	<0.047	<0.036	<0.046	<0.030	<0.042	<0.032	<0.039	<0.036	<0.046	<0.034
Corrected for blank concentrations and for total sample volume of 4 L to yield mg in sediment per litre of groundwater.										
Aluminum (mg in sediment/L)	Not Applicable		15.2	3.60	11.2	9.5	4.65	1.68	21.0	6.18
Iron			46.2	6.98	23.7	34.0	5.13	1.58	44.7	8.98
Cobalt			<0.012	<0.007	<0.011	<0.008	<0.010	<0.009	<0.011	<0.009

Notes: 1.) Data from baseline analyses, Table 5.

Table 7. Results of metals precipitation with groundwater aeration.

Analytes	Units	Sample Filtration	MW-305		MW-307	
			Pre-aeration	Post-aeration	Pre-aeration	Post-aeration
pH	SU	none	6.96	8.77	6.69	8.04
ORP	mV	none	-72	-19	-190	48
Iron	µg/L	none	28.4	12.9	330	27.2
Iron		0.45 µm	<27	<27	<27	<27
Cobalt	µg/L	none	19.8	17.9	16.5	8.9
Cobalt		0.45 µm	18.3	17.4	15.7	6.1

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Table 8. Results for cobalt adsorption trials.

Soil Sample	Soil Mass (g)	Aqueous Volume (L)	Liquid to Solid Ratio	Co Initial Concentration (µg/L)	pH (SU)	ORP (mV)	C_{aq} (Cobalt Final Concentration, µg/L)	Cobalt Mass Lost from Solution (µg)	C_{abs} (Cobalt Adsorbed Concentration, µg/kg)
Control Rep 1	0	0.2	---		7.41	47	135	---	---
Control Rep 2					7.38	42	136	---	---
Mean					7.40	45	136	---	---
MW-305X S8/S9	1.0	0.2	200	136	7.36	31	125	2.20	2200
	2.0		100		7.21	28	118	3.60	1800
	4.0		50		7.22	18	104	6.40	1600
	8.0		25		7.22	14	81.6	10.9	1360
	20.0		10		7.23	2.4	45.4	18.1	906
	40.0		5		7.22	-6.2	26.5	21.9	548
MW-307X S5 (<4 mm Fraction)	1.0	0.2	200	136	7.28	-5.3	122	2.80	2800
	2.0		100		7.27	-7.1	115	4.20	2100
	4.0		50		7.25	-6.8	97.1	7.78	1945
	8.0		25		7.23	-6.8	71.1	13.0	1623
	20.0		10		7.22	-9.2	34.1	20.4	1019
	40.0		5		7.18	-8.9	18.3	23.5	589
MW-312 S4/S5	1.0	0.2	200	136	7.27	-8.6	132	0.800	800
	2.0		100		7.27	-16	123	2.60	1300
	4.0		50		7.28	-14	113	4.60	1150
	8.0		25		7.27	-14	96.3	7.94	993
	20.0		10		7.25	-17	57.5	15.7	785
	40.0		5		7.23	-23	31.9	20.8	521
MW-313 S3	1.0	0.2	200	136	7.29	-66	119	3.40	3400
	2.0		100		7.32	-56	106	6.00	3000
	4.0		50		7.28	-53	85.6	10.1	2520
	8.0		25		7.25	-50	66.6	13.9	1735
	20.0		10		7.21	-49	41.0	19.0	950
	40.0		5		7.21	-48	27.3	21.7	544

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Table 9. Cobalt desorption summary.

Sample	Adsorption[1]		Desorption								
									Co Desorbed		
	L:S Ratio	µg Co/ g soil	L:S Ratio	pH (SU)	ORP (mV)	Soil (g)	Water (g)	Co (µg/L)	Total (µg)	µg Co/ g soil	Fraction Desorbed
MW-305X S8/S9	10	0.905	5	6.98	77	9.83	49.2	9.7	0.477	0.0485	0.0536
			10	6.73	82	9.76	97.6	12.5	1.22	0.125	0.138
MW-313 S3	10	0.950	5	6.92	63	9.25	46.3	4.8	0.222	0.0240	0.0253
			10	6.77	78	8.70	87	3.9	0.339	0.0390	0.0411

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Figure 1. Dissolved oxygen as a function of ORP.

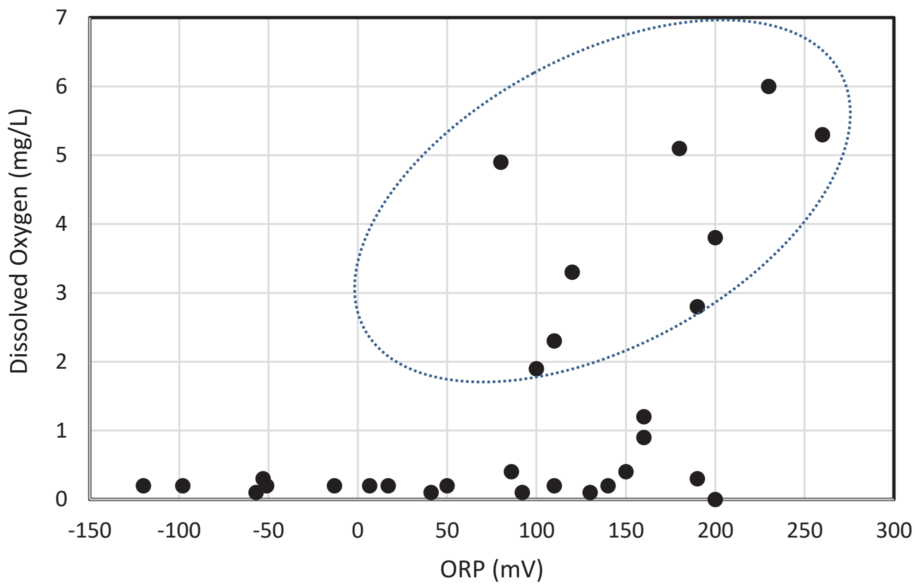

Figure 2. Dissolved iron as a function of total iron concentrations.

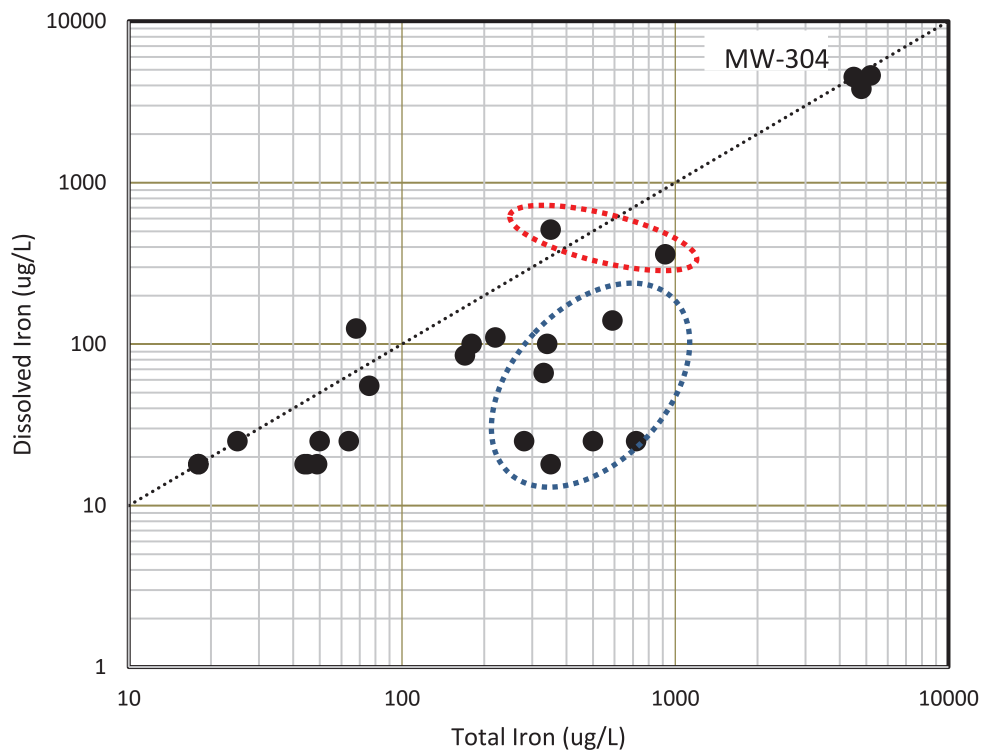

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Figure 3. Iron concentrations as a function of ORP.

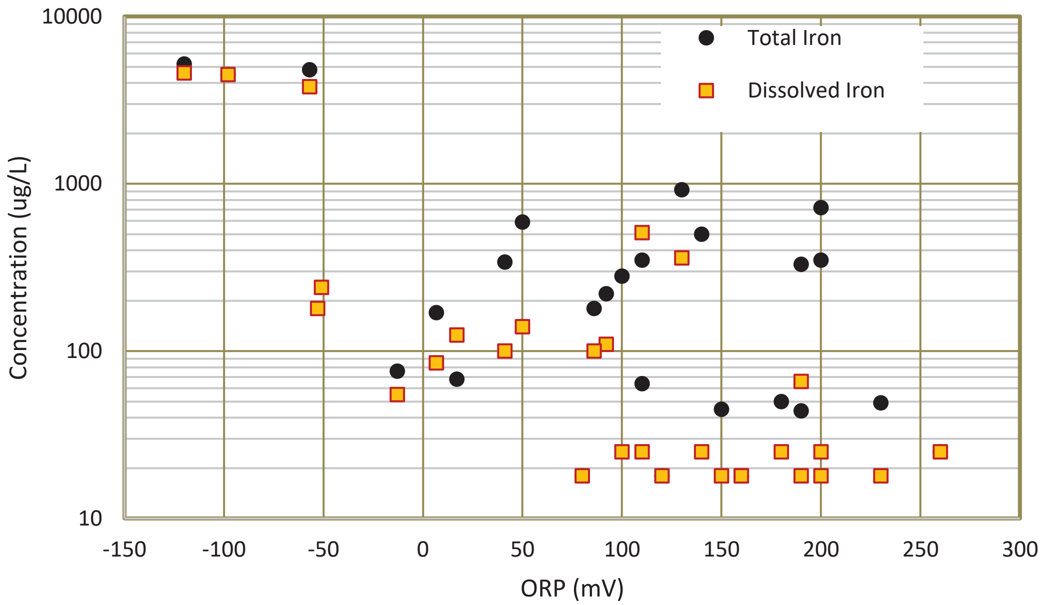

Figure 4. Total iron as a function of turbidity (suspended sediment surrogate).

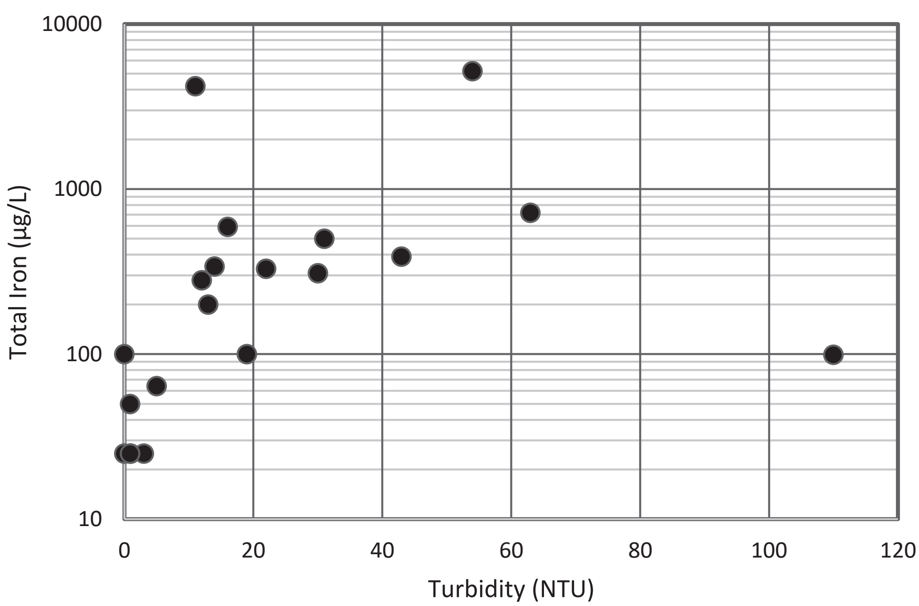

Figure 5. Total cobalt as a function of turbidity (suspended sediment surrogate).

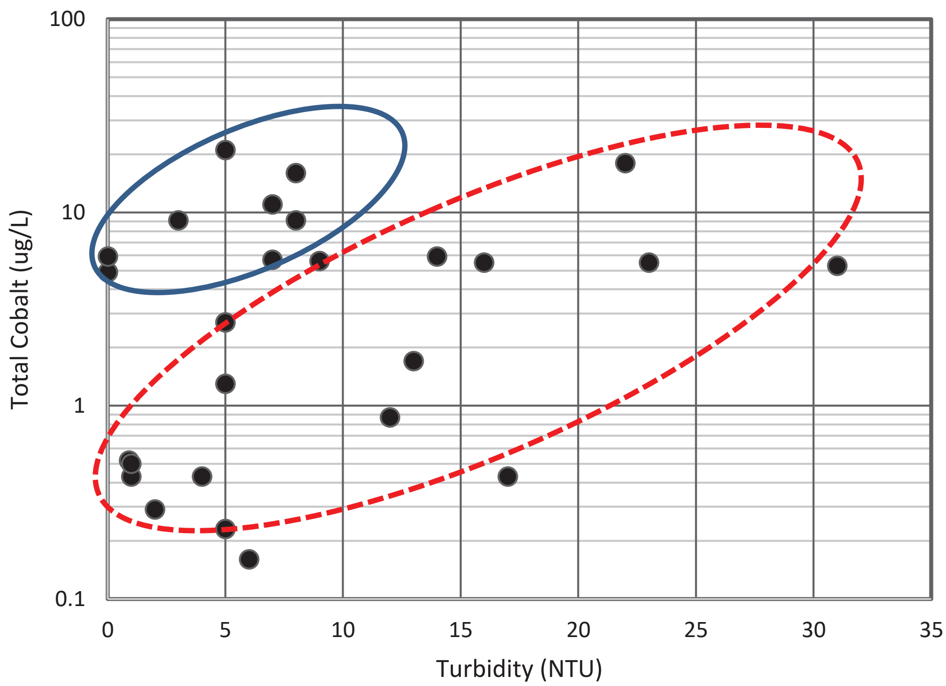

Figure 6. Dissolved cobalt as a function of total cobalt.

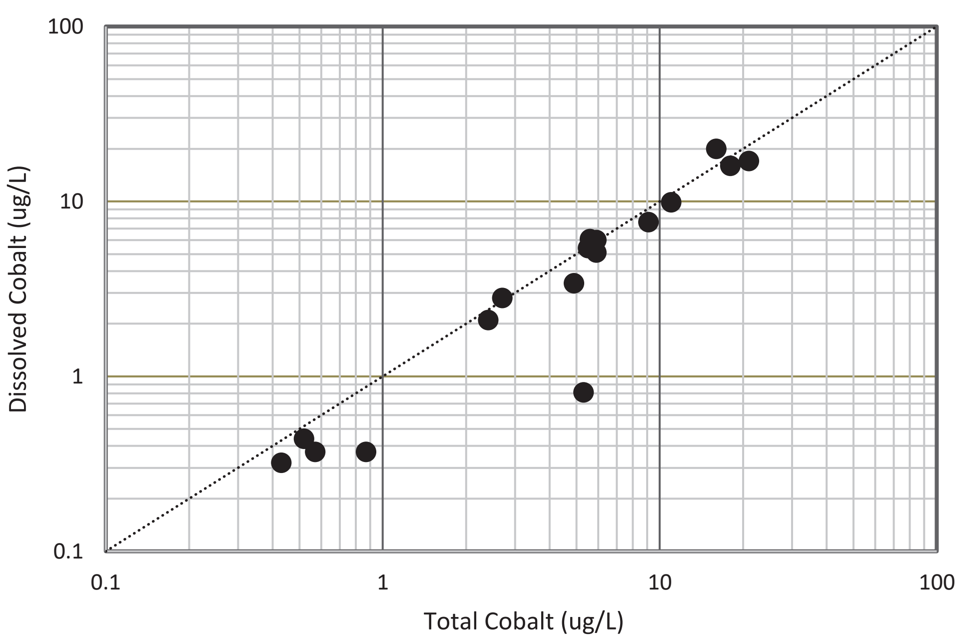

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Figure 7. Cobalt concentration as a function of ORP.

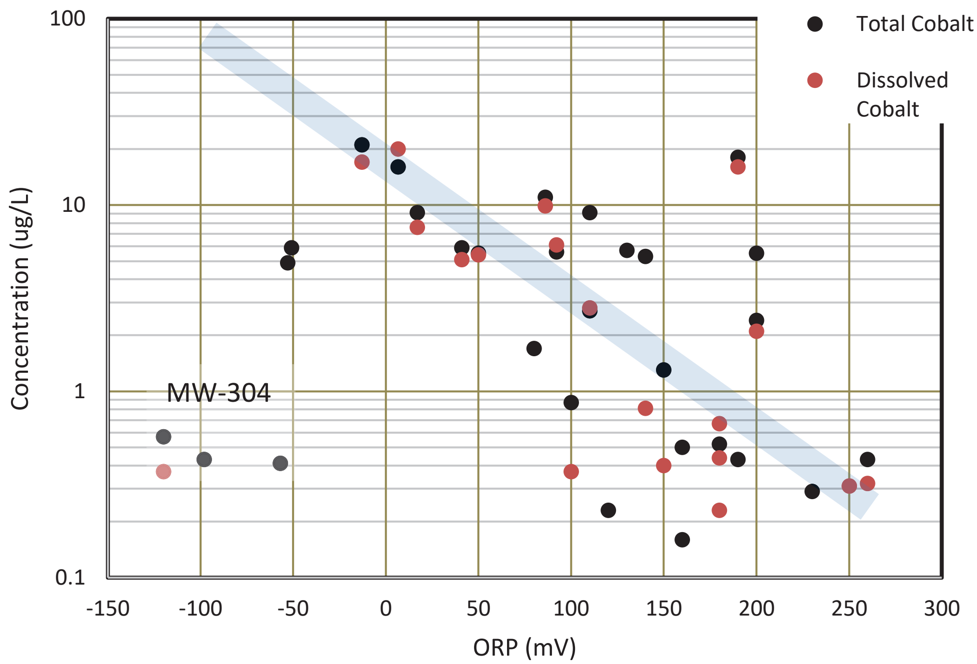

Figure 8. Dissolved cobalt as a function of dissolved iron.

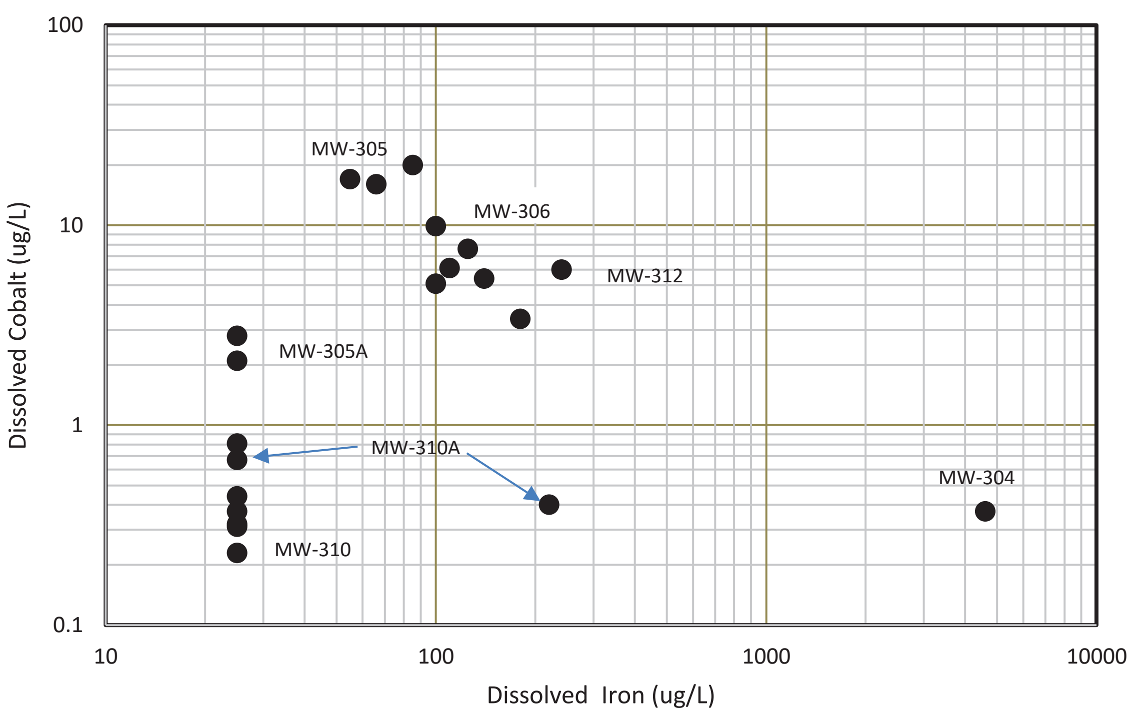

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Figure 9. Cobalt adsorption to iron oxyhydroxide in sediment samples.

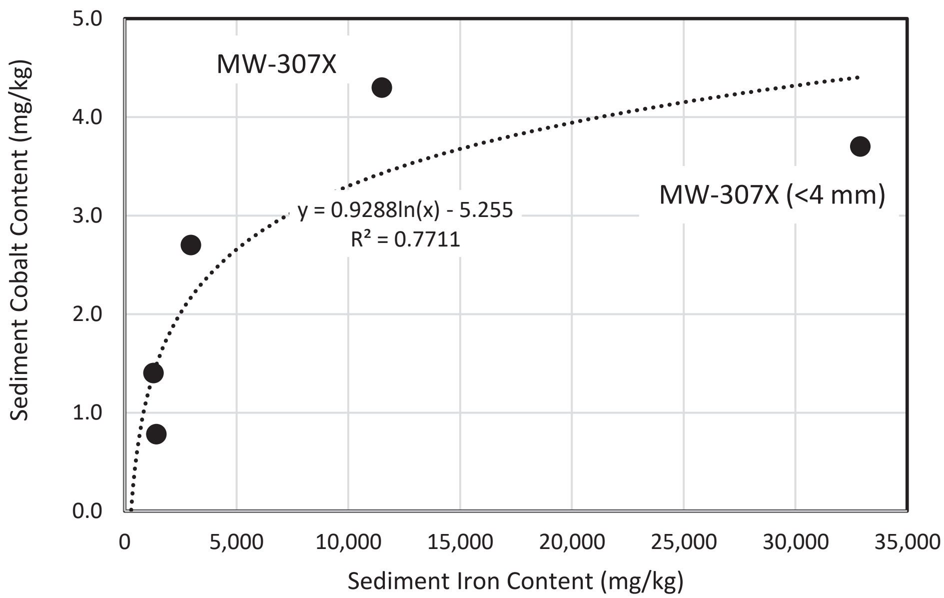

Figure 10. Total cobalt concentrations as a function of turbidity.
The cobalt GPS is 6 µg/L.

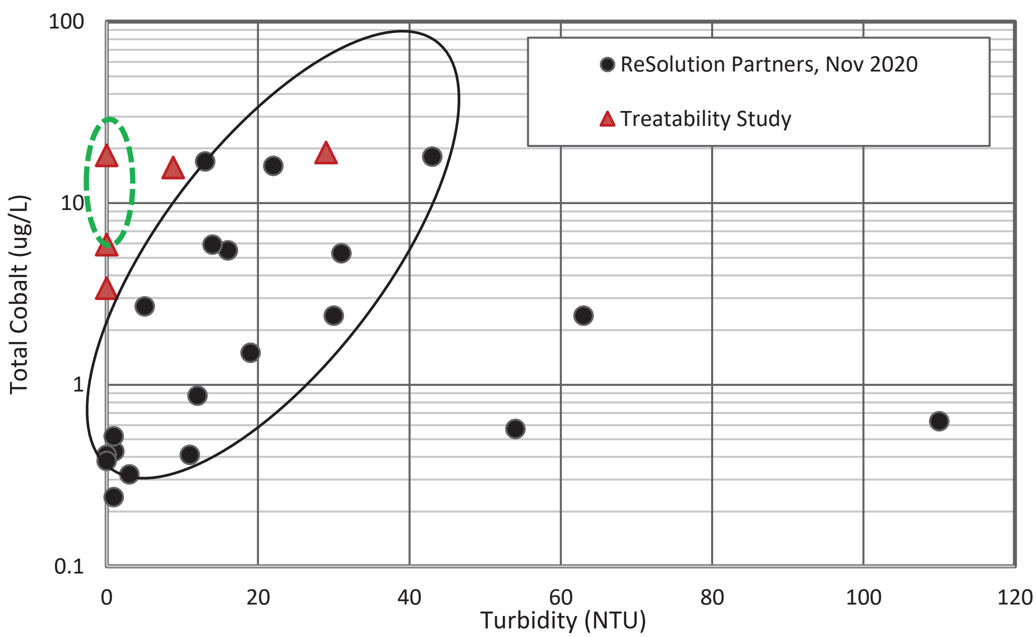

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Figure 11. Table 5 baseline total cobalt concentrations as a function of turbidity.

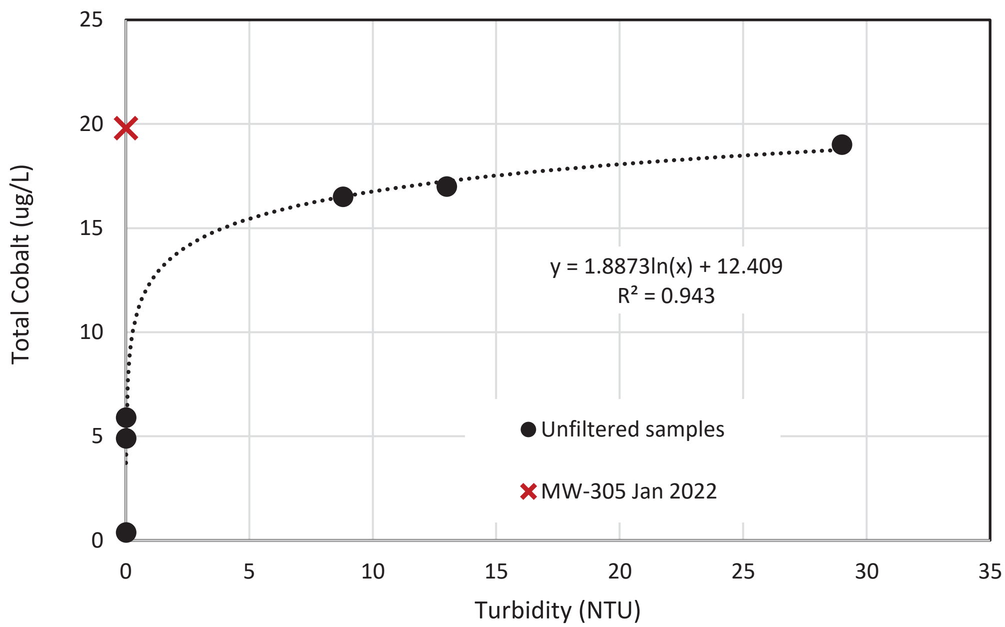


Figure 12. Cobalt concentrations as a function of ORP.
(TS = treatability study results)

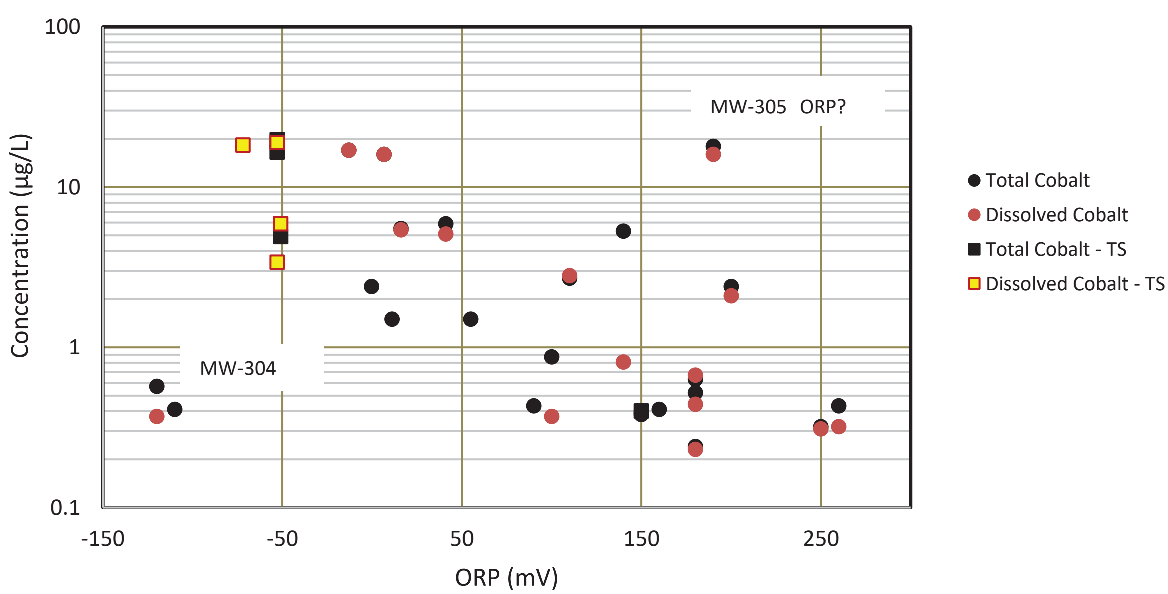


Figure 13. Aluminum and iron in sediment retained on 0.45 um and 0.20 um filters.

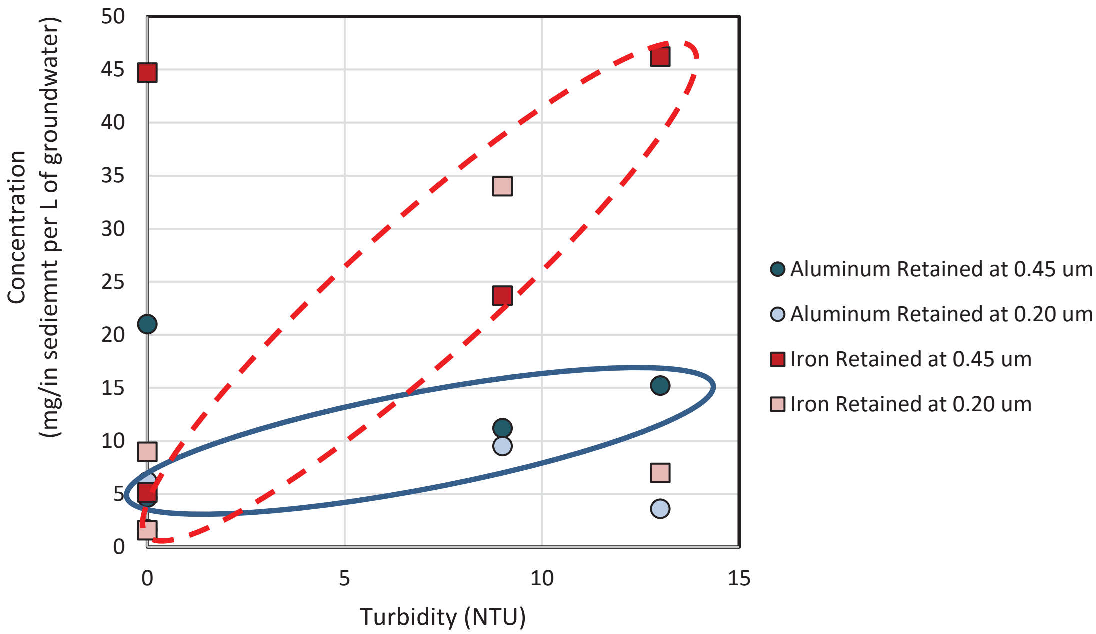
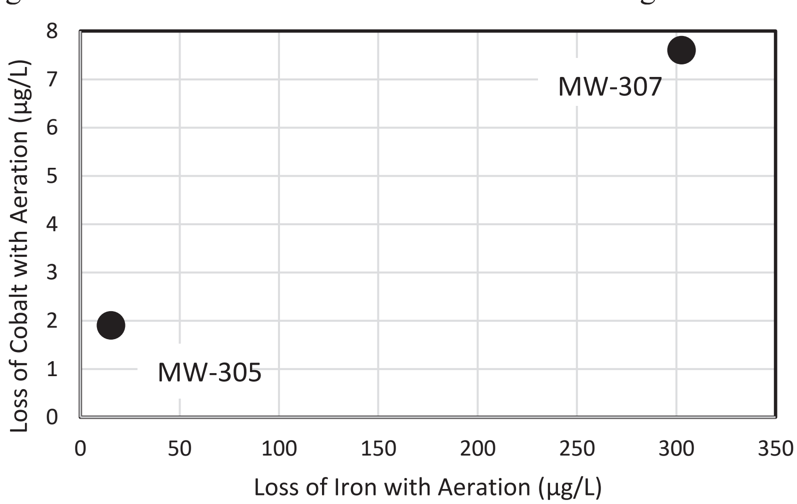
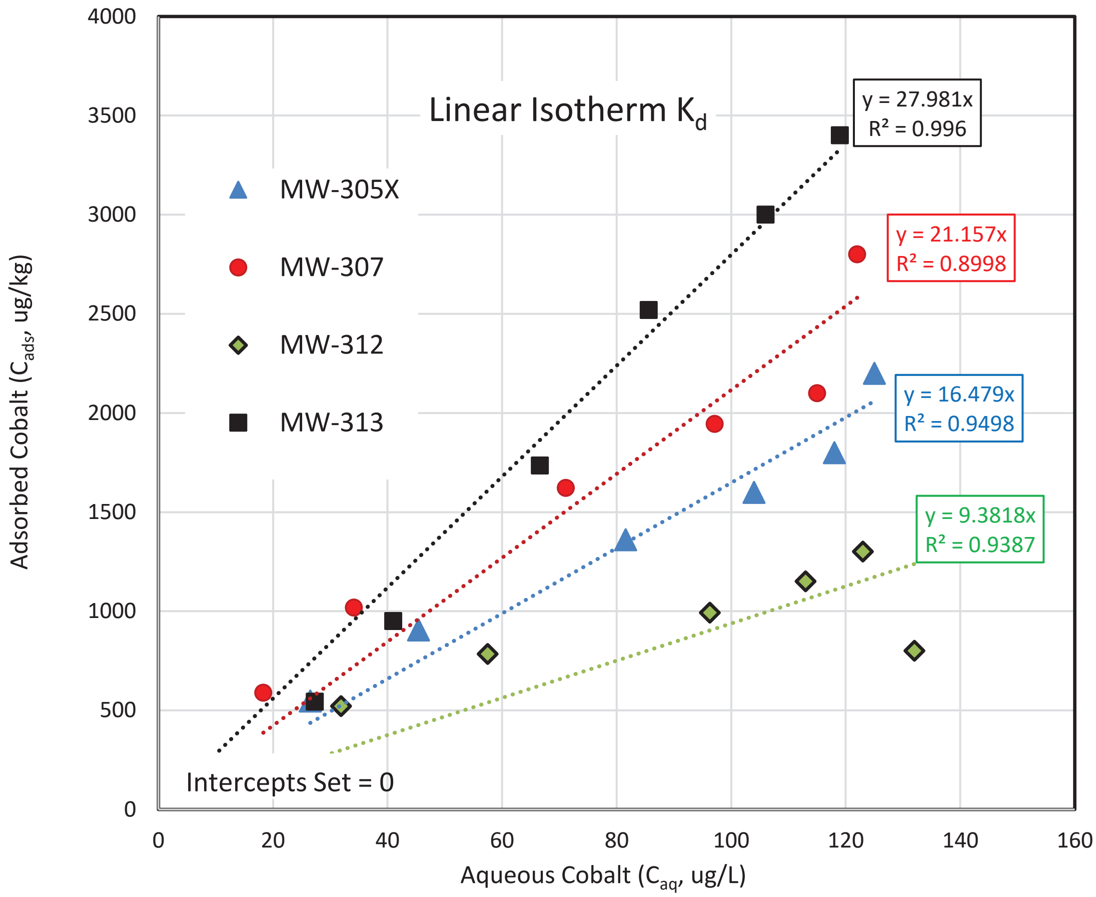


Figure 14. Loss of iron and cobalt with aeration of groundwater.



ReSolution Partners, LLC

Figure 15. Cobalt isotherms.



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Appendix A

Laboratory Reports

CT Laboratories LLC • 1230 Lange Ct • Baraboo, WI 53913
608 -356-2760 • www.ctlaboratories.com

delivering more than data from your environmental analyses

ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167331
Purchase Order #:

Arrival Temperature: 1.6
Report Date: 2/7/2022
Date Received: 1/28/2022
Reprint Date: 2/7/2022

CT LAB Sample#: 1096028 Sample Description: MW-307X <4MM Sampled: 1/27/2022 13:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**83.4**	%			1			1/31/2022 11:46	BMM	EPA 8000C
Metals Results										
Cobalt	**3.7**	mg/kg	0.066	0.32	1		1/31/2022 12:54	2/1/2022 22:08	NAH	EPA 6010C
Iron	**32900**	mg/kg	12	64	1	M,Y	1/31/2022 12:54	2/1/2022 22:08	NAH	EPA 6010C
Manganese	**419**	mg/kg	0.13	0.54	1	M	1/31/2022 12:54	2/1/2022 22:08	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers

Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Rev. 02/2017

CHAIN OF CUSTODY

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 167331
Company: RESOLUTION PARTNERS LLC
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal
Date Needed: ______
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	iron	manganese	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
1/27/2022	1300	GW			MW-307X <4mm	N	x	x	x			1096028

Relinquished By:	Date/Time	Received By:	Date/Time
Kevin L Baker	1/27/2022 1305	erc	1/28/22 1120
Received by:	Date/Time	Received for Laboratory by:	Date/Time
		erc	1/28/22 1408

Lab Use Only
Ice Present Yes No
Temp 1.6 IR Gun 28
Cooler # XXX

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ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167266
Purchase Order #:

Arrival Temperature: 1
Report Date: 1/28/2022
Date Received: 1/26/2022
Reprint Date: 1/28/2022

CT LAB Sample#: 1095306 Sample Description: MW-305 CO SPIKE UNFILTERED Sampled: 1/20/2022 16:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Total Cobalt	**137**	ug/L	0.55	2.5	1		1/26/2022 09:39	1/27/2022 15:05	NAH	EPA 6010C

CT LAB Sample#: 1095307 Sample Description: MW-305 CO SPIKE FILTERED Sampled: 1/20/2022 16:05

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**131**	ug/L	0.4	2.5	1			1/26/2022 14:24	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Rev. 02/2017

CHAIN OF CUSTODY

Page 1 of 1

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES

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www.ctlaboratories.com

Lab Use Only

Folder #: 167266

Company: RESOLUTION PARTNERS LLC

Project: SCS-ALLIANT OTTUMWA GS

Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ____________

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

3-DAY TAT

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
RUSH 3-DAY TAT
Date Needed: ________
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
1/20/2022	1600	WW			MW-305 Co Spike Unfiltered	N	x	1		1095306
1/20/2022	1605	WW			MW-305 Co Spike Filtered	Y	x	1		.07

Relinquished By:	Date/Time	Received By:	Date/Time
Kevin L Baker	1/25/2022 0900	[signature] ERC	1/26/22 1310
Received by:	Date/Time	Received for Laboratory by: ERC	Date/Time: 1/26/22 1319

Lab Use Only
Ice Present Yes No
Temp 1.0 IR Gun 27
Cooler # XXX

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ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167195
Purchase Order #:

Arrival Temperature: 2.1
Report Date: 2/2/2022
Date Received: 1/20/2022
Reprint Date: 2/2/2022

CT LAB Sample#: 1093556 Sample Description: MW-305 Sampled: 1/19/2022 08:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**18.6**	ug/L	0.4	2.5	1			1/26/2022 14:00	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/26/2022 14:00	NAH	EPA 6010C
Dissolved Manganese	**3310**	ug/L	1.2	5.0	1			1/26/2022 14:00	NAH	EPA 6010C

CT LAB Sample#: 1093557 Sample Description: MW-307 Sampled: 1/19/2022 08:05

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**16.7**	ug/L	0.4	2.5	1			1/26/2022 14:08	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/26/2022 14:08	NAH	EPA 6010C
Dissolved Manganese	**287**	ug/L	1.2	5.0	1			1/26/2022 14:08	NAH	EPA 6010C

CT LAB Sample#: 1093558 Sample Description: MW-305X S8/S9 Sampled: 1/19/2022 08:10

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167195

CT LAB Sample#: 1093558 Sample Description: MW-305X S8/S9 Sampled: 1/19/2022 08:10

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**85.0**	%			1			1/25/2022 11:22	BMM	EPA 8000C
Metals Results										
Cobalt	**0.78**	mg/kg	0.062	0.30	1		1/24/2022 10:42	1/27/2022 01:21	NAH	EPA 6010C
Iron	**1410**	mg/kg	11	60	1		1/24/2022 10:42	1/27/2022 01:21	NAH	EPA 6010C
Manganese	**142**	mg/kg	0.12	0.50	1		1/24/2022 10:42	1/27/2022 01:21	NAH	EPA 6010C

CT LAB Sample#: 1093559 Sample Description: MW-307X S5 Sampled: 1/19/2022 08:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**94.6**	%			1			1/25/2022 11:22	BMM	EPA 8000C
Metals Results										
Cobalt	**4.3**	mg/kg	0.056	0.27	1		1/24/2022 10:42	1/27/2022 01:51	NAH	EPA 6010C
Iron	**11500**	mg/kg	9.9	54	1		1/24/2022 10:42	1/27/2022 01:51	NAH	EPA 6010C
Manganese	**529**	mg/kg	0.11	0.45	1		1/24/2022 10:42	1/27/2022 01:51	NAH	EPA 6010C

CT LAB Sample#: 1093560 Sample Description: MW-312 S4/S5 Sampled: 1/19/2022 08:20

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**84.8**	%			1			1/25/2022 11:22	BMM	EPA 8000C
Metals Results										

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

CT LAB Sample#: 1093560 Sample Description: MW-312 S4/S5 Sampled: 1/19/2022 08:20

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Cobalt	**1.4**	mg/kg	0.068	0.33	1		1/24/2022 10:42	1/27/2022 01:58	NAH	EPA 6010C
Iron	**1290**	mg/kg	12	66	1		1/24/2022 10:42	1/27/2022 01:58	NAH	EPA 6010C
Manganese	**88.9**	mg/kg	0.13	0.55	1		1/24/2022 10:42	1/27/2022 01:58	NAH	EPA 6010C

CT LAB Sample#: 1093561 Sample Description: MW-313 S3 Sampled: 1/19/2022 08:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results										
Solids, Percent	**85.7**	%			1			1/25/2022 11:22	BMM	EPA 8000C
Metals Results										
Cobalt	**2.7**	mg/kg	0.063	0.31	1		1/24/2022 10:42	1/27/2022 02:27	NAH	EPA 6010C
Iron	**2960**	mg/kg	11	61	1		1/24/2022 10:42	1/27/2022 02:27	NAH	EPA 6010C
Manganese	**180**	mg/kg	0.12	0.51	1		1/24/2022 10:42	1/27/2022 02:27	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

CT LABORATORIES
delivering more than data from your environmental analyses

RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167195

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by:
Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers

Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Company: ReSolution Partners LLC
Project Contact: Angela Hassell
Telephone: 608-669-1248
Project Name: SCS-Alliant Ottumwa GS
Project #:
Location:
Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 167195
Company: RESOLUTION PARTNERS LLC
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ________

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company Address: 967 Jonathon Drive
Madison, WI 53713

Invoice To:* Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal
Date Needed: ________
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	iron	manganese	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
1/19/2022	800	GW			MW-305	Y	x	x	x			1093556
1/19/2022	805	GW			MW-307	Y	x	x	x			57
1/19/2022	810	S			MW-305X S8/S9	N	x	x	x			58
1/19/2022	815	S			MW-307X S5	N	x	x	x			59
1/19/2022	820	S			MW-312 S4/S5	N	x	x	x			60
1/19/2022	825	S			MW-313 S3	N	x	x	x			61

Relinquished By:	Date/Time	Received By:	Date/Time
K L Baker	1/19/22 1000	Spee Dee	

Received by:	Date/Time	Received for Laboratory by:	Date/Time
		lack	[illegible] 1145

erc [illegible] 1413

Lab Use Only
Ice Present Yes No
Temp 2.1 IR Gun 28
Cooler # XXX

CT LABORATORIES
delivering more than data from your environmental analyses

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ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167277
Purchase Order #:

Arrival Temperature: 1
Report Date: 2/3/2022
Date Received: 1/26/2022
Reprint Date: 2/3/2022

CT LAB Sample#: 1095341 Sample Description: MW-305 U Sampled: 1/20/2022 11:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Total Cobalt	**19.8**	ug/L	0.55	2.5	1		1/26/2022 09:39	1/27/2022 15:13	NAH	EPA 6010C
Total Iron	**28.4**	ug/L	11 *	37	1		1/26/2022 09:39	1/27/2022 15:13	NAH	EPA 6010C

CT LAB Sample#: 1095344 Sample Description: MW-305 F Sampled: 1/20/2022 11:02

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**18.3**	ug/L	0.4	2.5	1			1/27/2022 15:46	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/27/2022 15:46	NAH	EPA 6010C

CT LAB Sample#: 1095345 Sample Description: MW-307 U Sampled: 1/20/2022 10:50

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167277

CT LAB Sample#: 1095345 Sample Description: MW-307 U Sampled: 1/20/2022 10:50

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Total Cobalt	**16.5**	ug/L	0.55	2.5	1		1/26/2022 09:39	1/27/2022 15:21	NAH	EPA 6010C
Total Iron	**330**	ug/L	11	37	1		1/26/2022 09:39	1/27/2022 15:21	NAH	EPA 6010C

CT LAB Sample#: 1095346 Sample Description: MW-307 F Sampled: 1/20/2022 10:53

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**15.7**	ug/L	0.4	2.5	1			1/27/2022 16:29	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/27/2022 16:29	NAH	EPA 6010C

CT LAB Sample#: 1095347 Sample Description: MW-305 AU Sampled: 1/20/2022 13:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Total Cobalt	**17.9**	ug/L	0.55	2.5	1		1/26/2022 09:39	1/27/2022 15:29	NAH	EPA 6010C
Total Iron	**12.9**	ug/L	11 *	37	1		1/26/2022 09:39	1/27/2022 15:29	NAH	EPA 6010C

CT LAB Sample#: 1095348 Sample Description: MW-305 AF Sampled: 1/20/2022 13:17

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**17.4**	ug/L	0.4	2.5	1			1/27/2022 16:38	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/27/2022 16:38	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167277

CT LAB Sample#: 1095349 Sample Description: MW-307 AU Sampled: 1/20/2022 12:05

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Total Cobalt	**8.9**	ug/L	0.55	2.5	1		1/26/2022 09:39	1/27/2022 15:38	NAH	EPA 6010C
Total Iron	**27.2**	ug/L	11 *	37	1		1/26/2022 09:39	1/27/2022 15:38	NAH	EPA 6010C

CT LAB Sample#: 1095350 Sample Description: MW-307 AF Sampled: 1/20/2022 12:04

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**6.1**	ug/L	0.4	2.5	1			1/27/2022 16:46	NAH	EPA 6010C
Dissolved Iron	<27	ug/L	27	90	1			1/27/2022 16:46	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by:

Brett M. Szymanski
Project Manager
608-356-2760

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Rev. 02/2017

CHAIN OF CUSTODY

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 167277
Company: RESOLUTION PARTNERS LLC
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To:* Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal
Date Needed: ______
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	iron	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
1/20/2022	1100	WW			MW-305 U	N	x	x	1		1095341
1/20/2022	1102	WW			MW-305 F	Y	x	x	1		44
1/20/2022	1050	WW			MW-307 U	N	x	x	1		45
1/20/2022	1053	WW			MW-307 F	Y	x	x	1		46
1/20/2022	1315	WW			MW-305 AU	N	x	x	1		47
1/20/2022	1317	WW			MW-305 AF	Y	x	x	1		48
1/20/2022	1205	WW			MW-307 AU	N	x	x	1		49
1/20/2022	1204	WW			MW-307 AF	Y	x	x	1		50

Relinquished By: Kevin H Baker
Date/Time: 1/25/2022 0900
Received By: Spee Dee ERC
Date/Time: 1/26/22 1310
Received by:
Date/Time:
Received for Laboratory by: ERC
Date/Time: 1/26/22 1408

Lab Use Only
Ice Present Yes No 27
Temp 1.0 IR Gun
Cooler # XXX

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ANALYTICAL REPORT

. ESOLUTION PA. TNE. S LLC
ANGELA HASSELL
J67 RONATHON D. i
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167279
Purchase Order #:

Arr/ al Temgerature: 1
. egort Date: 2030p22
Date . ece/ ed: 10260p22
. egrnt Date: 2030p22

CT LAb Samgle#: 1pJ5353 Samgle Descrvgtvon: MW-3p5 FILTE. PAPE. pi2UM Samgled: 102p02p22 15:pp

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**268**	uf 0L	9i4	29	1			10270p22 16:54	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10270p22 16:54	NAH	EPA 6p1pC
Dvssol/ ed Iron	**691**	uf 0L	27	Jp	1			10270p22 16:54	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5354 Samgle Descrvgtvon: MW-3p5 FILTE. PAPE. pi45UM Samgled: 102p02p22 15:p5

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**373**	uf 0L	9i4	29	1			10270p22 17:p1	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10270p22 17:p1	NAH	EPA 6p1pC
Dvssol/ ed Iron	**1120**	uf 0L	27	Jp	1			10270p22 17:p1	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5355 Samgle Descrvgtvon: MW-3p7 FILTE. PAPE. pi2UM Samgled: 102p02p22 15:1p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless sgecvBcally stated to the contrary, sov0sedvment0sludf e samgle results0LOD0LOQ0 Ls were regorted on a Dry Wevf ht basvs

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Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167279

CT LAb Samgle#: 1pJ5355 Samgle Descrvgtvon: MW-3p7 FILTE. PAPE. pi2UM Samgled: 102p02p22 15:1p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**395**	uf 0L	9i4	29	1			102702p22 17:pJ	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			102702p22 17:pJ	NAH	EPA 6p1pC
Dvssol/ ed Iron	**1310**	uf 0L	27	Jp	1			102702p22 17:pJ	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5356 Samgle Descrvgtvon: MW-3p7 FILTE. PAPE. pi45UM Samgled: 102p02p22 15:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**331**	uf 0L	9i4	29	1			102702p22 17:16	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			102702p22 17:16	NAH	EPA 6p1pC
Dvssol/ ed Iron	**801**	uf 0L	27	Jp	1			102702p22 17:16	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5357 Samgle Descrvgtvon: MW-312 FILTE. PAPE. pi2UM Samgled: 102p02p22 15:2p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**175**	uf 0L	9i4	29	1			102702p22 17:24	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			102702p22 17:24	NAH	EPA 6p1pC
Dvssol/ ed Iron	**440**	uf 0L	27	Jp	1			102702p22 17:24	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5359 Samgle Descrvgtvon: MW-312 FILTE. PAPE. pi45UM Samgled: 102p02p22 15:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless sgecvBcally stated to the contrary, sovl0sedvment0sludf e samgle results0LOD0LOQ0 Ls were regorted on a Dry Wevf ht basvs

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. ESOLUTION PA. TNE. S LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167279

CT LAb Samgle#: 1pJ5359	Samgle Descrvgtvon: MW-312 FILTE. PAPE. pi45UM	Samgled: 102p02p22 15:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**223**	uf 0L	9i4	29	1			10270p22 17:32	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10270p22 17:32	NAH	EPA 6p1pC
Dvssol/ ed Iron	**480**	uf 0L	27	Jp	1			10270p22 17:32	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ535J	Samgle Descrvgtvon: MW-313 FILTE. PAPE. pi2UM	Samgled: 102p02p22 15:3p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**290**	uf 0L	9i4	29	1			10270p22 19:pp	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10270p22 19:pp	NAH	EPA 6p1pC
Dvssol/ ed Iron	**636**	uf 0L	27	Jp	1			10270p22 19:pp	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ536p	Samgle Descrvgtvon: MW-313 FILTE. PAPE. pi45UM	Samgled: 102p02p22 15:35

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**479**	uf 0L	9i4	29	1			10270p22 19:p7	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10270p22 19:p7	NAH	EPA 6p1pC
Dvssol/ ed Iron	**1110**	uf 0L	27	Jp	1			10270p22 19:p7	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5361	Samgle Descrvgtvon: bLAN8 FILTE. PAPE. pi2UM	Samgled: 102p02p22 15:4p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless sgecvBcally stated to the contrary, sov0sedvment0sludf e samgle results0LOD0LOQ0 Ls were regorted on a Dry Wevf ht basvs

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Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167279

CT LAb Samgle#: 1pJ5361 Samgle Descrvgtvon: bLAN8 FILTE. PAPE. pi2UM Samgled: 10/2p0/2p22 15:4p

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**105**	uf 0L	9i4	29	1			10/270/2p22 19:15	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10/270/2p22 19:15	NAH	EPA 6p1pC
Dvssol/ ed Iron	**347**	uf 0L	27	Jp	1			10/270/2p22 19:15	NAH	EPA 6p1pC

CT LAb Samgle#: 1pJ5362 Samgle Descrvgtvon: bLAN8 FILTE. PAPE. pi45UM Samgled: 10/2p0/2p22 15:45

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dvssol/ ed Alumvnum	**108**	uf 0L	9i4	29	1			10/270/2p22 19:22	NAH	EPA 6p1pC
Dvssol/ ed Co<alt	* pi4	uf 0L	pi4	2i5	1			10/270/2p22 19:22	NAH	EPA 6p1pC
Dvssol/ ed Iron	**314**	uf 0L	27	Jp	1			10/270/2p22 19:22	NAH	EPA 6p1pC

Unless sgecvBcally stated to the contrary, sovl0sedvment0sludf e samgle results0LOD0LOQ0 Ls were regorted on a Dry Wevf ht basvs

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Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167279

Notes regarding entire Chain of Custody:

Notes: (Indvcates a / alue vn <etween the LOD)lvmvt oBdetectvonqand the LOQ)lvmvt oBzuantvtatvonqi All LOD0LOQs are adjusted to reBect dvlutvon and also any dvBerences vn the samgle wevf ht 0/ olume as comgared to standard amountsi

All samgles were recevl ed vntact and grogerly greser/ ed unless otherwvse notedi The results regorted relate only to the samgles testedi Thvs regort shall not <e regroduced, excegt vn Bull, wvthout wrvtten aggro/ al oBthvs la<oratoryi The Chavn oBCustody vs attachedi

Su<mvtted <y:

brett Mi SkymansKv
Project Manaf er
6p9-356-276p

Current CT Laboratories Certifications

Wvsconsvn)WDN. qChemvstry ID# 157p66p3p
Wvsconsvn)DATCPqbactervolof y ID# 29J
Louvsvana NELAP)grvmaryqID# 115943
Illvnovs NELAP La< ID# 2ppp73
8ansas NELAP La< ID# E-1p369
Vvrf vnva NELAP La< ID# 46p2p3
ISO0IEC 17p25-2pp5 A2LA Cert # 39p6ip1
DoD-ELAP A2LA 39p6ip1

Rev. 02/2017

CHAIN OF CUSTODY

Company: ReSolution Partners LLC
Project Contact: Angela Hassell
Telephone: 608-669-1248
Project Name: SCS-Alliant Ottumwa GS
Project #:
Location:
Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Folder #: 167278
Company: RESOLUTION PARTNERS LLC
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ____

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal
Date Needed: ____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	iron	aluminum	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
1/20/2022	1500	WW			MW-305 Filter Paper 0.2um	Y	x	x	x			1095353
1/20/2022	1505	WW			MW-305 Filter Paper 0.45um	Y	x	x	x			54
1/20/2022	1510	WW			MW-307 Filter Paper 0.2um	Y	x	x	x			55
1/20/2022	1515	WW			MW-307 Filter Paper 0.45um	Y	x	x	x			56
1/20/2022	1520	WW			MW-312 Filter Paper 0.2um	Y	x	x	x			57
1/20/2022	1525	WW			MW-312 Filter Paper 0.45um	Y	x	x	x			58
1/20/2022	1530	WW			MW-313 Filter Paper 0.2um	Y	x	x	x			59
1/20/2022	1535	WW			MW-313 Filter Paper 0.45um	Y	x	x	x			60
1/20/2022	1540	WW			Blank Filter Paper 0.2um	Y	x	x	x			61
1/20/2022	1545	WW			Blank Filter Paper 0.45um	Y	x	x	x			62

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
K L Baker	1/25/2022 0900	Spee Dee erc	1/26/22 1310	Ice Present Yes No; Temp 1.0 IR Gun 27
Received by:	Date/Time	Received for Laboratory by: erc	1/26/22 1421	Cooler # [illegible]

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608 -356-2760 • www.ctlaboratories.com

ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 167527
Purchase Order #:

Arrival Tem8erature: 2.9
Re8ort Date: / 018 0 2/ /
Date Received: / 0p0 2/ /
Re8rint Date: / 01p0 2/ /

CT LAK Sam8le#: 129p1p/ Sam8le Descri8tion: ADS-CONTROL 1 Sam8led: / 070 2/ / 2p:22

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**135**	ug0L	2.4	/ .5	1			/ 090 2/ / / / :12	NAH	EPA 6212C

CT LAK Sam8le#: 129p1p3 Sam8le Descri8tion: ADS-CONTROL / Sam8led: / 070 2/ / 2p:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**136**	ug0L	2.4	/ .5	1			/ 090 2/ / / / :3/	NAH	EPA 6212C

CT LAK Sam8le#: 129p1p4 Sam8le Descri8tion: ADS-325-/ 22 Sam8led: / 070 2/ / 2p:12

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**125**	ug0L	2.4	/ .5	1			/ 090 2/ / / / :41	NAH	EPA 6212C

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

CT LABORATORIES

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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167527

CT LAK Sam8le#: 129p1p5 Sam8le Descri8tion: ADS-325-122 Sam8led: / 070 2/ / 2p:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**118**	ug0L	2.4	/ .5	1			/ 090 2/ / / / :49	NAH	EPA 6212C

CT LAK Sam8le#: 129p1p6 Sam8le Descri8tion: ADS-325-252 Sam8led: / 070 2/ / 2p:/ 2

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**104**	ug0L	2.4	/ .5	1			/ 090 2/ / / / :57	NAH	EPA 6212C

CT LAK Sam8le#: 129p1p7 Sam8le Descri8tion: ADS-325-2/ 5 Sam8led: / 070 2/ / 2p:/ 5

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**81.6**	ug0L	2.4	/ .5	1			/ 090 2/ / / 3:25	NAH	EPA 6212C

CT LAK Sam8le#: 129p1pp Sam8le Descri8tion: ADS-325-212 Sam8led: / 070 2/ / 2p:32

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**45.4**	ug0L	2.4	/ .5	1			/ 090 2/ / / 3:14	NAH	EPA 6212C

CT LAK Sam8le#: 129p1p9 Sam8le Descri8tion: ADS-325-225 Sam8led: / 070 2/ / 2p:35

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

CT LAK Sam8le#: 129p1p9 Sam8le Descri8tion: ADS-325-225 Sam8led: / 070 2/ / 2p:35

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**26.5**	ug0L	2.4	/ .5	1			/ 090 2/ / / 3:44	NAH	EPA 6212C

CT LAK Sam8le#: 129p192 Sam8le Descri8tion: ADS-327-/ 22 Sam8led: / 070 2/ / 2p:42

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**122**	ug0L	2.4	/ .5	1			/ 090 2/ / / 3:5/	NAH	EPA 6212C

CT LAK Sam8le#: 129p191 Sam8le Descri8tion: ADS-327-122 Sam8led: / 070 2/ / 2p:45

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**115**	ug0L	2.4	/ .5	1			/ 0120 2/ / 22:22	NAH	EPA 6212C

CT LAK Sam8le#: 129p19/ Sam8le Descri8tion: ADS-327-252 Sam8led: / 070 2/ / 2p:52

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**97.1**	ug0L	2.4	/ .5	1			/ 0120 2/ / 22:29	NAH	EPA 6212C

CT LAK Sam8le#: 129p193 Sam8le Descri8tion: ADS-327-2/ 5 Sam8led: / 070 2/ / 2p:55

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

CT LABORATORIES

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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167527

CT LAK Sam8le#: 129p193 Sam8le Descri8tion: ADS-327-2/ 5 Sam8led: / 0⁄0 2/ / 2p:55

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**71.1**	ug⁄L	2.4	/ .5	1			/ 0⁄120⁄2/ / 22:17	NAH	EPA 6212C

CT LAK Sam8le#: 129p194 Sam8le Descri8tion: ADS-327-212 Sam8led: / 0⁄0 2/ / 29:22

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**34.1**	ug⁄L	2.4	/ .5	1			/ 0⁄120⁄2/ / 22:/ 5	NAH	EPA 6212C

CT LAK Sam8le#: 129p195 Sam8le Descri8tion: ADS-327-225 Sam8led: / 0⁄0 2/ / 29:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**18.3**	ug⁄L	2.4	/ .5	1			/ 0⁄120⁄2/ / 22:33	NAH	EPA 6212C

CT LAK Sam8le#: 129p196 Sam8le Descri8tion: ADS-31/ -/ 22 Sam8led: / 0⁄0 2/ / 29:12

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**132**	ug⁄L	2.4	/ .5	1			/ 0⁄120⁄2/ / 22:41	NAH	EPA 6212C

CT LAK Sam8le#: 129p197 Sam8le Descri8tion: ADS-31/ -122 Sam8led: / 0⁄0 2/ / 29:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless s8ecificallb stated to the contrarb, soil⁄sediment⁄sludge sam8le results⁄LOD⁄LOy ⁄RLs Qere re8orted on a Drb Weight Kasis

CT LABORATORIES
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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167527

CT LAK Sam8le#: 129p197 Sam8le Descri8tion: ADS-31/ -122 Sam8led: / 0707 2/ / 29:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**123**	ug0L	2.4	/ .5	1			/ 01207 2/ / 22:52	NAH	EPA 6212C

CT LAK Sam8le#: 129p19p Sam8le Descri8tion: ADS-31/ -252 Sam8led: / 0707 2/ / 29:/ 2

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**113**	ug0L	2.4	/ .5	1			/ 01207 2/ / 22:5p	NAH	EPA 6212C

CT LAK Sam8le#: 129p199 Sam8le Descri8tion: ADS-31/ -2/ 5 Sam8led: / 0707 2/ / 29:/ 5

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**96.8**	ug0L	2.4	/ .5	1			/ 01207 2/ / 21:/ p	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 22 Sam8le Descri8tion: ADS-31/ -212 Sam8led: / 0707 2/ / 29:32

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**57.5**	ug0L	2.4	/ .5	1			/ 01207 2/ / 21:36	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 21 Sam8le Descri8tion: ADS-31/ -225 Sam8led: / 0707 2/ / 29:35

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

CT LAK Sam8le#: 129p/ 21	Sam8le Descri8tion: ADS-31/ -225	Sam8led: / 070 2/ / 29:35

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**31.9**	ug0L	2.4	/ .5	1			/ 0120 2/ / 21:44	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 2/	Sam8le Descri8tion: ADS-313-/ 22	Sam8led: / 070 2/ / 29:42

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**119**	ug0L	2.4	/ .5	1			/ 0120 2/ / 2/ :26	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 23	Sam8le Descri8tion: ADS-313-122	Sam8led: / 070 2/ / 29:45

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**106**	ug0L	2.4	/ .5	1			/ 0120 2/ / 2/ :14	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 24	Sam8le Descri8tion: ADS-313-252	Sam8led: / 070 2/ / 29:52

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**85.6**	ug0L	2.4	/ .5	1			/ 0120 2/ / 2/ :/ /	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 25	Sam8le Descri8tion: ADS-313-2/ 5	Sam8led: / 070 2/ / 29:55

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

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CT LAK Sam8le#: 129p/ 25	Sam8le Descri8tion: ADS-313-2/ 5	Sam8led: / 070 2/ / 29:55

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**66.6**	ug0L	2.4	/ .5	1			/ 0120 2/ / 2/ :32	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 26	Sam8le Descri8tion: ADS-313-212	Sam8led: / 070 2/ / 12:22

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**41.0**	ug0L	2.4	/ .5	1			/ 0120 2/ / 2/ :39	NAH	EPA 6212C

CT LAK Sam8le#: 129p/ 27	Sam8le Descri8tion: ADS-313-225	Sam8led: / 070 2/ / 12:25

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved CoBalt	**27.3**	ug0L	2.4	/ .5	1			/ 0120 2/ / 23:2p	NAH	EPA 6212C

Unless s8ecificallb stated to the contrarb, soil0sediment0sludge sam8le results0LOD0LOy 0RLs Qere re8orted on a Drb Weight Kasis

CT LABORATORIES

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RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 167527

Notes regarding entire Chain of Custody:

Notes: wIndicates a value in BetQeen the LOD *limit of detection(and the LOy *limit of) uantitation(. All LOD0LOy s are adjusted to reflect dilution and also anb differences in the sam8le Qeight 0volume as com8ared to standard amounts.

All sam8les Qere received intact and 8ro8erlb 8reserved unless otherQise noted. The results re8orted relate onlb to the sam8les tested. This re8ort shall not Be re8roduced, exce8t in full, Qithout Qritten a88roval of this laBoratorb. The Chain of Custodb is attached.

SuBmitted Bb: Krett M. Sqbmanszi
Project Manager
62p-356-/ 762

Current CT Laboratories Certifications

Wisconsin *WDNR(Chemistrb ID# 157266232
Wisconsin *DATCP(Kacteriologb ID# / p9
Louisiana NELAP *8rimarb(ID# 115p43
Illinois NELAP LaB ID# / 22273
k ansas NELAP LaB ID# E-1236p
Virginia NELAP LaB ID# 462/ 23
ISO0IEC 172/ 5-/ 225 A/ LA Cert # 3p26.21
DoD-ELAP A/ LA 3p26.21

Rev. 02/2017

CHAIN OF CUSTODY

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 167507
Company: RESOLUTION PARTNERS LL
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal
Date Needed: ______
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt, dissolved	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
2/7/2022	800	GW			ADS-Control 1	Y	x			1098182
2/7/2022	805	GW			ADS-Control 2	Y	x			83
2/7/2022	810	GW			ADS-305-200	Y	x			84
2/7/2022	815	GW			ADS-305-100	Y	x			85
2/7/2022	820	GW			ADS-305-050	Y	x			86
2/7/2022	825	GW			ADS-305-025	Y	x			87
2/7/2022	830	GW			ADS-305-010	Y	x			88
2/7/2022	835	GW			ADS-305-005	Y	x			89
2/7/2022	840	GW			ADS-307-200	Y	x			90
2/7/2022	845	GW			ADS-307-100	Y	x			91
2/7/2022	850	GW			ADS-307-050	Y	x			92
2/7/2022	855	GW			ADS-307-025	Y	x			93
2/7/2022	900	GW			ADS-307-010	Y	x			94
2/7/2022	905	GW			ADS-307-005	Y	x			95
2/7/2022	910	GW			ADS-312-200	Y	x			96

Relinquished By:	Date/Time	Received By:	Date/Time
Kevin L Baker	2/7/22 1030 A	Em	2/8/22 1120
Received By:	Date/Time	Received for Laboratory by: Em	2/8/22 1130

Lab Use Only
Ice Present Yes No
Temp 0.9 IR Gun 27
Cooler # XXX

CHAIN OF CUSTODY

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

167507

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ________

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

ANALYSES REQUESTED: cobalt, dissolved

Turnaround Time
Normal
Date Needed: ________
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt, dissolved	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
2/7/2022	915	GW			ADS-312-100	Y	x			1098197
2/7/2022	920	GW			ADS-312-050	Y	x			198
2/7/2022	925	GW			ADS-312-025	Y	x			199
2/7/2022	930	GW			ADS-312-010	Y	x			200
2/7/2022	935	GW			ADS-312-005	Y	x			201
2/7/2022	940	GW			ADS-313-200	Y	x			202
2/7/2022	945	GW			ADS-313-100	Y	x			203
2/7/2022	950	GW			ADS-313-050	Y	x			204
2/7/2022	955	GW			ADS-313-025	Y	x			205
2/7/2022	1000	GW			ADS-313-010	Y	x			206
2/7/2022	1005	GW			ADS-313-005	Y	x			207

Relinquished By: K. L. Baker — Date/Time: 2/7/22 1030 A

Received By: Eric — Date/Time: 2/8/22 1120

Received by: — Date/Time:

Received for Laboratory by: Eric — Date/Time: 2/8/22 1150

Lab Use Only
Ice Present: Yes No
Temp 2.9 IR Gun 27
Cooler # [illegible]

CT LABORATORIES
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CT Laboratories LLC • 1230 Lange Ct • Baraboo, WI 53913
608 -356-2760 • www.ctlaboratories.com

ANALYTICAL REPORT

RESOLUTION PARTNERS LLC
ANGELA HASSELL
967 JONATHON DR.
MADISON, WI 53713

Project Name: SCS-ALLIANT OTTUMWA GS
Project Phase:
Contract #: 3364
Project #:
Folder #: 168093
Purchase Order #:

Arrival Temperature: 1.2
Report Date: 3/16/2022
Date Received: 3/9/2022
Reprint Date: 3/16/2022

CT LAB Sample#: 1117509 Sample Description: DES-305-050-5:1 Sampled: 3/7/2022 10:00

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**9.7**	ug/L	0.4	2.5	1			3/11/2022 05:44	NAH	EPA 6010C

CT LAB Sample#: 1117510 Sample Description: DES-305-050-10:1 Sampled: 3/7/2022 10:05

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**12.5**	ug/L	0.4	2.5	1			3/11/2022 05:51	NAH	EPA 6010C

CT LAB Sample#: 1117511 Sample Description: DES-313-100-5:1 Sampled: 3/7/2022 10:10

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**4.8**	ug/L	0.4	2.5	1			3/11/2022 05:59	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

CT LAB Sample#: 1117512 Sample Description: DES-313-100-10:1 Sampled: 3/7/2022 10:15

Analyte	Result	Units	LOD	LOQ	Dilution	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Metals Results										
Dissolved Cobalt	**3.9**	ug/L	0.4	2.5	1	M,Y		3/11/2022 06:07	NAH	EPA 6010C

Unless specifically stated to the contrary, soil/sediment/sludge sample results/LOD/LOQ/RLs were reported on a Dry Weight Basis

CT LABORATORIES
delivering more than data from your environmental analyses

RESOLUTION PARTNERS LLC
Project Name: SCS-ALLIANT OTTUMWA GS
Project #:
Project Phase:

Contract #: 3364
Folder #: 168093

Notes regarding entire Chain of Custody:

Notes: * Indicates a value in between the LOD (limit of detection) and the LOQ (limit of quantitation). All LOD/LOQs are adjusted to reflect dilution and also any differences in the sample weight / volume as compared to standard amounts.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

Submitted by:

Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers

Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# 115843
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01

Rev. 02/2017

CHAIN OF CUSTODY

Company: ReSolution Partners LLC

Project Contact: Angela Hassell

Telephone: 608-669-1248

Project Name: SCS-Alliant Ottumwa GS

Project #:

Location:

Sampled By: Kevin Baker 608-669-6949

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only

Folder #: 168093
Company: RESOLUTION PARTNERS LLC
Project: SCS-ALLIANT OTTUMWA GS
Logged By: erc PM: BMS

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ____________

PO #

Report To:
EMAIL: ahassell@resolutionpartnersllc.net
brehm@resolutionpartnersllc.net
kbaker@resolutionpartnersllc.net
Company: 967 Jonathon Drive
Address: Madison, WI 53713

Invoice To: * Angela Hassell
EMAIL: ahassell@resolutionpartnersllc.net
Company: ReSolution Partners LLC
Address: 967 Jonathon Drive
Madison, WI 53713

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

ANALYSES REQUESTED

Turnaround Time
Normal TAT
Date Needed: ________
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered? Y/N	cobalt	Total # Containers	Designated MS/MSD	CT Lab ID # *Lab use only*
							Fill in Spaces with Bottles per Test			
3/7/2022	1000	WW			DES-305-050-5:1	Y	x	1		1117509
3/7/2022	1005	WW			DES-305-050-10:1	Y	x	1		10
3/7/2022	1010	WW			DES-313-100-5:1	Y	x	1		11
3/7/2022	1015	WW			DES-313-100-10:1	Y	x	1		12

Relinquished By:	Date/Time	Received By:	Date/Time
K W Baker	3/8/2022 0800	Spee Dee ERC	3/9/22 1125
Received by:	Date/Time	Received for Laboratory by: ERC	3/9/22 1202

Lab Use Only
Ice Present (Yes) No
Temp 1.2 IR Gun 26
Cooler # TPC

Appendix D

SPLP Sediment Analytical Laboratory Report

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Tel: (319)277-2401

Laboratory Job ID: 310-228473-1
Client Project/Site: Ottumwa Generating Station

For:
SCS Engineers
2830 Dairy Drive
Madison, Wisconsin 53718

Attn: Meghan Blodgett

Authorized for release by:
4/18/2022 3:03:58 PM

Sandie Fredrick, Project Manager II
(920)261-1660
Sandra.Fredrick@et.eurofinsus.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Job ID: 310-228473-1

Laboratory: Eurofins Cedar Falls

Narrative

Job Narrative
310-228473-1

Comments
No additional comments.

Receipt
The samples were received on 4/6/2022 5:10 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 0.6º C.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
310-228473-1	SC-1	Solid	04/05/22 11:45	04/06/22 17:10
310-228473-2	SC-2	Solid	04/05/22 09:00	04/06/22 17:10
310-228473-3	SC-3	Solid	04/05/22 11:00	04/06/22 17:10
310-228473-4	SC-5A	Solid	04/05/22 10:30	04/06/22 17:10
310-228473-5	SC-6	Solid	04/05/22 09:30	04/06/22 17:10
310-228473-6	SC-8A	Solid	04/05/22 10:00	04/06/22 17:10

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Client Sample ID: SC-1

Lab Sample ID: 310-228473-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	4.2	J	8.9	2.7	mg/Kg	4	☼	6010D	Total/NA
Iron	7600		450	120	mg/Kg	4	☼	6010D	Total/NA
pH	9.0	HF	0.1	0.1	SU	1		9045D	Soluble

Client Sample ID: SC-2

Lab Sample ID: 310-228473-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	4.4	J	8.3	2.5	mg/Kg	3	☼	6010D	Total/NA
Iron	7100		420	110	mg/Kg	3	☼	6010D	Total/NA
pH	9.3	HF	0.1	0.1	SU	1		9045D	Soluble

Client Sample ID: SC-3

Lab Sample ID: 310-228473-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	12		6.0	1.8	mg/Kg	2	☼	6010D	Total/NA
Iron	22000		300	78	mg/Kg	2	☼	6010D	Total/NA
pH	9.0	HF	0.1	0.1	SU	1		9045D	Soluble

Client Sample ID: SC-5A

Lab Sample ID: 310-228473-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	12		6.3	1.9	mg/Kg	3	☼	6010D	Total/NA
Iron	23000		320	82	mg/Kg	3	☼	6010D	Total/NA
pH	10.3	HF	0.1	0.1	SU	1		9045D	Soluble

Client Sample ID: SC-6

Lab Sample ID: 310-228473-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	3.5	J	11	3.2	mg/Kg	4	☼	6010D	Total/NA
Iron	7900		530	140	mg/Kg	4	☼	6010D	Total/NA
Cobalt	0.0018	J	0.0025	0.00095	mg/L	1		6020B	SPLP West
pH	9.2	HF	0.1	0.1	SU	1		9045D	Soluble

Client Sample ID: SC-8A

Lab Sample ID: 310-228473-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	11		9.3	2.8	mg/Kg	3	☼	6010D	Total/NA
Iron	23000		460	120	mg/Kg	3	☼	6010D	Total/NA
pH	9.8	HF	0.1	0.1	SU	1		9045D	Soluble

This Detection Summary does not include radiochemical test results.

Client Sample ID: SC-1

Date Collected: 04/05/22 11:45
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-1

Matrix: Solid

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:14	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**66.9**		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	**33.1**		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**9.0**	**HF**	0.1	0.1	SU			04/12/22 13:07	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Client Sample ID: SC-1
Date Collected: 04/05/22 11:45
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-1
Matrix: Solid
Percent Solids: 33.1

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	4.2	J	8.9	2.7	mg/Kg	☼	04/12/22 10:00	04/13/22 10:14	4
Iron	7600		450	120	mg/Kg	☼	04/12/22 10:00	04/13/22 10:14	4

Client Sample ID: SC-2
Lab Sample ID: 310-228473-2

Date Collected: 04/05/22 09:00
Matrix: Solid
Date Received: 04/06/22 17:10

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:18	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**69.9**		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	**30.1**		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**9.3**	**HF**	0.1	0.1	SU			04/12/22 13:08	1

Client Sample ID: SC-2
Date Collected: 04/05/22 09:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-2
Matrix: Solid
Percent Solids: 30.1

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	4.4	J	8.3	2.5	mg/Kg	☼	04/12/22 10:00	04/13/22 11:21	3
Iron	7100		420	110	mg/Kg	☼	04/12/22 10:00	04/13/22 11:21	3

Client Sample ID: SC-3
Date Collected: 04/05/22 11:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-3
Matrix: Solid

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:22	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**74.5**		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	**25.5**		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**9.0**	**HF**	0.1	0.1	SU			04/12/22 13:10	1

Client Sample Results

Client Sample ID: SC-3
Date Collected: 04/05/22 11:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-3
Matrix: Solid
Percent Solids: 25.5

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	12		6.0	1.8	mg/Kg	☼	04/12/22 10:00	04/13/22 11:23	2
Iron	22000		300	78	mg/Kg	☼	04/12/22 10:00	04/13/22 11:23	2

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Client Sample ID: SC-5A

Date Collected: 04/05/22 10:30
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-4
Matrix: Solid

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:26	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**65.1**		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	**34.9**		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**10.3**	**HF**	0.1	0.1	SU			04/12/22 13:11	1

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Client Sample ID: SC-5A

Lab Sample ID: 310-228473-4

Date Collected: 04/05/22 10:30
Date Received: 04/06/22 17:10

Matrix: Solid
Percent Solids: 34.9

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	12		6.3	1.9	mg/Kg	☼	04/12/22 10:00	04/13/22 11:25	3
Iron	23000		320	82	mg/Kg	☼	04/12/22 10:00	04/13/22 11:25	3

Client Sample Results

Client Sample ID: SC-6
Date Collected: 04/05/22 09:30
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-5
Matrix: Solid

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	0.0018	J	0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:30	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	66.4		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	33.6		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	9.2	HF	0.1	0.1	SU			04/12/22 13:12	1

Client Sample ID: SC-6
Date Collected: 04/05/22 09:30
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-5
Matrix: Solid
Percent Solids: 33.6

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.5	J	11	3.2	mg/Kg	☼	04/12/22 10:00	04/13/22 11:27	4
Iron	7900		530	140	mg/Kg	☼	04/12/22 10:00	04/13/22 11:27	4

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Client Sample ID: SC-8A

Date Collected: 04/05/22 10:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-6
Matrix: Solid

Method: 6020B - Metals (ICP/MS) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 16:34	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**73.1**		0.1	0.1	%			04/08/22 13:44	1
Percent Solids	**26.9**		0.1	0.1	%			04/08/22 13:44	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**9.8**	**HF**	0.1	0.1	SU			04/12/22 13:14	1

Client Sample ID: SC-8A

Lab Sample ID: 310-228473-6

Date Collected: 04/05/22 10:00
Matrix: Solid
Date Received: 04/06/22 17:10
Percent Solids: 26.9

Method: 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	11		9.3	2.8	mg/Kg	☼	04/12/22 10:00	04/13/22 11:29	3
Iron	23000		460	120	mg/Kg	☼	04/12/22 10:00	04/13/22 11:29	3

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Qualifiers

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 310-349532/1-A
Matrix: Solid
Analysis Batch: 349734

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349532

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.25		0.84	0.25	mg/Kg		04/12/22 10:00	04/13/22 09:59	1
Iron	<11		42	11	mg/Kg		04/12/22 10:00	04/13/22 09:59	1

Lab Sample ID: LCS 310-349532/2-A
Matrix: Solid
Analysis Batch: 349734

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349532

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cobalt	97.1	103		mg/Kg		106	80 - 120
Iron	194	224		mg/Kg		115	80 - 120

Lab Sample ID: 310-228473-1 MS
Matrix: Solid
Analysis Batch: 349734

Client Sample ID: SC-1
Prep Type: Total/NA
Prep Batch: 349532

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Cobalt	4.2	J	229	222		mg/Kg	☼	95	75 - 125
Iron	7600		458	8320	4	mg/Kg	☼	155	75 - 125

Lab Sample ID: 310-228473-1 MSD
Matrix: Solid
Analysis Batch: 349734

Client Sample ID: SC-1
Prep Type: Total/NA
Prep Batch: 349532

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Cobalt	4.2	J	222	217		mg/Kg	☼	96	75 - 125	2	20
Iron	7600		443	8410	4	mg/Kg	☼	179	75 - 125	1	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: LB 310-349513/1-C
Matrix: Solid
Analysis Batch: 350067

Client Sample ID: Method Blank
Prep Type: SPLP West
Prep Batch: 349608

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.00095		0.0025	0.00095	mg/L		04/13/22 09:00	04/15/22 15:59	1

Lab Sample ID: LCS 310-349513/2-C
Matrix: Solid
Analysis Batch: 350067

Client Sample ID: Lab Control Sample
Prep Type: SPLP West
Prep Batch: 349608

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cobalt	0.500	0.498		mg/L		100	80 - 120

Method: 9045D - pH

Lab Sample ID: LCS 310-349566/2
Matrix: Solid
Analysis Batch: 349566

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
pH			7.00	7.1		SU		101	98 - 102		

Method: Moisture - Percent Moisture

Lab Sample ID: 310-228473-1 DU
Matrix: Solid
Analysis Batch: 349300

Client Sample ID: SC-1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Percent Moisture	66.9			66.2		%				1	39
Percent Solids	33.1			33.8		%				2	10

Metals

Leach Batch: 349513

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	SPLP West	Solid	1312	
310-228473-2	SC-2	SPLP West	Solid	1312	
310-228473-3	SC-3	SPLP West	Solid	1312	
310-228473-4	SC-5A	SPLP West	Solid	1312	
310-228473-5	SC-6	SPLP West	Solid	1312	
310-228473-6	SC-8A	SPLP West	Solid	1312	
LB 310-349513/1-C	Method Blank	SPLP West	Solid	1312	
LCS 310-349513/2-C	Lab Control Sample	SPLP West	Solid	1312	

Prep Batch: 349532

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	Total/NA	Solid	3050B	
310-228473-2	SC-2	Total/NA	Solid	3050B	
310-228473-3	SC-3	Total/NA	Solid	3050B	
310-228473-4	SC-5A	Total/NA	Solid	3050B	
310-228473-5	SC-6	Total/NA	Solid	3050B	
310-228473-6	SC-8A	Total/NA	Solid	3050B	
MB 310-349532/1-A	Method Blank	Total/NA	Solid	3050B	
LCS 310-349532/2-A	Lab Control Sample	Total/NA	Solid	3050B	
310-228473-1 MS	SC-1	Total/NA	Solid	3050B	
310-228473-1 MSD	SC-1	Total/NA	Solid	3050B	

Prep Batch: 349608

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	SPLP West	Solid	3010A	349513
310-228473-2	SC-2	SPLP West	Solid	3010A	349513
310-228473-3	SC-3	SPLP West	Solid	3010A	349513
310-228473-4	SC-5A	SPLP West	Solid	3010A	349513
310-228473-5	SC-6	SPLP West	Solid	3010A	349513
310-228473-6	SC-8A	SPLP West	Solid	3010A	349513
LB 310-349513/1-C	Method Blank	SPLP West	Solid	3010A	349513
LCS 310-349513/2-C	Lab Control Sample	SPLP West	Solid	3010A	349513

Analysis Batch: 349734

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	Total/NA	Solid	6010D	349532
310-228473-2	SC-2	Total/NA	Solid	6010D	349532
310-228473-3	SC-3	Total/NA	Solid	6010D	349532
310-228473-4	SC-5A	Total/NA	Solid	6010D	349532
310-228473-5	SC-6	Total/NA	Solid	6010D	349532
310-228473-6	SC-8A	Total/NA	Solid	6010D	349532
MB 310-349532/1-A	Method Blank	Total/NA	Solid	6010D	349532
LCS 310-349532/2-A	Lab Control Sample	Total/NA	Solid	6010D	349532
310-228473-1 MS	SC-1	Total/NA	Solid	6010D	349532
310-228473-1 MSD	SC-1	Total/NA	Solid	6010D	349532

Analysis Batch: 350067

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	SPLP West	Solid	6020B	349608
310-228473-2	SC-2	SPLP West	Solid	6020B	349608
310-228473-3	SC-3	SPLP West	Solid	6020B	349608

Metals (Continued)

Analysis Batch: 350067 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-4	SC-5A	SPLP West	Solid	6020B	349608
310-228473-5	SC-6	SPLP West	Solid	6020B	349608
310-228473-6	SC-8A	SPLP West	Solid	6020B	349608
LB 310-349513/1-C	Method Blank	SPLP West	Solid	6020B	349608
LCS 310-349513/2-C	Lab Control Sample	SPLP West	Solid	6020B	349608

General Chemistry

Analysis Batch: 349300

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	Total/NA	Solid	Moisture	
310-228473-2	SC-2	Total/NA	Solid	Moisture	
310-228473-3	SC-3	Total/NA	Solid	Moisture	
310-228473-4	SC-5A	Total/NA	Solid	Moisture	
310-228473-5	SC-6	Total/NA	Solid	Moisture	
310-228473-6	SC-8A	Total/NA	Solid	Moisture	
310-228473-1 DU	SC-1	Total/NA	Solid	Moisture	

Leach Batch: 349557

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	Soluble	Solid	DI Leach	
310-228473-2	SC-2	Soluble	Solid	DI Leach	
310-228473-3	SC-3	Soluble	Solid	DI Leach	
310-228473-4	SC-5A	Soluble	Solid	DI Leach	
310-228473-5	SC-6	Soluble	Solid	DI Leach	
310-228473-6	SC-8A	Soluble	Solid	DI Leach	

Analysis Batch: 349566

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-228473-1	SC-1	Soluble	Solid	9045D	349557
310-228473-2	SC-2	Soluble	Solid	9045D	349557
310-228473-3	SC-3	Soluble	Solid	9045D	349557
310-228473-4	SC-5A	Soluble	Solid	9045D	349557
310-228473-5	SC-6	Soluble	Solid	9045D	349557
310-228473-6	SC-8A	Soluble	Solid	9045D	349557
LCS 310-349566/2	Lab Control Sample	Total/NA	Solid	9045D	

Lab Chronicle

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Client Sample ID: SC-1
Date Collected: 04/05/22 11:45
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:14	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:07	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Client Sample ID: SC-1
Date Collected: 04/05/22 11:45
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-1
Matrix: Solid
Percent Solids: 33.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		4	349734	04/13/22 10:14	CTB	TAL CF

Client Sample ID: SC-2
Date Collected: 04/05/22 09:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:18	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:08	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Client Sample ID: SC-2
Date Collected: 04/05/22 09:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-2
Matrix: Solid
Percent Solids: 30.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		3	349734	04/13/22 11:21	CTB	TAL CF

Client Sample ID: SC-3
Date Collected: 04/05/22 11:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:22	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:10	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Lab Chronicle

Client: SCS Engineers
Job ID: 310-228473-1
Project/Site: Ottumwa Generating Station

Client Sample ID: SC-3
Lab Sample ID: 310-228473-3
Date Collected: 04/05/22 11:00
Matrix: Solid
Date Received: 04/06/22 17:10
Percent Solids: 25.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		2	349734	04/13/22 11:23	CTB	TAL CF

Client Sample ID: SC-5A
Lab Sample ID: 310-228473-4
Date Collected: 04/05/22 10:30
Matrix: Solid
Date Received: 04/06/22 17:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:26	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:11	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Client Sample ID: SC-5A
Lab Sample ID: 310-228473-4
Date Collected: 04/05/22 10:30
Matrix: Solid
Date Received: 04/06/22 17:10
Percent Solids: 34.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		3	349734	04/13/22 11:25	CTB	TAL CF

Client Sample ID: SC-6
Lab Sample ID: 310-228473-5
Date Collected: 04/05/22 09:30
Matrix: Solid
Date Received: 04/06/22 17:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:30	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:12	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Client Sample ID: SC-6
Lab Sample ID: 310-228473-5
Date Collected: 04/05/22 09:30
Matrix: Solid
Date Received: 04/06/22 17:10
Percent Solids: 33.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		4	349734	04/13/22 11:27	CTB	TAL CF

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Client Sample ID: SC-8A
Date Collected: 04/05/22 10:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			349513	04/11/22 16:10	JTA	TAL CF
SPLP West	Prep	3010A			349608	04/13/22 09:00	ACM2	TAL CF
SPLP West	Analysis	6020B		1	350067	04/15/22 16:34	SAP	TAL CF
Soluble	Leach	DI Leach			349557	04/12/22 10:44	LBB	TAL CF
Soluble	Analysis	9045D		1	349566	04/12/22 13:14	LBB	TAL CF
Total/NA	Analysis	Moisture		1	349300	04/08/22 13:44	SJN	TAL CF

Client Sample ID: SC-8A
Date Collected: 04/05/22 10:00
Date Received: 04/06/22 17:10

Lab Sample ID: 310-228473-6
Matrix: Solid
Percent Solids: 26.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			349532	04/12/22 10:00	ACM2	TAL CF
Total/NA	Analysis	6010D		3	349734	04/13/22 11:29	CTB	TAL CF

Laboratory References:

TAL CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

Accreditation/Certification Summary

Client: SCS Engineers
Project/Site: Ottumwa Generating Station

Job ID: 310-228473-1

Laboratory: Eurofins Cedar Falls

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Iowa	State	007	12-01-21 *

1 2 3 4 5 6 7 8 9 10 11 12 13 14

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Method Summary

Method	Method Description	Protocol	Laboratory
6010D	Metals (ICP)	SW846	TAL CF
6020B	Metals (ICP/MS)	SW846	TAL CF
9045D	pH	SW846	TAL CF
Moisture	Percent Moisture	EPA	TAL CF
1312	SPLP Extraction	SW846	TAL CF
3010A	Preparation, Total Metals	SW846	TAL CF
3050B	Preparation, Metals	SW846	TAL CF
DI Leach	Deionized Water Leaching Procedure	ASTM	TAL CF

Protocol References:

ASTM = ASTM International

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401 eurofins | Environment Testing America

310-228473 Chain of Custody

Cooler/Sample Receipt and Temperature Log Form

Client Information			
Client	SLS		
City/State	CITY Madison	STATE WI	Project
Receipt Information			
Date/Time Received	DATE 4-6 22	TIME 1710	Received By [illegible]

Delivery Type ☐ UPS ☐ FedEx ☐ FedEx Ground ☐ US Mail ☐ Spee-Dee ☑ Lab Courier ☐ Lab Field Services ☐ Client Drop-off ☐ Other.______

Condition of Cooler/Containers

Sample(s) received in Cooler?	☑ Yes	☐ No	*If yes*	Cooler ID
Multiple Coolers?	☐ Yes	☑ No	*If yes*	Cooler # _____ of _____
Cooler Custody Seals Present?	☑ Yes	☐ No	*If yes*	Cooler custody seals intact? ☑ Yes ☐ No
Sample Custody Seals Present?	☐ Yes	☑ No	*If yes*	Sample custody seals intact? ☐ Yes ☐ No
Trip Blank Present?	☐ Yes	☑ No	*If yes.*	Which VOA samples are in cooler? ↓

Temperature Record

Coolant ☑ Wet ice ☐ Blue ice ☐ Dry ice ☐ Other.______ ☐ NONE

Thermometer ID	N	Correction Factor (°C)	0

• Temp Blank Temperature – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature

Uncorrected Temp (°C)	0.6	Corrected Temp (°C)	0.6

• Sample Container Temperature

	CONTAINER 1	CONTAINER 2
Container(s) used		
Uncorrected Temp (°C)		
Corrected Temp (°C)		

Exceptions Noted

1) If temperature exceeds criteria, was sample(s) received same day of sampling? ☐ Yes ☐ No
 a) *If yes.* Is there evidence that the chilling process began? ☐ Yes ☐ No

2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e.g , bulging septa, broken/cracked bottles, frozen solid?) ☐ Yes ☐ No

NOTE If yes, contact PM before proceeding If no, proceed with login

Additional Comments

Document: CED-P-SAM-FRM45521
Revision 26
Date. 27 Jan 2022

Eurofins Cedar Falls

General temperature criteria is 0 to 6°C
Bacteria temperature criteria is 0 to 10°C

Chain of Custody Record 459246

eurofins | Environment Testing TestAmerica

Address ____________

Regulatory Program ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Company Name: SCS Engineers	Tel/Email	Lab Contact:	Carrier:	___ of ___ COCs
Address: 2830 Dairy Dr	Analysis Turnaround Time			Sampler:
City/State/Zip: Madison WI 53718	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 608-224-2830	TAT if different from Below ____			Walk-in Client:
Fax:	☐ 2 weeks			Lab Sampling:
Project Name: Ottumwa	☐ 1 week			
Site: Ottumwa Generating Station	☐ 2 days			Job / SDG No.
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp. G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Total Iron	Total PH	Total Cobalt	SPLP for Cobalt	Sample Specific Notes.
SC-1	4/5	11 45	C	soil				X	X	X	X	
SC-2	4/5	9 00	C	soil				X	X	X	X	
SC-3	4/5	11 00	C	soil				X	X	X	X	
~~SC-4~~	~~4/5~~	—	~~C~~	~~soil~~				~~X~~	~~X~~	~~X~~		
SC-5A	4/5	10 30	C	soil				X	X	X	X	
SC-6	4/5	9 30	C	soil				X	X	X	X	
SC-8A	4/5	10 00	C	soil				X	X	X	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ______

Possible Hazard Identification
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (*A fee may be assessed if samples are retained longer than 1 month*)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for ______ Months

Special Instructions/QC Requirements & Comments.

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No. | Cooler Temp. (°C): Obs'd: ______ Corr'd. ______ Therm ID No. ______

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: [signature]	Company:	Date/Time: 4-6 22 1710

Login Sample Receipt Checklist

Client: SCS Engineers

Job Number: 310-228473-1
SDG Number:

Login Number: 228473
List Number: 1
Creator: Homolar, Dana J

List Source: Eurofins Cedar Falls

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

1 2 3 4 5 6 7 8 9 10 11 12 13 14