DRAFT REMEDY SELECTION REPORT
PLANT ARKWRIGHT
ASH POND 3 LANDFILL AND MONOFILL
MACON, GEORGIA

Prepared by

Stantec Consulting Services Inc.
10745 Westside Way, Suite 250
Alpharetta, Georgia 30009-7640

Prepared for

Georgia Power

February 28, 2024

Certification

I, Jennifer L. Kolbe, am a professional engineer and licensed in the State of Georgia. I hereby certify that this Draft Remedy Selection Report was prepared by, or under the direct supervision of, a Qualified Groundwater Scientist, in accordance with the Georgia Environmental Protection Division Rules of Solid Waste Management. According to 391- 3-4-.01, a Qualified Groundwater Scientist is "a professional engineer or geologist registered to practice in Georgia who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields that enable individuals to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action." By affixing my professional seal and signature, I hereby acknowledge that this report has been prepared in conformance with the United States Environmental Protection Agency coal combustion residual rule [40 Code of Federal Regulations (CFR) 257 Subpart D] and the Georgia Environmental Protection Division Rules for Solid Waste Management 391-3-4-.10.

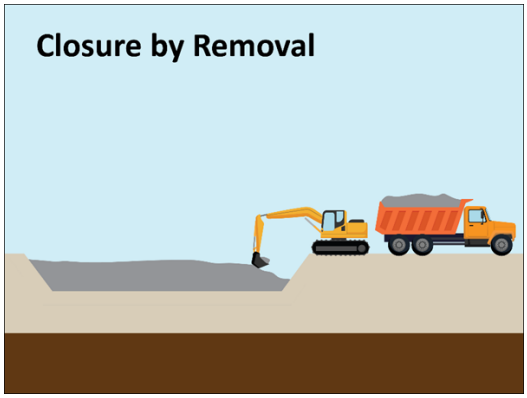
Jennifer L. Kolbe, PhD, P.E. (GEORGIA PE034643)
Principal

Plant Arkwright Ash Pond 3 Landfill and Monofill: Executive Summary

Plant Arkwright is a former coal-fired electric generation facility which consisted of four 40-megawatt units located in Bibb County, Georgia, approximately six miles northwest of the city of Macon, Georgia that was decommissioned in 2003. Coal combustion residuals (CCR), commonly referred to as "coal ash," a non-hazardous material generated from burning coal to generate electricity, were stored at the site in former Ash Ponds. Ash ponds were designed, installed, and operated to function as treatment systems for power plant wastewaters, and they have effectively served in this capacity for decades in compliance with the National Pollutant Discharge Elimination System (NPDES) permits under which they were regulated. In 2010, Georgia Power closed their Ash Pond 3 (AP-3) and an associated CCR management area (AP-3 Landfill and Monofill) by capping. As part of a comprehensive approach to managing CCR, Georgia Power has undertaken actions to close AP-3 Landfill and Monofill in accordance with federal and state regulations and completed a detailed evaluation of corrective measures to address cobalt above the Groundwater Protection Standard (GWPS) at AP-3 Landfill and Monofill at Plant Arkwright.

Ash Pond Closure

Georgia Power will close AP-3 Landfill and Monofill through the removal of approximately 988,000 cubic yards of CCR material from the CCR unit for disposal at a permitted, lined solid waste disposal facility. The closure of AP-3 Landfill and Monofill is regulated by the United States Environmental Protection Agency and the Georgia Environmental Protection Division (GA EPD).



Groundwater Monitoring and Assessment

Georgia Power has performed CCR groundwater monitoring at AP-3 Landfill and Monofill since June 2016. Over the period of Georgia Power's monitoring, concentrations of cobalt were identified above the GWPS in one groundwater monitoring well. Groundwater and surface water monitoring indicates that cobalt above the groundwater protection standard is limited in extent and delineated.

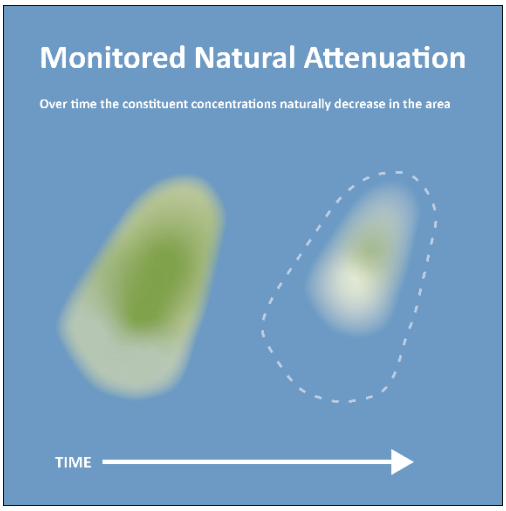
Risk Evaluation for Human Health and Environment

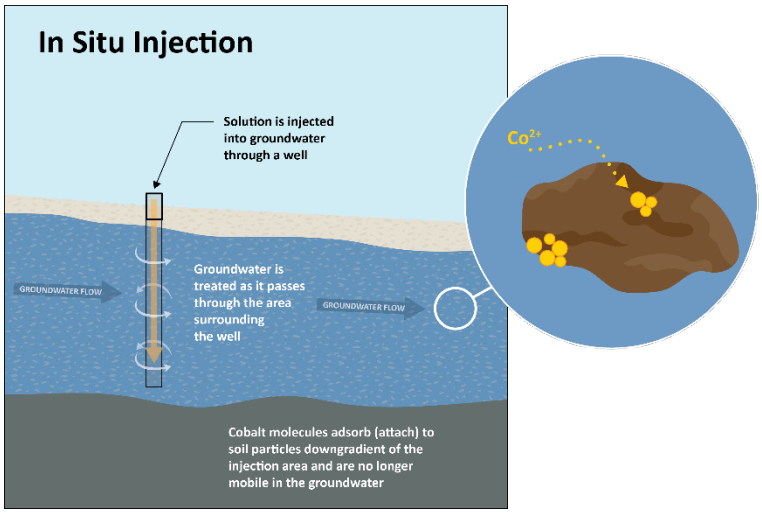
Georgia Power completed a human health and ecological risk evaluation that confirmed that cobalt identified on-site is not expected to pose a risk to human health or the environment.

Proposed Corrective Actions for Groundwater

Georgia Power initiated an assessment of corrective measures (ACM) program for AP-3 Landfill and Monofill in December 2020. Georgia Power has worked with GA EPD to adhere to regulations and select a comprehensive and technically sound approach for implementing corrective measures to address cobalt in groundwater. Using the criteria described in the CCR Rule, 40 Code of Federal Regulations (CFR) Part 257.97, the draft remedy proposed includes:

- **In-situ Injections**: In-situ injections are a well-recognized remediation approach utilizing a network of injection wells to introduce reagents into the subsurface to improve groundwater quality. Georgia Power will work with GA EPD on the permitting and approval of the reagent prior to use at the site. Injections will target the areas of highest groundwater concentrations of cobalt to immobilize this constituent. Groundwater monitoring will be performed to confirm the effectiveness of the in-situ injections.
- **Monitored Natural Attenuation (MNA)**: Natural attenuation of cobalt in groundwater at the site is primarily due to adsorption and co-precipitation of the dissolved metals into the aquifer matrix. These mechanisms have been demonstrated to be occurring at the site through extensive laboratory testing and study. Groundwater monitoring will continue to document natural attenuation, which is expected to be enhanced by the geochemical in-situ injections.





Adaptive Site Management

The remedy performance will be monitored and evaluated, and, if needed, the remedy will be adjusted or augmented to meet remedial objectives.

Long-Term Groundwater Monitoring

Georgia Power will monitor the performance of applied corrective measures in accordance with regulatory requirements.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
ACM	Assessment of Corrective Measures
AP-3	Arkwright Ash Pond 3
bgs	Below ground surface
CAMP	Corrective Action Groundwater Monitoring Plan
CCR	Coal Combustion Residuals
CCR Rule	40 Code of Federal Regulations (CFR) Part 257
CFR	Code of Federal Regulations
cm/s	centimeters per second
CSM	Conceptual Site Model
ft/day	feet per day
ft/ft	feet per foot
GA EPD	Georgia Environmental Protection Division
Georgia Power	Georgia Power Company
GWPS	Groundwater Protection Standard
ISI	In-Situ Injection
µg/L	micrograms per liter
MNA	Monitored Natural Attenuation
NAVD 88	North American Vertical Datum of 1988
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PDI	Pre-Design Investigation
PRB	Permeable Reactive Barrier
PWR	Partially Weathered Rock
RCRA	Resource Conservation and Recovery Act
Stantec	Stantec Consulting Services, Inc.
SSL	Statistically Significant Level
USEPA	United States Environmental Protection Agency

1. Introduction

Stantec Consulting Services Inc. (Stantec) prepared this Draft Remedy Selection Report on behalf of Georgia Power Company (Georgia Power) for Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill. As documented here, Georgia Power has completed a detailed evaluation of corrective measures to address cobalt in groundwater at statistically significant levels (SSLs) above the Groundwater Protection Standards (GWPSs). The evaluation was completed in accordance with the United States Environmental Protection Agency's (USEPA's) Coal Combustion Residuals (CCR) Rule, 40 Code of Federal Regulations (CFR) Part 257 effective October 19, 2015 (CCR Rule) including subsequent revisions and Georgia Environmental Protection Division's (GA EPD's) Rule for Solid Waste Management Rule 391-3-4-.10 for CCR.

This Draft Remedy Selection Report includes an overview of ongoing geologic and hydrogeologic investigations to refine the conceptual site model (CSM), identifies Appendix IV constituents detected in groundwater at SSLs above the GWPS, discusses the nature and extent of these inorganic constituents in groundwater, evaluates potential corrective measures to address SSLs in groundwater, and presents a proposed groundwater remedy for preliminary review by GA EPD. At GA EPD's request, following their preliminary review, a public meeting will be held to discuss the assessment of corrective measures and proposed remedy, after which a remedy will be selected, and the Remedy Selection Report will be submitted to GA EPD. Once a remedy is selected and implemented, the remediation will be monitored routinely and subject to potential modification based on adaptive management strategies, as appropriate.

2. Background

2.1 REMEDY SELECTION PROCESS

The remedy selection process involves assessment of potentially applicable groundwater remediation approaches. To date, this process has occurred as reported in previous submittals including the *Assessment of Corrective Measures* (ACM) (Wood, 2020) and *Semiannual Remedy Selection and Design Progress Report*s (Stantec 2023; Wood 2022; Wood 2021).

The remedy selected for the unit must meet the following required criteria:

§257.97 Selection of Remedy [Required Criteria]
(b) Remedies must:

(1) Be protective of human health and the environment;
(2) Attain the groundwater protection standard as specified pursuant to §257.95(h);
(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
(5) Comply with standards for management of wastes as specified in §257.98(d).

Technologies that meet the required criteria are then evaluated using the following comparative criteria:

§257.97 Selection of remedy [Comparative Criteria]
(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) magnitude of reduction of existing risks;
(ii) magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;
(iii) the type and degree of long-term management required, including monitoring, operation, and maintenance;
(iv) short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;
(v) time until full protection is achieved;
(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;
(vii) long-term reliability of the engineering and institutional controls; and
(viii) potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) the extent to which containment practices will reduce further releases; and

(ii) the extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) degree of difficulty associated with constructing the technology;

(ii) expected operational reliability of the technologies;

(iii) need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) availability of necessary equipment and specialists; and

(v) available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

Using the above criteria, this document evaluates the potential remedies identified in the ACM and subsequent updates to identify an appropriate groundwater remedy for the unit. Selection of an appropriate groundwater remedy is significantly influenced by CCR constituent chemistry and characteristics of Appendix IV parameters, which are inorganic trace elements—metals and metalloids that have attenuation and remediation characteristics markedly different than organic constituents. Common chemical mechanisms of attenuation for CCR constituents include adsorption to, or coprecipitation with, oxides and hydrous oxides (oxyhydroxides) of iron and manganese; coprecipitation with, and adsorption to, iron sulfides such as pyrite (FeS_2); and precipitation as carbonates, sulfides, sulfates, and/or phosphates (USEPA, 2007; EPRI, 2018). The attenuation capacity can be evaluated through site-specific field and laboratory testing and geochemical modeling. Processes such as precipitation/co-precipitation and adsorption and other methods such as groundwater extraction and treatment and engineered plant uptake (phytoremediation) are also evaluated for the remediation of Appendix IV constituents. The selected remedy will meet the criteria *of* §257.97(b) and the effectiveness of criteria specified in §257.97(c).

An evaluation of the degree to which community concerns are addressed by a potential remedy is not included in this Draft Remedy Selection Report. A discussion of this criterion will be substantially informed by a forthcoming public meeting following GA EPD preliminary review and comment on this Draft Remedy Selection Report. Following the public meeting, the Remedy Selection Report will be prepared for submission to GA EPD and will include a discussion of the "degree to which community concerns are addressed by a potential remedy."

2.2 UNIT LOCATION AND DESCRIPTION

Plant Arkwright AP-3 Landfill and Monofill is located in Bibb County, Georgia, approximately six miles northwest of the city of Macon. The Plant Arkwright property is bordered by sparsely populated wooded land to the north, Beaverdam Creek to the south, the Ocmulgee River to the east, and mixed-use development (industrial, retail, and residential) to the west (**Figure 1**). The physical address of the plant is 5241 Arkwright Road, Macon, GA 31210.

When in operation, the Plant Arkwright coal-fired power plant consisted of four 40-megawatt units. In the years before retirement, the plant was used primarily to provide peaking power and operated approximately 40 to 60 days per year. Plant Arkwright was retired in 2002 and decommissioned in 2003.

AP-3 was initially constructed as a surface impoundment prior to 1958 but did not receive CCR material from the Plant Arkwright facility until the 1970s. The AP-3 Landfill and Monofill were officially closed in 2010.

2.3 UNIT CLOSURE

The AP-3 Landfill and Monofill were officially closed in 2010 with GA EPD approval and in accordance with the solid waste landfill regulations specified by GA EPD Rule 391-3-4.14, in effect at the time of its closure. During this closure, the AP-3 Landfill and Monofill were capped with geosynthetic clay liners overlain by 18 inches of cover soil. A Closure Certificate was issued by GA EPD for AP-3 Landfill and Monofill on August 19, 2010. The Closure Certificate initiated the post-closure care period for the CCR unit, which has been performed in accordance with the GA EPD Permit No. 011-025D(LI). The CCR units referred to as AP-3 Landfill and Monofill are defined as inactive CCR landfills per GA EPD Rule 391-3-4-.10(2)(a)(3).

AP-3 Landfill and Monofill are exempt from the requirements in 40 CFR §257.50 (d) and (e), which state that the subpart does not apply to CCR landfills that have ceased receiving CCR material prior to October 19, 2015. These CCR units are, however, subject to the requirements of relevant portions of GA EPD 391-3-4-.10.

Georgia Power has elected to remove the CCR material from the AP-3 Landfill and Monofill. The CCR material will be excavated from the AP-3 Landfill and Monofill and will be placed in a lined landfill.

2.4 GROUNDWATER MONITORING

The current groundwater monitoring system for the CCR units includes the background/upgradient and downgradient monitoring wells, as summarized in **Table 1**. Compliance monitoring well locations are shown on **Figure 2.**

CCR groundwater monitoring-related activities have been performed at AP-3 Landfill and Monofill since June 2016 in accordance with the CCR Rule. The following Appendix IV SSL parameter, shown in **Table 2**, is the subject of this report:

Table 2. Appendix IV SSL Summary

Appendix IV SSL Constituent	Monitoring Well ID
Cobalt	ARGWC-17

Additional details regarding the statistical analyses are provided in the annual and semiannual *Groundwater and Corrective Action Monitoring Reports* submitted to GA EPD and posted on Georgia Power's website.

3. Groundwater Conceptual Site Model

A CSM is a dynamic tool that contextualizes available geological, hydrogeological, and geochemical information at a site to convey how groundwater and constituents (Appendix III and IV parameters) travel in a given geologic setting. A CSM is not static and may evolve as data are collected and more is known about the setting. A CSM was developed for AP-3 Landfill and Monofill. As data were gathered during the ACM process, the CSM was refined and used to eliminate potential groundwater remedial alternatives that were not compatible with the site-specific conditions and to pre-screen remedial technologies. The CSM for AP-3 Landfill and Monofill is summarized below.

3.1 GEOLOGIC AND HYDROGEOLOGIC SETTING

Near surface geology and hydrogeologic conditions present in the vicinity of AP-3 Landfill and Monofill influence the geochemical nature and extent of the inorganic constituents present in the area's groundwater. The geologic and hydrogeologic conditions at AP-3 Landfill and Monofill presented herein are based on information provided in the *Limited Hydrogeologic Assessment Report for AP-3 Landfill and Monofill* (Jacobs 2018) and updated with additional AP-3 Landfill and Monofill area data provided in more recently published investigation reports (i.e., 2020–2023 AP-3 Landfill and Monofill *Groundwater Corrective Action Reports* and 2021–2023 AP-3 Landfill and Monofill *Semi-Annual Remedy Selection and Design Progress Reports*). A summary of the regional geologic and hydrogeologic conditions has been included (**Section 3.1.1**) to provide context to the AP-3 Landfill and Monofill area-specific conditions (**Section 3.1.2**).

3.1.1 Regional Framework

Plant Arkwright is located along the Ocmulgee River in the northern part of Bibb County which is located on the southern edge of the Piedmont Province of the Appalachian Highland Physiographic District. Area topography is rolling to hilly, with the highest hills rising to about 800 feet above sea level. The topography is reflective of the deformation and subsequent long weathering of the underlying metamorphic and igneous rocks that extend across the Piedmont Province to the north of Plant Arkwright. Uppermost bedrock in the region is composed of moderate- to high-grade metamorphic rocks, consisting of biotite-granite gneiss, schist, and amphibolite, and igneous rocks like granite (LeGrand, 1962). Geologic bedrock maps indicate that bedrock at Plant Arkwright area is a biotite gneiss (See **Figure 3**).

The top of the bedrock surface in the area is described as highly weathered and, where exposed, the bedrock surface is generally soft and friable (LeGrand, 1962). In other upland areas, the crystalline bedrock is covered by a veneer of partially consolidated (saprolite) to unconsolidated (saprolitic) residuum, formed by the in-place chemical weathering of the underlying rock. Residuum thicknesses of up to 100 feet have been identified in the Piedmont Province in broad draws and valleys (Miller, 1990). Major geologic structures in the region include the Ocmulgee Fault, located approximately seven miles to the northwest of Plant Arkwright which strikes mostly northeast–southwest. This fault zone was formed and subsequently fused approximately 350 million years ago (Hooper and Hatcher, 1990). The region is not considered to be seismically active, with a earthquake hazard level of very low (GFDRR, 2020).

Tributary streams in the area, having adjusted their courses to the structure of the underlying crystalline bedrock, flow generally southeastward to join the south-flowing Ocmulgee River present at an elevation of approximately 300 feet above mean sea level adjacent to Plant Arkwright. Alluvial deposits ranging from clay to sand and gravel deposits are present within incised bedrock channels formed by the tributary streams and within the broader floodplains of the larger rivers. Reported alluvial (floodplain) deposits within the greater Ocmulgee River drainage are up to 40 feet thick and extend several thousand feet from the river axis along river segments to the south of the Piedmont Province (LeGrand 1962). These depositional conditions are not present along the Ocmulgee River adjacent to Plant Arkwright. Aerial photographs of the river show the presence of a narrow river with a restricted floodplain beyond the far bank of the river and a bedrock channel valley that has been scoured free of alluvial deposits.

There are no laterally extensive regional aquifers in the Piedmont Province (Miller 1990). Groundwater is mainly supplied by infiltrating precipitation and is found in the residuum/partially weathered rock (PWR) and fractured portions of the upper bedrock in upland areas and in alluvial deposits within incised stream channels. Shallow groundwater flow direction locally mimics area topography but regionally moves southward towards the coastal plain (Miller, 1990). The competent crystalline rock underneath the unconsolidated deposits (overburden) has little to no primary (intergranular) porosity. Where encountered, groundwater in the competent bedrock is found in secondary porosity features such as isolated open fractures, foliation separations, igneous/metamorphic rock contacts, and potential fault zones.

3.1.2 AP-3 Landfill and Monofill Area

The AP-3 Landfill and Monofill are constructed within a southward sloping sub-basin bounded to the east and west by areas of higher elevation. They are capped with geosynthetic clay liners overlain by 18 inches of cover soil. The original natural creek channel within the drainage area was relocated to run along the eastern side of the AP-3 Landfill to convey surface water at the head of the drainage around the AP-3 Landfill to the area below the AP-3 Landfill dike at the south end of the dike. The lower portion of the surface drainage eventually discharges into Beaverdam Creek located approximately 1,500 feet south of the AP-3 Landfill.

Investigation boring logs were used to construct three geologic cross-sections along the alignments shown in **Figure 4** to characterize area geology. Cross-sections A-A' through C-C' are provided as **Figures 4A through 4C**, respectively. The cross-sections are based on lithologic information from borings advanced in the area between 2008 and 2022.

The CCR material within the AP-3 Landfill varies in thickness from 11 feet (north end) to 35 feet (south end) and is composed primarily of silt- to fine-sand-sized particles and scattered horizons of coarser grained particles. Encountered fill materials include reworked/engineered native silty to sandy clays (for dike construction), sand and clay soils used in CCR management unit cap construction, and fill material found within the CCR unit.

The **overburden** materials present in the subsurface at AP-3 Landfill and Monofill from surface grade to depth are:

- **Native soils -** These shallow overburden soils consist primarily of alluvial and saprolitic soil deposits. Material that has developed into a soil following the complete in place chemical weathering of its parent bedrock is here referred to as a saprolitic soil. Saprolitic soils are the

predominant soil type observed in the area of AP-3 Landfill and Monofill. These soils are typically loose, red to light brown in color, and composed of fine sand-sized particles containing varying percentages of clay, silt and medium sand, with occasional larger, incompletely altered gravel. Saprolitic soil thicknesses range from absent to up to 20 feet in the AP-3 Landfill and Monofill area.

- **Saprolite -** Rock that has been chemically weathered in place, but still retains its primary rock fabric, is referred to as saprolite. Underlying the native soils is a typically grey to tan saprolite layer of varying thickness. The saprolite retains the streaky banding and foliations characteristic of gneiss but readily disintegrates into varying percentages of gravel, sand, silts, and clays when mechanically disturbed. Saprolite thicknesses range from absent to over 30 feet. The majority of the AP-3 Landfill and Monofill overburden monitoring wells are screened in saprolite.

The **bedrock** materials present beneath the overburden are:

- **Partially weathered rock** - As weathering preferentially occurs along horizontal and vertical fractures present within the rock matrix, less altered, more resistant layers or blocks of rock that are bounded by weathered zones or fractures may be preserved above the downward advancing weathering front at the bedrock contact. These less altered layers or blocks are referred to as PWR. Encountered thicknesses of PWR range from absent to approximately 15 feet.

- **Biotite gneiss bedrock** - The top of biotite gneiss bedrock is at depths of approximately 11 to 81 feet below original grade. Bedrock contact elevations range from approximately 302 feet North American Vertical Datum of 1988 (NAVD88) at the south end of the AP-3 landfill, to 352 feet NAVD88 just north of AP-3 landfill. Boring logs of the uppermost portion of bedrock indicate that it is fractured. The bedrock fractures are predominantly horizontal to slightly inclined. The degree of weathering noted on the fracture faces varies from highly weathered to closed and unweathered with increasing depth below the bedrock contact.

The uppermost aquifer at AP-3 Landfill and Monofill consists of 1) water-bearing overburden materials and 2) PWR and zones of shallow, highly fractured bedrock underlying the overburden or PWR. Comparison of AP-3 Landfill and Monofill groundwater elevation data from adjacent overburden and PWR/shallow bedrock monitoring wells shows that groundwater elevations in the overburden and shallow bedrock are similar. This, in combination with observed fragmented PWR and weathered fractures at the bedrock contact, suggests that groundwater in the overburden and shallow bedrock fractures are hydraulically connected and groundwater flow in the overburden and the PWR/shallow fractured bedrock is predominantly horizontal. The base of the uppermost aquifer is unfractured competent bedrock having no significant primary porosity and no to few observed secondary porosity features.

The January 2023 uppermost aquifer potentiometric surface contour map is shown in **Figure 5**. The uppermost aquifer at AP-3 Landfill and Monofill is unconfined. The water table is present in overburden at depths ranging from 12 to 39 feet below ground surface and at elevations ranging from approximately 325 to 358 feet NAVD88 (Stantec 2023).

The uppermost aquifer in this area is locally constrained by competent bedrock ridges to the east and west of AP-3 Landfill and Monofill. Groundwater in the uppermost aquifer at the AP-3 Landfill and Monofill generally flows southward between these ridges. A southeasterly flow component exists upgradient of the Monofill (See **Figure 5**). As groundwater moves past the Monofill, the groundwater flow returns to a southward direction.

The calculated average hydraulic gradient in the uppermost aquifer beneath AP-3 Landfill and Monofill is 0.011 feet per foot (ft/ft) based on measured groundwater levels (See **Table 1** in **Appendix C**). While the hydraulic gradient in the uppermost aquifer is locally steeper (0.021 ft/ft) beneath the southern end of AP-3 south of the Monofill (Stantec 2023), the overall average hydraulic gradient along the total length of AP-3 Landfill and Monofill (0.011 feet) was used to develop a representative uppermost aquifer average linear groundwater flow velocity value at the AP-3 Landfill and Monofill.

The average linear groundwater flow velocity (v) within the uppermost aquifer at AP-3 Landfill and Monofill can be estimated using the following equation:

$$v = Ki/n_e$$

where: K = hydraulic conductivity of the saturated media

i = hydraulic gradient

n_e = effective porosity

Hydraulic conductivity (slug) testing at AP-3 Landfill and Monofill area monitoring wells screened in the overburden and fractured bedrock (uppermost aquifer) was completed in 2021. The horizontal hydraulic conductivity at monitoring wells screened within the uppermost aquifer ranged from 1.63×10^{-4} to 5.79×10^{-3} centimeters per second (cm/s) (0.462 to 16.4 feet per day [ft/day]).

Site-specific values of effective porosity can be difficult to obtain. Accordingly, measured effective porosity values reported in the literature for saturated media having properties similar to those found at a site are commonly used to estimate average linear groundwater flow velocities. Table 10-4 of the *Interim Final RCRA Facility Investigation (RFI) Guidance* (US EPA, 1989) provides a list of effective porosity values that can be used to estimate groundwater flow velocities for differing soil and rock types. An effective porosity value of 0.20 from the *Guidance* will be used based on the predominant material types found within the uppermost aquifer at the AP-3 Landfill and Monofill.

Assuming an effective porosity value of 0.20, the previously discussed AP-3 Landfill and Monofill area hydraulic gradient of 0.011 ft/ft, and the average horizontal hydraulic conductivities provided above, the calculated average linear velocity for the uppermost aquifer ranges from 0.051 to 1.80 ft/day (19 to 657 feet per year). These calculated values are consistent with the average groundwater velocity of 0.35 ft/day (128 feet per year) determined by calibration of the Reactive Transport Model (**Appendix C**).

3.2 GEOCHEMICAL CSM

As detailed in the *Geochemical Conceptual Site Model Report* (**Appendix A**) (Geochemical CSM Report), groundwater quality at the Arkwright Plant is affected by numerous geochemical processes, including sorption, cation exchange, precipitation, and dissolution. The effect of these geochemical processes can explain the observed behavior of cobalt in groundwater and can influence the attenuation of CCR constituents. The nature and extent of the interaction between dissolved constituents in groundwater, unconsolidated materials, saprolite, and bedrock range from limited interaction for constituents such as

boron, chloride, and sulfate, to strong interaction for constituents such as cobalt. The following geochemical reactions or processes are likely mechanisms influencing the fate and transport of cobalt in groundwater:

- Sorption on the surfaces of metal oxyhydroxides
- Cation exchange with clay minerals
- Mineral precipitation or dissolution

3.3 NATURE AND EXTENT OF GROUNDWATER ABOVE THE GWPS

Based on statistical analysis of Appendix IV groundwater data, the cobalt SSL identified in the compliance well ARGWC-17 is horizontally and vertically delineated to levels below GWPS. Please refer to the February 2023 iso-concentration map for cobalt presented in **Figure 6**. Compliance wells with SSLs and the pertinent horizontal and vertical delineation wells are also provided in **Table 3**.

Table 3. Cobalt Delineation Summary

Detected Constituent	GWPS (mg/L)	Monitoring Well ID	Concentration (mg/L)
Cobalt	0.006	ARGWC-17	0.0332
Vertical Delineation			
Cobalt	0.006	ARAMW-4	0.00343
Horizontal Delineation			
Cobalt	0.006	ARGWC-16	< 0.000300

Notes:

1. *mg/L = milligrams per liter*
2. *"<" indicates that the constituent was below the laboratory method detection limit*
3. *Data presented are from the January-February 2023 groundwater monitoring event*

4. Assessment of Corrective Measures Summary

An ACM Report was completed on December 4, 2020, in accordance with 40 CFR §257.96 and identified the following corrective measures as potentially applicable to remediate groundwater at AP-3 Landfill and Monofill:

- Geochemical Approaches (In-Situ Injection [ISI])
- Hydraulic Containment (Pump and Treat [P&T])
- Monitored Natural Attenuation (MNA)
- Permeable Reactive Barrier (PRB)
- Phytoremediation /TreeWell ®
- Subsurface Vertical Barrier Walls

Georgia Power also plans to proactively utilize adaptive site management to support the remedial strategy and address potential changes in site conditions as appropriate. Under an adaptive site management strategy, a remedial approach will be selected whereby: (1) a remedy will be installed or implemented to address current conditions; (2) the performance of the remedy will be monitored, evaluated, and reported semiannually; (3) the site conceptual model will be updated as more data are collected; and (4) adjustments and augmentations will be made to the remedy, as warranted, to assure that site objectives are met.

Further evaluation and refinement of the groundwater corrective measures were presented in *Semiannual Remedy Selection and Design Progress Reports* submitted since the ACM Report in 2020. The corrective measures identified for the CCR unit in the ACM have been further evaluated using the criteria outlined in 40 CFR §257.96(c) and GA EPD Rule 391-3-4.10(6)(a). The screening of the corrective measures, as presented in the *Semiannual Remedy Selection and Design Progress Reports*, is summarized in **Table 4**.

The corrective measures that were not screened out and were retained for further evaluation under the 40 CFR §257.97 remedy selection criteria in this document include the following:

- **Corrective Measure 1 - In-Situ Injection (ISI)**: In-situ treatment can be accomplished through reagent injections and constitutes a remediation technology for inorganic constituents, such as cobalt. Cobalt can be precipitated or sorbed/immobilized under different combinations of pH and oxidation-reduction (redox) conditions. In-situ treatment is a potentially viable corrective measure for cobalt in groundwater at AP-3 Landfill and Monofill.
- **Corrective Measure 2 - Pump and Treat (P&T)**: Hydraulic containment refers to the use of groundwater extraction to induce a hydraulic gradient for hydraulic capture or control of the migration of groundwater. This approach uses extraction wells or trenches to capture groundwater, which may subsequently require above-ground treatment and permitted discharge to a receiving water feature, reinjection into the groundwater, or reuse. Groundwater pump and treat is often slow to restore groundwater quality, but can be more effective as an interim measure, or combined with another measure, to provide hydraulic containment to limit constituent migration toward a potential receptor.

- **Corrective Measure 3 - Monitored Natural Attenuation (MNA)**: MNA relies on natural attenuation processes to achieve site-specific remediation objectives within a similar time frame relative to more active methods. Under certain circumstances (e.g., through sorption or mineral precipitation), MNA effectively reduces the dissolved concentrations of inorganic constituents in groundwater. Attenuation mechanisms for inorganic constituents, such as cobalt, are either physical (e.g., dilution, dispersion, flushing, and related processes) or chemical (e.g., sorption or redox reactions). Physical and chemical MNA mechanisms for cobalt can be effective in reducing groundwater concentrations without the potential for additional mass of constituents migrating to downgradient groundwater. As detailed in the Geochemical CSM Report provided in **Appendix A**, natural attenuation of cobalt is primarily due to adsorption and co-precipitation and does not rely solely on physical means of attenuation.
- **Corrective Measure 4 - Permeable Reactive Barrier (PRB)**: PRBs typically involve the installation of a permeable subsurface wall constructed with reactive media for the removal of constituents as groundwater passes through the subsurface. PRBs can be installed in downgradient locations using conventional excavation methods, one-pass trenching method, or through injection of a solid slurry. Reactive media are emplaced within the treatment zone to create a permeable barrier that treats dissolved constituents as they passively flow through the PRB with the groundwater (ITRC, 2011). These systems can either be constructed as continuous “walls” or as “funnel-and-gate” systems where (impermeable) slurry walls create a “funnel” that directs groundwater to permeable “treatment gates” filled with reactive materials. PRBs are typically keyed into an underlying low-permeability unit such as a clay layer. Treatment of cobalt within a PRB is primarily due to adsorption and co-precipitation associated with the reactive media within the barrier.
- **Corrective Measure 5 - Phytoremediation/TreeWell®**: Phytoremediation uses trees or other plants to uptake or immobilize constituents or achieve hydraulic control without the need for an above ground water treatment system and infrastructure. However, the effectiveness of groundwater remediation using traditional phytoremediation approaches can be limited by compacted soil conditions that impede root penetration or target groundwater that is too deep for root access. Given depth of the screened interval for monitoring well ARGWC-17, which exhibits SSLs of cobalt (20 to 30 feet below ground surface [bgs]), traditional plantings of phytoremediation are not expected to be successful. However, more recently, an engineered approach to phytoremediation, the TreeWell® system (which is a proprietary system developed by Applied Natural Sciences), has been shown to overcome these constraints (e.g., Gatliff et al., 2016). By installing a cased “well” for tree planting using large diameter auger technology, extraction of deeper groundwater zones (i.e., in excess of 50 feet bgs) can be achieved since the surface of the “well” is sealed and only groundwater from a targeted zone is allowed into the cased-off borehole. This type of system mirrors a traditional mechanical extraction system using the trees as pumps. Also, the advantage of the system includes no above-ground water management needs and limited long-term operations and maintenance requirements following the establishment of the tree system.

Preliminary or conceptual remedy design drawings of the five corrective measures are shown on **Figures 7A through 7E**. Since the layouts are considered conceptual, the configuration of the implemented remedy may vary. The imagery shown on **Figures 7A through 7E** may not be fully representative of post

closure conditions and actual layouts would be determined based on site conditions at the time of implementation.

5. Corrective Measures Evaluation

The purpose of this section is to evaluate and rank the five corrective measures alternatives using the required criteria described in 40 CFR §257.97(b) and the comparative criteria described in 40 CFR §257.97(c).

5.1 REQUIRED CRITERIA (§257.97(b))

As described in 40 CFR §257.97(b), for a groundwater corrective measure to be selected, it must meet the following criteria:

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to 40 CFR §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards for management of wastes as specified in 40 CFR §257.98(d).

Below, the corrective measures alternatives are evaluated against the required criteria.

5.1.1 Protective of Human Health and the Environment (§257.97(b)(1))

CCR material is classified as a non-hazardous Resource Conservation and Recovery Act (RCRA) solid waste, a determination confirmed in 40 CFR 257 Preamble part III.A. Nevertheless, Georgia Power has conservatively and protectively conducted a risk evaluation. A groundwater Risk Evaluation Report was prepared for AP-3 Landfill and Monofill and was submitted with the ACM document (Wood 2020). The Risk Evaluation Report has subsequently been updated to include groundwater and surface water monitoring data collected through August 2023 and October 2023, respectively, and is included as **Appendix B**. This evaluation is one of many lines of evidence evaluated herein and factored into the remedy selection process. The risk evaluation for the SSL-related constituents in groundwater at AP-3 Landfill and Monofill was conducted using methods consistent with GA EPD and USEPA guidance and included multiple conservative assumptions. Based on the evaluation, which assessed potential receptors and exposure pathways, cobalt observed in groundwater at AP-3 Landfill and Monofill is not expected to pose a risk to human health or the environment. The 2023 Risk Evaluation Report concluded that based on multiple lines of evidence and various conservative assumptions, further risk evaluation for groundwater or surface water is not warranted.

Accordingly, no further risk evaluation of groundwater or surface water is warranted in connection with the remedy selection process. In short, because no risk to human health or the environment currently exists, human health and the environment will be protected through implementation of any of the remedies being evaluated.

5.1.2 Attain the Groundwater Protection Standards (§257.97(b)(2))

The proposed remedies are each predicted attain the GWPS at the compliance boundary (waste boundary) and throughout the area of groundwater SSL exceedances. For each of the remedies retained, attainment of the GWPS is expected based on constituent transport evaluations. The groundwater flow and constituent transport evaluations, and associated input parameters, are described in detail in *Reactive Transport Model Report* included in **Appendix C.** These evaluations suggest that the GWPS can be met at the compliance boundary through monitored attenuation within approximately 27 years following closure by removal, in the absence of a more active remedy.

5.1.3 Control the Source of Release (§257.97(b)(3))

In connection with a groundwater remedy, the source of the contamination must be controlled to reduce or eliminate, to the maximum extent feasible, further releases. The following section describes how each potential remedy would, in the context of the planned unit closure, control the source of release.

Closure by removal will be completed safely, in compliance with applicable federal and state regulations, and is protective of public health and the environment. Closure by removal includes excavation of the CCR material and removal from AP-3 Landfill and Monofill. Physical removal of the CCR material would, over time, be supportive of concentrations of Appendix IV constituents in downgradient groundwater declining and overall groundwater concentrations attenuating.

As noted above, Georgia Power also plans to proactively utilize adaptive site management to support the remedial strategy and address potential changes in site conditions as appropriate.

For the purpose of groundwater remedy selection, the control provided by the closure by removal approach ensures that the control requirement would be met for all corrective measures being evaluated. None of the remedies being evaluated will interfere with the control provided by the closure, and Appendix IV constituents beyond the waste boundary that are present within the groundwater plume will be controlled by the groundwater remedy:

- **In-Situ Injection (ISI)** - Cobalt can be precipitated and/or immobilized under different combinations of pH and redox conditions. A variety of pH and/or redox-altering technologies are available which can incorporate biological processes, chemical oxidants and reductants, and/or mechanical processes such as air sparging. These processes chemically immobilize constituents in groundwater through precipitation and sorption, which effectively remove these constituents from groundwater, thereby controlling contaminant release/movement.
- **Pump-and-Treat (P&T)** - Hydraulic containment (or control) refers to the use of pumping (extraction) or injection to create a hydraulic gradient to capture or control the downgradient migration of impacted groundwater. Hydraulic containment would thereby limit potential contaminant release/movement to the capture zone.
- **Monitored Natural Attenuation (MNA)** - The natural attenuation processes that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in groundwater. As detailed in the Geochemical CSM Report provided in **Appendix A**, the primary mechanisms governing attenuation and immobilization of cobalt at AP-3 Landfill and Monofill are adsorption and co-

precipitation. MNA of cobalt does not rely solely on physical means of attenuation. These in-situ processes, applicable to inorganic constituents found in CCR material, effectively attenuate the movement of inorganic CCR constituents in groundwater, thereby controlling contaminant release/movement.

- **Permeable Reactive Barrier (PRB)** - A PRB is a zone of reactive material that extends below the water table to intercept and treat target groundwater. PRBs have proven to be effective in passively treating several inorganic constituents found at CCR sites, including cobalt (e.g., ITRC, 2011). These processes can essentially immobilize and/or precipitate such inorganic constituents, thereby controlling contaminant release/movement. Reagents utilized in a PRB at AP-3 Landfill and Monofill would be selected to enhance geochemical processes that attenuate cobalt.
- **Phytoremediation** - Phytoremediation is the use of specific plant species for their ability to degrade, immobilize, or contain certain constituents in soil, groundwater, surface water, and sediments. These processes can essentially immobilize and/or precipitate contaminates thereby controlling contaminant release/movement.

5.1.4 Removal of Contaminated Material from the Environment (§257.97(b)(4))

The remedial alternatives retained for further consideration in the ACM and ACM updates would be effective at removing Appendix IV constituents from groundwater, either through processes of physical removal, immobilization, or chemical attenuation in groundwater, as provided below:

The remedies considered herein remove contaminated material from the environment as follows:

- **In-Situ Injection (ISI)** - Cobalt can be precipitated and/or immobilized under different combinations of pH and redox conditions. A variety of pH and/or redox-altering technologies are available which can incorporate biological processes, chemical oxidants and reductants, and/or mechanical processes such as air sparging. These processes remove contamination from the environment by reducing the presence of contaminants in groundwater through immobilization and/or precipitation.
- **Pump-and-Treat (P&T)** - Hydraulic containment (or control) refers to the use of groundwater extraction to artificially induce a hydraulic gradient and capture or control the migration of impacted groundwater. This remedy would remove contamination from the environment by reducing the presence of contaminants in groundwater through withdrawal within the capture zone.
- **Monitored Natural Attenuation (MNA)** - The natural attenuation processes that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. Precipitation and sorption are the dominant mechanisms responsible for the reduction of mobility, toxicity, or bioavailability of inorganic contaminants, including cobalt. These processes remove contamination from the environment by reducing the presence of contaminants in groundwater.
- **Permeable Reactive Barrier (PRB)** - PRBs have proven to be effective in passively treating several inorganic constituents found at CCR sites, including cobalt (e.g., ITRC, 2011). PRBs rely on

physical and chemical processes such as sorption, reduction, or oxidation. These processes remove contamination from the environment by reducing the presence of contaminants in groundwater through immobilization and/or precipitation. Cobalt can be attenuated in a PRB through use of media that provides additional sorption sites and/or adjusts geochemical conditions to favor precipitation and adsorption reactions.

- **Phytoremediation** - Phytoremediation is the use of plants to degrade, immobilize, or contain constituents in soil, groundwater, surface water, and sediments. These processes remove contamination from the environment by reducing the presence of contaminants in groundwater through hydraulic control (e.g., use of plants deep root systems to provide migration control for groundwater plumes) and/or removal or degradation of groundwater contaminants through inherent transpiration mechanisms.

5.1.5 Comply with Waste Management Standards (§257.97(b)(5))

In accordance with 40 CFR §257.98(d), any waste generated during the implementation of any of the remedies under consideration would be managed in a manner that complies with any applicable requirements of the Resource Conservation and Recovery Act and the Georgia Comprehensive Solid Waste Management Act.

5.1.6 Evaluation of Required Criteria

Each of the five remedy alternatives were evaluated with respect to the required criteria. Results of this evaluation are summarized in **Table 5**.

Table 5. Summary of Required Criteria

REQUIRED CRITERIA	Corrective Measures				
	Alternative 1 In-Situ Injections (ISI)	Alternative 2 Pump and Treat (P&T)	Alternative 3 Monitored Natural Attenuation (MNA)	Alternative 4 Permeable Reactive Barrier (PRB)	Alternative 5 Phytoremediation/ TreeWell®
Be protective of human health and the environment	✓	✓	✓	✓	✓
Attain the groundwater protective standard	✓	✓	✓	✓	✓
Control the source of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of Appendix IV constituents into the environment	✓	✓	✓	✓	✓
Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems	✓	✓	✓	✓	✓
Management of waste to comply with all applicable RCRA requirements	✓	✓	✓	✓	✓

5.2 COMPARATIVE CRITERIA (§257.97(c))

This section compares the alternatives using the comparative criteria listed in 40 CFR §257.97(c). Each of the comparative criteria consists of several sub-criteria listed in the CCR Rule, which are considered in this remedy selection below. The goal of this analysis is to further evaluate the alternatives that meet the required criteria to support remedy selection. Consistent with 40 CFR §257.98(b), the selected and implemented remedy will be continually evaluated and, if warranted, modified consistent with adaptive management practices.

A graphic is provided within each subsection to provide a visual depiction of the favorability of each alternative, where dark green represents that the "option's performance under this criterion is *highly favorable*", medium green represents that the "option performs *favorably* under this criterion," and light green represents that the "option performs *less favorably* under this criterion."

5.2.1 Long- and Short-Term Effectiveness and Protectiveness

This comparative criterion takes into consideration the following sub-criteria relative to the long-term and short-term effectiveness of each remedy. Long-term effectiveness and protectiveness mean that the remedy will protect human health and the environment after the remedial objectives have been met.

The short-term effectiveness of a potential remedy relates to the protectiveness of human health and the environment during construction and implementation. The degree of protection and the time period to achieve remedial action objectives are also considered.

5.2.1.1 Magnitude of reduction of existing risks

As indicated by the nature and extent evaluation, the most recent groundwater and surface water sampling results, and the Risk Evaluation Report summarized in **Section 5.1.1**, Appendix IV constituents in groundwater and surface water from AP-3 Landfill and Monofill are not expected to pose a risk to human health or the environment. Therefore, this criterion is considered highly favorable for all remedial alternatives. In addition, each groundwater remedy retained for this comparative analysis will be effective at reducing concentrations to levels below the GWPS, as described in **Section 5.1.2** above.

5.2.1.2 Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy

AP-3 Landfill and Monofill closure through closure by removal provides effective source control, as described in **Section 5.1.3** above. As demonstrated by the results of the *Reactive Transport Model Report* **(Appendix C)**, each of the groundwater remedies retained for comparison will be effective at reducing the concentration of Appendix IV constituents in groundwater beyond the waste boundary to levels below the GWPS. Consequently, all remedies being evaluated perform similarly for purposes of this criterion and, therefore, this criterion is considered favorable for all remedies being evaluated.

5.2.1.3 The type and degree of long-term management required, including monitoring, operations, and maintenance

In accordance with 40 CFR §257.97(c)(1)(iii), this sub-criterion considers the long-term management of each groundwater remedy.

Alternative 3 (MNA) is highly favorable with respect to this criterion because it requires the least amount of long-term management and involves no mechanical systems as part of the remedy. Alternative 1 (ISI) and Alternative 4 (PRB) are considered favorable because the in-situ treatment systems will require long-term monitoring and possible reapplication/replenishment of reagent or amendment, but there will not be a permanent treatment system requiring operations and maintenance (O&M). Alternative 5 (phytoremediation) is considered favorable because it will require long term monitoring of the TreeWells® but minimal active maintenance is expected. Alternative 2 (P&T) requires ongoing O&M of the pumping and ex-situ treatment system and management of the withdrawn water;

this alternative is considered less favorable under this criterion when compared to the other alternatives.

5.2.1.4 Short-term risks that might be posed to the community or the environment during implementation of such a remedy

In accordance with 40 CFR §257.97(c)(1)(iv), this sub-criterion relates to the potential for threats to human health (including without limitation worker safety and the community) and the environment associated with remedy implementation.

Community impacts include general impacts to the community, such as potentially increased truck traffic on public roads during construction of the remedies, as well as increased vehicle emissions, resource consumption, and noise. Alternatives 2 and 4 (P&T and PRB) are considered less favorable since these alternatives will require construction beyond what is anticipated for the other alternatives. Alternative 2 (P&T) requires construction of a treatment system with conveyance piping, and management of treated water. For Alternative 4, the PRB construction will likely require trenching activities, off-site disposal of excavated soils, and import of low-permeability material over local roadways.

Alternatives 1 and 5 (ISI and phytoremediation) are considered favorable. While construction activities will occur, less infrastructure is required. Alternative 1 (ISI) will require management of nominal amounts of reagent waste associated with the in-situ treatment activities, which are anticipated to include injection of reagents through a series of closely spaced injection points. Alternative 5 (phytoremediation) will require the drilling of points to allow for the planned trees to have roots deep enough to intercept the contaminated groundwater and will also require the disposal and import of material. Minimal disturbance is anticipated with Alternative 3 (MNA); therefore, this alternative is considered highly favorable with respect to this criterion.

5.2.1.5 Time until full protection is achieved

In accordance with 40 CFR §257.97(c)(1)(v), the time until the GWPS is achieved for a period of three years in accordance with 40 CFR §257.98(c)(2), for each of the remedies was evaluated based on the transport modeling results or professional judgement, depending on the remedial alternative. Remedial alternatives that require less time to meet the GWPS at the waste boundary would be considered more favorable.

As previously stated, the risk evaluation for the SSL-related constituents in groundwater and surface water at AP-3 Landfill and Monofill was conducted using methods consistent with GA EPD and USEPA guidance and included multiple conservative assumptions and concluded that the impacts are not expected to pose a risk to human health or the environment; therefore, receptors are protected. The timeframes to achieve GWPS at the waste boundary were evaluated using a predictive groundwater flow and transport model, and all timeframes are considered reasonable. Based upon predictive modeling of post-closure conditions following removal of CCR material, under Alternative 3 (MNA), cobalt concentrations are expected to fall below the GWPS within approximately 27 years. MNA is expected to require the longest amount of time to achieve the GWPS; therefore, this alternative is considered less favorable under this criterion.

A sensitivity analysis of groundwater modeling results indicates that the timeframe required for attenuation of cobalt is dependent on groundwater flow velocity. Alternative 2 (P&T), which includes hydraulic containment and is less reliant on groundwater flow velocity, is predicted perform favorably,

dependent on the extent of the extraction well network and the availability of cobalt in the groundwater. Alternatives 1 (ISI) and 4 (PRB) leverage geochemical changes to accelerate attenuation and are also expected to perform favorably. Predictive modeling and treatability testing indicate that increasing pH results in rapid reductions in cobalt concentrations with less than one year required for cobalt concentrations to fall below GWPS. Pilot testing would be used to evaluate the longevity of Alternative 1 (ISI) and Alternative 4 (PRB). Alternative 5 (Phytoremediation) does not include geochemical manipulation and is expected to perform less favorably with respect to this criterion.

5.2.1.6 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

In accordance with 40 CFR §257.97(c)(1)(vi), this sub-criterion considers elements such as CCR material outside of the unit boundary or the handling of impacted groundwater encountered during construction and operation of the remedy.

Alternative 3 (MNA) and Alternative 1 (ISI) are considered highly favorable since potential exposure through contact with CCR-impacted material or groundwater is minimal. Alternative 2 (P&T) will require ongoing management of removed water; therefore Alternative 2 (P&T) is considered less favorable. Alternative 4 (PRB) will require excavation of soil and exposure to impacted groundwater during the placement of the PRB and is considered less favorable. Alternative 5 (phytoremediation) requires management of a relatively minimal amount of soils during installation, and is considered favorable.

5.2.1.7 Long-term reliability of the engineering and institutional controls

The following describes the overall long-term reliability for each of the proposed groundwater remedial alternatives (engineering controls) for purposes of comparison. Of note, the reliability of all alternatives is bolstered by the long-term reliability of the closure method and its expected positive effect on groundwater conditions.

Alternative 3 (MNA) is expected to have high long-term reliability and is considered highly favorable with respect to this criterion, as minimal long-term engineering controls are required. Alternative 2 (P&T) is considered to be a reliable technology and is expected to perform favorably relative to long-term reliability. Field pilot studies to evaluate potential for groundwater recovery and bench-scale testing to evaluate ex-situ treatment technologies would be used to confirm the efficacy, and this alternative relies on mechanical systems (groundwater pumping and treatment systems) to operate and maintain. Alternatives 1 and 4 (ISI and PRB) rely on geochemical approaches which have been demonstrated to be effective by treatability testing. These methods are considered to be favorable; however, these methods have uncertainties related to potential subsurface issues such as uneven substrate distribution and preferential flow paths. Additionally, the long-term reliability of any geochemical approach would be verified through pilot testing. Alternative 5 (phytoremediation) is considered less favorable since the remedy would involve field studies to evaluate effectiveness and would rely on maintenance of the trees.

5.2.1.8 Potential need for replacement of the remedy

Any need to replace a remedy would be based on a systematic site review during the remedy implementation process if warranted to improve remedy protectiveness, effectiveness or facilitate progress toward meeting remedial objectives. In accordance with 40 CFR §257.98(b), adaptive site

management practices will be used to modify or replace the remedy if the requirements of 40 CFR §257.97(b) are not being achieved.

Alternative 3 (MNA) is considered highly favorable, as it is the remedy with the lowest likelihood of requiring replacement because natural processes will reduce the concentration of Appendix IV constituents in groundwater over time. From the perspective of needing to replace the remedy, alternatives that rely on ex-situ treatment systems such as Alternative 2 (P&T) are considered more likely to require replacement than Alternative 3 (MNA) and are therefore considered favorable. Alternative 1 (ISI) and Alternative 4 (PRB), which rely on in-situ treatment to address cobalt, are considered favorable since the ability to treat groundwater is subject to the effectiveness and longevity of geochemical changes. In addition, Alternative 1 (ISI) and Alternative 4 (PRB) may create geochemical conditions that promote the mobilization or remobilization of other CCR constituents in groundwater. Effectiveness of Alternative 5 (phytoremediation) would be dependent on groundwater flow direction, groundwater preferential pathways, and behavior of cobalt under existing geochemical conditions. Alternative 5 (phytoremediation) is considered less favorable when compared to other alternatives. During the implementation process, all remedies will be evaluated for effectiveness and modified if remedial objectives are not being met, in accordance with adaptive site management practices and 40 CFR §257.98(b).

5.2.1.9 Long- and short-term effectiveness summary

Each of the five remedy alternatives were evaluated with respect to the long- and short-term effectiveness. Results of this evaluation are summarized in **Table 6**.

Table 6. Category 1 - Long- and Short-Term Effectiveness, Protectiveness, and Certainty of Success Summary

	Alternative 1 In-Situ Injection (ISI)	Alternative 2 Pump and Treat (P&T)	Alternative 3 Monitored Natural Attenuation (MNA)	Alternative 4 Permeable Reactive Barrier (PRB)	Alternative 5 Phyto-remediation
Sub-Criterion i Magnitude of reduction of risks					
Sub-Criterion ii Magnitude of residual risk in terms of likelihood of further release					
Sub-criterion iii Type and degree of long-term management required					
Sub-criterion iv Short term risk to community or environment during implementation					
Sub-criterion v Time until full protection is achieved					
Sub-criterion vi Potential for exposure of humans and environmental receptors to remaining wastes					
Sub-criterion vii Long-term reliability of engineering and institutional controls					
Sub-criterion viii Potential need for replacement of the remedy					
Summary					

Color Legend:

Option performs *highly favorably* under this criterion

Option performs *favorably* under this criterion

Option performs *less favorably* under this criterion

5.2.2 Source Control Effectiveness

This comparative criterion takes into consideration the ability of the remedy to control further releases. Physical removal of the CCR would, over time, be supportive of declining concentrations of Appendix IV constituents in groundwater downgradient of AP-3 Landfill and Monofill and improve overall groundwater quality. None of the corrective measures under consideration would interfere with or diminish the anticipated benefits of the closure method.

5.2.2.1 The extent to which containment practices will reduce further releases

Through closure by removal, CCR material will be removed from the AP-3 Landfill and Monofill. Since the CCR will be removed at the time of unit closure, the closure addresses the potential for further releases from the unit. Appendix IV constituents that are present in groundwater at or currently beyond the waste boundary will be controlled by the groundwater remedy. Therefore, all groundwater remedy alternatives are considered favorable for this sub-criterion.

5.2.2.2 The extent to which treatment technologies may be used

In accordance with 40 CFR §257.97(c)(2)(ii), alternatives that include more limited treatment approaches may be considered less favorable. Alternatives that rely on more extensive treatment approaches may be considered more favorable.

CCR will be removed from the AP-3 Landfill and Monofill during closure of the unit. Therefore, all groundwater remedy alternatives are considered favorable for this sub-criterion.

5.2.2.3 Source control effectiveness summary

Each of the five remedy alternatives were evaluated with respect to the effectiveness of source control. Results of this evaluation are summarized in **Table 7**.

Table 7. Category 2 - Source Control Effectiveness Summary

	Alternative 1 In-Situ Injection (ISI)	Alternative 2 Pump and Treat (P&T)	Alternative 3 Monitored Natural Attenuation (MNA)	Alternative 4 Permeable Reactive Barrier (PRB)	Alternative 5 Phyto-remediation
Sub-criterion i Extent to which containment practices will reduce further releases					
Sub-criterion ii Extent to which treatment technologies may be used					
Summary					

Color Legend:

Option performs *highly favorably* under this criterion

Option performs *favorably* under this criterion

Option performs *less favorably* under this criterion

5.2.3 Ease of Implementation

This comparative criterion takes into consideration technical and logistical challenges required to implement a remedy, including practical considerations such as equipment availability and disposal facility capacity.

5.2.3.1 Degree of difficulty associated with constructing the technology

This sub-criterion considers the relative technical difficulty between implementing each of the remedies.

Alternative 3 (MNA) is considered highly favorable since the infrastructure required for implementation of a long-term monitoring program to confirm attenuation is already in place at the site. Alternative 2 (P&T) is considered less favorable since the hydraulic containment system and ex-situ treatment will involve additional treatability testing and field pilot studies. Alternative 4 (PRB) is considered less favorable due to challenges associated with wall construction in the subsurface and limited access to the relevant area. Implementation of Alternatives 1 and 5 (ISI and phytoremediation) are less challenging; however, pilot studies will be used to develop designs, and these alternatives are therefore considered to be favorable.

5.2.3.2 Expected operational reliability of the technologies

This section compares the operational reliability of each of the proposed remedies in accordance with 40 CFR §257.97(c)(3)(ii). Typically, remedies that do not require the installation of significant infrastructure are generally more reliable and do not require significant O&M; however, more complex remedies that rely on groundwater flow or geochemical manipulation or mechanical systems would be considered less favorable.

Alternative 3 (MNA) is considered highly favorable from an operational perspective because MNA has a proven track record and only requires long-term monitoring following implementation. While Alternative 2 (P&T), is expected to be reliable, this alternative will utilize pumping of wells, associated piping, and an ex-situ treatment system with ongoing O&M. Therefore, P&T is considered less favorable with respect to this criterion. Alternative 4 (PRB) is considered favorable due to the potential for preferential flow paths to develop in the reactive barrier and/or the potential need to replace reactive materials. Alternative 1 (ISI) will include in-situ treatment and subsequent monitoring and is therefore considered favorable from a reliability standpoint. Alternative 5 (phytoremediation) will rely on a tree system requiring some maintenance and can be less favorable from a reliability standpoint.

5.2.3.3 Need to coordinate with and obtain necessary approvals and permits from other agencies

Section 40 CFR §257.97(c)(3)(iii) requires consideration be given and compared between remedies regarding the various agencies and type of permits that would be required for implementation of the groundwater remedy. A remedial alternative that could require several permits (for example, a P&T system) would be considered less favorable when compared to a remedial alternative that would require fewer permits (for example, MNA).

Alternative 3 (MNA) is highly favorable since the implementation does not require additional permitting. The remaining alternatives will require additional permitting and approvals for field scale pilot testing, groundwater discharge or injection, groundwater treatment, and/or management of secondary material streams. Alternative 2 (P&T) is considered less favorable since it will potentially require permitting of extraction wells and regulatory approval of discharge/management methods for the resulting treated water stream.

5.2.3.4 Availability of necessary equipment and specialists

Typically, remedies that could be implemented by local contractors and without specialty contractors or experts may be considered more favorable. Consideration should be given to specialty contractor/consultant proximity to the CCR unit, contractor or equipment availability, and the effectiveness of the proposed remedy on similar sites.

Alternative 3 (MNA) is highly favorable since specialty equipment will not be required to implement the MNA remedy. Alternative 1 (ISI) is considered to be favorable since specialists will be used to pilot test, design, and implement the in-situ treatment system for cobalt while not altering the existing and otherwise favorable subsurface geochemical conditions. Although significant quantities of reagents may be required for injections, well construction and injection techniques are common. Alternative 2 (P&T) will require equipment for drilling, recovery well installation, construction of groundwater conveyance systems, and an ex-situ treatment system and is considered less favorable. While identifying qualified contractors should not present a great challenge, supply chain issues could be a challenge and pilot testing and bench-scale testing will be involved to confirm treatment prior to full-scale implementation.

Alternative 4 (PRB) is considered less favorable because it would require specialized equipment and media for installing the PRB, and supply-chain issues could present a challenge for implementation. Alternative 5 (phytoremediation) would involve engaging a specialist for design and testing, and use of specialized equipment (TreeWells® and live trees) for the installation of the treatment system and is considered less favorable.

5.2.3.5 Available capacity and location of needed treatment, storage, and disposal services

This sub criterion (40 CFR §257.97(c)(3)(v)) considers disposal options for materials generated by the groundwater remedy and land area that is available for implementation of the remedy.

Alternative 3 (MNA) is considered highly favorable since no additional treatment, storage, or disposal services are anticipated. Alternative 2 (P&T) is considered less favorable since it includes ex-situ treatment, and operation of a treatment system may generate materials requiring off-site management. Alternative 1 (ISI) is considered favorable since treatment will be in-situ, no additional material streams will be generated, and suitable land area is available for the injection well installations. Alternative 4 (PRB) will generate a large volume of soil during construction which would need to be managed and is less favorable with respect to this criterion. Alternative 5 (phytoremediation) is favorable, however installation of the TreeWells® will result in generation of soil that will require management.

5.2.3.6 Ease of implementation summary

Each of the five remedy alternatives were evaluated with respect to the ease of implementation. Results of this evaluation are summarized in **Table 8**.

Table 8. Category 3 - Ease of Implementation Summary

	Alternative 1 In-Situ Injection (ISI)	Alternative 2 Pump and Treat (P&T)	Alternative 3 Monitored Natural Attenuation (MNA)	Alternative 4 Permeable Reactive Barrier (PRB)	Alternative 5 Phyto-remediation
Category 3 – Sub-criterion i Degree of difficulty associated with constructing the technology					
Category 3 – Sub-criterion ii Expected operational reliability of the technologies					
Category 3 – Sub-criterion iii Need to coordinate with and obtain necessary approvals and permits from other agencies					
Category 3 – Sub-criterion iv Availability of necessary equipment and specialists					
Category 3 – Sub-criterion v Available capacity and location of needed treatment, storage, and disposal services					
Summary					

Color Legend:

Option performs *highly favorably* under this criterion

Option performs *favorably* under this criterion

Option performs *less favorably* under this criterion

5.2.4 Evaluation of Comparison Criteria

The various sub-criteria were evaluated, and relative comparisons were made between the remedial alternatives to determine which remedy or remedies would be expected to be the most and least favorable regarding each of the criteria. The results of this comparison are included in **Table 9** for all the Comparison Criteria.

Table 9. Summary of Comparison Criteria

	Alternative 1 In-Situ Injection (ISI)	Alternative 2 Pump and Treat (P&T)	Alternative 3 Monitored Natural Attenuation (MNA)	Alternative 4 Permeable Reactive Barrier (PRB)	Alternative 5 Phyto-remediation
Category 1 Long- and Short-Term Effectiveness, Protectiveness, and Certainty of Success					
Category 2 Effectiveness in controlling the source to reduce further releases					
Category 3 Ease of implementation					

Color Legend:

Option performs *highly favorably* under this criterion

Option performs *favorably* under this criterion

Option performs *less favorably* under this criterion

5.3 PUBLIC MEETING AND COMMUNITY ENGAGEMENT

As noted in **Section 2.1**, this criterion will be addressed in the Final Remedy Selection Report ultimately submitted to GA EPD after a public meeting.

6. Proposed Remedy Selection

This section provides a summary of the selected groundwater remedy and provides a schedule for remedy implementation in accordance with 40 CFR §257.97(d). Georgia Power also plans to proactively utilize adaptive site management to support the remedial strategy and address potential changes in site conditions, as appropriate. Under an adaptive site management strategy, a remedial approach will be selected whereby: (1) a corrective measure will be installed or implemented to address current conditions; (2) the performance of the corrective measure will be monitored, evaluated, and reported semiannually; (3) the site conceptual model will be updated as more data are collected; and (4) adjustments and augmentations will be made to the corrective measure(s), as needed, to assure that performance criteria and site remedial objectives are met.

6.1 SUMMARY OF PROPOSED REMEDY SELECTION

The closure by removal of AP-3 Landfill and Monofill will provide effective source control such that groundwater quality downgradient of AP-3 Landfill and Monofill is expected to improve over time with decreasing concentrations of Appendix IV constituents. Based on the evaluation of corrective measures and the comparative criteria included in §257.97(c), the primary proposed remedy for the cobalt SSL is performing ISI to effect a geochemical shift in the aquifer, influencing the behavior of cobalt in groundwater. Additionally, MNA processes will be incorporated to further reduce concentrations of cobalt.

In-situ treatment can be accomplished through reagent injections and constitutes a remediation technology for inorganic constituents, such as cobalt. Cobalt can be precipitated or sorbed/immobilized under different combinations of pH and oxidation-reduction (redox) conditions. In-situ treatment is being selected as a corrective measure for cobalt in groundwater at AP-3 Landfill and Monofill given the long-term and short-term effectiveness and likelihood of success, as predicted by reactive transport modeling and demonstrated by treatability testing results.

MNA relies on natural attenuation processes to reduce dissolved concentrations of inorganic constituents in groundwater. Attenuation of cobalt at AP-3 Landfill and Monofill, is primarily due to adsorption and co-precipitation and does not rely solely on physical (e.g., dilution, dispersion, flushing, and related processes) means of attenuation. MNA was selected for cobalt remediation primarily due to its long- term effectiveness, as predicted by reactive transport modeling, and ease of implementation.

Prior to implementation of in-situ injections, an in-situ pilot study will be performed to confirm site-specific design criteria, such as radius of influence, reagent effectiveness, and dosage. In-situ injection will be performed either via permanent injection wells or direct push technology (temporary points) and may be include multiple rounds of injections. A conceptual layout for in-situ injection is illustrated on **Figure 7A**. The exact configuration and frequency of injection will be based on results of the pilot study and design parameters. Groundwater monitoring will be performed to evaluate the performance of the remedy and adaptive site management practices will be incorporated into the data review process.

6.2 SCHEDULE

In accordance with 40 CFR §257.97(d), the following factors were considered when developing the schedule:

- **Extent and nature of contamination**: The size of the relevant area in groundwater is directly related to the time required to implement remediation. The horizontal and vertical extent of cobalt present in groundwater above the GWPS has been delineated, as described in **Section 2** of this report, and is limited to a small area around ARGWC-17, located between the two CCR units in the permitted area. The selected remedy will address the impacts to groundwater and adaptive site management practices will be utilized to evaluate whether to modify the remedial approach.
- **Reasonable probabilities of remedial technologies in achieving compliance with the GWPS and other remedial objectives**: Based on results of reactive transport modeling and treatability testing, the selected remedy (in-situ treatment with MNA) is expected to achieve compliance with the GWPS within one year following completion of injections. As considered in **Section 5** of this report, the proposed remedy is expected to address Appendix IV constituents in groundwater. In the event that adequate progress is not made towards achieving the GWPS, Georgia Power will enlist adaptive management strategies to modify the remedial approach, in accordance with 40 CFR §257.98(b). Site and remedy-specific performance metrics will be developed and documented in the Corrective Action Groundwater Monitoring Plan.
- **Availability of treatment or disposal capacity for CCR managed during remedy implementation**: Georgia Power has identified and pre-qualified a disposal facility with capacity to accept material that will be generated during implementation of the remedy. Accordingly, this factor has been accounted for and should not have a material impact on the project schedule.
- **Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy**: As described in **Section 5.1.1** of this report, the Risk Evaluation for the SSL-related constituents in groundwater and surface water at AP-3 Landfill and Monofill was conducted using methods consistent with GA EPD and USEPA guidance, included multiple conservative assumptions, and concluded that groundwater and surface water conditions are not expected to pose a risk to human health or the environment. These results are detailed in **Appendix B**. Therefore, this factor should not have a material impact on the project schedule. Additional risks that may be present during remedy implementation were considered in **Section 5** of this report, as required under 40 CFR §257.97(c)(1).
- **Resource value of the aquifer**: As summarized in **Section 5.1.1** of this report and detailed in the Risk Evaluation (**Appendix B**), cobalt is not expected to pose a risk to human health and the environment. As such, considerations related to an alternative drinking water supply or interim remedial measure, as outlined in 40 CFR §257.98(a)(3), are not currently necessary or expected to become so. Further, Georgia Power will retain ownership of the Plant Arkwright property and future development for non-industrial purposes is not currently anticipated. Because cobalt is not expected to pose a risk to human health or the environment, this factor should not have a material impact on the project schedule.

The schedule for implementing and completing the groundwater remedial activities is described below. The general approach and implementation schedule will be modified based on new groundwater quality data obtained during the remedial implementation process, following adaptive site management practices and in accordance with 40 CFR §257.98(b).

6.2.1 Planning and Design

Following GA EPD approval of the selected remedy, approximately 24 months will be required to design the selected remedy and develop a corrective action plan. Significant planning and design activities include:

- **Pre-design Investigation**: A field pre-design investigation (PDI) will be conducted to characterize and refine the treatment area. This investigation will provide valuable data for the design of geochemical injections and provide additional refinement of the plume extent. Samples may be collected for additional treatability testing to refine reagent dosing. Permanent wells may be installed for further aquifer characterization and could serve as pilot testing injection points or performance monitoring wells. The field component of the PDI will take approximately 2 to 4 months to complete.
- **Pilot Study**: To expedite remedy design and implementation, Georgia Power requests written concurrence from GA EPD to initiate pilot studies following receipt of the Draft Remedy Selection Report. Following receipt of GA EPD concurrence to proceed, a pilot study workplan for AP-3 Landfill and Monofill will be developed, submitted to GA EPD for approval, and implemented at a pilot study area near ARGWC-17. Prior to implementation of the pilot study workplan, a Pilot Test Notification form will be prepared and submitted to the GA EPD for review and approval. The form will be submitted to GA EPD a minimum of 30 days prior to initiation of the pilot test. The pilot study will evaluate injection delivery, spacing, and other criteria requiring evaluation for final design. Pilot study injections are expected to occur over one-month period with an additional 8 to 10 months of performance monitoring and assessment. The pilot study will be conducted consistent with adaptive site management practices. As such, a second phase pilot study may be implemented prior to completion of the anticipated 8 to 10-months of performance monitoring and prior to finalizing the injection design.
- **Finalize Design and Corrective Action Plan**: Following completion of the pilot study, a corrective action plan, including detailed remedy design will be prepared and submitted to GA EPD as an attachment to the Corrective Action Groundwater Monitoring Plan (CAMP). While design activities will be concurrent with the previously listed activities, the final design and corrective action plan will not be finalized until successful completion of the pilot study. The CAMP will outline steps to ensure that these key objectives are met. Specifically, the plan will define how the monitoring well data, Site conditions, and statistical analysis will be routinely evaluated. Should these data call the efficacy of the selected remedy (ISI with MNA) into question, Georgia Power will reassess alternative technologies. Concurrent with the preparation of the CAMP, a full-scale UIC permit application will be submitted to GA EPD for approval.

6.2.2 Construction and Implementation

Given the small footprint of the treatment area, a relatively small number of injection points is anticipated. Following GA EPD concurrence, establishing the injection and performance monitoring well network is anticipated to take approximately 2 to 6 months, with geochemical injections occurring over the following 2 to 4 months. The injections are anticipated to reduce concentrations below GWPS and facilitate MNA. Additional performance monitoring wells may be necessary to evaluate groundwater geochemistry and whether conditions favorable for MNA will be maintained. The duration of construction and implementation may vary based on the results of the pre-design investigation and other design activities. Following injections, groundwater will be monitored to evaluate the effectiveness of the remedy.

6.2.3 Operation

While the estimated timeframe will be refined during design, it is anticipated that the geochemical injection phase of the remedy may only require 6 months to a year of operation. The need for additional injections will be evaluated as part of pilot testing, and the anticipated duration of the injection phase may be adjusted based on results.

Following the injection phase, operational requirements will be limited to groundwater performance monitoring. In total, it is estimated based on reactive transport modeling and treatability testing that less than 2 years from initiation of injections will be required to achieve GWPS.

The groundwater remedy will be considered complete when the GWPS is achieved for a minimum of 3 years. In accordance with adaptive site management practices and 40 CFR §257.98(b), the groundwater remedy will be modified if it is determined that the site goals are not being met or will not be met.

6.3 REPORTING

In accordance with 40 CFR §257.105(h), Georgia Power will place the Final Remedy Selection Report into the AP-3 Landfill and Monofill operating record and post the document to Georgia Power's publicly accessible internet site. Thereafter, Georgia Power will develop a corrective action groundwater monitoring program and implement and report on the selected remedy in accordance with applicable regulatory requirements.

7. References

Clark, W.Z. and Zisa A.C., 1976, *Physiographic Map of Georgia, Georgia Department of Natural Resources*. 1976.

EPRI, 2018. *Technical Report - Framework and Demonstration for Monitored Natural Attenuation at Coal Combustion Product Sites*. 2018.

GA EPD, 2018. *Risk Reduction Standards*. Georgia Comp. R. & Regs, Rule 391-3-19-07, revised September 25, 2018.

Gatliff et al 2016. *Chapter 23- Phytoremediation of Soil and Groundwater: Economic Benefits Over Traditional Methodologies*, Bioremediation and Bioeconomy, 2016.

Global Facility for Disaster Reduction and Recovery (GFDRR). "ThinkHazard!" June 30, 2020. Think Hazard - Taylor - Earthquake. Accessed November 30, 2023.

Hessler, C.W., C.J. Thurmond & W.G., Hester (1983). Groundwater in the greater Atlanta region, Georgia. Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey. Information Circular 63.

Hooper R.J. and R.D. Hatcher (1990). Ocmulgee Fault: the piedmont-avalon terrane boundary in central Georgia. Geology(1990) 18 (8): 708–711.

ITRC (Interstate Technology & Regulatory Council), 2011, Permeable Reactive Barrier: Technology Update, Washington D.C.: Interstate Technology & Regulatory Council, PRB: Technology Update Team.

Jacobs, 2018. *Limited Hydrogeological Assessment Report for Inactive CCR Landfill- Former Plant Arkwright- AP-3 Landfill* and Monofill. November 2018.

LeGrand, H. E. 1962, *Geology and Ground-water Resources of the Macon Area, Georgia. The Geological Survey Bulletin No. 72.* 1962.

Miller, J. A, 1990. Ground Water Atlas of United States – Alabama, Florida, Georgia, and South Carolina, Paper HA-730-G. United States Geological Survey.

Sanitas: *Groundwater Statistical Software, Sanitas Technologies, Shawnee, KS*, 2007. www.sanitastech.com

Southern Company Services, Inc., 2005, *Plant Arkwright Ash Ponds 2 and 3 and Ash Monofill Site Acceptability Report, Revision 1*

Stantec, 2022a. *2022 Annual Groundwater Monitoring and Corrective Action Report- Plant Arkwright Ash Pond 3 Landfill and Monofill.* July 2022.

Stantec, 2022b. *2022 Semi-Annual Remedy Selection and Design Progress Report- Plant Arkwright Ash 3 Landfill and Monofill*. July 2022.

Stantec, 2022c. *2022 Semi-Annual Remedy Selection and Design Progress Report- Plant Arkwright Ash 3 Landfill and Monofill*. February 2022.

Stantec, 2023a. *2023 Semi-Annual Remedy Selection and Design Progress Report- Plant Arkwright Ash Pond 3 Landfill and Monofill*. July 2023

Stantec, 2023b. *2023 Semi-Annual Remedy Selection and Design Progress Report- Plant Arkwright Ash Pond 3 Landfill and Monofill*. February 2023.

Stantec, 2023c. *2022 Semi- Annual Groundwater Monitoring and Corrective Action Report- Plant Arkwright Ash Pond 3 Landfill and Monofill*. February 2023.

Stantec, 2023d. *2023 Annual Groundwater Monitoring and Corrective Action Report- Plant Arkwright Ash Pond 3 Landfill and Monofill*. July 2023.

US EPA (1989). *Interim final RCRA facility investigation (RFI) guidance - soil, ground water and subsurface gas releases*, Vol. II of IV. USEPA Waste Management Division Office of Solid Waste. EPA 530/SW-89-031. (OSWER DIRECTIVE 9502.00-6)

USEPA, 2007. *Monitored Natural Attenuation of Inorganic Contaminants in Ground Water. Volume 1: Technical Basis for Assessment. Office of Research and Development*. EPA/600/R-07/139. October 2007.

USEPA, 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Resource Conservation and Recovery – Program Implementation and Information Division. March 2009.

USEPA, 2011. *Region* IV *Data Validation Standard Operating Procedures.* Science and Ecosystem Support Division. Region IV. Athens, GA. September 2011.

USEPA, 2015. Federal Register. Volume 80. No. 74. Friday April 17, 2015. Part II. Environmental Protection Agency. *40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule.* [EPA-HQ-RCRA–2009–0640; FRL–9919–44– OSWER]. RIN–2050–AE81. April 2015.

USEPA. 2015. *Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites.* USEPA Office of Solid Waste and Emergency Response. Directive 9283.1-36. August 2015.

USEPA, 2017. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. OLEM 9355.0-135 [EPA-540-R-2017-001]. Washington, DC. January 2017.

Wood, 2020. *Assessment of Correct Measures Report – Georgia Power Company – Plant Arkwright Ash Pond 3 Landfill and Monofill*. December 2020.

Wood, 2021a. *2021 Semi-Annual Groundwater Monitoring and Corrective Action Report -Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill*. February 2021.

Wood, 2021b. *Semi-Annual Remedy Selection and Design Progress Report- Georgia Power Company – Plant Arkwright Ash Pond 3 Landfill and Monofill*. July 2021.

Wood, 2021c. *2021 Annual Groundwater Monitoring and Corrective Action Report -Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill*. July 2021.

Wood, 2022a. *Semi-Annual Remedy Selection and Design Progress Report- Georgia Power Company – Plant Arkwright Ash Pond 3 Landfill and Monofill*. February 2022.

Wood, 2022b. *2021 Semi-Annual Groundwater Monitoring and Corrective Action Report -Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill*. February 2022.

TABLES

Table 1.
Groundwater Monitoring System Summary
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Well	Installation Date	Northing [1]	Easting [1]	Top of Casing Elevation (feet NAVD88)[2][3]	Ground Surface Elevation (feet NAVD88)[2][3]	Top of Screen Elevation (feet NAVD88)[4]	Screen Bottom Elevation (feet NAVD88)[4]	Screen Length (feet)	Total Well Depth on Construction Log (ft below land surface)	Water Bearing Zone Screened	Hydraulic Location
Detection Monitoring Wells											
ARGWA-3	12/9/1992	1066899.39	2437431.05	388.33	386.53	356.2	346.2	10.0	40.5	Overburden	Upgradient
ARGWA-5	1/10/1994	1066885.12	2437209.22	376.15	373.51	353.8	343.8	10.0	30.0	Overburden	Upgradient
ARGWA-12	12/10/2008	1067003.79	2436788.45	372.72	369.27	349.2	339.2	10.0	30.3	Bedrock	Upgradient
ARGWA-13	12/11/2008	1065951.25	2438129.93	371.57	368.10	337.7	327.7	10.0	40.7	Bedrock	Upgradient
ARGWA-14	2/4/2009	1066023.70	2438384.80	388.25	384.94	339.3	329.3	10.0	56.0	Bedrock	Upgradient
ARGWA-24[5]	11/12/2020	1066895.28	2437012.63	373.75	370.85	355.9	345.9	10.0	25.3	Overburden	Upgradient
ARGWC-7	12/11/2003	1064410.59	2438355.19	352.42	348.97	314.2	304.2	10.0	46.5	Overburden	Downgradient
ARGWC-8	12/10/2003	1064521.98	2437572.92	355.53	352.19	322.6	312.6	10.0	40.5	Overburden	Downgradient
ARGWC-9	12/9/2003	1065139.64	2437297.96	367.07	363.44	338.6	328.6	10.0	36.5	Overburden	Downgradient
ARGWC-10	12/9/2003	1065419.44	2437192.51	370.67	367.56	342.6	332.6	10.0	41.5	Overburden	Downgradient
ARGWC-15	12/4/2008	1065475.43	2438360.90	375.64	371.76	342.1	332.1	10.0	40.0	Bedrock	Downgradient
ARGWC-16	12/15/2008	1065263.69	2438174.15	364.90	361.52	340.2	330.2	10.0	31.6	Bedrock	Downgradient
ARGWC-17	12/4/2008	1065458.82	2438009.52	368.24	365.04	344.5	334.5	10.0	30.9	Overburden	Downgradient
ARGWC-18	11/19/2008	1064482.45	2437961.15	355.20	351.92	314.1	304.1	10.0	48.1	Overburden	Downgradient
Assessment Monitoring Well											
ARAMW-4	11/15/2019	1065463.83	2438004.43	367.86	364.56	320.6	310.6	10.0	54.0	Bedrock	Downgradient
Piezometers											
ARAMW-3	11/25/2019	1064530.73	2437569.81	355.39	352.20	298.2	288.2	10.0	64.0	Bedrock	Downgradient
ARAMW-6	11/25/2019	1064439.35	2437606.99	337.46	334.23	314.2	304.2	10.0	30.0	Overburden	Downgradient

Notes:

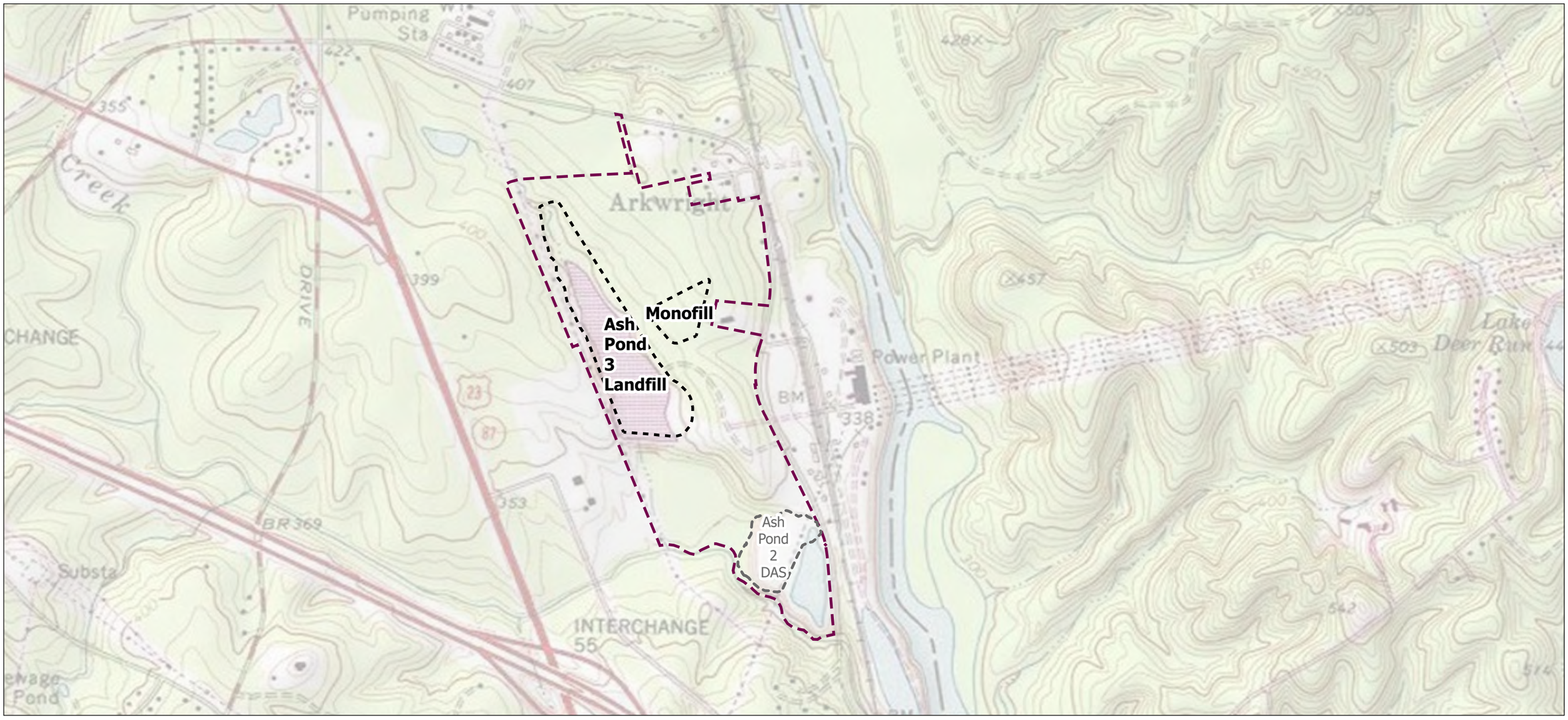
1. Horizontal locations referenced to Georgia State Plane West, North American Datum (NAD) of 1983 surveyed in June 26, 2020.
2. Vertical elevations are feet referenced to North American Vertical Datum of 1988 (NAVD88).
3. Elevations updated with revised survey certified by Donaldson & Garrett Associates on June 26, 2020.
4. Screen elevations calculated using Ground Surface Elevation surveyed on June 26, 2020.
5. ARAMW-24 was surveyed by Donaldson & Garrett Associates and certified on December 18, 2020.

Table 4. Remedy Evaluation Summary
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, GA

Technology	Description	Retain Technology for Further Evaluation?
Geochemical Approach (In-Situ Injection)	In-Situ treatment through injection of a reagent to change geochemical conditions and precipitate or sorb/immobilize cobalt.	Yes
Hydraulic Containment (Pump and Treat [P&T])	Use of groundwater extraction wells to induce a hydraulic gradient that will capture or control the migration of impacted groundwater downgradient.	Yes
Monitored Natural Attenuation (MNA)	Reliance on natural attenuation processes to reduce concentrations in groundwater to achieve remediation objectives.	Yes
Permeable Reactive Barrier (PRB)	Installation of a permeable subsurface wall containing reactive media to remove constituents as groundwater passes through the subsurface.	Yes
Phytoremediation	Use of trees or other plants to uptake or immobilize constituents or achieve hydraulic control without need for an above-ground treatment system.	Yes
Subsurface Barrier Walls	Use of subsurface barriers to control and/or alter the flow and migration of impacted groundwater.	No. Barrier wall was removed from consideration due to uncertainties in site layout post closure and potential lack of space available to install a barrier wall downgradient of monitoring wells where constituents exceed GWPS.

Acronyms and Abbreviations:
GWPS = groundwater protection standard

FIGURES



Legend

- Approximate Property Boundary
- Ash Pond 2 Dry Ash Stockpile (DAS) (approximate location)
- Ash Pond 3 Landfill and Monofill (approximate location)

0 1,000 2,000 Feet

(At original document size of 11x17)
1:12,000

N

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
1

Title
Site Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Site Boundary and Ash Pond Boundaries provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Copyright:© 2013 National Geographic Society, i-cubed, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Legend

- Assessment Monitoring Well
- Detection Monitoring Well
- Piezometer
- Porewater Piezometer
- Surface Water Sampling Location
- Stantec September-October 2022 Overburden Sample
- Wood September 2021 Overburden Sample
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Stantec

Georgia Power

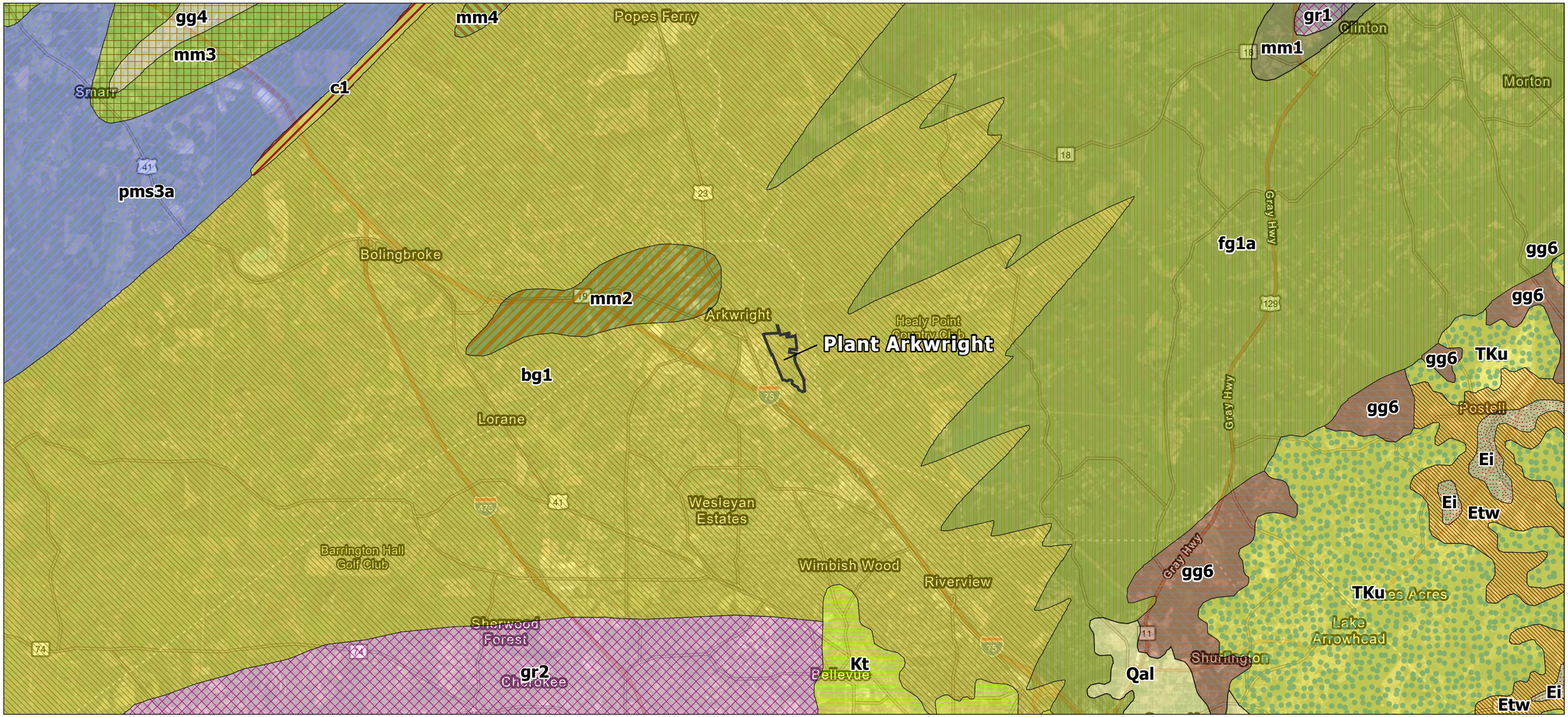
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
2

Title
Groundwater Monitoring System and Sampling Locations Map



Legend

Approximate Property Boundary

Geology

- bg1 - Biotite Gneiss
- c1 - Mylonite & Ultramylonite
- Ei - Irwinton Sand
- Etw - Twiggs Glay
- fg1a - Biotite Granite Gneiss/Feldspathic Biotite Gneiss/Amphibolite-Hornblende Gneiss
- gg4 - Granite Gneiss/Amphibolite
- gg6 - Granite Gneiss/Granite
- gr1 - Granite Undifferentiated
- gr2 - Granite/Granite Gneiss
- Kt - Tuscaloosa Formation
- mm1 - Amphibolite
- mm2 - Hornblende Gneiss
- mm3 - Hornblende Gneiss/Amphibolite
- mm4 - Hornblende Gneiss/Amphibolite/Granite Gneiss
- pms3a - Mica Schist/Gneiss/Amphibolite
- Qal - Stream Alluvium
- TKu - Lower Teriary-Cretaceous Undifferentiated

0 1.5 3 Miles

(At original document size of 11x17)
1:95,040

N

Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Site Boundary provided by Southern Company Services and Wood Environment & Infrastructure, Geologic Information obtain from https://mrdata.usgs.gov/geology/state/state.php?state=GA
3. Background: Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
3

Title
Geologic Map of General Area

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- CPT Sounding
- Direct Push Boring
- Stantec SPT Boring
- Jacobs SPT Boring
- Sonic Boring
- Wood September 2021 Overburden Sample
- Cross Section Alignment
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Monitoring Wells, Property Boundary, Topography, and Beaverdam Creek provided by Southern Company Services and Wood Environment & Infrastructure Solutions; Contours, Flow Arrow, and Ocmulgee River provided by Stantec
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Stantec

Georgia Power

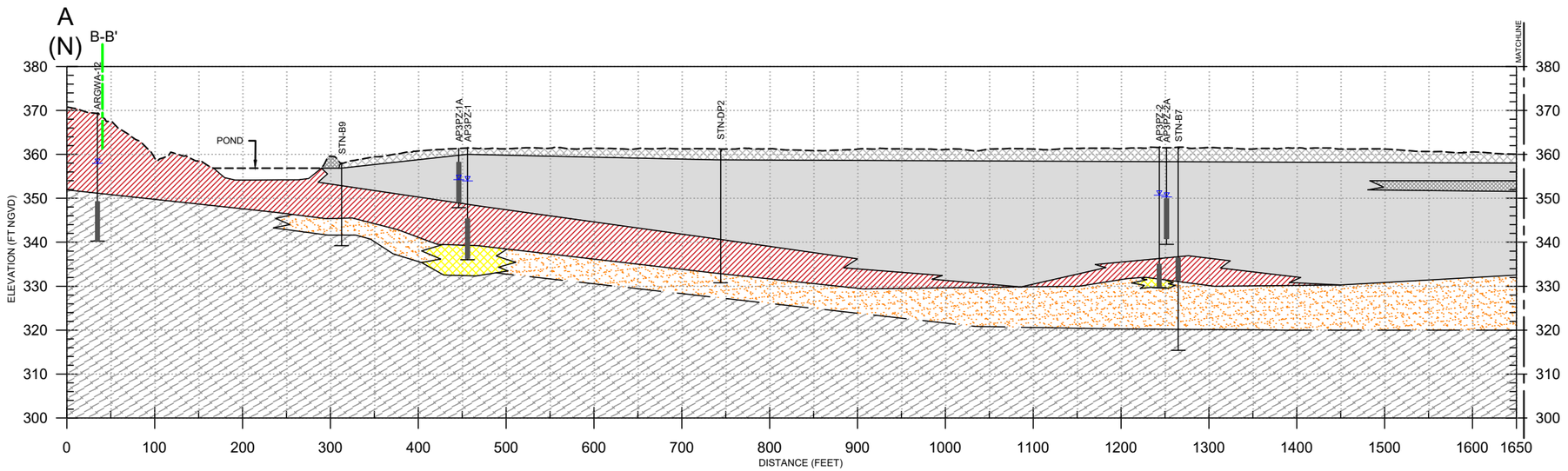
Project Location
Macon, Georgia

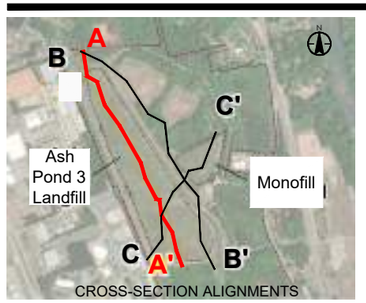
Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
4

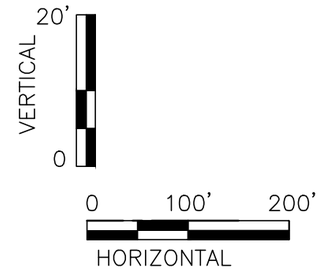
Title
Cross Section Layout Map





LEGEND

- LINER/CAP = SOIL LINER OR SOIL/ GEOSYNTHETIC CAP UNIT
- FILL
- COAL COMBUSTION RESIDUALS
- NATIVE SOILS
- SAPROLITE
- PARTIALLY WEATHERED ROCK (PWR)
- BIOTITE-GNEISS BEDROCK
- MONITORING WELL/PIEZOMETER SCREEN INTERVAL
- OVERBURDEN SAMPLE INTERVAL
- MEASURED GROUNDWATER ELEVATION (JANUARY 31, 2023)
- CROSS-SECTION INTERSECTION
- INTERPOLATED OR INFERRED MATERIAL CONTACT LINE



Stantec

Georgia Power

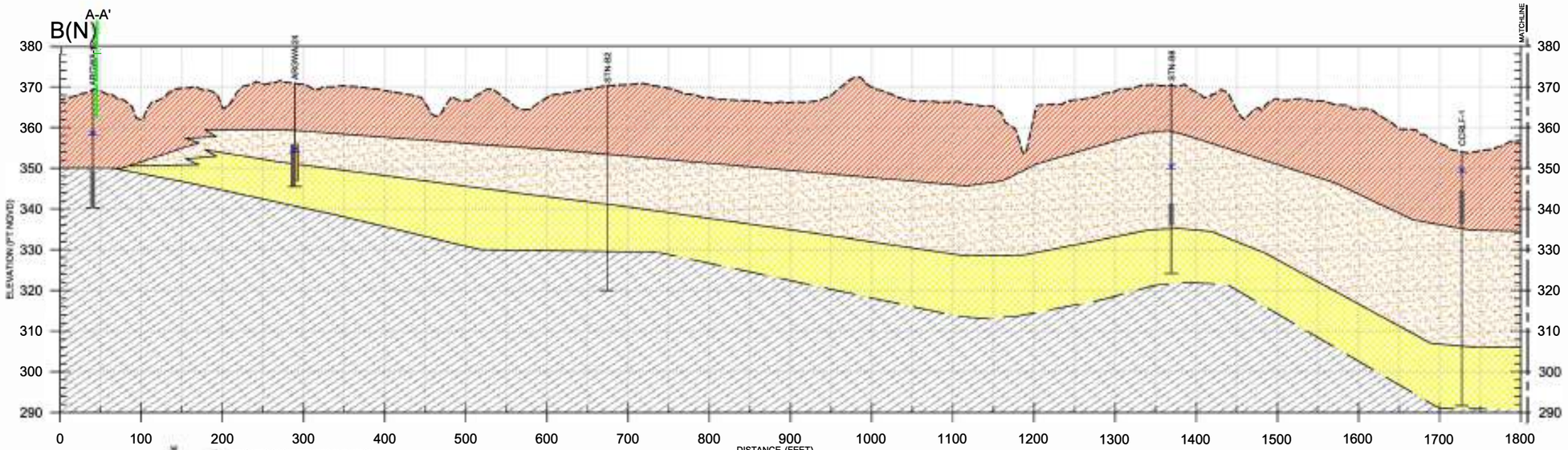
Project Location
Macon, Georgia

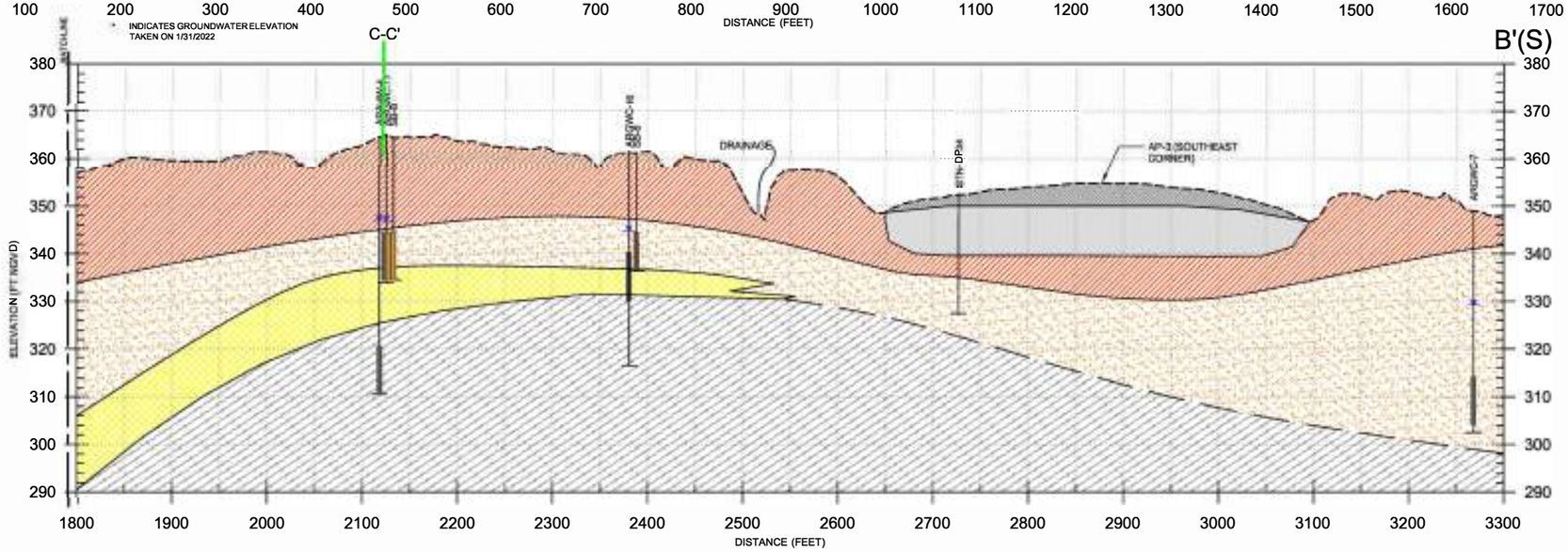
Prepared by VEN on 8/30/2023
TR by PD on 8/30/2023
IR by ES on 8/30/2023

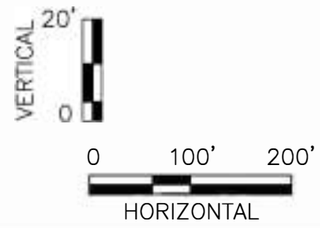
Client/Project
172678281
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

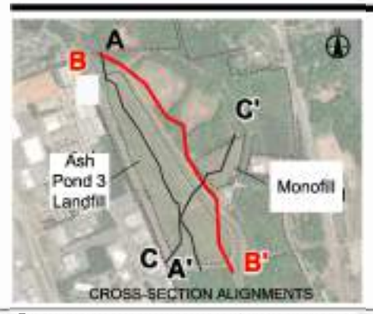
Figure No.
4A

Title
CROSS SECTION A-A'









LEGEND

- LINER/CAP = SOIL LINER OR SOIL/ GEOSYNTHETIC CAP UNIT
- FILL
- COAL COMBUSTION RESIDUALS
- NATIVE SOILS
- SAPROLITE
- PARTIALLY WEATHERED ROCK (PWR)
- BIOTITE-GNEISS BEDROCK
- MONITORING WELL/PIEZOMETER SCREEN INTERVAL
- OVERBURDEN SAMPLE INTERVAL
- MEASURED GROUNDWATER ELEVATION (JANUARY 31, 2023)
- CROSS-SECTION INTERSECTION
- INTERPOLATED OR INFERRED MATERIAL CONTACT LINE

Stantec

Georgia Power

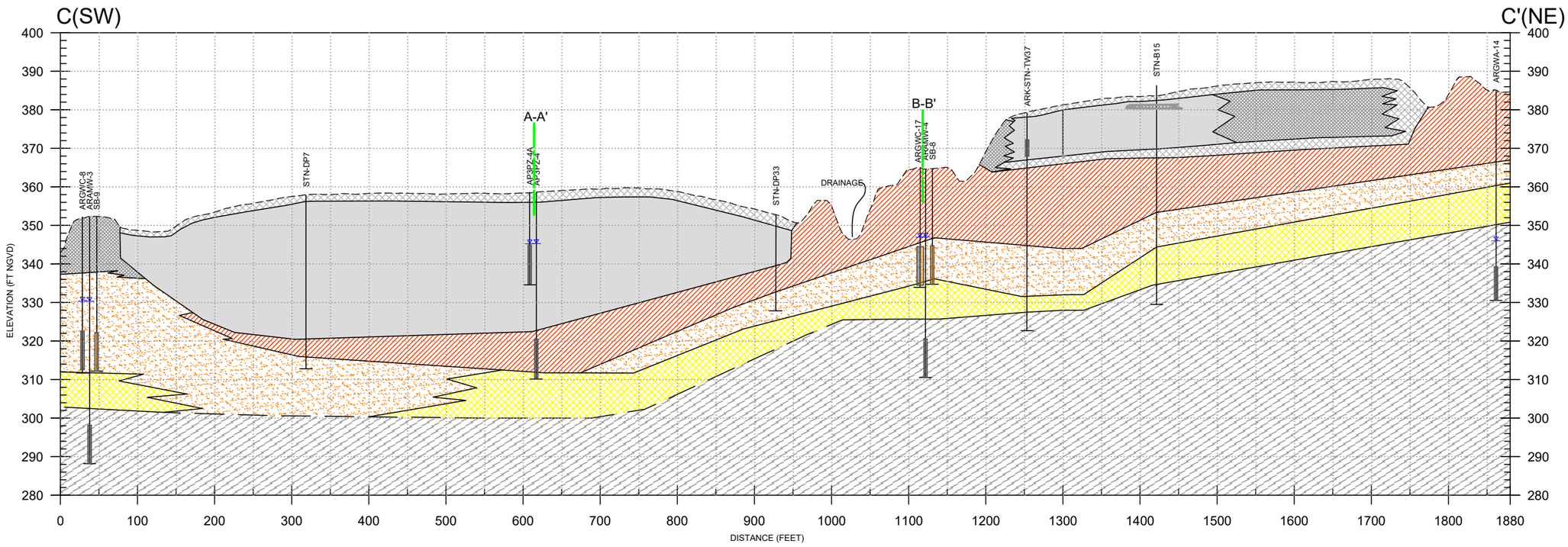
Project Location
Macon, Georgia

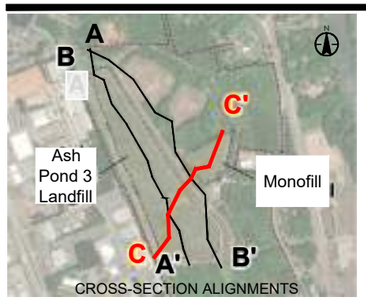
Prepared by VEN on 8/30/2023
TR by PD on 8/30/2023
IR by ES on 8/30/2023

Client/Project 172678281
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
4B

Title
CROSS SECTION B-B'





LEGEND

- LINER/CAP = SOIL LINER OR SOIL/ GEOSYNTHETIC CAP UNIT
- FILL
- COAL COMBUSTION RESIDUALS
- NATIVE SOILS
- SAPROLITE
- PARTIALLY WEATHERED ROCK (PWR)
- BIOTITE-GNEISS BEDROCK
- MONITORING WELL/PIEZOMETER SCREEN INTERVAL
- OVERBURDEN SAMPLE INTERVAL
- MEASURED GROUNDWATER ELEVATION (JANUARY 31, 2023)
- CROSS-SECTION INTERSECTION
- INTERPOLATED OR INFERRED MATERIAL CONTACT LINE

VERTICAL 20' 0

0 100' 200'
HORIZONTAL

Stantec

Georgia Power

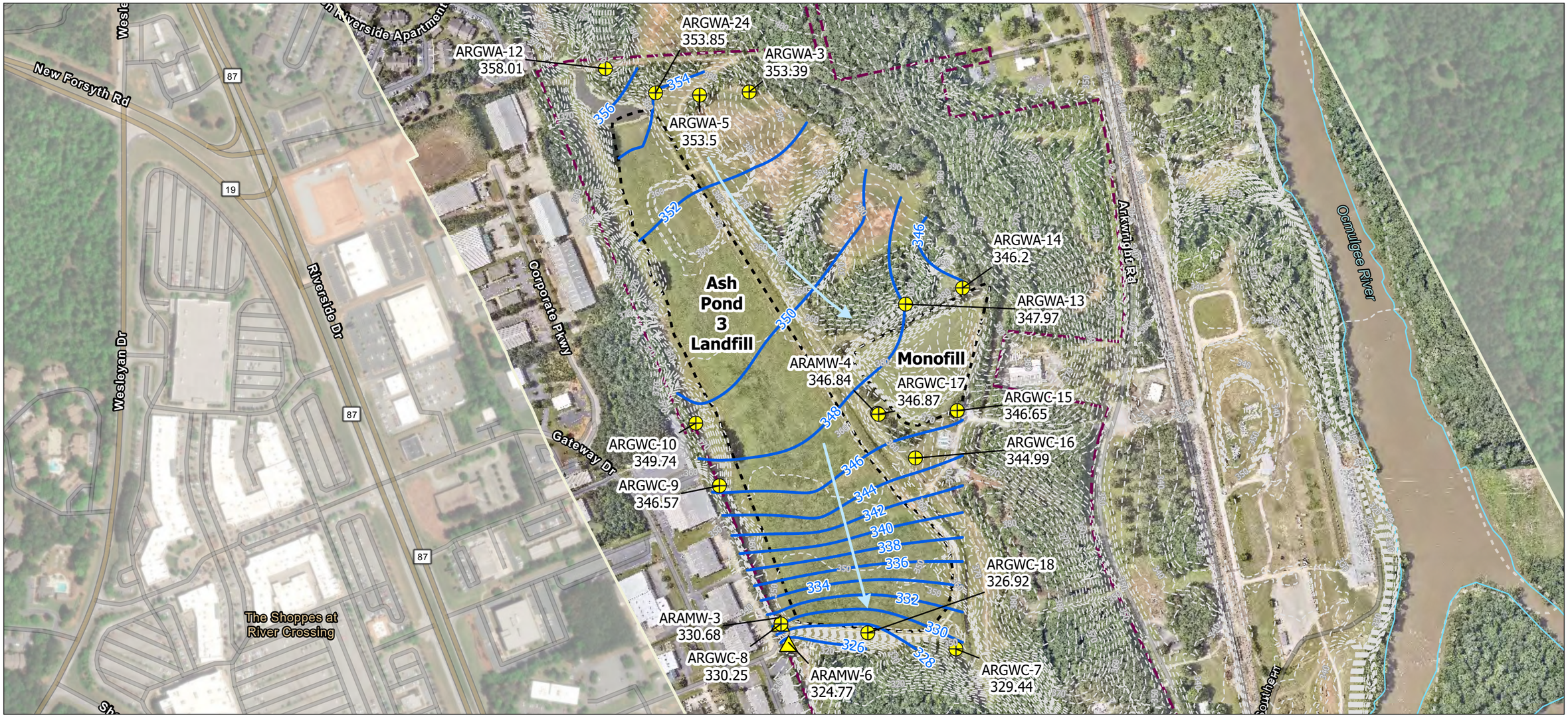
Project Location
Macon, Georgia

Prepared by VEN on 8/30/2023
TR by PD on 8/30/2023
IR by ES on 8/30/2023

Client/Project 172678281
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
4C

Title
CROSS SECTION C-C'



Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Monitoring Wells, Property Boundary, Topography, and Beaverdam Creek provided by Southern Company Services and Wood Environment & Infrastructure Solutions; Contours, Flow Arrow, and Ocmulgee River provided by Stantec
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Interpreted Groundwater Flow Direction
- Potentiometric Surface Contour Jan 2023 (ft NAVD88)
- Ocmulgee River (Approximate)
- Topographic Contour 2018 (2 ft interval)
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)

357.23 Groundwater Elevation (ft NAVD88)

KATIE T. ROSS
GEORGIA REGISTERED PROFESSIONAL GEOLOGIST
No. 1776

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

Project Location
Macon, Georgia

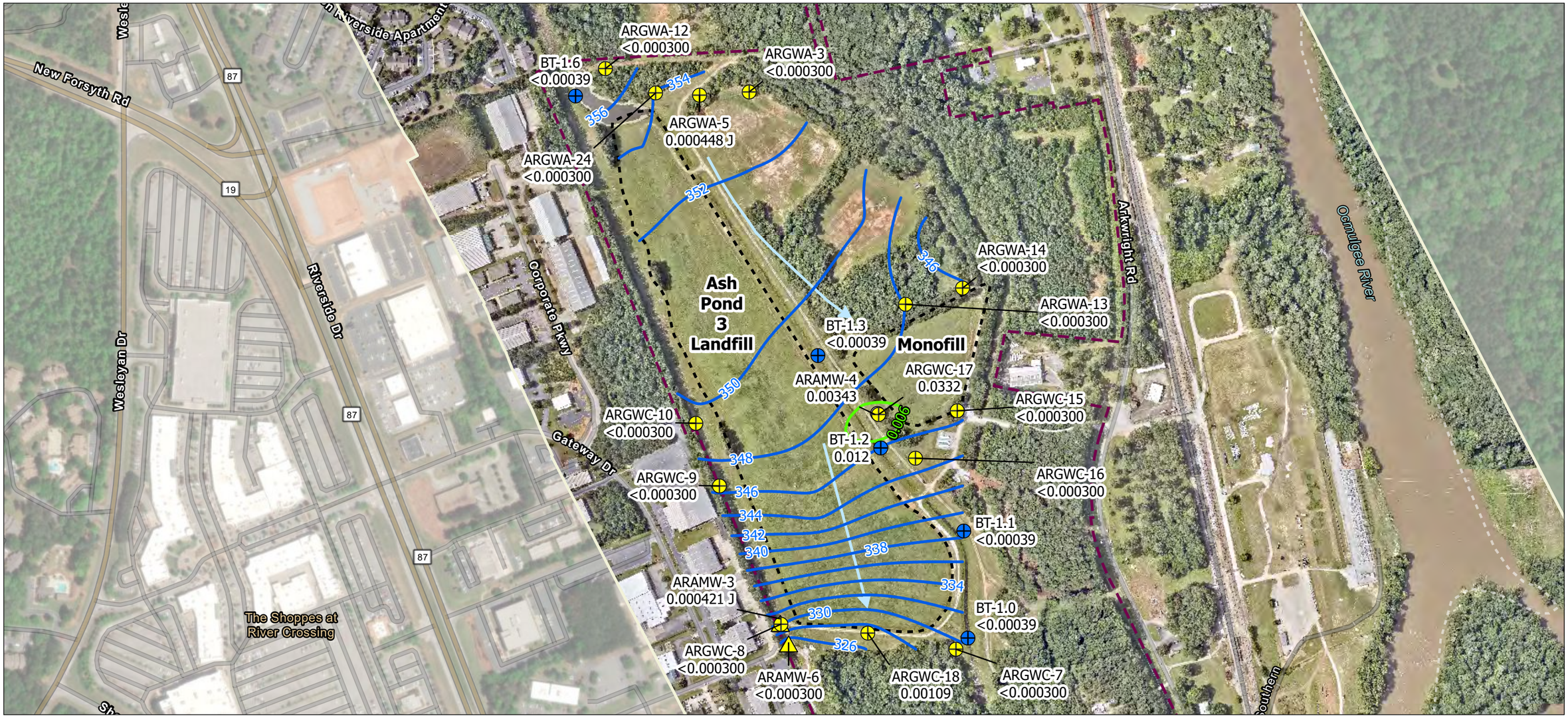
Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by MD on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
5

Title
Potentiometric Surface Contour Map – January 30, 2023

U:\175569434\gis\mxds\GW_20220101GW_202109_AP2_AP3GW_202201_AP3_SemiAnnualRemedy_Sandl_ProgressReport.aprx Revised: 2023-11-02 By: mbough



Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet

2. Data Sources: Ash Pond Boundaries, Monitoring Wells, Sampling Locations, Property Boundary, Flow Arrow, Contours, and Beaverdam Creek provided by Southern Company Services and Wood Environment & Infrastructure Solutions

3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Surface Water Sampling Location
- Cobalt SSL location
- Potentiometric Surface Contour Jan 2023 (ft NAVD88)
- Interpreted Groundwater Flow Direction
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)

0.000421 (J) Cobalt Concentration milligrams per Liter (mg/L)

Isoconcentration Notes:

Cobalt concentration data from groundwater and surface water samples collected during the January - February 2023 monitoring event.

J indicates the constituent was detected between the analytical method detection limit and the laboratory reporting limit. The value followed by J is qualified by the laboratory as estimated.

GWPS - Groundwater Protection Standard

Analyte	Units	GWPS
Cobalt	mg/L	0.006

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

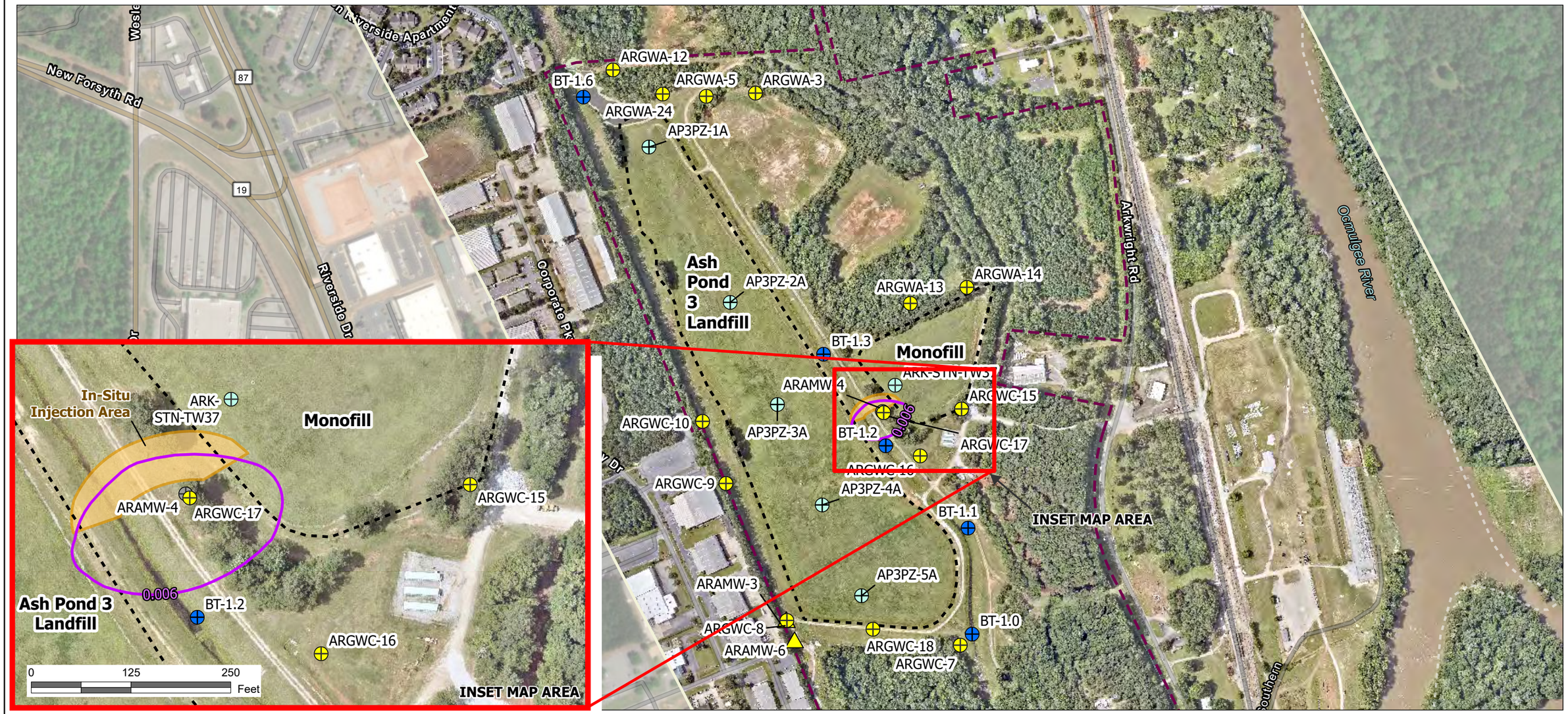
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
6

Title
Cobalt Concentration Map with Statistically Significant Level (SSL) Location - February 2023



Reference Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- Surface Water Sampling Location
- Cobalt SSL location
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)
- AP-3 Landfill and Monofill Remedial Alternative

0 450 900 Feet
(At original document size of 11x17)
1:5,400

N

Notes

1. Isoconcentration line for cobalt developed based on groundwater monitoring data collected during the January – February, 2023 monitoring event.
2. Cobalt groundwater protection standard (GWPS) = 0.006 milligrams per liter (mg/L).
3. It is anticipated that CCR materials will be removed from Ash Pond 3 Landfill and Monofill and the units will be closed prior to commencement of full-scale remediation activities. Closure activities will result in modifications to site topography and layout, and current aerial imagery is not representative of future conditions.
4. Actual locations and numbers of injection points will be determined if remedy selected.

Stantec

Georgia Power

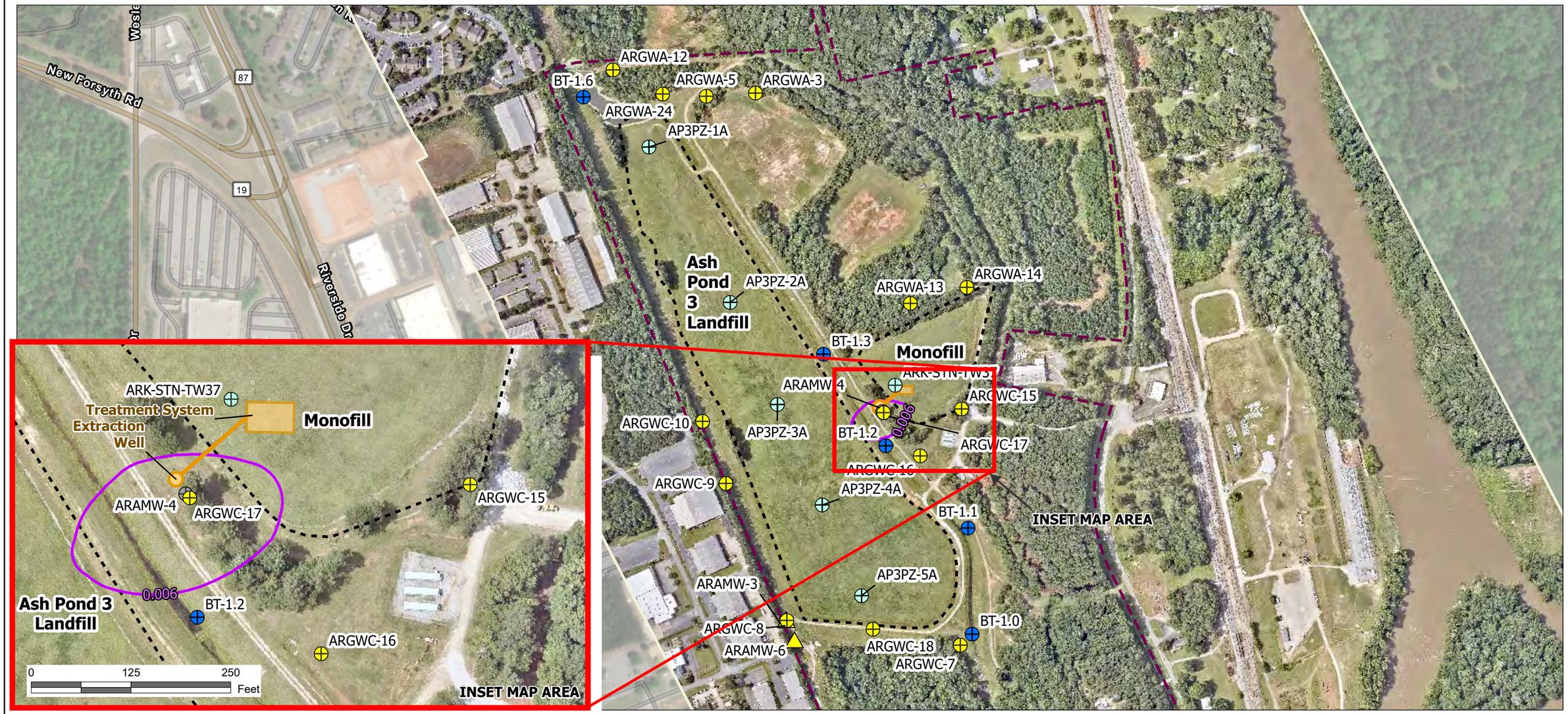
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7A

Title
Conceptual Layout
Remedial Alternative 1
In-Situ Injection



Reference Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- AP-3 Landfill and Monofill Remedial Alternative
- Surface Water Sampling Location
- Cobalt SSL location
- AP-3 Landfill and Monofill Remedial Alternative
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)
- AP-3 Landfill and Monofill Remedial Alternative

0 450 900 Feet
(At original document size of 11x17)
1:5,400

N

Notes

1. Isoconcentration line for cobalt developed based on groundwater monitoring data collected during the January – February, 2023 monitoring event.
2. Cobalt groundwater protection standard (GWPS) = 0.006 milligrams per liter (mg/L).
3. It is anticipated that CCR materials will be removed from Ash Pond 3 Landfill and Monofill and the units will be closed prior to commencement of full-scale remediation activities. Closure activities will result in modifications to site topography and layout, and current aerial imagery is not representative of future conditions.
4. Actual number and location(s) of extraction wells, and location of treatment system will be determined if remedy is selected.

Stantec

Georgia Power

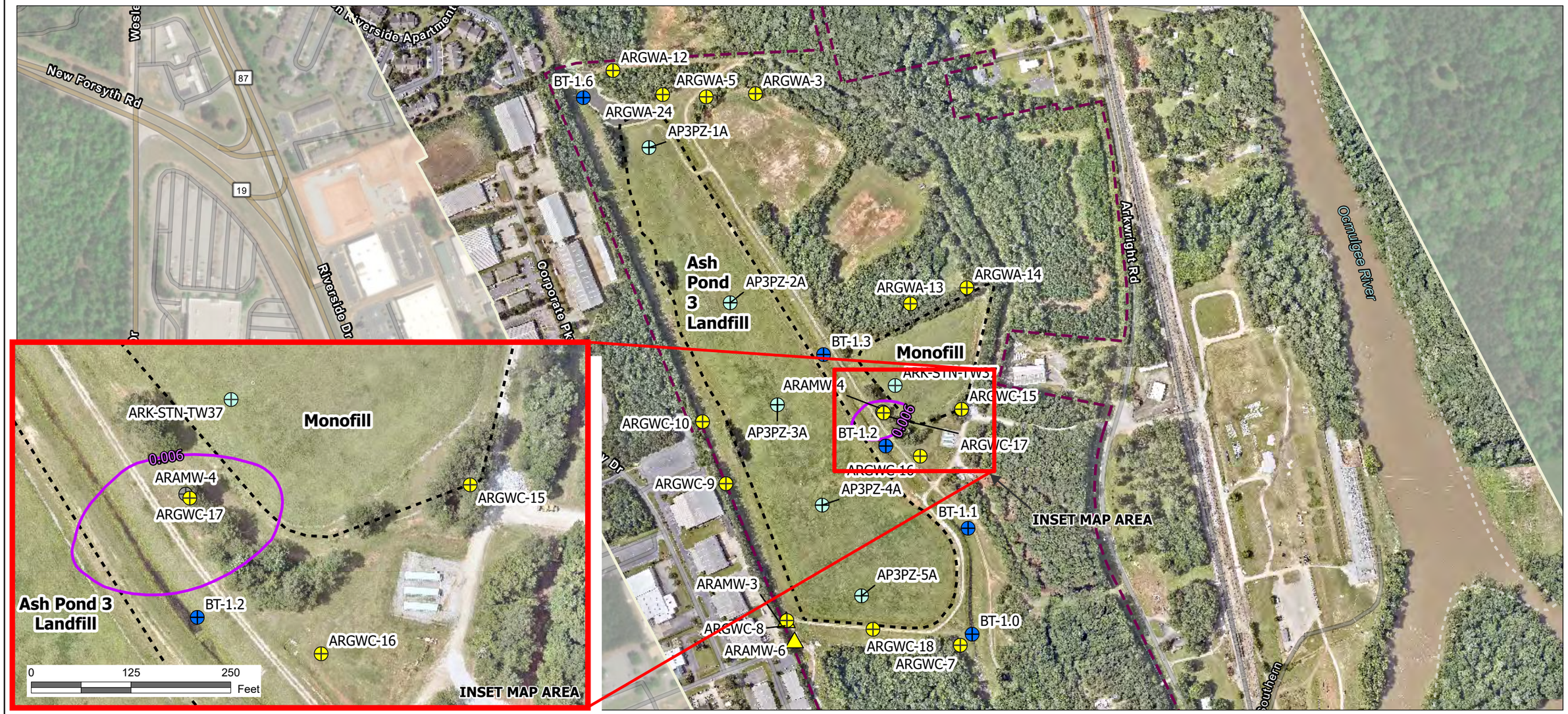
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7B

Title
Conceptual Layout
Remedial Alternative 2
Pump and Treat



Reference Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- Surface Water Sampling Location
- Cobalt SSL location
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)

0 450 900 Feet
(At original document size of 11x17)
1:5,400

N

Notes

1. Isoconcentration line for cobalt developed based on groundwater monitoring data collected during the January – February, 2023 monitoring event.
2. Cobalt groundwater protection standard (GWPS) = 0.006 milligrams per liter (mg/L).
3. It is anticipated that CCR materials will be removed from Ash Pond 3 Landfill and Monofill and the units will be closed prior to commencement of full-scale remediation activities. Closure activities will result in modifications to site topography and layout, and current aerial imagery is not representative of future conditions.

Stantec

Georgia Power

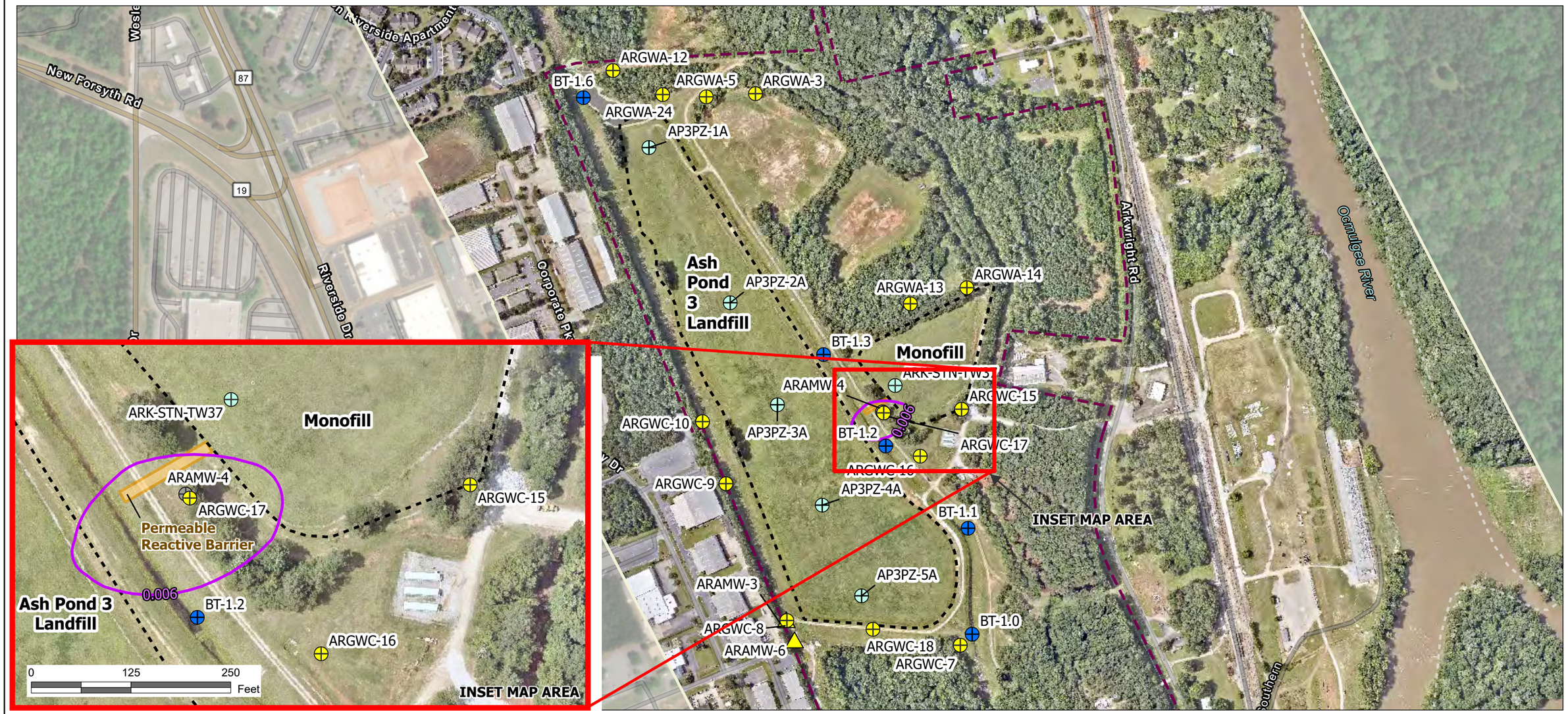
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project
175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7C

Title
Conceptual Layout
Remedial Alternative 3
Monitored Natural Attenuation



Reference Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- Surface Water Sampling Location
- Cobalt SSL location
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)
- AP-3 Landfill and Monofill Remedial Alternative

0 450 900 Feet
(At original document size of 11x17)
1:5,400

N

Notes

1. Isoconcentration line for cobalt developed based on groundwater monitoring data collected during the January – February, 2023 monitoring event.
2. Cobalt groundwater protection standard (GWPS) = 0.006 milligrams per liter (mg/L).
3. It is anticipated that CCR materials will be removed from Ash Pond 3 Landfill and Monofill and the units will be closed prior to commencement of full-scale remediation activities. Closure activities will result in modifications to site topography and layout, and current aerial imagery is not representative of future conditions.
4. Actual size and location of permeable reactive barrier will be determined if remedy is selected.

Stantec

Georgia Power

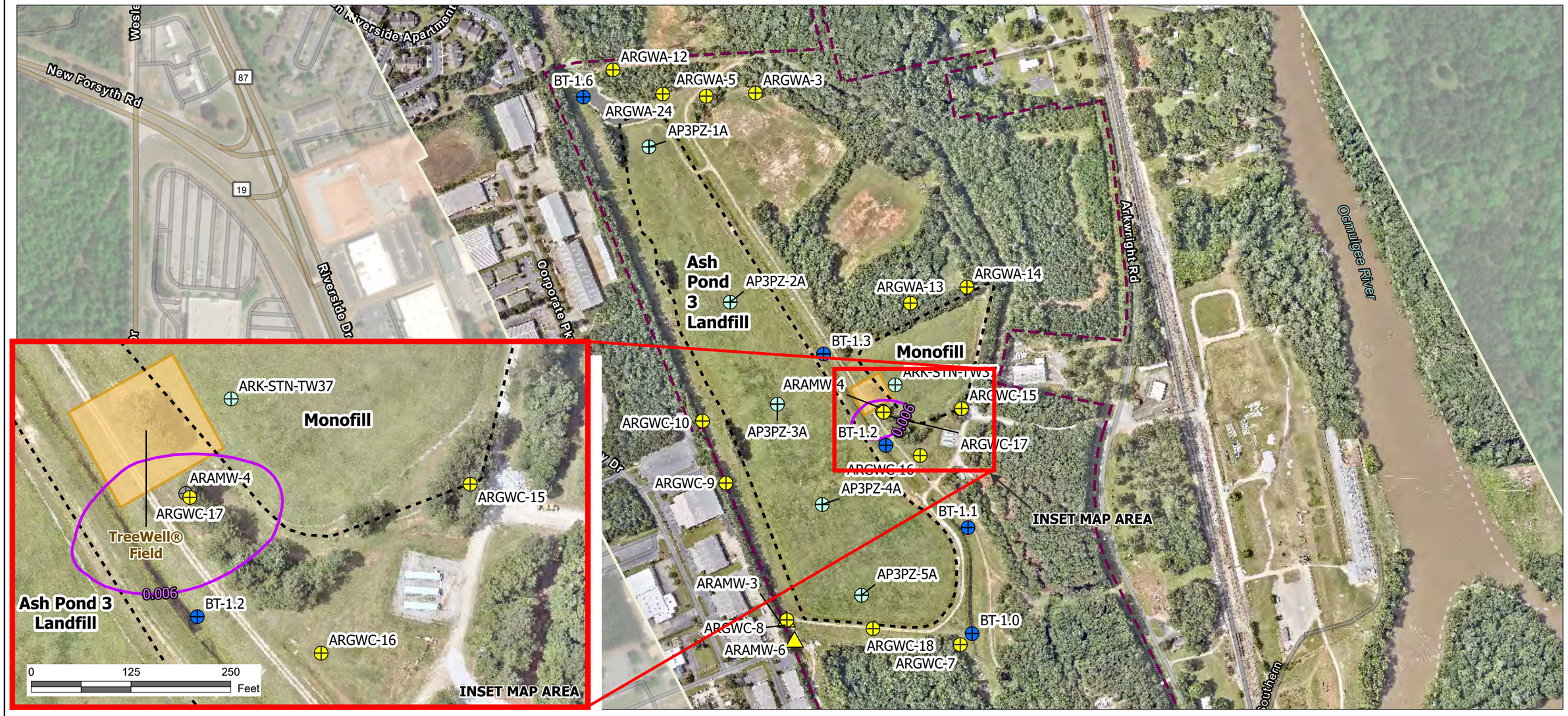
Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7D

Title
Conceptual Layout
Remedial Alternative 4
Permeable Reactive Barrier



Reference Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet

2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions

3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Piezometer
- Porewater Piezometer
- Surface Water Sampling Location
- Cobalt SSL location
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)
- AP-3 Landfill and Monofill Remedial Alternative

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Notes

1. Isoconcentration line for cobalt developed based on groundwater monitoring data collected during the January – February, 2023 monitoring event.

2. Cobalt groundwater protection standard (GWPS) = 0.006 milligrams per liter (mg/L).

3. It is anticipated that CCR materials will be removed from Ash Pond 3 Landfill and Monofill and the units will be closed prior to commencement of full-scale remediation activities. Closure activities will result in modifications to site topography and layout, and current aerial imagery is not representative of future conditions.

4. Actual number and location(s) of TreeWells® will be determined if remedy is selected.

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by DMB on 11/2/2023
TR by JK on 11/2/2023
IR by RB on 11/2/2023

Client/Project 175569434
Georgia Power
Draft Remedy Selection Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7E

Title
Conceptual Layout
Remedial Alternative 5
Phytoremediation

APPENDIX A
GEOCHEMICAL CONCEPTUAL SITE MODEL

GEOCHEMICAL CONCEPTUAL SITE MODEL REPORT

Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

February 28, 2024

Prepared for:

Georgia Power

Prepared by:
Stantec Consulting Services Inc.
10745 Westside Way, Suite 250
Alpharetta, Georgia 30009-7640

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Acronyms / Abbreviations

AP-3	Ash Pond 3
CCR	Coal Combustion Residuals
CEC	Cation Exchange Capacity
cm/s	centimeters per second
DPT	Direct Push Technology
EPA	Environmental Protection Agency
GCSM	Geochemical Conceptual Site Model
GA EPD	Georgia Environmental Protection Division
Georgia Power	Georgia Power Company
GWPS	Groundwater Protection Standard
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mV	millivolts
ORP	Oxidation-Reduction Potential
SEP	Sequential Extraction Procedure
SSL	Statistically Significant Level
s.u.	Standard Units
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSI	Terra Systems, Inc.
XRD	X-ray Diffraction

1 Introduction

1.1 Purpose

This Geochemical Conceptual Site Model (GCSM) report has been prepared for the Georgia Power Company (Georgia Power) Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill to support the remedy selection process. The purpose of this GCSM is to provide an assessment of the site-specific geochemical conditions that influence the fate and transport of cobalt in groundwater. The site-specific data and assessment of aquifer geochemistry will be the framework for constituent transport modeling and guide the selection of appropriate remedies for corrective action at AP-3 Landfill and Monofill.

This GCSM is prepared as an "interim" submittal that incorporates available geochemical data for AP-3 Landfill and Monofill. By the nature of site evaluations, GCSMs are subject to update as additional relevant data becomes available.

1.2 Background

Plant Arkwright is a former coal-fired electric generation facility located in Bibb County, Georgia approximately six miles northwest of the city of Macon. The AP-3 Landfill and Monofill are closed CCR units located at Plant Arkwright. Details regarding the site location, closure of the CCR units, and the geologic and hydrogeologic setting are provided in the Draft Remedy Selection Report.

1.3 Groundwater Quality

Statistical analysis of the January-February 2023 semi-annual assessment monitoring groundwater data reported in the *2023 Annual Groundwater Monitoring and Corrective Action Report* (Stantec 2023) identified a Statistically Significant Level (SSL) of the Appendix IV constituent cobalt exceeding the groundwater protection standard (GWPS) in a single monitoring well (ARGWC-17) located at a downgradient location between the AP-3 Landfill and the Monofill. This GCSM will focus on cobalt fate and transport mechanisms, particularly within the overburden material in the area coinciding with the screened interval of the ARGWC-17 well (See Figure 4B of the Draft Remedy Selection Report).

A time series graph of cobalt concentration at well ARGWC-17 is depicted on Figure 1, and Figure 2 depicts an iso-concentration map for cobalt. The spatial distribution of cobalt is further described in section 2.1.2.

1.3.1 COBALT GEOCHEMISTRY AND FATE AND TRANSPORT PROPERTIES

Cobalt is commonly found in biotite and other ferromagnesian minerals (Smith 1990). Cobalt occurs naturally in the Co^{2+} and Co^{3+} valence states (Adriano 1986), with the Co^{2+} valence state being the predominant form under environmental conditions and the Co^{3+} form having very low solubility. Cobalt solubility and mobility is affected by a number of environmental factors such as pH, redox condition, and the presence of organics (e.g., humic substances). Cobalt mobility increases with decreasing oxidation-reduction potential (ORP) and pH. Reducing conditions in saturated soil release cobalt into solution through direct reduction of Co^{3+} to Co^{2+} and reductive dissolution of iron and manganese oxyhydroxides

(Han and Banin 2000). These oxyhydroxides typically control cobalt mobility under neutral pH and aerobic conditions through sorption and coprecipitation. At a pH below 6 standard units (s.u.) cobalt will tend to sorb less onto oxyhydroxides even when the redox condition is aerobic and the sorbing mineral species are stable. Complexation with dissolved organic compounds can also increase the mobility of cobalt.

Cobalt sorbs strongly to the surface of iron and manganese oxyhydroxide minerals when groundwater pH is neutral to alkaline under aerobic conditions, when these minerals are stable and sorption sites are available on the mineral surfaces. The stability of iron and manganese oxyhydroxide minerals in the soils is influenced by the groundwater pH and the degree of oxidation or reduction (i.e., the redox condition). While oxyhydroxide minerals can dissolve under the influence of very low pH conditions, cobalt stops sorbing to iron oxyhydroxide minerals long before they dissolve under acidic conditions. Iron and manganese minerals are also sensitive to the redox condition of groundwater and can dissolve as conditions become increasingly reducing, which also releases sorbed constituents to groundwater, including cobalt. If reductive dissolution of manganese oxide occurs under lower pH conditions (i.e., less than 6 s.u.), cobalt mobilized by manganese oxide dissolution would not sorb to iron oxyhydroxide because the pH would be too low for cobalt sorption.

2 Summary of Site Characterization

The following section summarizes the field investigations and data evaluations completed at AP-3 and Monofill that have been used to develop the current GCSM. This material is presented in part in the Assessment of Corrective Measures Report, Semiannual Remedy Selection and Design Progress Reports, and/or the Annual and Semiannual Groundwater Monitoring and Corrective Action Reports but have been compiled here to evaluate the data from a geochemical viewpoint. Site characterization data collected for AP-3 and Monofill, and pertinent to the GCSM, includes groundwater chemistry, CCR pore water chemistry, geochemical data, and properties of solid matrix materials. This section provides a review of site groundwater, CCR pore water, and aquifer solids geochemistry with specific relation to cobalt.

2.1 Groundwater and CCR Pore Water Geochemistry

The evaluation in this section describes the general chemistry and major ion distribution observed across AP-3 and Monofill to provide a foundation for interpretation of the source of cobalt detected in ARGWC-17 and ultimately leading into the description of the GCSM presented in Section 4. The following sections describe the available groundwater and CCR pore water data from the AP-3 and Monofill area.

2.1.1 GROUNDWATER AND CCR PORE WATER ANALYSIS

Results of groundwater and CCR pore water sampling and field geochemical measurements from 2016 through 2023 are presented in Appendix A. A map depicting monitoring well and sample collection locations is presented as Figure 2 of the Draft Remedy Selection Report.

Groundwater characteristics

Groundwater sampling is performed semiannually for the full suites of Appendix III and Appendix IV constituents and Appendix I constituent (silver). During certain sampling events, geochemical constituents (aluminum, bicarbonate and carbonate alkalinity, iron, manganese, magnesium, potassium, and sodium) were analyzed to supplement the Appendix III and Appendix IV constituent analyses.

The pH of groundwater ranged from mildly acidic to neutral in the approximate range of 5.0 to 7.6 s.u. The lowest groundwater pH measured was observed in monitoring wells located between AP-3 and the Monofill (i.e., ARGWC-17 and ARGWC-16), where pH ranged from approximately 5.0 to 5.7 s.u.

The redox condition of the groundwater proximal to AP-3 and Monofill is presented in Table 1 and ranged from oxic to anoxic (ORP generally ranges from approximately -120 to +500 millivolts [mV]). The most chemically reducing conditions were observed in one bedrock well located down gradient of the Monofill and AP-3, ARAMW-4 (anoxic). In addition, overburden wells ARGWC-16 (anoxic), ARGWC-17, (anoxic), and ARGWC-18 (anoxic) located downgradient of the monofil and/or AP-3 exhibit slightly reducing conditions. Other groundwater wells in the vicinity of AP-3 and Monofill reflect more oxidizing (ORP > 0 mV; mixed; or oxic) conditions.

Figure 3, a cross-plot of ORP and total iron concentration, shows concentrations of iron in groundwater are negatively correlated with the redox condition (represented by field measured ORP) of groundwater, which is consistent with the potential for precipitation of iron hydroxides in locations with oxidizing conditions. Amorphous hydroxides of iron in addition to poorly crystalline oxyhydroxides and amorphous manganese oxides are important in the sorption of metals, including cobalt, and will collectively be referred to herein as oxyhydroxides, except when a specific mineral phase is being discussed. Locations with a lower ORP exhibit higher iron concentrations, apart from the upgradient bedrock well ARGWA-14 that records a lower ORP while also reporting low iron.

The relationship between manganese concentration and ORP is less direct than the relationship between iron concentration and ORP, in that once manganese is reduced and dissolved into groundwater there are kinetic limitations to reprecipitation of manganese in response to re-oxidation. Manganese concentrations at AP-3 and Monofill do not exhibit a strong correlation with ORP most likely due to kinetic factors. A cross-plot of total manganese concentration as a function of ORP is shown as Figure 4.

CCR Pore Water Characteristics

The CCR pore water from AP-3 was collected in 2022 and 2023 from existing CCR pore water piezometers that were installed and sampled in 2020 (AP3PZ-1A through AP3PZ-5A). CCR pore water piezometers wells were completed in the Monofill in 2022, but there was insufficient water available for sampling from those wells during the 2022 monitoring event. In April 2023, one CCR pore water sample was collected from one piezometer in the Monofill (ARK-STN-TW37) on April 26, 2023. CCR pore water samples were analyzed for the same suite of parameters as the groundwater, including geochemical constituents. Preliminary geochemical analyses involving the Monofill pore water were conducted using the one sample result from ARK-STN-TW37, but limited recharge may have influenced geochemical conditions.

The condition of the AP-3 pore water is defined by a neutral pH, ranging from 6.15 to 7.60 s.u. with a 6.99 s.u. average, and chemically reducing signature with ORP ranging from -175 to 2.8 mV. Chemically reducing conditions result in measurable aqueous concentrations of iron and manganese (Figures 3 and

4). Cobalt concentrations are generally low, and cobalt was not detected in the 2022 AP-3 pore water samples above the GWPS of 0.006 mg/L, except at AP3PZ-1A (0.0199 mg/L) and AP3PZ-5A (0.0102 mg/L).

The condition of the Monofill pore water is defined by a lower pH (6.04 s.u.) and an ORP of -2.9 mV. The Monofill pore water had arsenic (0.0243 mg/L), cobalt (0.0441 mg/L), and lithium (0.236 mg/L) concentrations above their respective GWPSs in the sample collected from ARK-STN-TW37. Iron was detected at 68.1 mg/L and manganese at 6.38 mg/L, both indicative of reducing conditions that are conducive to iron and manganese oxide dissolution.

Comparisons and Analysis

Overall, AP-3 and Monofill pore water is generally higher in pH and lower in ORP than groundwater. The combination of lower pH in some groundwater monitoring wells (including ARGWC-17) with variable ORP likely contributes to the geochemical behavior of metals/metalloids by either directly influencing sorption reactions or through solubility controls on metal oxyhydroxides (iron and manganese) that act as sorbing surfaces for metals/metalloids.

General cation (calcium, magnesium, potassium, and sodium) and anion (chloride, sulfate, and alkalinity) concentrations measured during the January-February 2023 groundwater monitoring event and April 2023 CCR pore water sampling event were used to create Piper and Stiff Diagrams (Figures 5 and 6). These diagrams illustrate differences or similarities in water types based on major ion chemistry to assess sources of water and chemical constituents.

- The Piper diagram (Figure 5) depicts the chemical composition of the January – February 2023 groundwater samples, the November 2022 AP-3 pore water samples, and the April 2023 Monofill pore water sample. The major ion chemistry of groundwater at AP-3 and Monofill includes a broad range of water types, from a calcium-bicarbonate type water, reflected predominantly in the upgradient groundwater wells, to a calcium-sulfate type water reflected predominantly in groundwater wells to the east (Monofill side) of the surface water drainage feature located between AP-3 and the Monofill. The water-type signatures observed from the Piper diagram can be separated into three generalized categories, including (1) groundwater reflective of upgradient or baseline conditions, (2) groundwater in the immediate vicinity of AP-3, and (3) groundwater in the immediate vicinity of the Monofill. These three generalized categories are depicted by dashed outlines in Figure 5.

- The Stiff diagram (Figure 6) shows the spatial distribution of water types across AP-3 and Monofill. Geochemical signatures generally correlate with geographic location, with the wells in close proximity exhibiting similar signatures. A strong calcium sulfate signature is apparent in the Monofill pore water sample and the samples collected from the AP-3 piezometers AP3PZ-1A, AP3PZ-2A, and AP3PZ-5A. Influence of CCR pore water is suggested by the presence of this calcium-sulfate signature, which is not present in background groundwater.

Generally, most groundwater monitoring wells, including upgradient wells, sampled around AP-3 and Monofill are a calcium-bicarbonate water-type with variable proportions of sodium. This water type is interpreted to represent baseline groundwater chemistry conditions for Plant Arkwright and is observed

for several overburden and bedrock groundwater monitoring wells on both sides of the surface water drainage situated between AP-3 and the Monofill.

To the east of the surface water drainage feature, several groundwater monitoring wells exhibit a strong calcium-sulfate water-type including ARGWC-17, ARAMW-4, and ARGWC-16. In addition, upgradient monitoring well ARGWA-13 exhibits a similar calcium-sulfate type water, suggesting a residual influence of the Monofill on this upgradient well location, potentially associated with historic mounding in the Monofill or another conduit for CCR pore water influence. The calcium-sulfate signature is observed in the majority of groundwater monitoring wells east of the surface water drainage, monitoring wells in the immediate vicinity of the Monofill, and in three AP-3 pore water sampling locations. These CCR pore waters have a boron concentration ranging from 0.4 to 3.0 mg/L. The combination of detectable concentrations of the CCR tracer constituent boron in ARGWC-17 and ARAMW-4, and associated bulk groundwater and CCR pore water chemistry, supports an interpretation that the chemical composition near wells ARGWC-17 and ARAMW-4 may be attributed to influence of CCR pore water.

To the west of the surface water drainage, most groundwater monitoring wells exhibit a mixed-type water with variable proportions of calcium, sulfate, bicarbonate, and lesser amounts of magnesium. The two groundwater monitoring wells situated to the west of AP-3 are exceptions and exhibit a water-type more closely aligned with the upgradient or baseline water composition. The distribution of water types aligns with the interpreted groundwater flow direction from the northwest to the southeast (Figure 5 of the Draft Remedy Selection Report).

In summary, the background signature of groundwater chemistry at AP-3 and Monofill is a calcium-bicarbonate water-type with mildly acidic to neutral pH and generally oxidizing conditions (see Figures 5 and 6). CCR pore water from AP-3 and the Monofill exhibits a more reducing condition (average ORP of -100 mV) and contains elevated concentrations of dissolved iron and manganese that, when mixed with upgradient oxidizing water could form oxyhydroxides. Dissolved iron and manganese might also be introduced to the groundwater system by dissolution of minerals in the native soils and ash resulting from the reducing conditions observed downgradient of the AP-3 Landfill and Monofill. Oxidation of the dissolved iron, a reaction that contributes acidity to groundwater, may contribute to the decrease in alkalinity and pH observed downgradient of AP-3 and the Monofill in ARGWC-17. This observation is supported by the fact that the upgradient well ARGWA-14 has low dissolved iron concentration and also has the highest groundwater pH of 6.8 s.u. (little to no iron is available for oxidation in this location). Downgradient well ARGWC-17, in contrast, has a pH as low as 5.02 s.u., which may be related to oxidation of dissolved iron in the area immediately upgradient (between the CCR units and ARGWC-17).

Geochemist's Work Bench (Bethke, 2022) was used to calculate mineral saturation indices (Table 2) and Eh pH diagrams (Figures 7 through 9) for the evaluation of cobalt, iron, and manganese mineral solubility and stability. The activities used in development of the Eh pH diagrams were the average values from ARGWC-17. Although minor differences occur based on site variability in activity, the values at ARGWC-17 provide for an assessment of the mineral stability system at the location of concern. Table 2 lists the results of the saturation index analysis listing mineral phases most likely to be reactive in the groundwater environment. The results of the saturation index calculation for amorphous iron hydroxide (ferrihydrite; $Fe(OH)_3$) indicates that it is slightly undersaturated for the groundwater evaluated; however, the Eh pH diagram for iron (Figure 8) indicates that when looking at a larger data set, amorphous iron hydroxide is predicted to be stable in upgradient wells when more oxidizing conditions exist. The samples

from ARGWC-17 reflect conditions slightly undersaturated in iron hydroxides, which indicates that iron is favored for dissolution along with any cobalt under current Eh pH conditions. Increases in groundwater pH near ARGWC-17 would shift the equilibrium towards precipitation of amorphous iron hydroxides. Therefore, depending on site conditions in the respective areas, iron may precipitate as an amorphous hydroxide, which creates mineral surfaces available for sorption of constituents including cobalt. Precipitation of iron will also have a secondary effect of consuming alkalinity and subsequently lowering the pH. The other minerals listed in Table 2, including manganese oxides, are below saturation, and if present, would tend to dissolve in contact with the groundwater.

Undersaturated conditions of manganese-bearing minerals as observed in groundwater suggest that these minerals are favored for dissolution under current conditions. Cobalt is known to naturally occur in association with manganese-bearing minerals and manganese hydroxides, and it is likely that these minerals are a source of cobalt to groundwater near ARGWC-17. The AP-3 pore water has cobalt concentrations ranging from below the detection limit to 0.033 mg/L, and the Monofill pore water was reported to contain 0.044 mg/L cobalt. Therefore, the contribution of cobalt from CCR pore water is also likely.

Figure 7 supports predictions of soluble cobalt under conditions at AP-3 and Monofill with pH ranging from 5 to 7 and Eh generally greater than +200 mV. Together, the solubility data for iron and cobalt reflect the potential for iron minerals (ferrihydrite and/or amorphous iron hydroxide) to control the mobility of cobalt in the AP-3 and Monofill groundwater through sorption. Figure 9 indicates that manganese is predicted to be soluble at the pH and Eh observed at AP-3 and Monofill, indicating that manganese minerals, if present, are predicted to dissolve under groundwater conditions. Dissolution of cobalt-bearing manganese minerals would potentially result in release of cobalt incorporated into these minerals.

2.1.2 SPATIAL DISTRIBUTION OF COBALT

An SSL of the Appendix IV constituent cobalt was identified in a single groundwater monitoring well, ARGWC-17. The overburden monitoring well ARGWC-17 is located at a downgradient location between AP-3 and the Monofill. The cobalt SSL is vertically bounded by the adjacent bedrock well ARAMW-4, and horizontally bounded by downgradient overburden well ARGWC-16. Detections of cobalt above the laboratory reporting limit are only in two other groundwater monitoring wells (ARGWC-18, and ARAMW-4), and the lateral extent of the cobalt SSL is limited to an area around ARGWC-17 with an approximate diameter of less than 250 feet, as shown on Figure 2.

Cobalt was detected in four of the five CCR pore water piezometers installed in AP-3 and in the Monofill pore water sample (Appendix A). Two of the five AP-3 pore water piezometers (AP3PZ-1A and AP3PZ-5A) have cobalt concentrations in the range of 0.01 to 0.03 mg/L, two (AP3PZ-3A and AP3PZ-4A) have concentrations of approximately 0.001 mg/L and one (AP3PZ-2A) did not have detectable cobalt. In the Monofill, cobalt was detected at a concentration of 0.0441 mg/L in the CCR pore water sample collected from ARK-STN-TW37. While the highest cobalt concentrations detected in the pore water of both CCR units were similar to cobalt concentrations detected in monitoring well ARGWC-17 (located between the units), cobalt was not detected at concentrations exceeding the GWPS in other groundwater monitoring wells located directly downgradient of the units.

2.2 Aquifer Solids Characterization

Samples of overburden from within the uppermost aquifer were collected from four locations in 2021 and two additional locations in 2022 (locations shown on Figure 2 of the Draft Remedy Selection Report). These samples of overburden material were collected adjacent to existing monitoring wells targeting the depth of each monitoring well's screened interval. Because the cobalt SSL was identified in the overburden material, bedrock samples were not collected. The results of aquifer solids characterization are discussed in this GCSM in the context of the fate and transport of cobalt downgradient of the AP-3 and Monofill.

Overburden samples were collected by Wood Environment & Infrastructure Solutions, Inc. (Wood 2021) using a direct push technology (DPT) rig in 2021 at four locations in the vicinity of AP-3 and Monofill (as shown on Figure 2 of the Draft Remedy Selection Report) and submitted for analysis. The sample depths were selected to coincide with the overburden screen sections of adjacent monitoring wells. DPT boring depths and depths of adjacent monitoring wells are summarized in Table 3.

Additional overburden samples were collected for geochemical characterization from borings directly adjacent to wells ARGWC-17 and ARGWC-24 using a DPT rig in September and October 2022. The samples were collected in the field using DPT sleeves that were cut using a hand saw in the field into two-foot sections. To preserve aquifer conditions and reduce oxidation the sections were capped on both ends of the sleeves, preserved on ice, and shipped to SGS Canada Inc for analysis.

A compilation of the aquifer solids characterization results is presented in Tables 4 through 7. The overburden samples were characterized for baseline chemical and mineralogical composition by application of the following analytical/testing methods:

- Cation Exchange Capacity (CEC): CEC of a soil or aquifer is an important variable to understand when evaluating attenuation processes. Cation exchange is generally defined as the capacity of a soil to retain positively charged ions, such as many metals. Understanding the capacity of solids in the subsurface to retain positively charged solutes helps in the evaluation of attenuation mechanisms and capacity.

- Total Organic Carbon (TOC): This analyte represents the presence of substrate for sorption and an energy source for microbially mediated metal/metalloid transformations. Organic carbon in the subsurface can serve to sorb/retain metals, and it can also provide food to microorganisms that use certain metals/metalloids as electron acceptors and therefore change their oxidation-reduction (redox) state, which affects their mobilization/ immobilization. Organic carbon, if present, can contribute to the CEC and anion exchange capacity of a soil.

- Total Metals Concentration: This analysis measures the total concentrations of targeted metal/metalloids in the solid phase (digested using EPA Method 200.7, which uses nitric and hydrochloric acid to dissolve undissolved constituents). This analysis helps to understand the presence of site-specific constituents in aquifer solids as well as the presence of elements such as iron, aluminum, and manganese that form major mineral phases known to sorb/retain many metals. Although total metals concentration does not provide information regarding the mobility of the metal/metalloids, the total concentrations provide the occurrence and availability of specific metals for subsequent weathering and mobilization.

- X-Ray Diffraction (XRD): This method provides qualitative and quantitative confirmation of mineral phases present. XRD is limited to identifying crystalline mineral phases at a weight percent concentration and does not identify amorphous or poorly crystalline minerals. Understanding whether mineral phases important to metal/metalloid sorption are present in aquifer solids is essential in the evaluation of attenuation mechanisms and capacity.

- Sequential Extraction Procedure (SEP): This method of analysis provides information regarding the mineral phases targeted by a series of extraction methods and elements liberated by the extraction associated with each targeted mineral phase. The series of extractions focuses on mineral phases that tend to control metal/metalloid cation and anion retention that are typically not identifiable by XRD. Specific mineral phases are not definitively determined by SEP results due to limited ability of the extraction reagents to replicate actual conditions, modification of aquifer solids chemistry by previous reagents, and/or high detection limits masking potentially substantial constituent concentrations. Despite these limitations, SEP results remain a useful tool for assessing geochemical characteristics of aquifer solids. Methods and results of SEP analysis, including descriptions of each extraction step, are summarized in Tables 6 and 7.

Samples collected in 2021 were analyzed using the five techniques listed above, and samples collected in 2022 were analyzed only for XRD, total metals, and SEP. Results of these analyses are summarized below.

The CEC ranged from 9.9 to 22 milliequivalents per 100 grams of soil (low CEC [Sonon et al. 2022]). TOC values were below detection limits of 870 to 1,000 milligrams per kilogram (mg/kg) at locations analyzed (Table 4). CEC and TOC results indicate low variability between samples and therefore similar capacity to attenuate metal/metalloid migration in soils across the overburden sample locations analyzed.

The most geochemically meaningful minerals identified by XRD analysis were clay minerals, predominantly the minimally reactive kaolinite, with some smectite and vermiculite, which may provide CEC that could influence the concentration of cobalt. Most other minerals identified from XRD are unreactive in the shallow groundwater system and will not participate in the geochemical reactions that are relevant to this GCSM (Tables 4 and 5). The feldspar minerals identified in the aquifer solids have likely weathered to secondary clay minerals in the saprolite. Thus, the mineralogical composition supports favorable abundance of secondary clays that may contribute to attenuation of metals. No iron-bearing minerals were identified from bulk mineralogical XRD analysis of overburden materials collected in 2021 and 2022 which is consistent with predictions that the iron minerals expected to form, and that control metal mobility, are poorly crystalline or amorphous minerals that do not generate a discernible XRD signature.

Methods and results of SEP analysis, including descriptions of each extraction step, are summarized in Tables 6 and 7. The SEP results found iron, manganese, and aluminum-bearing oxyhydroxide minerals are the dominant minerals in the sorption reactions that account for attenuation of dissolved metals such as cobalt in the shallow groundwater system. Total iron concentrations from the sum of iron in the SEP test results range from 57,548 to 71,902 mg/kg, manganese concentrations range from 1,016 to 1,659 mg/kg, and aluminum concentrations range from 58,812 to 84,981 mg/kg (Tables 6 and 7). Iron in the more soluble phases targeted by the SEP (steps 1 – 4) ranges from 2,388 to 2,772 mg/kg (3.8 – 4.1%). This iron is associated with highly sorptive iron mineral phases (e.g., iron hydroxides, which are shown in the Eh pH diagram in Figure 8). Similarly, aluminum concentrations associated with the same sorptive

mineral phases (SEP steps 1 – 4) range from 272 to 471 mg/kg (0.5 – 0.6%). Manganese is also present within the sampled soils, with the sorptive and more soluble portion ranging from 355 to 971 mg/kg (35 – 59%). The SEP results further support the occurrence of reactive and recalcitrant iron, manganese, and aluminum minerals within the aquifer solids matrix and confirm their association with the iron and manganese oxyhydroxide phase important in cobalt sorption.

Cobalt is found in association with the aquifer solids collected both upgradient and downgradient of AP-3 and the Monofill, ranging from 11 to 82 mg/kg, based on the total metal analyses (Tables 4 and 5). These concentrations of cobalt are within the average crustal abundance of cobalt for the continental United States (Shacklette and Boerngen 1984), but some are enriched compared to an average consensus of 25 mg/kg (Smith and Huyck, 1999). The presence of cobalt in soils upgradient of the AP-3 and Monofill supports the observation that there is naturally occurring cobalt in aquifer soils. Most of the cobalt from SEP analysis for three of the four solid samples analyzed in 2022 and 2021 is associated with the metal oxide/hydroxide fraction and more soluble fractions. In particular, the cobalt-metal oxyhydroxide association in the sample from ARGWC-17 constitutes about 60 percent of the total cobalt (Table 7). The mass and proportion of cobalt bound with the same fraction of the soil were found to be about half as much in the upgradient sample ARGWC-24, although there is still ample cobalt in the upgradient soil to influence the concentration of cobalt in groundwater.

Neither arsenic nor lithium were measured above detectable limits for the SEP analyses for the ARGWC-17 soil sample collected in 2022, which is an important consideration for treatability testing and remedy selection. Treatments that optimize cobalt sorption may also mobilize other Appendix IV constituents such as arsenic and lithium, if these constituents are present. While some lithium was measured in SEP analyses conducted in 2021, most of the extracted mass was associated with non-available fractions (Tables 6 and 7). Total metal concentrations generally aligned with the SEP sum of the individual steps, apart from arsenic for the ARGWC-17 sample, which was not detected in the SEP fractions. Discrepancies between the sum of SEP results and the total metal results commonly occur due to the small subsample size used for analysis, and varying detection limits and acid strengths. ARGWC-17 groundwater and soil samples were used in treatability testing to evaluate whether the SSL exceedance for cobalt could be addressed through optimization of in situ geochemical conditions.

3 Treatability Testing

Treatability testing has been completed by Terra Systems, Inc. (TSI) on soil and groundwater from ARGWC-17. The purpose of the testing was to evaluate whether iron addition, pH adjustment, and/or ORP adjustment can be used to control cobalt concentrations in groundwater. The mechanisms targeted for treatment stem from the mechanisms identified as controlling cobalt mobility under site conditions. Those mechanisms include raising the groundwater pH (using sodium hydroxide or sodium bicarbonate) to increase cobalt sorption and adjusting the ORP and/or enhancing the precipitation of iron while buffering the pH to precipitate amorphous iron hydroxides and increase sorption of cobalt (using Ferroblack, Ceres MTS 73MF2, or Ceres MTS 73MF3 reagents).

As described in the TSI report in Appendix C, titrations were conducted with sodium hydroxide and sodium bicarbonate to evaluate dosing requirements for batch testing to target optimal pH for sorption to aquifer solids. Batch testing was conducted using sodium hydroxide, sodium bicarbonate, Ferroblack,

Ceres MTS 73MF2, and Ceres MTS 73MF3. The Ferroblack reagent was found to contain arsenic, cobalt, and molybdenum and was excluded from further evaluations. The Ceres treatments did not mobilize arsenic, cobalt, lithium, or molybdenum under site conditions. Control samples were prepared by mixing aquifer solids and groundwater from ARGWC-17 and were found to contain arsenic above the GWPS in addition to cobalt. Therefore, subsequent testing included cobalt and arsenic. Arsenic detected in control samples is likely an indication of soil composition. Although arsenic was not detected in extractions during SEP analysis of soil form ARGWC-17, total arsenic was detected at 13 mg/kg in the same soil sample. This discrepancy may be partly due to elevated detection limits of the SEP analysis, variability within the soil sample, or other sampling or analytical testing artifacts.

Batch testing results are presented on Figure 10 for arsenic and Figure 11 for cobalt. During batch testing, cobalt was reduced below the GWPS in the batch tests using sodium hydroxide, sodium bicarbonate, and the two Ceres reagents, except for the pH 6.5 s.u. treatment with sodium hydroxide. Arsenic remained above the GWPS in the batch tests except for the three percent loading rates of both Ceres reagents. Based on the batch testing, sodium bicarbonate and the two Ceres reagents were selected for column testing.

Column study testing results are presented on Figure 12 for arsenic and Figure 13 for cobalt. There were initial problems with plugging of the Ceres MTS 73MF2 column. Ceres MTS 73MF2 is a solid reagent and did not fully dissolve, which led to plugging problems. The test using that reagent was stopped, the column was repacked by mixing soil with the solid reagent and started again. The column study results indicate that all three reagents effectively treated both arsenic and cobalt to below the GWPS for the duration of the study. The data indicated that both sodium bicarbonate and Ceres MTS 73MF3 are effective soluble reagents which could work as injection solutions for treatment. Ceres MTS 73MF2, which is a solid, is more applicable as a soil reagent that could be mixed with soil and used in a reactive barrier, or as a surface soil treatment to prevent leaching of cobalt and arsenic.

The TSI treatability testing final reports for batch and column studies are included in Appendix C.

4 Geochemical Conceptual Site Model

4.1 Overview of Geochemical System

This section provides a summary of the geochemical system that serves as the basis for developing a GCSM to be used in construction of geochemical models and in remedy selection.

Groundwater quality at the Arkwright Plant is affected by numerous geochemical processes, including sorption, cation exchange, precipitation, and dissolution. The effect of these geochemical processes can explain the observed behavior of cobalt in CCR pore water and groundwater and can influence the attenuation of CCR constituents. The nature and extent of the interaction between dissolved constituents in groundwater, unconsolidated materials, saprolite and bedrock range from limited interaction for constituents such as boron, chloride, and sulfate, to strong interaction for constituents such as cobalt. The following geochemical reactions or processes are likely mechanisms influencing the fate and transport of cobalt in groundwater:

- **Sorption on the surfaces of metal oxyhydroxides** – an interaction between dissolved constituents and the surface of certain metal oxyhydroxide minerals (most often iron, but also manganese and aluminum), whereby constituents sorb onto metal oxyhydroxides that are often coating soil mineral surfaces, or constituents desorb (i.e., reaction is reversible) and become dissolved in groundwater; this process is controlled by the pH of groundwater.

- **Cation exchange with clay minerals** – primarily affects positively charged constituents by interacting with the clay minerals; CEC varies by clay mineral, sorption is influenced by competition among cations and concentrations of constituents; cation exchange reactions are reversible.

- **Mineral precipitation or dissolution** – a process where constituents in groundwater combine to form a soil mineral (typically iron and manganese oxyhydroxides); minerals are also subject to dissolution (i.e., reaction is reversible) under certain groundwater pH and redox conditions.

Groundwater quality at AP-3 and Monofill is influenced by the chemistry of source waters and subsequent interaction with the geology of the uppermost aquifer. At AP-3 and Monofill there are at least three potential sources of water: the upgradient groundwater observed at monitoring wells ARGWA-3, ARGWA-5, ARGWA-12, ARGWA-14 and ARGWA-24; pore water from AP-3 observed at AP3PZ-1A through AP3PZ-5A (which shows a wide range of chemical composition); and pore water from the Monofill observed at ARK-STN-TW37. Surface water from nearby drainage features may also influence the downgradient groundwater geochemistry.

The evidence of CCR pore water influence in downgradient wells is observed in Figures 5 and 6. Sulfate, a common indicator of CCR material influence, is observed at concentrations roughly one order of magnitude higher in downgradient wells than is observed in most upgradient wells. Sulfate concentrations in pore water samples from AP-3 and Monofill are higher than concentrations in background wells, indicating potential influence of CCR pore water on downgradient well chemistry. Boron, another common indicator of CCR influence, is observed in downgradient groundwater at concentrations that are comparable to those observed in CCR pore water but is generally not detected in background wells (Appendix A).

As discussed in section 2.1.1, geochemical conditions in well ARGWA-13 (located near the northern edge of Monofill) indicates potential residual influence of CCR pore water at this location. ARAGW-13 has a calcium-sulfate water type and sulfate concentrations close to those observed in the ARK-STN-TW37 (Monofill) pore water. Although ARGWA-13 has high and variable concentrations of total dissolved solids (TDS) and sulfate, it also has a higher pH which appears to influence the concentration of cobalt observed in that well. The cobalt concentration in ARGWA-13 has dropped below detection limits over the past nine monitoring events and does not exceed the GWPS.

Geochemical conditions at ARGWC-17 indicate limited potential for attenuation of cobalt in this immediate area, potentially due to iron precipitation during mixing of CCR pore water and groundwater upgradient of this location, lowering the pH (and consequently the extent of cobalt sorption). ARGWC-17 has low pH (5.02 to 5.75 s.u.) compared to most other wells, and sulfate and TDS concentrations that are in the same range or lower than many of the other wells. In addition, iron concentrations are lower in ARGWC-17 (0.057 to 0.171 mg/L) than those observed in the CCR pore water samples for AP-3 (12.3 to 52.5 mg/L) and the Monofill (68.1 mg/L). Manganese concentrations are also slightly lower in ARGWC-17, but

manganese is also lower in the pore water from AP-3 and Monofill and tends to precipitate more slowly than iron. ORP is much higher in upgradient wells than CCR pore water samples, such that if mixing occurs between groundwater and CCR pore water, iron would be predicted to precipitate. However, the reducing conditions from the CCR pore water might also influence manganese, which undergoes reduction at a higher ORP than does iron. Low pH and low iron concentrations in ARGWC-17 are consistent with iron precipitation reactions occurring upgradient of this well. The Eh pH diagram for iron (Figure 8) indicates that water from ARGWC-17 is on the boundary of the stability threshold for the formation of amorphous iron hydroxide, upgradient wells ARGWA-3, ARAGWA-5, ARAGW-12, and ARAGW-24 border on the stability range. The CCR pore water plots outside of the stability range for amorphous iron hydroxide in Figure 8, the basis for the diagram is the iron concentration of ARGWC-17. When the pore water iron concentration is the basis for the diagram, the pore water remains outside of the stability range of amorphous iron hydroxide. Both ARGWC-17 and CCR pore water fall in the stability range for dissolved manganese (Figure 9). Mixing of CCR pore water and more oxidizing upgradient water would tend to form the low iron and pH, and manganese reducing conditions observed at ARGWC-17.

The stability diagram for manganese in CCR pore water and ARGWC-17 in Figure 9 appears to indicate that reductive dissolution of manganese oxides could be one of the explanations for the cobalt detections above the GWPS. In particular, reductive dissolution is supported by the undersaturation of manganite (Table 2), the high concentration of reactive phase (SEP Steps 1-4) manganese (Table 7), and the correlation between manganese and cobalt (Figure 14). There is likely a potential linkage between manganese oxide dissolution and cobalt mobilization. Due to instability of manganese oxides in site groundwater the role of manganese in attenuation of dissolved cobalt is not likely to be significant relative to iron.

4.2 Cobalt Mobilization and Attenuation Processes

Based on this geochemical evaluation, the site-specific processes influencing cobalt mobilization at ARGWC-17 may be related to two potential sources that are driven by geochemical processes: (1) the influence of CCR pore water; and (2) release of naturally occurring cobalt from aquifer solids as a result of desorption from iron oxyhydroxides and/or manganese oxides. Potential influence of these sources contributing to cobalt mobilization and detection in the vicinity of ARAMW-7 is suggested by the following:

1. Potential contributions of cobalt from AP-3 and/or Monofill pore water in the vicinity of ARGWC-17 is suggested by the following:

    a. CCR pore water contained within AP-3 and the Monofill exhibits cobalt concentrations approximately one order of magnitude greater than the GWPS (Appendix A). The one monitoring well with cobalt concentrations above the GWPS, ARGWC-17, is located downgradient and between AP-3 and the Monofill, within the potential area of influence of both units. The stream separating AP-3 and the Monofill is a relocated stream following the construction of the CCR disposal facilities and does not appear to act as a groundwater divide, based on hydrogeologic evaluations. Measured stream elevations are approximately similar to groundwater elevations on either side of this drainage feature (Figure 4C of the Draft Remedy Selection Report).

b. Groundwater samples collected from ARGWC-17 have a similar geochemical signature to AP-3 and Monofill pore water (Figures 5 and 6), as indicated by major ion concentrations and CCR indicators such as boron and sulfate.

c. As upgradient groundwater migrates below AP-3 and the Monofill and potentially mixes with CCR pore water, iron hydroxides may form, which would sorb dissolved metals such as cobalt, but also generate acidity, potentially lowering the pH, limiting sorption of cobalt such that CCR pore water cobalt remains in solution. ARGWC-17 has one of the lowest pH values in the monitoring well network and is also in close proximity to both AP-3 and the Monofill, which could explain the detections of cobalt above the GWPS.

d. Analysis of solubility indices and review of the Eh pH diagram (Figure 8) indicate iron hydroxides are stable in groundwater at upgradient monitoring wells, which is consistent with the oxidizing conditions and low iron and manganese concentrations observed at these wells. However, the data indicate that iron hydroxides are not stable in CCR pore water samples from AP-3 and the Monofill. Groundwater conditions at ARGWC-17 are on the boundary of the stability range for iron hydroxides, which suggests possible influence of both groundwater and CCR pore water at this location. Sorption on iron hydroxides is a primary mechanism for cobalt attenuation.

2. Potential mobilization of cobalt from naturally occurring soils in the vicinity of ARGWC-17 is suggested by the following:

a. Total and SEP cobalt analyses indicate that up to 61% of cobalt is present in potentially mobile forms in soils from ARGWC-17, i.e., in the form of iron and manganese oxides and exchangeable phases. These are variable charge minerals and their sorption potential is highly dependent on pH. The lower pH in the vicinity of ARGWC-17 tends to reduce sorption and would desorb cobalt from naturally occurring aquifer solids.

b. Iron and manganese minerals are sensitive to the redox condition of groundwater and can dissolve as conditions become increasingly reduced, which would also release sorbed constituents to the groundwater, including cobalt. If reductive dissolution of manganese oxide occurs at lower pH conditions (i.e., less than 6), cobalt mobilized by manganese oxide dissolution would not sorb to iron oxyhydroxides because the iron oxyhydroxides tend to desorb cobalt at a higher pH than manganese oxides (Kosmulski 2020).

c. The potential dissolution of cobalt-bearing manganese minerals in the soil strata may serve as a source of cobalt in groundwater in the vicinity of ARGWC-17, which is located downgradient of AP-3 and the Monofill. Groundwater conditions around AP-3 and the Monofill are generally oxidizing, except in discrete areas downgradient of AP-3 and the Monofill (ARAMW-3, ARGWC-18, andARAMW-4) and in one well upgradient of the Monofill (ARGWA-14). The reducing condition observed in the groundwater downgradient of AP-3 and the Monofill appears to be due to influence from CCR pore water infiltrating into the underlying soils. This influence of chemically reduced CCR pore water on the downgradient groundwater results in higher concentrations of dissolved iron and manganese as iron and manganese oxyhydroxides present in the soils dissolve through

the process of reductive dissolution. This relationship is observed both from the negative correlation of iron and ORP in Figure 3 and to a lesser degree from the correlation of manganese and ORP in Figure 4. ARGWC-17 is anoxic (Table 1) and groundwater chemistry for this well suggests reductive dissolution has occurred based on the undersaturation of pyrolusite (Table 2), the high concentration of reactive phase (SEP Steps 1-4) manganese (Table 7), and the correlation between manganese and cobalt (Figure 14).

d. The Eh pH diagrams (Figures 7 - 9) of cobalt, iron, and manganese indicate that the groundwater system at ARGWC-17 is consistent with cobalt and manganese in solution and iron at the edge of iron hydroxide formation. The data illustrated in Figure 14 show a correlation between the concentrations of cobalt and manganese in groundwater downgradient of the Monofill, which is consistent with release of cobalt through dissolution of cobalt-bearing manganese minerals.

4.3 Summary of Geochemical Conceptual Site Model

The GCSM indicates that pH and ORP are controlling the attenuation of cobalt at ARGWC-17. Cobalt is likely to be attenuated by iron and manganese oxyhydroxide sorption. Key details are discussed below.

Groundwater and aquifer solid data from AP-3 and Monofill suggests two potential sources of the cobalt SSL at ARGWC-17 that is screened in the overburden (saprolite) near the interface with partially weathered rock: (1) a source of cobalt from CCR pore water (AP-3 and/or Monofill); and (2) naturally occurring cobalt from aquifer solids.

The following provides the rationale for the two possible mechanisms for the occurrence of cobalt (above GWPS) at ARGWC-17:

1. Iron appears to precipitate between AP-3/Monofill wells and ARGWC-17, which will tend to both sorb cobalt but also generate acidity which will reduce the downgradient pH and limit cobalt sorption, resulting in downgradient cobalt concentrations above the GWPS.

2. Although iron is oxidized through mixing with upgradient groundwater between CCR pore water wells (AP-3 and Monofill) and groundwater well ARGWC-17, there is evidence of reductive dissolution of manganese oxides in the aquifer solids (Figures 9 and 14), releasing cobalt into groundwater, resulting in an increased concentration of cobalt at ARGWC-17.

It is likely that one or both mechanisms are contributing to the presence of cobalt in groundwater above the GWPS in ARGWC-17. Attenuation of dissolved cobalt is likely to be primarily controlled by pH-dependent sorption reactions with iron oxyhydroxides. Current treatability results indicate that sodium bicarbonate and Ceres MTS 73MF3 are effective methods to treat groundwater. Ceres MTS 73MF2, although effective, is poorly soluble and would be limited to mixing with solid material.

5 References

Adriano, D.C. 1986. Other trace elements. p. 475–479. In Trace elements in the terrestrial environment. Springer, New York.

Appelo, C.A.J. and Postma D. 1996. Geochemistry, Groundwater, and Pollution. Balkema. 535 p.

Bethke, Craig. 2022. Geochemical and Biogeochemical Reaction Modeling. 3rd Edition. Cambridge University Press.

Clark, William Z. and Arnold C. Zisa. "Physiographic map of Georgia [1976]." University of Georgia. Map and Government Information Library. 1976, http://dlg.galileo.usg.edu/do:dlg_ggpd_s-ga-bn200-pg3-bm1-b1976-bp46.

Georgia Power. 2018. AP3-DAS Landfill – Limited Hydrogeological Assessment Report for Inactive CCR landfill Former Plant Arkwright, Ap2 Das Landfill Macon-Bibb County, Georgia. November 2018**.**

Han, F.X., and A. Banin. 2000. Long-term transformations of cadmium, cobalt, copper, nickel, zinc, vanadium, manganese, and iron in arid-zone soils under saturated condition. Commun. Soil Sci. Plant Anal. 31:943–957.

Jacobs, 2018. Limited Hydrogeological Assessment Report for Inactive CCR Landfill – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, February 28, 2022.

Jurgens, B.C., McMahon, P.B., Chapelle, F.H., and Eberts, S.M., 2009, An Excel® workbook for identifying redox processes in ground water: U.S. Geological Survey Open-File Report 2009–1004 8 p.

Kosmulski, M. 2020. The pH dependent surface charging and points of zero charge. VIII. Update. Advances in Colloid and Interface Science. Volume 275, January 2020.

LeGrand, H.E. 1962. geology and ground-water resources of the Macon area, Georgia. Geological Survey. Bul. No 72. United States Geological Survey.

Miller, J. A, 1990. Ground Water Atlas of United States – Alabama, Florida, Georgia, and South Carolina, Paper HA-730-G. United States Geological Survey.

Shacklette and Boerngen, 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, Paper 1270. United States Geological Survey.

Smith, K.A. 1990. Manganese and cobalt. p. 197–221. In B.J. Alloway (ed.) Heavy metals in soils. Blackie and Son, London.

Smith, K.S. and Huyck, H.L.O. 1999. *An Overview of the Abundance, Relative Mobility, Bioavailability, and Human Toxicity of Metals*. In G.S. Plumlee and M.J. Logsdon (Eds.), The Environmental Chemistry of Mineral Deposits, Reviews in Economic Geology, Volume 6A, pp. 29-70

Sonon, Leticia S., David E. Kissel, and Uttam Saha. Revised 2022. Cation Exchange Capacity and Base Saturation. University of Georgia Extension, Circular 1040.

Southern Company Services, Inc., 2005, *Plant Arkwright Ash Ponds 2 and 3 and Ash Monofill Site Acceptability Report*, Revision 1.

Stantec, 2023. Semi-Annual Groundwater Monitoring and Corrective Action Report – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, February 28, 2023.

Stantec. 2023b. Annual groundwater monitoring and corrective action report. Plant Arkwright, Ash Pond 3 Landfill and Monofill. Macon, Georgia. July 31, 2023.

Stefaniak, S., Kmieck, E., Miszczak, E., Szczepanska-Plewa, J., and Twardowska, I. 2015. Effect of weathering transformations of coal combustion residuals on trace elements mobility in view of the environmental safety and sustainability of their disposal and use. II. Element release. Journal of Environmental Management, vol. 156, pp. 167-180.

Tessier A., P.G.C. Campbell, and M. Bisson (1979). Sequential Extraction Procedures for the Speciation of Particulate Trace Metals. Anal. Chem. 51(7): 844-851.

Wood Environment & Infrastructure Solutions, Inc. 2021. Semi-Annual Remedy Selection and Design Progress Report, Georgia Power Company – Plant Arkwright Ash Pond 3 Landfill and Monofill, Macon, Georgia, February 28, 2021.

TABLES

TABLE 1
Redox Classification of Groundwater
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Sample ID	Date	Dissolved Oxygen	Nitrate as Nirogen	Dissolved Manganese	Dissolved Iron	Sulfate	Sulfide/ Iron	Redox Classification	Redox Process
		(mg/L)					Mass Ratio		
ARGWA-24	8/9/2023	2.44	0.379	0.001	0.033	6.34		Oxic	O_2
ARAMW-4	8/9/2023	0.28	0.015	0.649	2.29	1140	45.8	Anoxic	Fe(III)
ARGWA-12	8/9/2023	2.95	0.522	0.001	0.033	6.19		Oxic	O_2
ARGWC-17	8/9/2023	0.31	0.436	2.67	0.061	237		Anoxic	Mn(IV)
ARGWC-10	8/9/2023	3.60	0.084	0.007	0.122	0.541	2.44	Mixed (Oxic-Anoxic)	O_2-Fe(III)-SO_4
ARGWA-13	8/9/2023	1.50	0.841	0.014	0.073	784		Oxic	O_2
ARGWA-3	8/9/2023	6.16	0.007	0.001	0.033	0.419		Oxic	O_2
ARGWC-15	8/9/2023	3.24	0.111	0.121	2.56	6.91	51.2	Mixed (Oxic-Anoxic)	O_2-Fe(III)/SO_4
ARGWC-9	8/9/2023	6.93	0.781	0.001	0.033	1.45		Oxic	O_2
ARGWC-8	8/9/2023	0.15	0.007	0.356	0.107	52.3	2.14	Mixed (Anoxic)	Fe(III)-SO_4
ARGWC-18	8/9/2023	0.35	0.007	0.854	1.02	194	20.4	Anoxic	Fe(III)
ARGWA-14	8/9/2023	6.74		0.002	0.046	14.4		O2 >= 0.5 mg/L	Unknown
ARGWC-7	8/9/2023	3.57	0.284	0.001	0.033	34.5		Oxic	O_2
ARGWA-5	8/9/2023	5.43	0.484	0.003	0.033	0.581		Oxic	O_2
ARGWC-16	8/9/2023	0.32	0.469	0.380	0.040	328		Anoxic	Mn(IV)
Criteria for inferring process from water-quality data									
		≥0.5	—	<0.05	<0.1	—		Oxic	O_2
		<0.5	<0.5	<0.05	<0.1	—		Suboxic	Suboxic
		<0.5	≥0.5	<0.05	<0.1	—		Anoxic	NO_3
		<0.5	<0.5	≥0.05	<0.1	—		Anoxic	Mn(IV)
		<0.5	<0.5	—	≥0.1	≥0.5	no data	Anoxic	Fe(III)/SO_4
		<0.5	<0.5	—	≥0.1	≥0.5	>10	Anoxic	Fe(III)
		<0.5	<0.5	—	≥0.1	≥0.5	≥0.3, ≤10	Mixed(anoxic)	Fe(III)-SO_4
		<0.5	<0.5	—	≥0.1	≥0.5	<0.3	Anoxic	SO_4
		<0.5	<0.5	—	≥0.1	<0.5		Anoxic	CH_4gen

Notes:

1. Table was modified from McMahon and Chapelle, 2008.
2. Redox process: O_2, oxygen reduction; NO_3, nitrate reduction; Mn(IV), manganese reduction; Fe(III), iron reduction; SO_4, sulfate reduction; CH_4gen, methanogenesis.
3. ARGWA-14 does not have nitrogen data due to insufficient water.

mg/L	milligram per liter
—	criteria do not apply because the species concentration is not affected by the redox process
≤	less than or equal to
≥	greater than or equal to
<	less than
>	greater than

TABLE 2
2023 GROUNDWATER MINERAL CALCULATED SATURATION INDICES
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill

Location	Date	Classification	pH	pe	Alabandite	$Co(OH)_2$	CoS	$Fe(OH)_3$	Hausmannite	Rhodochrosite	Pyrite	Pyrolusite	Siderite	$O_2(g)$	$CO_2(g)$
ARGWC-16	2/2/2023	East	5.18	6.25	-63.46	-10.41	-61.56	-3.41	-17.55	-1.50	-98.73	-11.73	-4.65	-37.37	-0.85
ARGWC-17	2/3/2023	East	5.22	5.95	-61.98	-8.23	-57.69	-2.84	-18.68	-1.91	-95.06	-12.46	-4.02	-38.44	-1.06
ARGWA-24	2/2/2023	Upgradient	5.62	4.31	-53.66	-9.43	-51.02	-3.98	-19.86	-1.21	-81.67	-14.51	-3.65	-43.39	-0.78
ARAMW-4	2/7/2023	East	5.64	3.23	-42.32	-8.53	-39.74	-3.23	-19.04	-0.29	-61.24	-15.64	-1.90	-47.62	-0.85
ARGWA-13	2/3/2023	Upgradient	5.84	8.69	-88.46	-9.07	-86.52	-0.54	-7.424	-0.40	-145.4	-4.22	-5.09	-24.97	-1.05
ARGWC-7	2/2/2023	West	5.85	5.53	-64.41	-8.98	-61.90	-1.81	-15.20	-1.19	-100.7	-11.02	-3.50	-37.58	-1.35
ARGWA-12	2/2/2023	Upgradient	5.86	5.47	-64.65	-8.96	-62.19	-2.15	-15.10	-0.70	-101.7	-11.06	-3.37	-37.81	-0.94
ARGWC-10	2/2/2023	West	5.86	5.75	-68.33	-8.94	-65.49	-1.12	-15.60	-1.21	-107.1	-10.85	-2.77	-36.68	-1.09
ARGWA-5	2/3/2023	Upgradient	5.93	4.69	-60.4	-8.63	-57.46	-1.44	-16.97	-1.08	-92.92	-12.62	-2.18	-40.63	-1.16
ARGWC-9	2/2/2023	West	6.00	6.25	-73.22	-8.65	-70.12	-0.33	-14.24	-1.81	-115.5	-9.544	-3.26	-34.12	-1.72
ARGWA-3	2/3/2023	Upgradient	6.07	4.99	-64.01	-8.51	-61.18	-1.19	-15.41	-1.14	-99.91	-11.51	-2.66	-38.86	-1.45
ARGWC-18	2/2/2023	West	6.12	3.63	-51.78	-7.95	-47.70	-3.01	-20.07	-1.36	-77.22	-14.82	-2.71	-44.11	-0.99
ARGWA-14	2/7/2023	Upgradient	6.25	4.52	-60.93	-8.19	-58.17	-2.04	-14.82	-0.38	-95.67	-11.71	-2.84	-40.04	-1.08
ARAMW-3	2/2/2023	West	6.26	4.54	-59.45	-8.04	-57.00	-1.05	-13.38	-0.05	-92.61	-11.19	-2.01	-39.92	-1.22
ARAMW-6	2/2/2023	West	6.45	4.94	-64.34	-7.81	-61.98	-0.85	-11.20	0.03	-102.3	-9.67	-2.66	-37.54	-1.47
ARGWC-8	2/2/2023	West	6.53	4.41	-60.50	-7.67	-58.34	-0.99	-11.09	0.56	-95.84	-10.23	-2.16	-39.34	-1.27
ARGWC-15	2/3/2023	East	6.73	5.22	-69.90	-7.26	-67.44	-0.14	-8.74	0.29	-113	-8.10	-2.69	-35.30	-1.65

Notes:

1. Values listed are logarithms and are unitless.
2. pe is the negative of the logarithm of the aqueous activity of an electron. pe = Eh/59.2 for Eh in millivolts; Eh = ORP + 200 for ORP in millivolts.
3. The SI for CO2(g) and O2(g) is equal to the calculated partial pressure of each gas.
4. Alabandite is MnS; $Co(OH)_2$ is cobalt(II) hydroxide; CoS is Cobalt Sulfide; $Fe(OH)_3$ is Ferrihydrite; Hausmannite is Mn_3O_4; Rhodochrosite is $MnCO_3$; Pyrite is FeS; Pyrolusite is MnO_2; Siderite is $FeCO_3$; $O_2(g)$ is oxygen gas; $CO_2(g)$ is carbon dioxide gas.
5. thermo.com.V8.R6+.tdat database was used to calculate SI in Geochemist's Workbench® (Bethke, 2022).

TABLE 3
GROUNDWATER MONITORING WELL DETAILS AND SAMPLE COLLECTION DEPTHS
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Well/Boring ID	Sample Collection Date	Sample Collection Depth (ft bgs)	Top of Casing Elevation (feet NAVD88)[1][2]	Ground Surface Elevation (feet NAVD88)[1][2]	Top of Screen Elevation (feet NAVD88)[1][2]	Bottom of Screen Elevation (feet NAVD88)[1][2]	Top of Screen Depth (feet bgs)[3]	Bottom of Screen Depth (feet bgs)[3]
Detection Monitoring Wells								
ARGWA-3			388.33	386.53	356.23	346.23	30.3	40.3
ARGWA-5			376.15	373.51	353.81	343.81	19.7	29.7
ARGWA-12			372.72	369.27	349.23	339.23	20.04	30.04
ARGWA-13			371.57	368.1	337.66	327.66	30.44	40.44
ARGWA-14			388.25	384.94	339.28	329.28	45.66	55.66
ARGWA-24			373.75	370.85	355.9	345.9	14.95	24.95
GWA-24-SB[4]	10/18/2022	15-23.9						
ARGWC-7			352.42	348.97	314.17	304.17	34.8	44.8
ARGWC-8			355.53	352.19	322.59	312.59	29.6	39.6
SB-9[5]	10/18/2021	29.6-39.6						
ARGWC-9			367.07	363.44	338.64	328.64	24.8	34.8
ARGWC-10			370.67	367.56	342.56	332.56	25	35
ARGWC-15			375.64	371.76	342.08	332.08	29.68	39.68
ARGWC-16			364.90	361.52	340.24	330.24	21.28	31.28
SB-6[5]	10/18/2021	17-25						
ARGWC-17			368.24	365.04	344.45	334.45	20.59	30.59
SB-8[5]	10/18/2021	20.6-30.6						
GWC-17-SB[4]	9/13/2022	20-30						
ARGWC-18			355.2	351.92	314.11	304.11	37.81	47.81
Assessment Monitoring Wells								
ARAMW-3			355.39	352.2	298.2	288.2	54	64
ARAMW-4			367.86	364.56	320.56	310.56	44	54
ARAMW-6			337.46	334.23	314.23	304.23	20	30
SB-7[5]	10/18/2021	20-30						

Notes:

1. Horizontal locations referenced to Georgia State Plane West, North American Datum (NAD) of 1983 surveyed in June 26, 2020.
2. Vertical elevations are feet referenced to North American Vertical Datum of 1988 (NAVD88).
3. ft bgs = feet below ground surface
4. Soil sample collected in September 2022
5. Soil sample collected in August 2021

TABLE 4
2021 AQUIFER SOLIDS MINERALOGY RESULTS
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Sample ID	SB-6-17-25	SB-7-20-30	SB-8-20.6-30.6	SB-9-29.6-39.6
Date	10/18/2021	10/18/2021	10/18/2021	10/18/2021
Location	SB-6	SB-7	SB-8	SB-9
Depth (ft-bgs)	17-25	20-30	20.6-30.6	29.6-39.6
Cation Exchange Capacity (USEPA Method 9081)(meq/100 gm)				
Cation Exchange Capacity	19	9.9	13	22
Total Organic Carbon (Lloyd Kahn Method)(mg/kg)				
Total Organic Carbon	<1000	<870	<970	<1000
X-Ray Diffraction, Rietveld Quantitative Analysis (wt%)				
Smectite	2.4	--	--	0.9
Kaolinite	12.5	--	8.9	2.0
Illite/Mica	0.4	3.5	18.9	1.4
Mx IS clays	4.3	2.1	1.3	2.7
Quartz	22.7	32.1	16.9	48.6
K-Feldspar	2.4	1.6	--	--
Plagioclase	13.1	41.4	40.8	32.8
Pyroxene	--	2.4	1.7	1.0
Maghemite	--	--	--	--
Pyrite	--	--	--	--
Goethite	--	--	--	--
Sepiolite	1.8	--	--	--
Amphibole	40.4	16.9	11.5	10.6
X-Ray Fluorescence (ppm)				
Aluminum	124,100	80,700	112,300	85,800
Silica	201,600	259,000	222,800	277,200
Titanium	5,700	4,000	4,300	--
Iron	150,400	81,600	107,200	72,300
Manganese	2,891	2,130	2,225	1,459
Magnesium	68,100	61,700	63,900	59,800
Calcium	36,546	36,547	27,048	30,903
Phosphorous	--	--	--	--
Barium	221	182	301	197
Chromium	898	766	597	670
Molybdenum	--	15	5	8
Niobium	7	7	9	4
Lead	--	--	--	--
Strontium	85	195	149	284
Tantalum	--	--	--	--
Thalium	--	--	--	--
Yttrium	55	41	62	34
Zinc	172	122	143	116
Zircon	95	122	94	87
Grain Size (Sieve and Hydrometer)				
Gravel (% Sample)	1.1	0.0	1.7	0.0
Total Sand (% Sample)	71.1	76.7	81.2	72.9
Coarse Sand	3.4	4.4	0.9	6.5
Medium Sand	25.2	29.1	22.1	27.1
Fine Sand	42.5	43.2	58.2	39.3
Silt	22.2	19.8	13.4	21.6
Clay	5.6	3.5	3.7	5.5
Total Metals (ppm)				
Mercury	<0.004	<0.004	<0.004	<0.004
Arsenic	0.09	0.18	0.13	0.09
Aluminum	29,600	15,700	24,700	13,600
Boron	<10	<10	<10	<10
Barium	284	147	294	156.5
Beryllium	1.72	0.47	1.33	0.76
Cadmium	0.049	0.069	0.106	0.059
Cobalt	82	16	30	11
Chromium	202	317	161	191
Iron	50,000	33,500	45,100	21,300
Lithium	18	6	8	5
Manganese	1,040	898	1,310	519
Molybdenum	2.49	9.68	4.67	4.14
Lead	9.57	3.30	3.81	4.03
Antimony	0.018	0.038	0.025	0.026
Selenium	0.045	0.028	0.018	0.022
Thallium	0.327	0.111	0.313	0.118

Notes:

1. Results are presented in feet below ground surface (ft-bgs); weight percent (wt%); parts per million (ppm);
2. -- is not detected
3. < indicates the constituent was not detected above the analytical method detection limit

TABLE 5
2022 AQUIFER SOLIDS MINERALOGY RESULTS
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Sample ID	ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913
Date	10/18/2022	9/13/2022
Location	ARGWA-24	ARGWC-17
Depth (ft-bgs)	15.0-23.9	20.0-30.0
X-Ray Diffraction, Rietveld Quantitative Analysis (wt%)		
Quartz	16.2	NA
Albite	30.1	NA
Microcline	8.5	NA
Actinolite	14.4	NA
Kaolinite	13.4	NA
Stilpnomelane	2.7	NA
Vermiculite	0.3	NA
Gypsum	1.8	NA
Hydroxylapatite	0.6	NA
Muscovite	11.0	NA
Lizardite	1.0	NA
X-Ray Fluorescence (%)		
Silica as SiO2	53.2	NA
Aluminum as Al2O3	17.9	NA
Iron as Fe2O3	9.96	NA
Magnesium as MgO	2.51	NA
Calcium as CaO	4.60	NA
Sodium as Na2O	2.80	NA
Potassium as K2O	1.20	NA
Titanium as TiO2	1.50	NA
Phosphorous as P2O5	0.33	NA
Manganese as MnO	0.16	NA
Chromium as Cr2O3	0.02	NA
Vanadium as V2O5	0.04	NA
Loss On Ignition	5.53	NA
Total Metals (µg/g)		
Mercury	< 0.05	< 0.05
Arsenic	4.1	13.0
Aluminum	15,000	20,000
Boron	< 1	< 1
Barium	170	210
Beryllium	0.45	2.60
Cadmium	0.05	0.13
Cobalt	17	48
Chromium	14	12
Iron	35,000	51,000
Lithium	6	7
Manganese	690	1400
Molybdenum	0.3	0.5
Lead	5.9	12.0
Antimony	< 6	< 6
Selenium	< 0.7	< 0.7
Thallium	0.11	0.20

Notes:

1. Results are presented in feet below ground surface (ft-bgs); weight percent (wt%); percent (%); micrograms per gram (µg/g).
2. Loss On Ignition refers to mineral water, carbonates, and hydroxides.
3. < indicates the constituent was not detected above the analytical method detection limit

TABLE 6
2021 AQUIFER SOLIDS SEQUENTIAL EXTRACTION PROCEDURE (SEP) ANALYTICAL DATA SUMMARY
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Cobalt																	
Sample ID	Sample Collection Date	SEP Step 1 Exchangeable Phase		SEP Step 2 Carbonate Phase		SEP Step 3 Non-Crystalline Minerals Phase		SEP Step 4 Metal Hydroxide Phase		SEP Step 5 Organic Phase		SEP Step 6 Acid/Sulfide Fraction		SEP Step 7 Residual Fraction		Sum SEP Steps 1-7	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
SB-6-17-25	9/1/2021	<0.25	---	<0.26	---	35	38	27	29	<0.84	---	13	14	18	19	93	18
SB-8-20.6-30.6	9/1/2021	<0.23	---	<0.24	---	12	43	3	11	<0.78	---	6.3	23	6.3	23	28	34
Lithium																	
Sample ID	Sample Collection Date	SEP Step 1 Exchangeable Phase		SEP Step 2 Carbonate Phase		SEP Step 3 Non-Crystalline Minerals Phase		SEP Step 4 Metal Hydroxide Phase		SEP Step 5 Organic Phase		SEP Step 6 Acid/Sulfide Fraction		SEP Step 7 Residual Fraction		Sum SEP Steps 1-7	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
SB-6-17-25	9/1/2021	<0.84	---	<0.63	---	<0.21	---	1.6	3.5	25	55	10	22	8.9	20	46	19
SB-8-20.6-30.6	9/1/2021	<0.78	---	<0.58	---	0.34	1.1	0.83	2.7	22	71	4.6	15	3.3	11	31	8.9
Molybdenum																	
Sample ID	Sample Collection Date	SEP Step 1 Exchangeable Phase		SEP Step 2 Carbonate Phase		SEP Step 3 Non-Crystalline Minerals Phase		SEP Step 4 Metal Hydroxide Phase		SEP Step 5 Organic Phase		SEP Step 6 Acid/Sulfide Fraction		SEP Step 7 Residual Fraction		Sum SEP Steps 1-7	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
SB-6-17-25	9/1/2021	<0.46	---	<0.34	---	<0.11	---	<0.11	---	<1.8	---	<0.14	---	<0.11	---	---	<0.11
SB-8-20.6-30.6	9/1/2021	<0.42	---	<0.32	---	<0.11	---	<0.11	---	<1.6	---	<0.13	---	<0.11	---	---	<0.53

Notes:

1. Discrepancies between the sum of SEP results and the Total Metal commonly occur, in particular due to the small subsample sizes used for analysis and varying detection limits.
2. SEP extractions performed as described in: Eurofins Test America Standard Operating Procedure (SOP)
3. Total concentrations determined by acid digestion (EPA Method 200.7)

TABLE 7
2022 AQUIFER SOLIDS SEQUENTIAL EXTRACTION PROCEDURE (SEP) ANALYTICAL DATA SUMMARY
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Aluminum

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	11	0.01	15	0.02	35	0.04	410	0.48	510	0.60	84,000	99	84,981	20,000
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	8	0.01	13	0.02	31	0.05	220	0.37	540	0.92	58,000	99	58,812	15,000

Arsenic

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	< 0.5	---	< 0.5	---	< 0.5	---	< 0.5	---	< 0.5	---	< 0.5	---	---	13
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	< 0.5	---	< 0.5	---	< 0.5	---	< 0.5	---	< 0.5	---	1.1	100	1.1	4.1

Cobalt

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	0.09	0.18	0.43	0.88	0.13	0.27	30	61	3.2	6.6	15	31	49	48
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	0.01	0.05	0.06	0.30	0.05	0.25	5.8	29	1.9	9.6	12	61	20	17

Iron

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	21	0.03	27	0.04	24	0.03	2700	3.8	130	0.18	69,000	96	71,902	51,000
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	16	0.03	26	0.05	46	0.08	2300	4.0	160	0.28	55,000	96	57,548	35,000

Lithium

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	< 2	---	< 2	---	< 2	---	< 2	---	< 2	---	9	100	9	7
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	< 2	---	< 2	---	< 2	---	< 2	---	< 2	---	8	100	8	6

Manganese

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	2.4	0.14	13	0.78	5.1	0.31	950	57	88	5.3	600	36	1,659	1,400
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	1	0.10	8.7	0.86	5.3	0.52	340	33	91	9.0	570	56	1,016	690

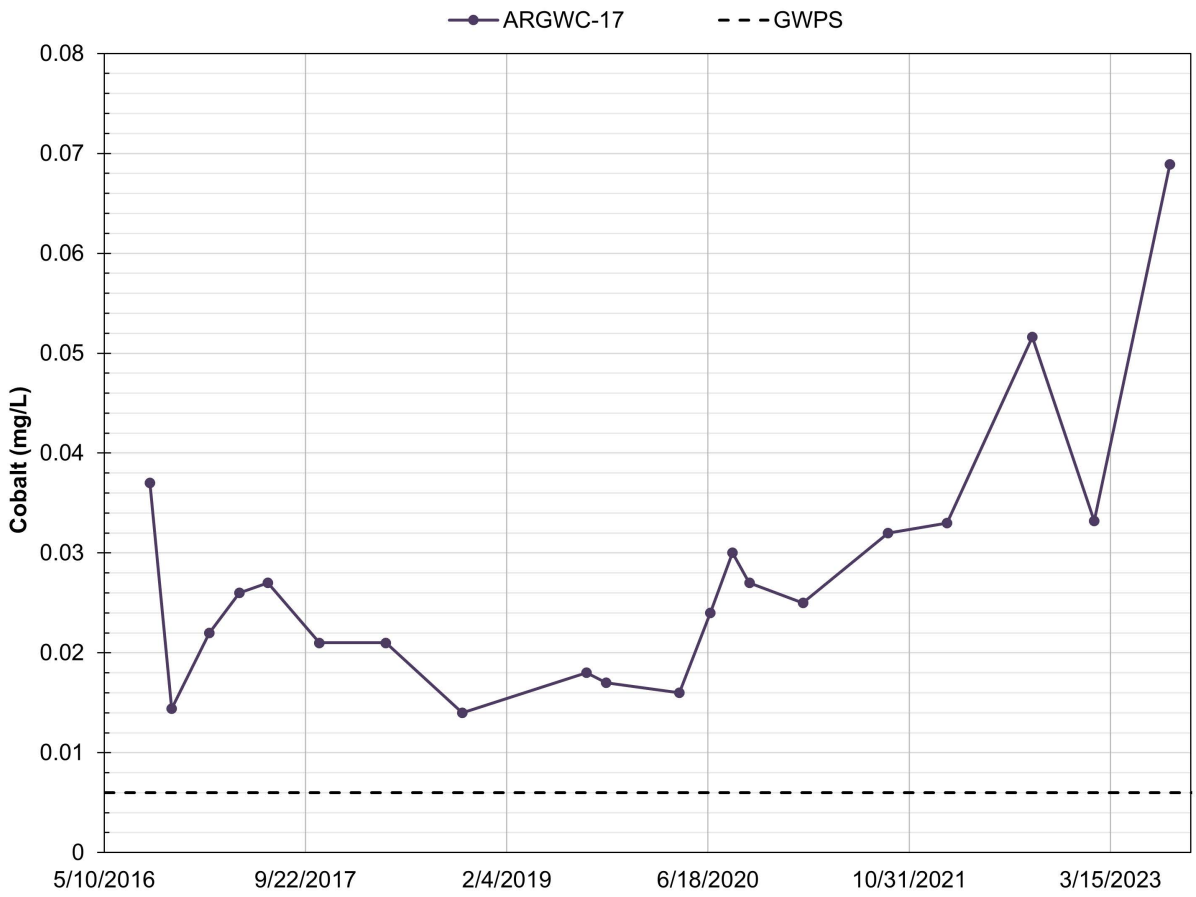
Molybdenum

Sample Name	Associated Well Location	SEP Step 1 Water Soluble Phase		SEP Step 2 Exchangeable Phase		SEP Step 3 Carbonates		SEP Step 4 Iron and Manganese Oxides		SEP Step 5 Organic Phase		SEP Step 6 Residual Phase		Sum SEP Steps 1-6	Total Concentration
		mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	%	mg/kg	mg/kg
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	ARGWC-17	<0.1	---	<0.1	---	<0.1	---	<0.1	---	0.3	43	0.4	57	0.7	0.5
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	ARGWA-24	<0.1	---	<0.1	---	<0.1	---	<0.1	---	0.1	13	0.7	88	0.8	0.3

Notes

1. Discrepancies between the sum of SEP results and the Total Metal commonly occur, in particular due to the small subsample sizes used for analysis and varying detection limits.
2. SEP extractions performed as described in: Tessier A., P.G.C. Campbell, and M. Bisson (1979). Sequential Extraction Procedures for the Speciation of Particulate Trace Metals. Anal. Chem. 51(7): 844-851.
3. Total concentrations determined by acid digestion (EPA Method 200.7)

FIGURES



Notes
1. mg/L - milligram per liter
2. GWPS - Groundwater Protection Standard

Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Stantec

Georgia Power

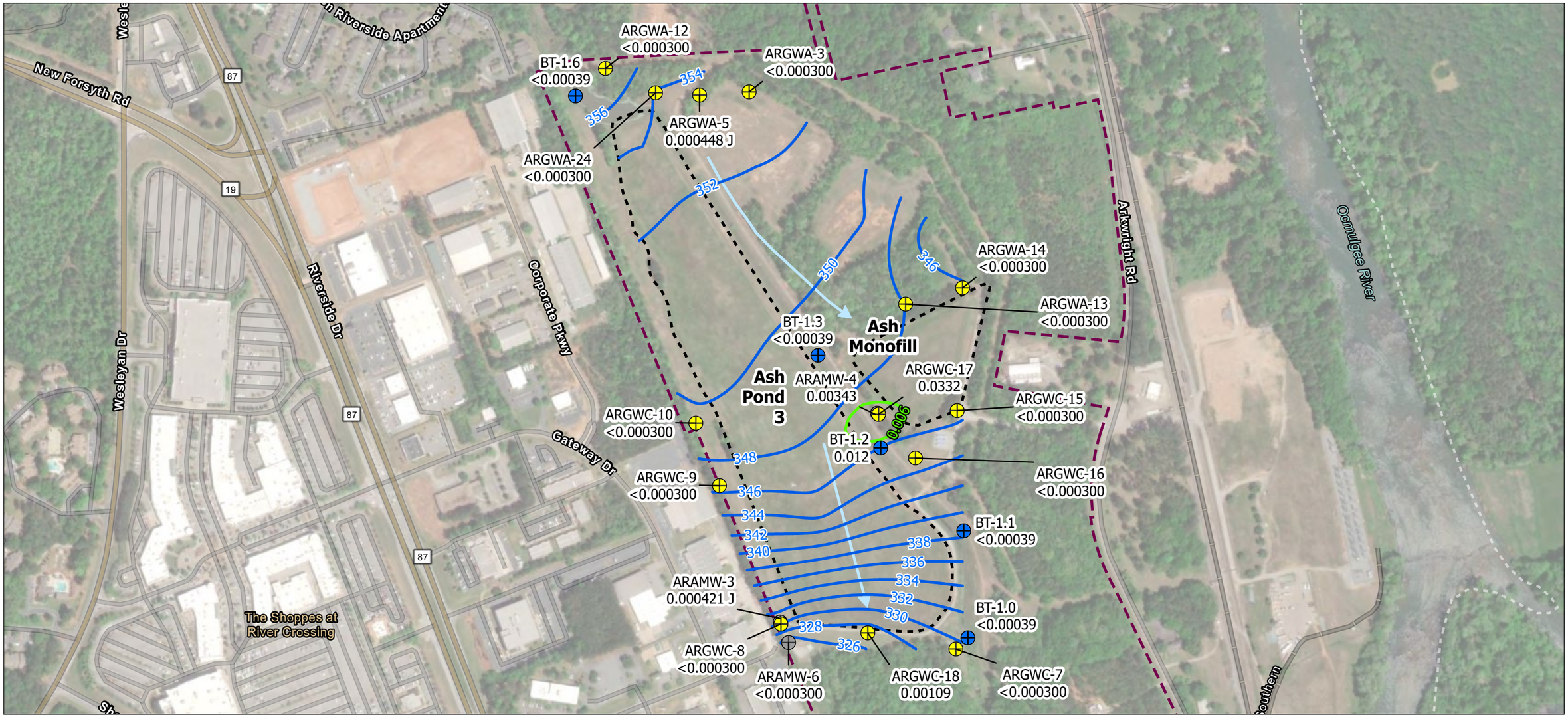
Project Location
Macon, Georgia

Prepared by PR on 2023-06-30
TR by BS on 2023-06-30
IR Review by RB on 2023-06-30

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
1

Title
Time Series - ARGWC-17 Cobalt



Notes
1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Monitoring Wells, Sampling Locations, Property Boundary, Flow Arrow, Contours, and Beaverdam Creek provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Surface Water Sampling Location
- Cobalt Concentration Contour Jan/Feb 2023 (mg/L)
- Potentiometric Surface Contour Jan 2023 (ft NAVD88)
- Interpreted Groundwater Flow Direction
- Approximate Property Boundary
- Ash Pond 3 and Ash Monofill Approximate Limits of Waste

0.000421 (J) Cobalt Concentration milligrams per Liter (mg/L)

Isoconcentration Notes:

Cobalt concentration data from groundwater and surface water samples collected during the January - February 2023 monitoring event.

J indicates the constituent was detected between the analytical method detection limit and the laboratory reporting limit. The value followed by J is qualified by the laboratory as estimated.

GWPS - Groundwater Protection Standard

Analyte	Units	GWPS
Cobalt	mg/L	0.006

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

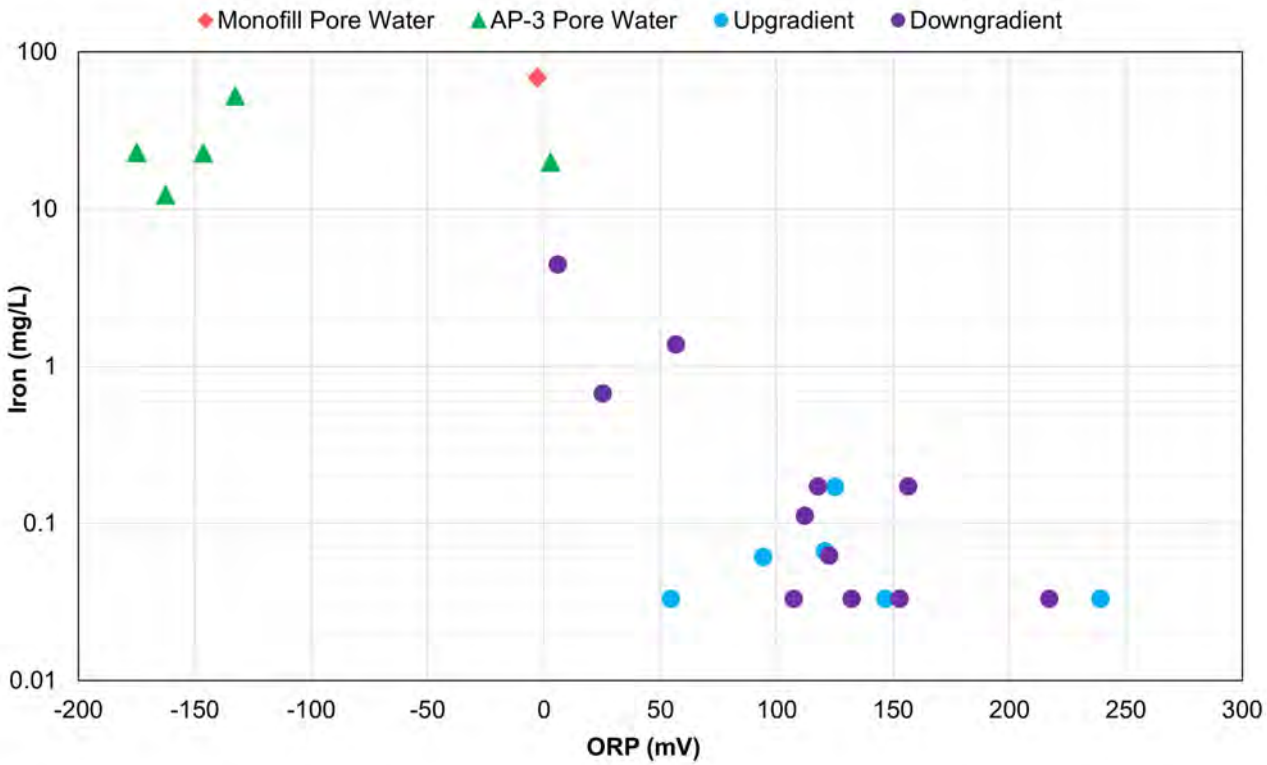
Project Location
Macon, Georgia

Prepared by DMB on 5/15/2023
TR by BS on 5/15/2023
IR by RB on 5/15/2023

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
2

Title
Isoconcentration Map for Cobalt February 2023



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. mg/L - milligrams per Liter
2. mV - millivolts
3. ORP - Oxidation Reduction Potential
4. Groundwater data presented was collected between August and September 2022; AP-3 pore water data was collected in September 2022; Monofil pore water was collected in April 2023.
5. Upgradient wells include ARGWA-3, ARGWA-5, ARGWA-12, ARGWA-13, ARGWA-14, and ARGWA-24.
6. Downgradient wells include ARGMW-3, ARGMW-4, ARGMW-6, ARGWC-7, ARGWC-8, ARGWC-9, ARGWC-10, ARGWC-15, ARGWC-16, ARGWC-17, and ARGWC-18.
7. Monofil pore water well includes ARK-STN-TW37.
8. AP-3 Pore water wells include AP3PZ-1A, AP3PZ-2A, AP3PZ-3A, AP3PZ-4A, and AP3PZ-5A.

Stantec

Georgia Power

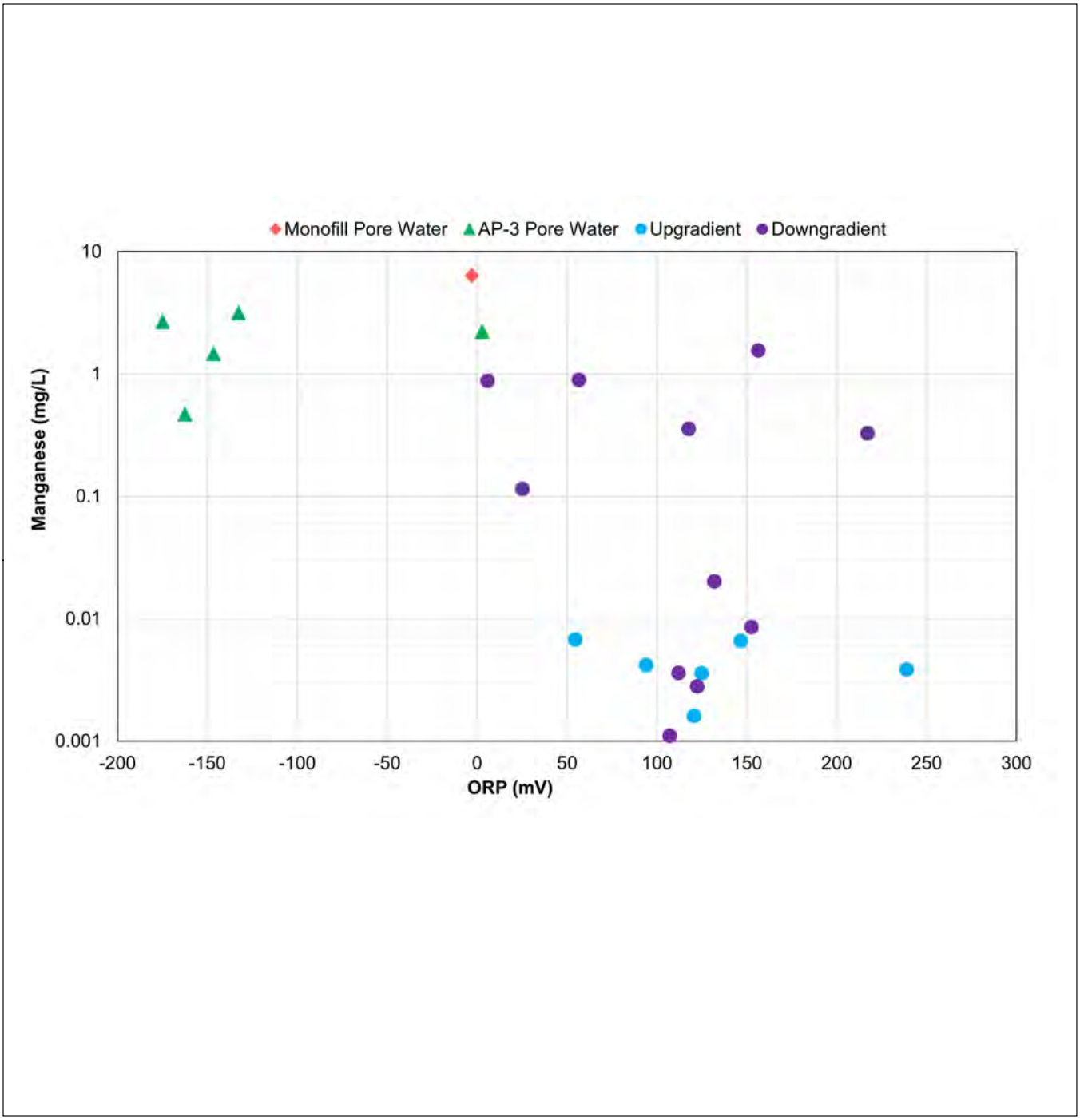
Project Location
Macon, Georgia

Prepared by DMB on 2023-06-23
TR by BS on 2023-06-23
IR Review by RB on 2023-06-23

Client/Project
175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
3

Title
Iron ORP Cross Plot



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. mg/L - milligrams per Liter
2. mV - millivolts
3. ORP - Oxidation Reduction Potential
4. Groundwater data presented was collected between August and September 2022; AP-3 pore water data was collected in September 2022; Monofil pore water was collected in April 2023.
5. Upgradient wells include ARGWA-3, ARGWA-5, ARGWA-12, ARGWA-13, ARGWA-14, and ARGWA-24.
6. Downgradient wells include ARGMW-3, ARGMW-4, ARGMW-6, ARGWC-7, ARGWC-8, ARGWC-9, ARGWC-10, ARGWC-15, ARGWC-16, ARGWC-17, and ARGWC-18.
7. Monofil pore water well includes ARK-STN-TW37.
8. AP-3 Pore water wells include AP3PZ-1A, AP3PZ-2A, AP3PZ-3A, AP3PZ-4A, and AP3PZ-5A.

Stantec

Georgia Power

Project Location
Macon, Georgia

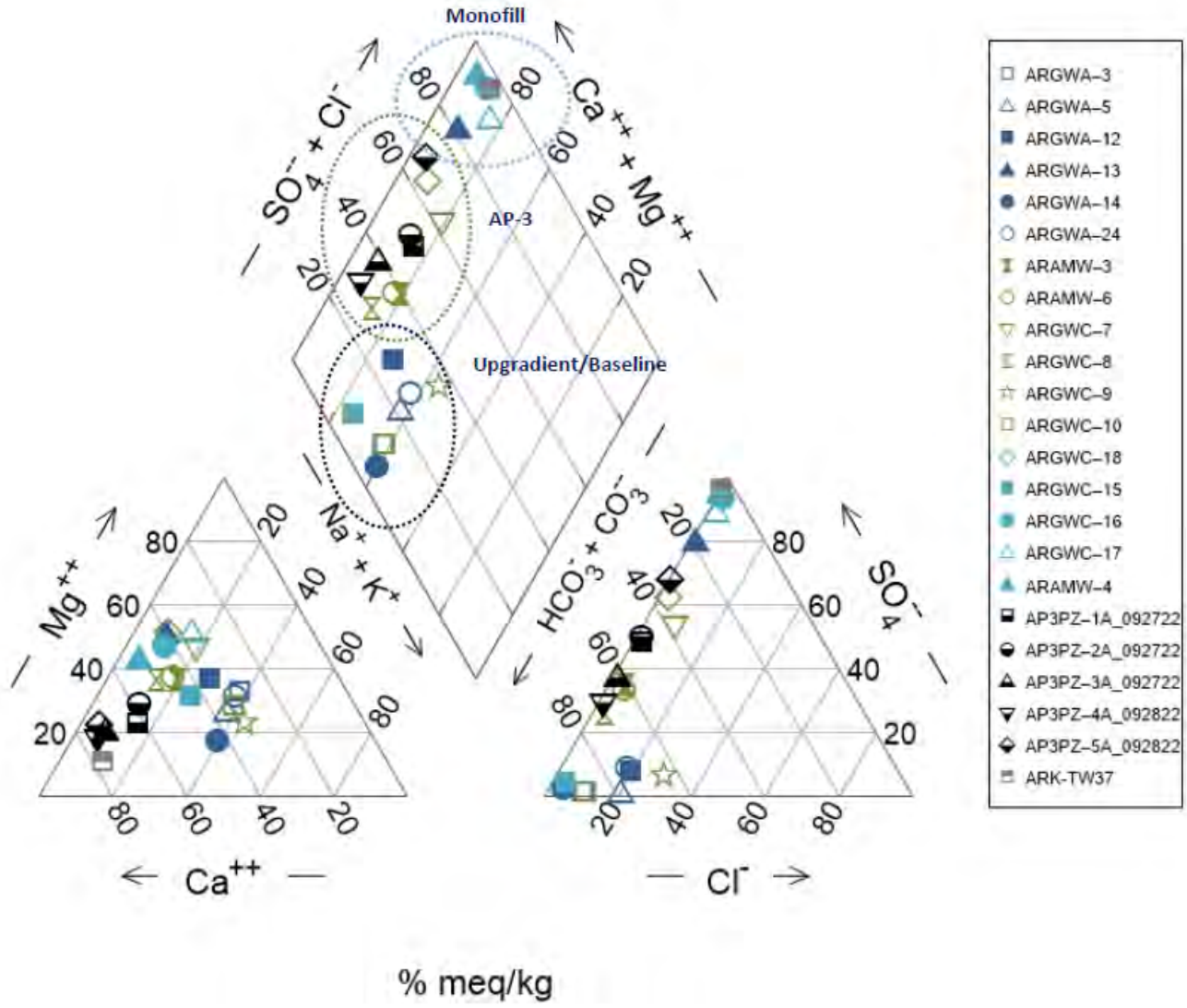
Prepared by DMB on 2023-06-23
TR by BS on 2023-06-23
IR Review by RB on 2023-06-23

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
4

Title
Manganese ORP Cross Plot

SCS Arkwright AP 3



% meq/kg

Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

Legend
- Upgradient
- East of Drainage Ditch
- West of Drainage Ditch
- Pore Water
- Temporary Well
- Bedrock (closed symbol)
- Overburden (open symbol)

Stantec

Georgia Power

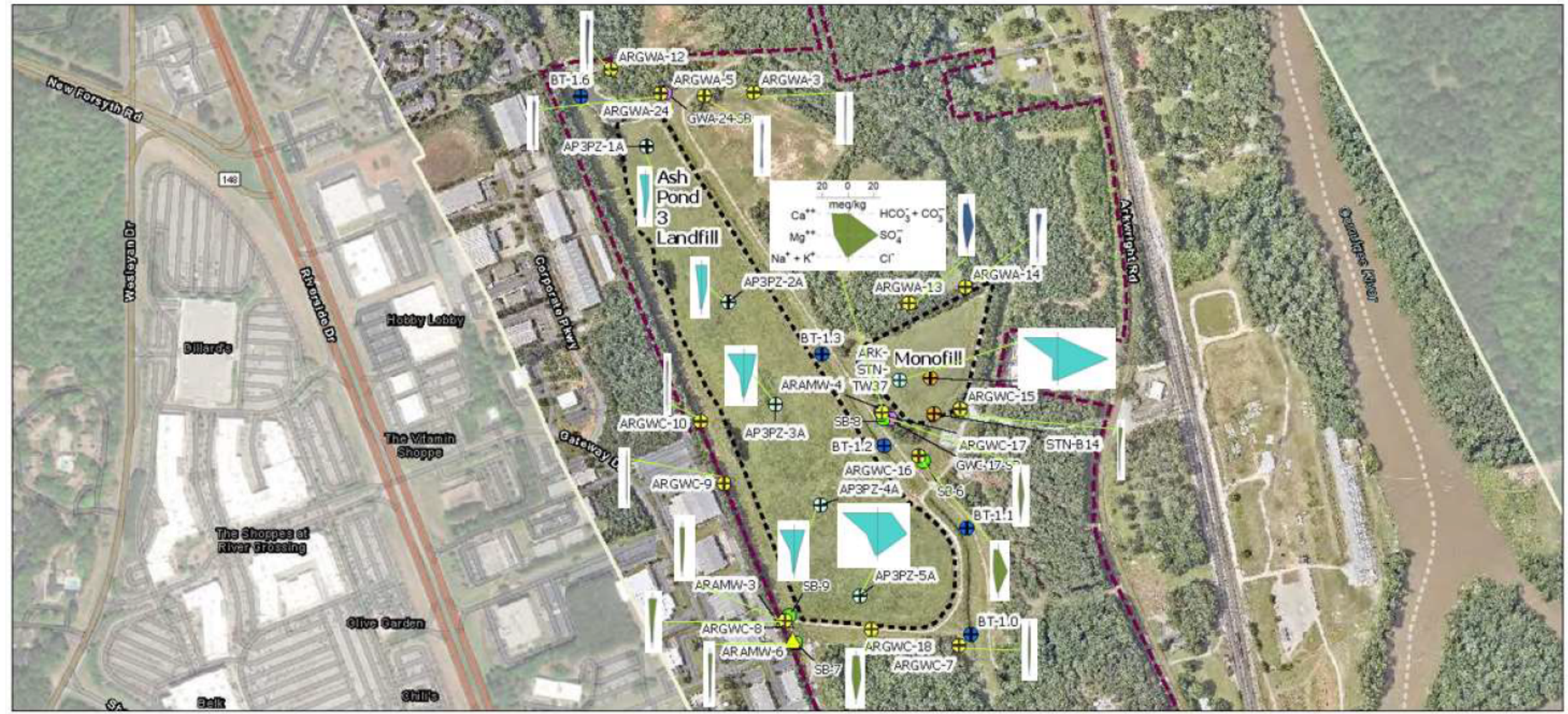
Project Location
Macon, Georgia

Prepared by DMB on 2023-05-22
TR by BS on 2023-05-22
IR Review by RB on 2023-05-22

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
5

Title
Piper Trilinear Plot

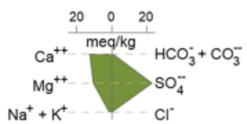


Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS, Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS. Plant imagery provided by client and is dated 7/13/2023.

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Porewater Piezometer
- Soil Boring
- Surface Water Sampling Location
- Stantec September-October 2022 Overburden Sample
- Wood September 2021 Overburden Sample
- Approximate Property Boundary
- Ash Pond 3 Landfill and Monofill (approximate location)
- Limit of Client Imagery (dated 7/13/2023)



Down Gradient

CCR Porewater

Up Gradient

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

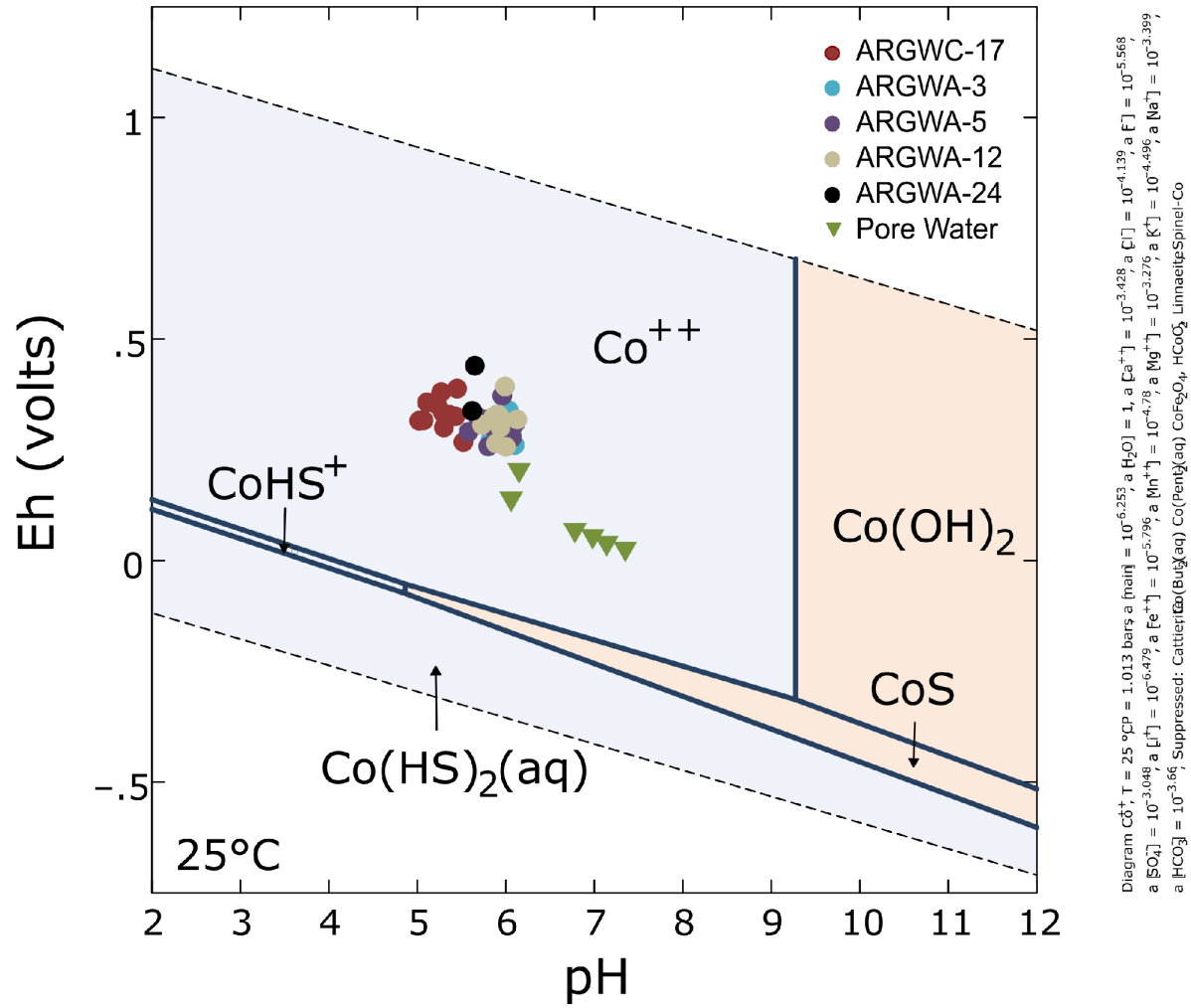
Project Location
Macon, Georgia

Prepared by DMB on 2/27/2024
TR by JK on 2/27/2024
IR by RB on 2/27/2024

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
6

Title
Stiff Diagrams



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. pH - acidity
2. Eh - electrical potential
3. Eh = ORP + 200 for ORP in millivolts
4. ORP - Oxidation-Reduction Potential
5. Ag/AgCl electrode used to measure ORP
6. Co^{++} - Cobalt ion
7. $Co(OH)_2$ - Cobalt Hydroxide
8. CoS - Cobalt Sulfide
9. $CoHS^+$ - Cobalt Hydrosulfide ion
10. $Co(HS)_2$ - Cobalt Hydroxidesulfide

Stantec

Georgia Power

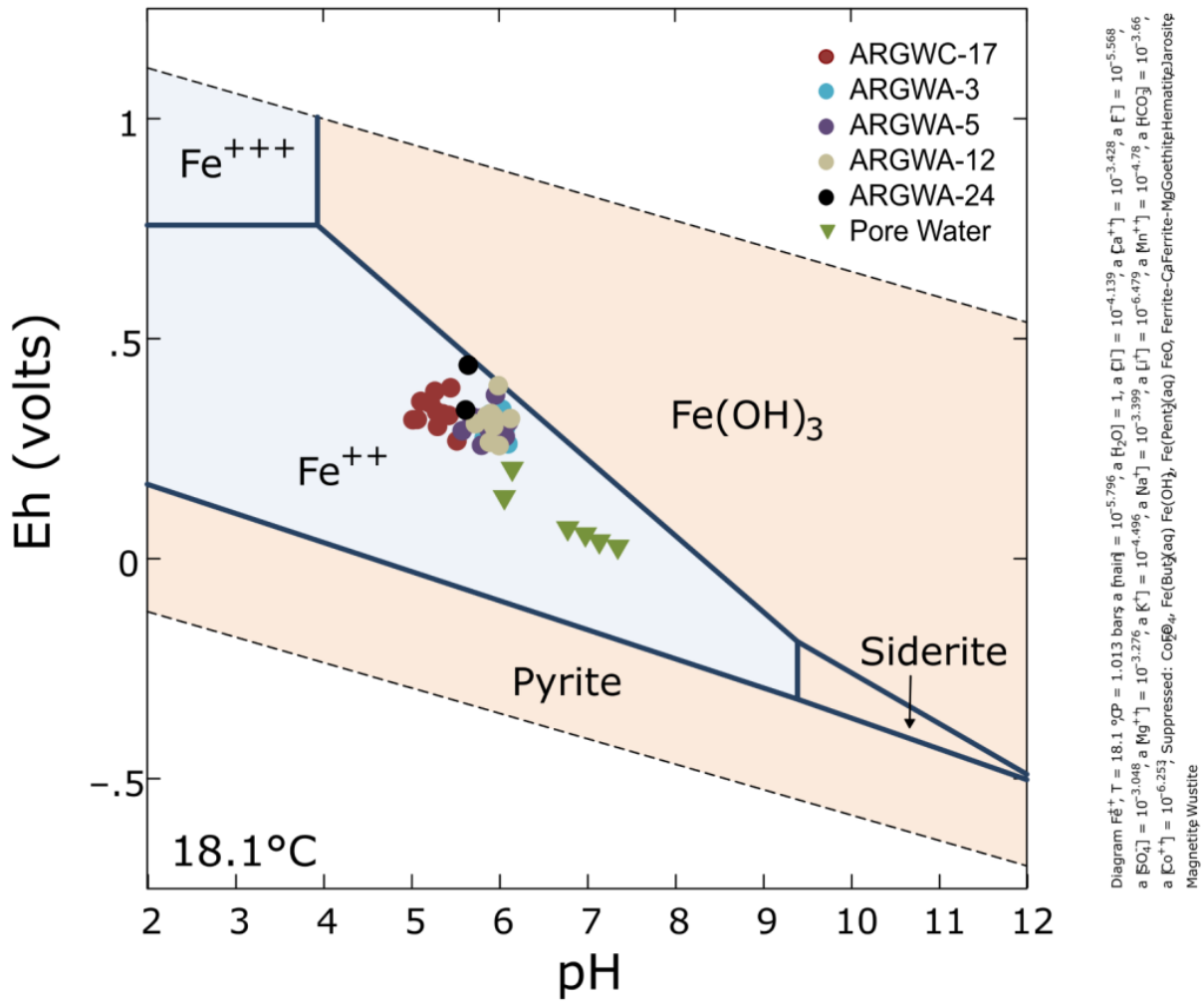
Project Location
Macon, Georgia

Prepared by PR on 2024-01-31
TR by BS on 2024-01-31
IR Review by RB on 2024-01-31

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7

Title
Eh pH Diagram - Cobalt



Notes
1. pH - acidity
2. Eh - electrical potential
3. Eh = ORP + 200 for ORP in millivolts
4. ORP - Oxidation-Reduction Potential
5. Ag/AgCl electrode used to measure ORP
6. Fe^{++} - Iron (II)
7. Fe^{+++} - Iron (III)
8. $Fe(OH)_3$ - Ferrihydrate

Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by PR on 2024-01-31
TR by BS on 2024-01-31
IR Review by RB on 2024-01-31

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
8

Title
Eh pH Diagram – Iron

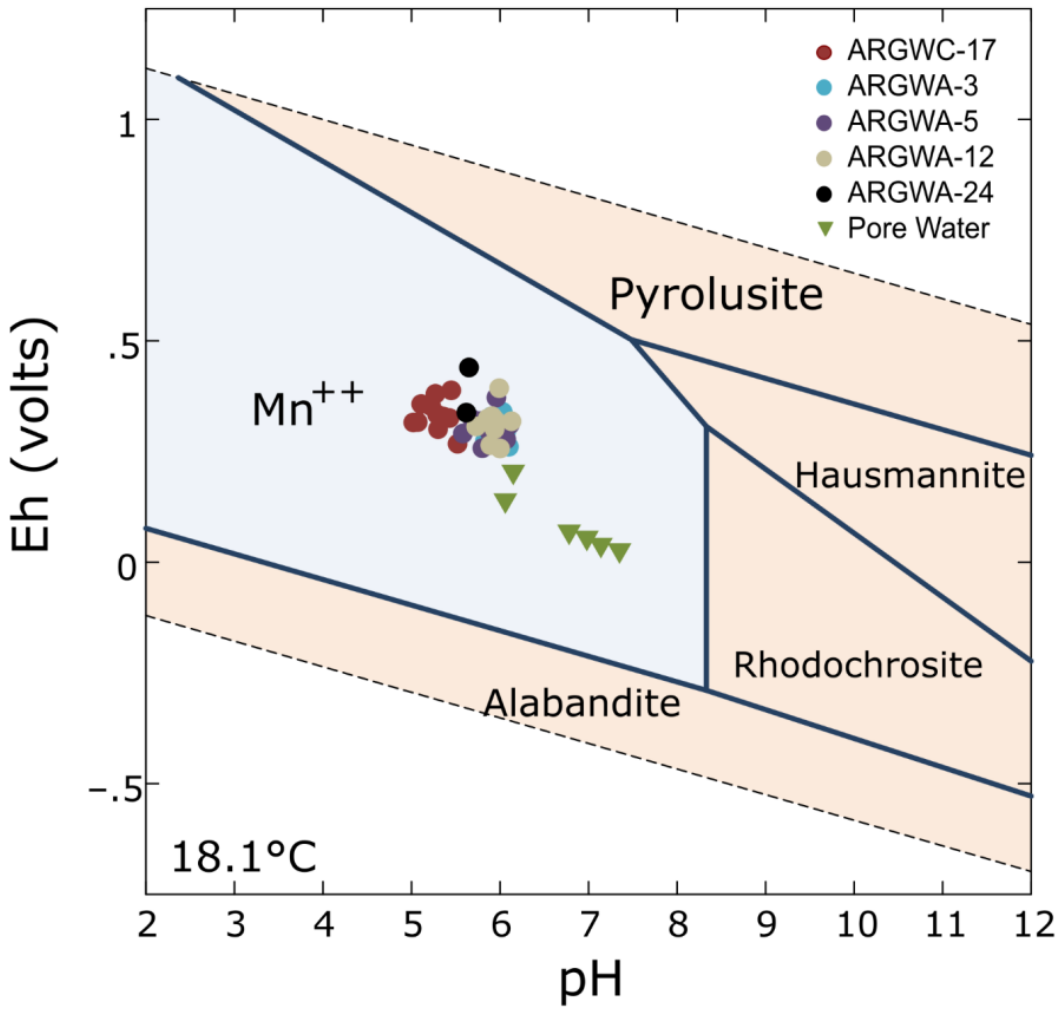


Diagram Mn^{++}, T = 18.1 °C, P = 1.013 bars, a [H2O] = 1, a [Ca^{++}] = $10^{-3.428}$, a [Cl^-] = $10^{-4.139}$, a [F^-] = $10^{-5.568}$, a [SO_4^{--}] = $10^{-3.048}$, a [H^+] = $10^{-6.479}$, a [Fe^{++}] = $10^{-5.796}$, a [Co^{++}] = $10^{-6.253}$, a [Mg^{++}] = $10^{-3.276}$, a [K^+] = $10^{-4.496}$, a [Na^+] = $10^{-3.399}$, a [HCO_3^-] = $10^{-3.66}$, Suppressed: Bixbyite, Mn(But), Mn(But)2(aq) Mn(CH3COO)2(aq) Mn(CH3COO)3 Mn(Lac)2(aq) Mn(Pent), Mn(Pent)2(aq) Mn(Prop), Mn(Prop)2(aq)

Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. pH - acidity
2. Eh - electrical potential
3. Eh = ORP + 200 for ORP in millivolts
4. ORP - Oxidation-Reduction Potential
5. Ag/AgCl electrode used to measure ORP
6. Mn^{++} - Manganese ion

Stantec

Georgia Power

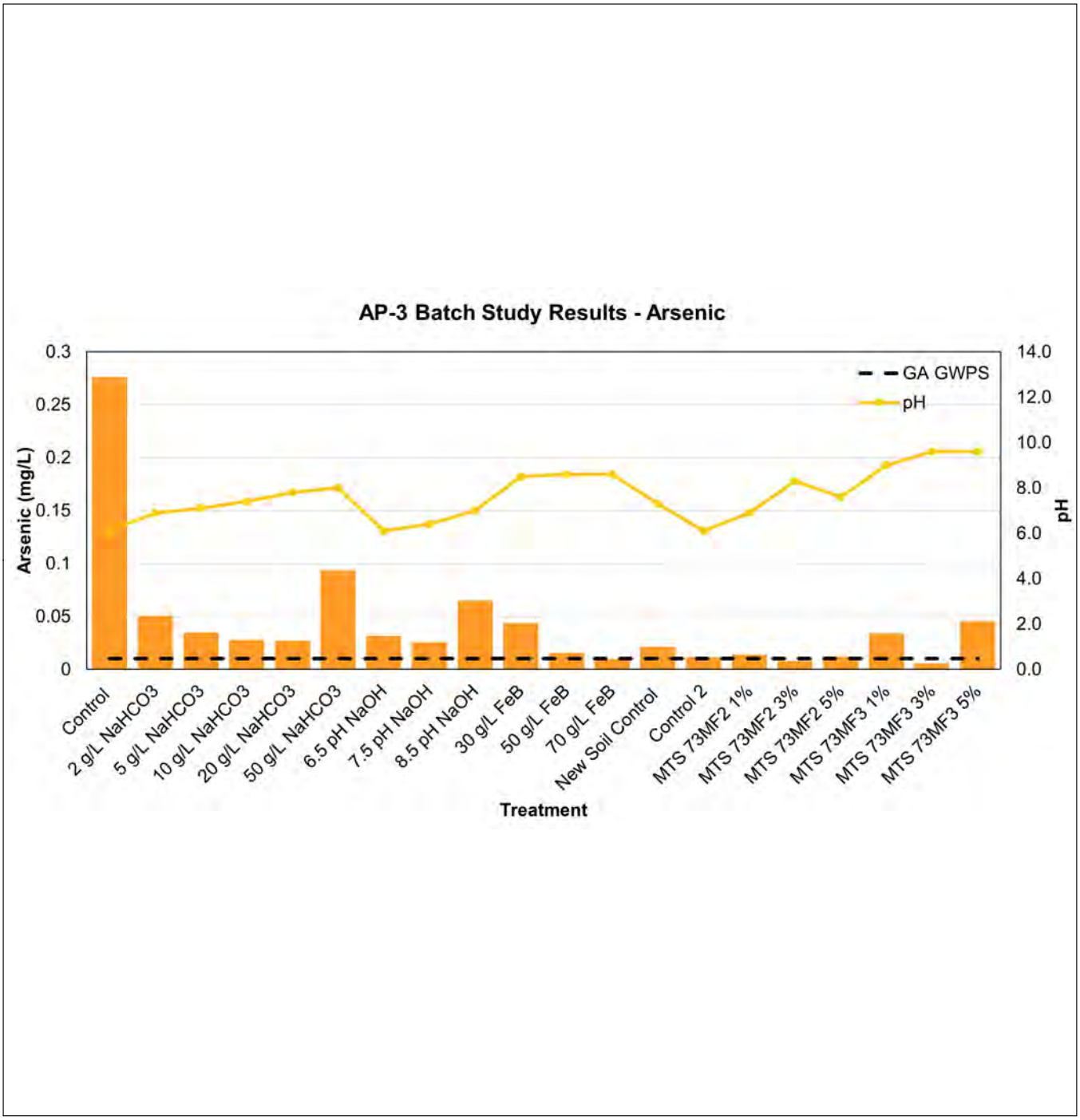
Project Location
Macon, Georgia

Prepared by PR on 2024-01-31
TR by BS on 2024-01-31
IR Review by RB on 2024-01-31

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
9

Title
Eh pH Diagram – Manganese



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. mg/L - milligrams per Liter
2. g/L - grams per Liter
3. NaOH – Sodium Hydroxide
4. $NaHCO_3$ - Sodium Bicarbonate
5. MTS 73MF2 and 73MF3 - Metals Treatment Solutions
6. FeB - Iron Boride
7. Groundwater collected in September 2022.
8. Soil collected in September 2022 and October 2022.
9. Source of data: TSI Report

Stantec

Georgia Power

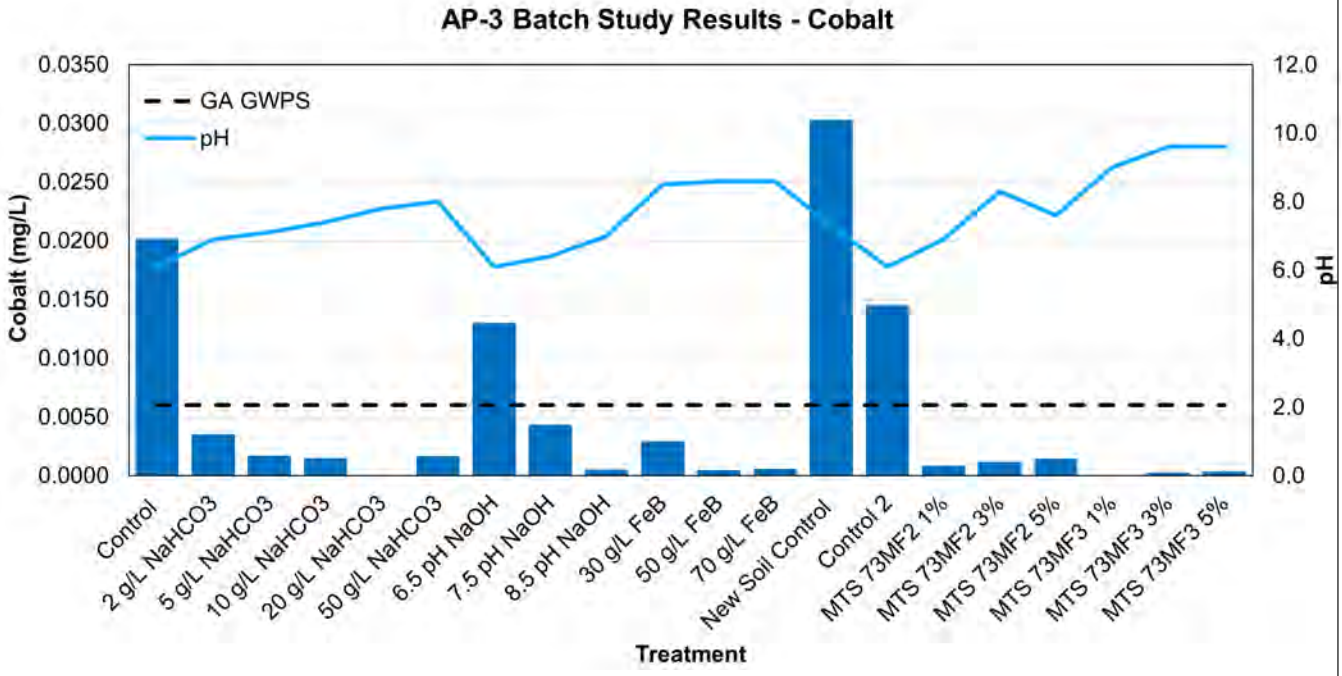
Project Location
Macon, Georgia

Prepared by PR on 2023-06-30
TR by BS on 2023-06-30
IR Review by RB on 2023-06-30

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
10

Title
Treatability Testing Batch Testing Results - Arsenic



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. mg/L - milligrams per Liter
2. g/L - grams per Liter
3. NaOH – Sodium Hydroxide
4. $NaHCO_3$ - Sodium Bicarbonate
5. MTS 73MF2 and 73MF3 - Metals Treatment Solutions
6. FeB - Iron Boride
7. Groundwater collected in September 2022
8. Soil collected in September 2022 and October 2022
9. Source of data: TSI Report

Stantec

Georgia Power

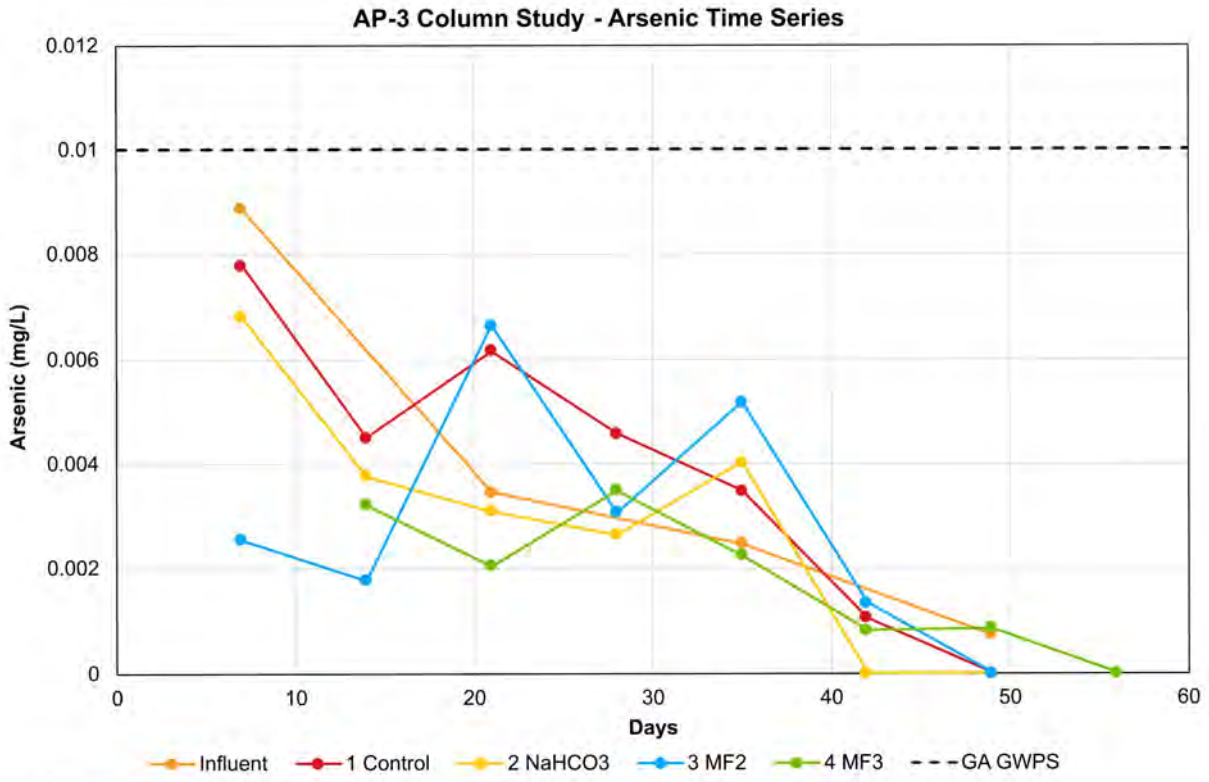
Project Location
Macon, Georgia

Prepared by PR on 2023-06-30
TR by BS on 2023-06-30
IR Review by RB on 2023-06-30

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
11

Title
Treatability Testing Batch Testing Results - Cobalt



	Influent	Control	$NaHCO_3$	MF2	MF3
pH range	7.2 to 9.4	6.6 to 8.4	7.2 to 8.5	7.1 to 8.6	7.1 to 8.3
ORP range:	7.2 to 9.4	118 to 208	107 to 196	102 to 187	92 to 191

Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes

1. mg/L - milligrams per Liter
2. g/L - grams per Liter
3. $NaHCO_3$ - Sodium Bicarbonate
4. MTS 73MF2 and 73MF3 - Metals Treatment Solutions
5. GWPS - Georgia Groundwater Protection Standard
6. pH and ORP ranges do not include anomalous readings
7. Groundwater collected in September 2022.
8. Soil collected in September 2022 and October 2022
9. Source of data: TSI Report

Stantec

Georgia Power

Project Location
Macon, Georgia

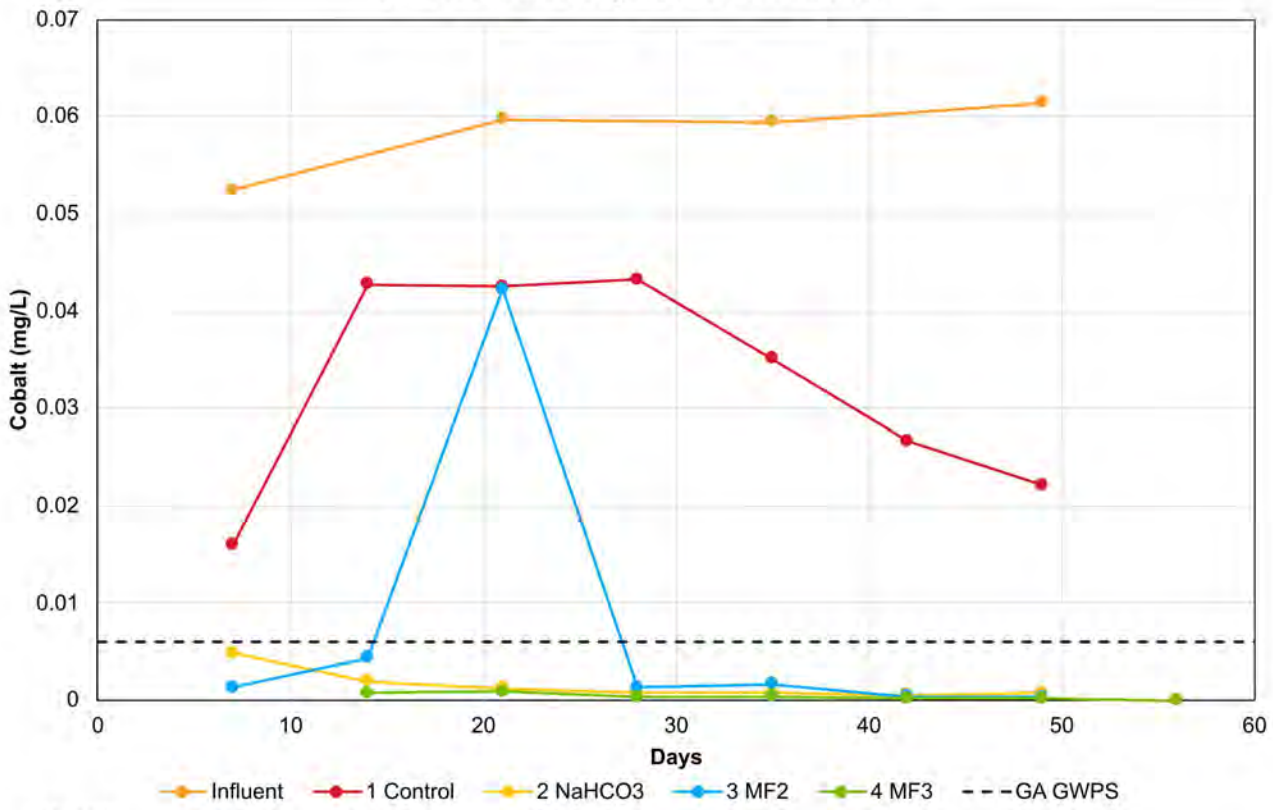
Prepared by PR on 2023-06-30
TR by BS on 2023-06-30
IR Review by RB on 2023-06-30

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
12

Title
Treatability Testing Column Testing Results - Arsenic

AP-3 Column Study - Cobalt Time Series



	Influent	Control	$NaHCO_3$	MF2	MF3
pH range	7.2 to 9.4	6.6 to 8.4	7.2 to 8.5	7.1 to 8.6	7.1 to 8.3
ORP range:	7.2 to 9.4	118 to 208	107 to 196	102 to 187	92 to 191

Notes

1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes

1. mg/L - milligrams per Liter
2. g/L - grams per Liter
3. $NaHCO_3$ - Sodium Bicarbonate
4. MTS 73MF2 and 73MF3 - Metals Treatment Solutions
5. GWPS - Georgia Groundwater Protection Standard
6. pH and ORP ranges do not include anomalous readings
7. Groundwater collected in September 2022.
8. Soil collected in September 2022 and October 2022
9. Source of data: TSI Report

Stantec

Georgia Power

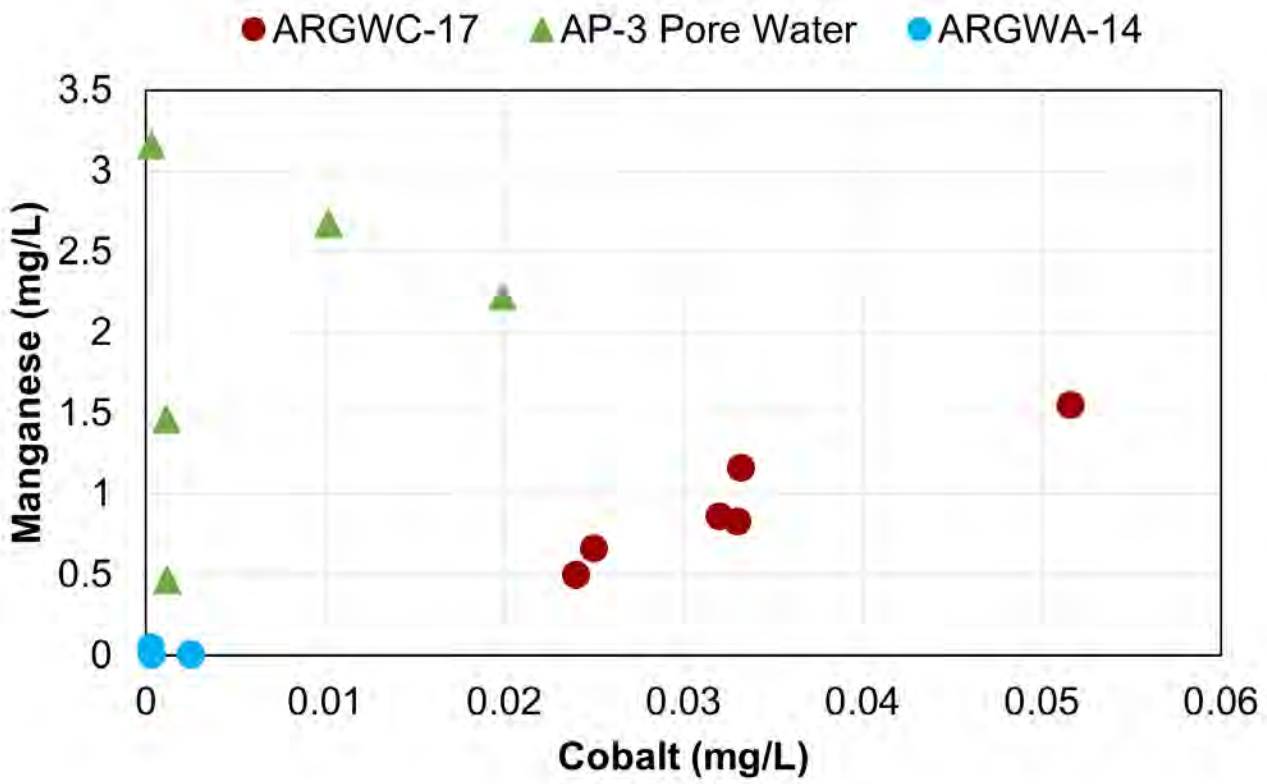
Project Location
Macon, Georgia

Prepared by PR on 2023-06-30
TR by BS on 2023-06-30
IR Review by RB on 2023-06-30

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
13

Title
Treatability Testing Column Testing Results - Cobalt



Notes
1. Coordinate System:
2. Data Sources:
3. Background Location Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Notes
1. mg/L - milligrams per Liter
2. Groundwater data presented was collected in June 2020, February and September 2021 and 2022, and February 2023; AP-3 pore water data was collected in September 2022.
3. AP-3 Pore water wells include AP3PZ-1A, AP3PZ-2A, AP3PZ-3A, AP3PZ-4A, and AP3PZ-5A.

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by DMB on 2023-05-17
TR by BS on 2023-05-17
IR Review by RB on 2023-05-17

Client/Project 175569434
Georgia Power
Geochemical Conceptual Site Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
14

Title
Scatter Diagram for Cobalt and Manganese

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID										
		ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-3	ARAMW-4	ARAMW-4
		1/15/2020	6/24/2020	8/20/2020	9/30/2020	2/10/2021	9/9/2021	2/2/2022	8/31/2022	2/2/2023	1/15/2020	6/24/2020
APPENDIX III	Boron	1	0.99	NA	1.1	0.99	1	0.99	0.950	0.903	0.32	0.4
	Calcium	NA	33	NA	37	30	32	32	27.4	28.3	NA	170
	Chloride	NA	5.9	NA	5.5	6.6	6.9	5.2	5.59	5.35	NA	6.4
	Fluoride	NA	0.18	<0.1	0.064 J	0.099 J	0.12	0.072 J	0.127	0.138	NA	0.041 J
	Sulfate	NA	45	NA	49	60	63	50	53.0	50.6	NA	860
	TDS	NA	NA	NA	240	230	230	230	218	201	NA	NA
	pH	6.77	6.38	6.24	6.41	6.15	6.14	6.37	6.14	6.26	6.36	5.78
APPENDIX IV	Antimony	NA	NA	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	NA	NA
	Arsenic	NA	NA	<0.001	<0.001	<0.001	<0.001	0.00034 J	<0.00200	<0.00200	NA	NA
	Barium	NA	NA	0.093	0.094	0.066	0.066	0.067	0.0619	0.0559	NA	NA
	Beryllium	NA	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	NA	NA
	Cadmium	NA	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	NA	NA
	Chromium	NA	NA	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	NA	NA
	Cobalt	NA	0.00053 J	0.00056 J	0.0011 J	0.00055 J	0.00044 J	0.00057 J	0.000465 J	0.000421 J	0.0064	0.0049
	Lead	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	NA	NA
	Lithium	NA	0.0046 J	<0.005	0.0055	0.0046 J	0.0041 J	0.0045 J	0.00404 J	0.00391 J	NA	0.013
	Mercury	NA	NA	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	NA	NA
	Molybdenum	0.0053	0.0077 J	0.0029 J	0.0061 J	0.00065 J	0.0029 J	0.0035 J	0.000869 J	0.000312 J	NA	0.00079 J
	Radium	NA	NA	-0.137 U	0.539 U	0.83	0.413 U	0.573 U	1.02 U	1.99 U	NA	NA
	Selenium	NA	NA	<0.005	<0.005	<0.005	0.0024 J	<0.00074	<0.00150	<0.00150	NA	NA
	Thallium	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	NA	NA
*	Silver	NA	NA	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	NA	NA
ADDITIONAL PARAMETERS	Total Alkalinity	NA	140	NA	NA	100	110	100	103	91.4	NA	64
	Bicarbonate Alkalinity	NA	140	NA	NA	100	110	100	103	91.4	NA	64
	Carbonate Alkalinity	NA	<5	NA	NA	<5	<5	<5.0	<1.45	<1.45	NA	<5
	Aluminum	NA	NA	NA	NA	NA	NA	NA	<0.0193	<0.0193	NA	NA
	Iron, Dissolved	NA	6.3	NA	NA	1.5	NA	1.2	NA	NA	NA	7.5
	Iron, Total	NA	NA	NA	NA	NA	1.5	NA	0.671	0.267	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	0.21	0.16	NA	NA	NA	NA
	Manganese, Total	NA	1.2	NA	NA	0.21	0.2	NA	0.114	0.0779	NA	2.3
	Magnesium	NA	17	NA	NA	15	16	16	14.4	14.2	NA	97
	Potassium	NA	5.2	NA	NA	3.2	3	3.1	2.93	2.74	NA	12
	Sodium	NA	15	NA	NA	13	13	13	12.8	12.9	NA	28
	Oxidation Reduction Potential	-121.50	NA	NA	NA	NA	NA	NA	25.31	68.50	-20.20	NA
	pH, Field	6.77	6.38	6.24	6.41	6.15	6.14	6.37	6.14	6.26	6.36	5.78
	RDO Concentration	0.30	NA	NA	NA	NA	NA	NA	0.18	1.68	0.30	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	315.45	313.70	NA	NA
	Temperature, Field	19.70	NA	NA	NA	NA	NA	NA	21.68	17.83	20.50	NA
	Turbidity, Field	2.7	NA	NA	NA	NA	NA	NA	0.76	1.0	2.4	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID									
		ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-4	ARAMW-6	ARAMW-6
		8/20/2020	9/30/2020	2/10/2021	9/8/2021	2/2/2022	9/2/2022	2/7/2023	8/9/2023	1/15/2020	6/24/2020
APPENDIX III	Boron	NA	0.36	0.4	0.45	0.43	0.477	0.495	0.523	0.96	1
	Calcium	NA	210	220	230	240	240	254	261	NA	33
	Chloride	NA	5	5.1	5.3	5.1	4.58	4.85	4.64	NA	5.4
	Fluoride	<0.1	0.028 J	0.028 J	0.034 J	0.055 J	0.0590 J	0.0380 J	0.230	NA	0.082 J
	Sulfate	NA	790	1000	1100	1000	1080	1110	1140	NA	58
	TDS	NA	1300	1500	1700	1600	1610	1690	1820	NA	NA
	pH	5.77	5.94	5.64	5.52	6.17	5.651137 5.65	5.64	5.62	6.09	6.33
APPENDIX IV	Antimony	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	NA
	Arsenic	0.00034 J	0.00039 J	<0.001	<0.001	0.00035 J	0.00339 J	<0.00200	0.00241 J	NA	NA
	Barium	0.053	0.053	0.042	0.037	0.036	0.0374	0.0364	0.0372	NA	NA
	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA	NA
	Cadmium	<0.0025	NA	<0.0025	<0.0025	0.00023 J	<0.000300	<0.000300	<0.000300	NA	NA
	Chromium	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	<0.00300	NA	NA
	Cobalt	0.005	0.0046	0.0053	0.0048	0.0042	0.00411	0.00343	0.00337	NA	0.0049
	Lead	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	NA	NA
	Lithium	0.012	0.012	0.014	0.013	0.014	0.0117	0.0133	0.0130	NA	<0.005
	Mercury	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670	NA	NA
	Molybdenum	<0.015	0.00073 J	<0.015	<0.015	<0.00061	0.000288 J	0.000328 J	<0.000200	0.00065 J	<0.015
	Radium	0.624 U	0.532	0.932	0.528	0.675 U	0.947 U	1.16 U	2.55	NA	NA
	Selenium	<0.005	<0.005	<0.005	<0.005	0.0011 J	<0.00150	<0.00150	<0.00150	NA	NA
	Thallium	0.00022 J	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	NA
*	Silver	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	NA	NA
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	57	59	52	50.6	56.2	53.6	NA	120
	Bicarbonate Alkalinity	NA	NA	57	59	52	50.6	56.2	53.6	NA	120
	Carbonate Alkalinity	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725	NA	<5
	Aluminum	NA	NA	NA	NA	NA	<0.0193	0.0323 J	<0.0193	NA	NA
	Iron, Dissolved	NA	NA	4.3	NA	2.3	NA	NA	2.35	NA	1
	Iron, Total	NA	NA	NA	2.9	NA	4.42	3.45	2.63	NA	NA
	Manganese, Dissolved	NA	NA	NA	0.92	0.64	NA	NA	0.659	NA	NA
	Manganese, Total	NA	NA	1.1	0.93	NA	0.872	0.771	0.680	NA	0.23
	Magnesium	NA	NA	110	110	120	128	127	130	NA	19
	Potassium	NA	NA	11	11	11	12.0	11.7	10.9	NA	1.3
	Sodium	NA	NA	28	27	27	28.4	27.5	24.6	NA	12
	Oxidation Reduction Potential	NA	NA	NA	NA	NA	5.97	-8.74	-26.01	-57.80	NA
	pH, Field	5.77	5.94	5.64	5.52	6.17	5.65	5.64	5.62	6.09	6.33
	RDO Concentration	NA	NA	NA	NA	NA	0.22	0.34	0.28	0.20	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	1904.68	2212.29	1902.24	NA	NA
	Temperature, Field	NA	NA	NA	NA	NA	20.37	18.88	21.82	19.00	NA
	Turbidity, Field	NA	NA	NA	NA	NA	2.0	4.6	1.2	3.5	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L). Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value. Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARAMW-6	ARAMW-6	ARAMW-6	ARAMW-6	ARAMW-6	ARAMW-6	ARAMW-6	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3
		8/21/2020	10/1/2020	2/9/2021	9/9/2021	2/2/2022	8/31/2022	2/2/2023	6/23/2016	8/31/2016	10/25/2016	1/24/2017	4/11/2017
APPENDIX III	Boron	NA	1.1	0.85	0.8	0.68	0.607	0.558	NA	<0.05	0.0068 J	<0.05	<0.05
	Calcium	NA	38	33	32	30	26.4	24.8	NA	5.4	4.47	5.8	5.3
	Chloride	NA	5	5.8	5.6	5.0	5.10	4.93	3.3	2.7	3.1	2.5	2.4
	Fluoride	0.051 J	0.071 J	0.083 J	0.13	0.089 J	0.168	0.143	NA	<0.2	0.14 J	<0.2	<0.2
	Sulfate	NA	58	59	58	46	46.5	40.7	<1	<1	0.3 J	<1	<1
	TDS	NA	220	220	210	210	167	162	NA	80	65	70	64
	pH	6.32	6.37	6.34	6.37	5.58	6.28	6.45	NA	6.09	5.92	5.98	5.82
APPENDIX IV	Antimony	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025
	Arsenic	<0.001	<0.001	<0.001	<0.001	<0.00028	<0.00200	<0.00200	<0.0013	<0.0013	<0.005	<0.0013	0.00067 J
	Barium	0.049	0.044	0.041	0.038	0.041	0.0400	0.0394	0.019	0.018	0.016	0.017	0.016
	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	NA	<0.0025	<0.003	<0.0025	<0.0025
	Cadmium	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.0025	<0.0025	<0.001	<0.0025	<0.0025
	Chromium	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	NA	0.003	0.0028 J	0.0031	0.0029
	Cobalt	0.0018 J	0.0018 J	0.00047 J	0.00024 J	<0.00026	<0.000300	<0.000300	NA	<0.0025	<0.01	<0.0025	<0.0025
	Lead	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.0013	<0.0013	<0.005	<0.0013	<0.0013
	Lithium	<0.005	<0.005	<0.005	<0.005	<0.00083	<0.00300	<0.00300	NA	<0.005	<0.05	<0.005	<0.005
	Mercury	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	NA	<0.0002	<0.0005	<0.0002	<0.0002
	Molybdenum	<0.015	<0.015	<0.015	<0.015	<0.00061	<0.000200	<0.000200	NA	<0.015	<0.01	<0.015	<0.015
	Radium	0.285 U	0.0114 U	0.18 U	1.24	0.620	0.871 U	1.48 U	NA	0.226 U	0.273 U	0.11 U	0.358 U
	Selenium	<0.005	<0.005	<0.005	<0.005	<0.00074	<0.00150	<0.00150	<0.0013	<0.0013	<0.01	<0.0013	<0.0013
	Thallium	0.00018 J	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005
*	Silver	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	120	110	94	90.4	79.2	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	NA	NA	120	110	94	90.4	79.2	NA	NA	NA	NA	NA
	Carbonate Alkalinity	NA	NA	<5	<5	<5.0	<1.45	<1.45	NA	NA	NA	NA	NA
	Aluminum	NA	NA	NA	NA	NA	<0.0193	<0.0193	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	0.082	NA	<0.028	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	0.05	NA	<0.0330	0.0469 J	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	0.014	0.0097	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	0.018	0.015	NA	0.00848	0.00119 J	NA	NA	NA	NA	NA
	Magnesium	NA	NA	16	15	14	14.1	12.3	NA	NA	NA	NA	NA
	Potassium	NA	NA	1.3	1.3	1.2	1.27	1.26	NA	NA	NA	NA	NA
	Sodium	NA	NA	11	11	11	11.2	10.5	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	NA	NA	NA	NA	152.81	92.50	NA	106.60	102.90	110.20	114.90
	pH, Field	6.32	6.37	6.34	6.37	5.58	6.28	6.45	NA	6.09	5.92	5.98	5.82
	RDO Concentration	NA	NA	NA	NA	NA	0.22	2.68	NA	6.24	6.42	6.19	6.20
	Specific Conductance, Field	NA	NA	NA	NA	NA	285.02	274.76	NA	NA	NA	NA	NA
	Temperature, Field	NA	NA	NA	NA	NA	22.71	19.09	NA	24.69	22.72	19.79	20.12
	Turbidity, Field	NA	NA	NA	NA	NA	0.76	1.3	NA	9.3	4.9	7.4	4.8

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID										
		ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3
		6/20/2017	10/25/2017	4/10/2018	10/16/2018	3/27/2019	8/20/2019	10/8/2019	4/7/2020	6/25/2020	8/18/2020	9/29/2020
APPENDIX III	Boron	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.08	<0.08	<0.08	NA	<0.08
	Calcium	5.8	5.9	5.9	5.8	5.4	NA	6	5.5	5.7	NA	5.9
	Chloride	2.5	2.3	2.4	2.5	2.5	NA	2.6	2.9	2.8	NA	2.7
	Fluoride	<0.2	<0.2	<0.2	0.1 J	0.034 J	0.053 J	0.056 J	0.098 J	0.06 J	<0.1	0.065 J
	Sulfate	<1	<1	<1	<1	0.38 J	NA	0.7 J	0.67 J	1.6	NA	<1
	TDS	52	72	86	74	69	NA	66	64	NA	NA	62
	pH	5.8	5.89	5.85	6.03	6.1	5.83	5.96	5.9	5.75	6.47	6.02
APPENDIX IV	Antimony	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA
	Arsenic	0.00064 J	<0.0013	<0.0013	<0.0013	0.00055 J	0.00045 J	<0.001	<0.001	NA	<0.001	<0.001
	Barium	0.02	0.019	0.019	0.018	0.019	0.02	0.02	0.018	NA	0.021	0.019
	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00025 J	<0.001	<0.0025	NA	<0.0025	<0.0025
	Cadmium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00014 J	<0.001	<0.0025	NA	<0.0025	NA
	Chromium	0.0037	0.0031	0.0036	0.0035	NA	0.0039	0.0031	0.0023	NA	0.0027	0.003
	Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00018 J	<0.0005	<0.0025	<0.0025	0.00022 J	<0.0025
	Lead	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00014 J	0.001	<0.001	NA	0.00019 J	<0.001
	Lithium	<0.005	<0.005	<0.005	0.0017 J	NA	<0.005	0.0047 J	<0.005	<0.005	<0.005	<0.005
	Mercury	<0.0002	<0.0002	<0.0002	<0.0002	NA	<0.0002	NA	0.00016 J	NA	<0.0002	NA
	Molybdenum	<0.015	0.00093 J	<0.015	<0.015	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015
	Radium	0.265 U	0.5	0.323	0.798	NA	0.352 U	0.419 U	0.0354 U	NA	0.132 U	-0.0479 U
	Selenium	<0.0013	0.00032 J	<0.0013	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005
	Thallium	<0.0005	<0.0005	<0.0005	<0.0005	NA	0.0002 J	<0.001	<0.001	NA	0.00036 J	<0.001
*	Silver	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	0.00019 J	<0.001	NA	NA	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	33	NA	NA
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	33	NA	NA
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	<5	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	<0.005	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	2.8	NA	NA
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	1.3	NA	NA
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	7.9	NA	NA
	Oxidation Reduction Potential	114.50	102.90	80.90	138.60	60.30	72.70	115.70	128.50	NA	NA	NA
	pH, Field	5.80	5.89	5.85	6.03	6.10	5.83	5.96	5.90	5.75	6.47	6.02
	RDO Concentration	6.25	6.20	6.14	5.70	6.25	5.81	6.32	6.48	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	21.23	19.01	18.85	22.27	18.81	20.67	20.12	19.52	NA	NA	NA
	Turbidity, Field	9.7	9.9	8.8	2.4	4.0	2.8	3.3	2.3	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-3	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5
		2/9/2021	2/11/2021	9/8/2021	2/1/2022	8/31/2022	2/3/2023	8/9/2023	6/23/2016	8/30/2016	10/25/2016	1/24/2017	4/11/2017
APPENDIX III	Boron	<0.08	NA	<0.08	<0.060	0.00589 J	<0.00520	0.00594 J	NA	<0.05	0.0073 J	<0.05	<0.05
	Calcium	5.8	NA	5.8	5.4	5.91	5.79	5.96	NA	5.1	4.76	5.6	4.7
	Chloride	3	NA	3	3.4	2.94 J	2.67	2.71	4.6	4.3	5	5.1	4.4
	Fluoride	0.084 J	<0.05	0.1	0.086 J	0.184	0.155 J	0.316	NA	<0.2	0.09 J	<0.2	<0.2
	Sulfate	<1	NA	<1	1.4	0.399 J	0.448	0.419	<1	<1	0.4 J	<1	<1
	TDS	62	NA	79	75	65.0	63.0	50.0	NA	58	34	120	76
	pH	5.94	5.94	5.97	5.93	5.96	6.07	5.83	NA	6.07	5.96	5.89	5.78
APPENDIX IV	Antimony	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025
	Arsenic	<0.001	NA	<0.001	<0.00028	<0.00200	<0.00200	<0.00200	<0.0013	<0.0013	<0.005	<0.0013	0.00077 J
	Barium	0.017	NA	0.018	0.018	0.0181	0.0177	0.0191	0.025	0.026	0.0293	0.028	0.024
	Beryllium	<0.0025	NA	<0.0025	<0.00027	<0.000200	<0.000200 UJ	<0.000200	NA	<0.0025	<0.003	<0.0025	<0.0025
	Cadmium	<0.0025	NA	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	<0.001	<0.0025	<0.0025
	Chromium	0.0028	NA	0.0026	0.0029	0.00358 J	0.0139	<0.00300	NA	0.0012 J	0.0014 J	0.0012 J	<0.0025
	Cobalt	<0.0025	NA	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300	NA	<0.0025	<0.01	<0.0025	<0.0025
	Lead	<0.001	NA	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	<0.005	<0.0013	<0.0013
	Lithium	<0.005	NA	<0.005	<0.00083	<0.00300	<0.00300	<0.00300	NA	<0.005	<0.05	<0.005	<0.005
	Mercury	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670	NA	<0.0002	<0.0005	<0.0002	<0.0002
	Molybdenum	<0.015	NA	<0.015	<0.00061	<0.000200	0.000393 J	<0.000200	NA	<0.015	<0.01	<0.015	<0.015
	Radium	-0.187 U	NA	0.188 U	0.594 U	0.805 U	1.51 U	0.426 U	NA	0.505 U	0.177 U	0.107 U	-0.0587 U
	Selenium	<0.005	NA	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	<0.0013	<0.0013	<0.01	<0.0013	<0.0013
	Thallium	<0.001	NA	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005
*	Silver	<0.001	NA	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025
ADDITIONAL PARAMETERS	Total Alkalinity	44	NA	42	40	41.4	33.0	40.9	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	44	NA	42	40	41.4	33.0	40.9	NA	NA	NA	NA	NA
	Carbonate Alkalinity	<5	NA	<5	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA
	Aluminum	NA	NA	NA	NA	0.114	0.0833	0.0894	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	<0.028	NA	NA	<0.0330	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	0.170	0.162	0.0793 J	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	<0.0013	NA	NA	<0.00100	NA	NA	NA	NA	NA
	Manganese, Total	NA	<0.005	0.00094 J	NA	0.00355 J	0.00435 J	0.00190 J	NA	NA	NA	NA	NA
	Magnesium	3.3	NA	3.1	3.4	3.82	3.92	3.57	NA	NA	NA	NA	NA
	Potassium	1.1	NA	1.1	0.99	1.09	1.04	1.13	NA	NA	NA	NA	NA
	Sodium	7.2	NA	7.1	7.3	7.93	8.15	7.06	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	NA	NA	NA	125.01	95.43	195.91	NA	76.70	171.10	106.80	118.10
	pH, Field	5.94	5.94	5.97	5.93	5.96	6.07	5.83	NA	6.07	5.96	5.89	5.78
	RDO Concentration	NA	NA	NA	NA	6.04	6.55	6.16	NA	5.90	6.06	5.75	5.67
	Specific Conductance, Field	NA	NA	NA	NA	87.78	93.75	93.19	NA	NA	NA	NA	NA
	Temperature, Field	NA	NA	NA	NA	21.46	17.19	21.11	NA	20.73	17.93	18.92	19.15
	Turbidity, Field	NA	NA	NA	NA	3.7	3.6	4.96	NA	0.70	2.7	1.2	1.1

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5
		6/20/2017	10/25/2017	4/10/2018	10/16/2018	3/27/2019	8/20/2019	10/8/2019	4/7/2020	6/25/2020	8/18/2020	9/29/2020	2/9/2021
APPENDIX III	Boron	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.08	<0.08	<0.08	NA	<0.08	<0.08
	Calcium	5.4	6	5.3	5.6	4.5	NA	5.9	4	6.1	NA	6.6	6.2
	Chloride	5	5.3	5.1	5.3	4.3	NA	5.7	3.7	4.2	NA	4.6	5.1
	Fluoride	<0.2	<0.2	<0.2	<0.2	0.026 J	0.047 J	0.05 J	0.072 J	0.042 J	<0.1	0.051 J	0.055 J
	Sulfate	<1	<1	<1	<1	0.55 J	NA	0.7 J	<1	<1	NA	<1	<1
	TDS	36	64	60	54	61	NA	68	65	NA	NA	61	73
	pH	5.69	6.11	5.58	5.86	5.97	5.8	5.93	5.86	5.87	6.18	6	5.88
APPENDIX IV	Antimony	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA	NA
	Arsenic	0.00052 J	<0.0013	<0.0013	<0.0013	0.00055 J	0.00058 J	<0.001	<0.001	NA	<0.001	<0.001	<0.001
	Barium	0.027	0.03	0.028	0.027	0.024	0.029	0.03	0.02	NA	0.031	0.03	0.028
	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00035 J	0.00041 J	<0.0025	NA	<0.0025	<0.0025	<0.0025
	Cadmium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025
	Chromium	<0.0025	<0.0025	0.0012 J	0.0012 J	NA	0.0032	<0.002	<0.002	NA	<0.002	<0.002	<0.002
	Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00012 J	<0.0005	0.00014 J	<0.0025	<0.0025	<0.0025	<0.0025
	Lead	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00014 J	0.00016 J	<0.001	NA	0.00013 J	<0.001	<0.001
	Lithium	<0.005	<0.005	<0.005	<0.005	NA	<0.005	0.0055	<0.005	<0.005	<0.005	<0.005	<0.005
	Mercury	<0.0002	<0.0002	0.00007 J	<0.0002	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA
	Molybdenum	<0.015	<0.015	<0.015	<0.015	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015
	Radium	0.503	0.512	0.262 U	0.989	NA	-0.0925 U	0.348 U	0.198 U	NA	1.12	-0.146 U	-0.312 U
	Selenium	<0.0013	0.00027 J	<0.0013	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005
	Thallium	<0.0005	<0.0005	<0.0005	<0.0005	NA	0.00023 J	<0.001	0.00015 J	NA	0.00021 J	0.00019 J	<0.001
*	Silver	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	0.0003 J	<0.001	NA	NA	<0.001	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	37	NA	NA	41
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	37	NA	NA	41
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	<5	NA	NA	<5
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	0.00091 J	NA	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	2.5	NA	NA	2.5
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	1.2	NA	NA	1.1
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	7.9	NA	NA	8.1
	Oxidation Reduction Potential	122.20	110.10	90.00	117.50	61.70	56.90	72.80	111.90	NA	NA	NA	NA
	pH, Field	5.69	6.11	5.58	5.86	5.97	5.80	5.93	5.86	5.87	6.18	6.00	5.88
	RDO Concentration	5.69	5.70	4.68	5.40	5.81	5.36	5.90	4.40	NA	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	19.24	18.53	18.34	19.24	18.39	19.45	17.66	18.96	NA	NA	NA	NA
	Turbidity, Field	3.4	1.2	2.4	3.2	1.5	1.4	0.89	1.3	NA	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-5	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12
		2/11/2021	9/8/2021	2/1/2022	8/30/2022	2/3/2023	8/10/2023	6/23/2016	8/30/2016	10/24/2016	1/23/2017	4/11/2017	6/21/2017	10/25/2017
APPENDIX III	Boron	NA	<0.08	<0.060	0.00855 J	0.00660 J	0.0139 J	NA	0.032 J	0.0406 J	0.023 J	0.025 J	<0.05	0.028 J
APPENDIX III	Calcium	NA	7.3	6.5	9.56 J	10.4	12.6	NA	11	10.4	12	12	12	13
APPENDIX III	Chloride	NA	5.3	5.3	8.47	8.74	12.4	11	11	12	11	11	11	10
APPENDIX III	Fluoride	<0.05	0.1	0.059 J	0.155	<0.0330	0.128	NA	<0.2	0.1 J	<0.2	<0.2	<0.2	<0.2
APPENDIX III	Sulfate	NA	<1	0.77 J	0.519	0.500	0.581	9.8	9.5	11	11	9.1	10	11
APPENDIX III	TDS	NA	86	76	81.0	76.0	105	NA	100	136	16	120	140	120
APPENDIX III	pH	5.87	5.93	5.83	5.88	5.93	5.61	NA	6.82 o	5.99	5.94	5.88	5.73	6.13
APPENDIX IV	Antimony	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Arsenic	NA	<0.001	<0.00028	<0.00200	<0.00200	0.00593	<0.0013	<0.0013	<0.005	<0.0013	0.00076 J	<0.0013	<0.0013
APPENDIX IV	Barium	NA	0.033	0.033	0.0446	0.0484	0.0638	0.063	0.062	0.0674	0.069	0.064	0.074	0.07
APPENDIX IV	Beryllium	NA	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Cadmium	NA	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Chromium	NA	<0.002	<0.0015	<0.00300	<0.00300	<0.00300	NA	0.0012 J	0.0011 J	<0.0025	0.0011 J	<0.0025	<0.0025
APPENDIX IV	Cobalt	NA	<0.0025	<0.00026	<0.000300	0.000448 J	<0.000300	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Lead	NA	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	0.0002 J	<0.0013	<0.0013	<0.0013	<0.0013
APPENDIX IV	Lithium	NA	<0.005	<0.00083	<0.00300	<0.00300	<0.00300	NA	0.0052	<0.05 ,o	0.0039 J	0.004 J	0.0041 J	0.0056
APPENDIX IV	Mercury	NA	<0.0002	<0.00013	<0.0000670 J	<0.0000670	<0.0000670 hH	NA	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002
APPENDIX IV	Molybdenum	NA	<0.015	<0.00061	<0.000200	0.000302 J	<0.000200	NA	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015
APPENDIX IV	Radium	NA	0.558	0.423 U	0.546 U	2.97	1.63	NA	1.1	0.808 U	0.121 U	0.378 U	0.511	0.587
APPENDIX IV	Selenium	NA	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	<0.0013	<0.0013	<0.01	<0.0013	<0.0013	0.00025 J	0.00027 J
APPENDIX IV	Thallium	NA	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
*	Silver	NA	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013
ADDITIONAL PARAMETERS	Total Alkalinity	NA	43	41	46.2	47.0	53.2	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Bicarbonate Alkalinity	NA	43	41	46.2	47.0	53.2	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Carbonate Alkalinity	NA	<5	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Aluminum	NA	NA	NA	0.0267 J	<0.0193	<0.0193	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Dissolved	NA	NA	<0.028	NA	NA	<0.0330	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Total	NA	NA	NA	0.0611 J	0.529	<0.0330	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Dissolved	NA	NA	<0.0013	NA	NA	0.00161 J	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Total	<0.005	<0.005	NA	0.00414 J	0.0779	0.00254 J	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Magnesium	NA	2.7	2.9	3.87	4.61	5.25	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Potassium	NA	1.1	1.1	1.26	1.40	1.49	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Sodium	NA	8.1	8.8	9.37	11.8	11.7	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Oxidation Reduction Potential	NA	NA	NA	94.21	77.57	197.07	NA	84.60	192.40	99.80	113.80	105.70	117.70
ADDITIONAL PARAMETERS	pH, Field	5.87	5.93	5.83	5.88	5.93	5.61	NA	6.82	5.99	5.94	5.88	5.73	6.13
ADDITIONAL PARAMETERS	RDO Concentration	NA	NA	NA	4.37	3.28	5.43	NA	3.73	3.59	2.95	3.18	3.04	1.82
ADDITIONAL PARAMETERS	Specific Conductance, Field	NA	NA	NA	120.10	132.19	163.96	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Temperature, Field	NA	NA	NA	19.03	18.17	19.67	NA	22.34	20.21	17.81	20.01	19.09	19.16
ADDITIONAL PARAMETERS	Turbidity, Field	NA	NA	NA	2.1	0.84	2.95	NA	4.2	4.8	4.3	1.5	4.8	4.14

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-12
		4/10/2018	10/16/2018	3/27/2019	8/20/2019	10/8/2019	4/7/2020	6/26/2020	8/18/2020	9/29/2020	2/9/2021	9/7/2021	2/1/2022
APPENDIX III	Boron	0.027 J	0.023 J	<0.05	NA	<0.08	<0.08	<0.08	NA	<0.08	<0.08	<0.08	<0.060
	Calcium	13	12	11	NA	13	12	15	NA	14	14	14	12
	Chloride	9.9	11	11	NA	64 o	11	12	NA	12	15	14	12
	Fluoride	<0.2	0.1 J	0.031 J	0.049 J	0.27 J	0.082 J	0.051 J	0.041 J	0.06 J	0.07 J	0.11	0.065 J
	Sulfate	9.5	10	9.1	NA	55	8	9	NA	8.3	11	9	7.8
	TDS	130	150	110	NA	130	120	NA	NA	130	140	140	130
	pH	5.95	5.94	6	5.89	5.93	5.91	5.94	6.48	5.88	5.92	5.89	5.97
APPENDIX IV	Antimony	<0.0025	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051
	Arsenic	<0.0013	<0.0013	0.00049 J	0.00046 J	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00028
	Barium	0.073	0.069	0.063	0.075	0.078	0.066	NA	0.079	0.079	0.076	0.073	0.079
	Beryllium	<0.0025	<0.0025	NA	<0.001	<0.001	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027
	Cadmium	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022
	Chromium	0.0013 J	<0.0025	NA	0.0026	<0.002	0.0015 J	NA	<0.002	<0.002	<0.002	0.0017 J	<0.0015
	Cobalt	<0.0025	<0.0025	NA	0.00019 J	<0.0005	0.00029 J	0.00013 J	0.00019 J	0.00016 J	<0.0025	0.00043 J	0.00041 J
	Lead	<0.0013	<0.0013	<0.0013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00017
	Lithium	0.007	0.0045 J	NA	0.0053	0.0078	0.0036 J	0.0061	0.0039 J	0.0048 J	0.0051	0.0042 J	0.0047 J
	Mercury	0.000072 J	<0.0002	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013
	Molybdenum	<0.015	<0.015	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.00061
	Radium	0.513	0.53	NA	0.759	0.76	0.622	NA	0.587	0.765	1.16	0.385	0.615
	Selenium	0.00033 J	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.005	<0.00074
	Thallium	<0.0005	<0.0005	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00047
*	Silver	<0.0013	<0.0013	<0.0013	NA	<0.001	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	69	NA	NA	77	72	69
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	69	NA	NA	77	72	69
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	<5	NA	NA	<5	<5	<5.0
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.025	<0.028
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0013
	Manganese, Total	NA	NA	NA	NA	NA	NA	<0.005	NA	NA	0.0019 J	0.001 J	NA
	Magnesium	NA	NA	NA	NA	NA	NA	8.9	NA	NA	8.7	8.8	8.4
	Potassium	NA	NA	NA	NA	NA	NA	2.5	NA	NA	2.4	2.1	2.3
	Sodium	NA	NA	NA	NA	NA	NA	11	NA	NA	11	11	12
	Oxidation Reduction Potential	620.30	121.70	56.10	63.60	107.10	129.00	NA	NA	NA	NA	NA	NA
	pH, Field	5.95	5.94	6.00	5.89	5.93	5.91	5.94	6.48	5.88	5.92	5.89	5.97
	RDO Concentration	1.11	1.78	2.53	3.32	2.70	2.77	NA	NA	NA	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	17.99	20.13	17.75	20.34	20.09	18.53	NA	NA	NA	NA	NA	NA
	Turbidity, Field	5.0	2.6	4.9	3.4	2.5	3.5	NA	NA	NA	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce
   a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWA-12	ARGWA-12	ARGWA-12	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13
		8/30/2022	2/2/2023	8/9/2023	6/23/2016	8/31/2016	10/25/2016	1/24/2017	4/11/2017	6/21/2017	10/25/2017	4/9/2018	10/16/2018	3/26/2019
APPENDIX III	Boron	0.0214	0.0179	0.0235	NA	0.1	0.204	0.064	0.081	0.13	0.17	0.059	0.34	0.32
APPENDIX III	Calcium	14.2	14.9	16.0	NA	110	150	78	78	110	120	49	110	95
APPENDIX III	Chloride	12.8 J	13.2	13.3	5.7	5.7	7.9	4.4	4.3	5.5	5.2	3.8	6	4.6
APPENDIX III	Fluoride	0.167 J	0.221	0.271	NA	<0.2	0.08 J	<0.2	<0.2	<0.2	<1	<0.2	<0.4	<0.2
APPENDIX III	Sulfate	7.11 J	6.71	6.19	380	600	820	370	340	540	580	230	520	430
APPENDIX III	TDS	139 J	128	110	NA	1000	1280	590	610	880	900	440	910	750
APPENDIX III	pH	5.88 J	5.86	6.13	NA	6.67 o	5.8	5.82	5.78	5.67	5.72	5.78	5.74	5.96
APPENDIX IV	Antimony	<0.00100 J	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
APPENDIX IV	Arsenic	<0.00200 J	<0.00200	<0.00200	<0.0013	<0.0013	<0.005	<0.0013	0.00063 J	<0.0013	<0.0013	<0.0013	0.00055 J	0.00089 J
APPENDIX IV	Barium	0.0850 J	0.0870	0.100	0.036	0.041	0.0429	0.025	0.024	0.034	0.03	0.023	0.028	0.029
APPENDIX IV	Beryllium	<0.000200	<0.000200	<0.000200	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
APPENDIX IV	Cadmium	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Chromium	<0.00300	<0.00300	<0.00300	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
APPENDIX IV	Cobalt	0.000509 J	<0.000300	0.000325 J	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
APPENDIX IV	Lead	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
APPENDIX IV	Lithium	0.00493 J	0.00499 J	0.00479 J	NA	0.0053	0.0048 J	0.0032 J	0.0036 J	0.0052	0.0059	0.0056	0.0057	NA
APPENDIX IV	Mercury	<0.0000670	<0.0000670	<0.0000670 hH	NA	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA
APPENDIX IV	Molybdenum	0.000274 J	0.000357 J	0.000299 J	NA	<0.015	<0.01	<0.015	<0.015	<0.015	0.0018 J	<0.015	<0.015	NA
APPENDIX IV	Radium	0.804 U	4.25	1.45	NA	0.788	0.503 U	0.369	0.71	0.124 U	0.981	0.157 U	0.305 U	NA
APPENDIX IV	Selenium	<0.00150	<0.00150	<0.00150	0.0096	0.017	0.0257	0.0097	0.0079	0.019	0.022	0.0063	0.021	0.015
APPENDIX IV	Thallium	<0.000600 J	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA
*	Silver	<0.000300 J	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	0.00013 J	<0.0013	<0.0013	<0.0013
ADDITIONAL PARAMETERS	Total Alkalinity	68.4 J	67.8	75.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Bicarbonate Alkalinity	68.4 J	67.8	75.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Carbonate Alkalinity	<1.45 J	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Aluminum	0.0544 J	0.0209 J	<0.0193	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Dissolved	NA	NA	<0.0330	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Total	0.0662	<0.0330	<0.0330	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Dissolved	NA	NA	<0.00100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Total	0.00160 J	0.00168 J	<0.00100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Magnesium	9.51	9.44	9.83	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Potassium	2.45 J	2.57	2.63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Sodium	12.1	12.0	11.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Oxidation Reduction Potential	120.81	123.53	150.38	NA	95.30	181.20	97.00	89.80	93.80	116.10	105.10	118.60	67.40
ADDITIONAL PARAMETERS	pH, Field	5.88	5.86	6.13	NA	6.67	5.80	5.82	5.78	5.67	5.72	5.78	5.74	5.96
ADDITIONAL PARAMETERS	RDO Concentration	2.53	2.71	2.95	NA	0.82	0.59	1.97	1.47	0.69	1.14	1.77	0.89	2.78
ADDITIONAL PARAMETERS	Specific Conductance, Field	197.58	219.21	219.38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Temperature, Field	20.50	16.90	20.25	NA	20.25	18.61	17.15	18.68	18.61	17.14	16.91	19.30	17.44
ADDITIONAL PARAMETERS	Turbidity, Field	4.0	1.2	1.15	NA	2.1	0.79	0.73	0.50	0.75	0.88	1.7	1.8	1.7

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13	ARGWA-13
		8/19/2019	10/8/2019	4/7/2020	6/25/2020	8/18/2020	9/29/2020	2/9/2021	9/7/2021	2/1/2022	8/31/2022	2/3/2023	8/9/2023
APPENDIX III	Boron	NA	0.68	0.23	0.32	NA	0.35	0.38	0.96	0.30	0.933	0.260	1.06
	Calcium	NA	190	61	100	NA	120	110	190	73	165	49.0	186
	Chloride	NA	6.7	3.8	5.8	NA	5.7	6	8.2	4.6	6.89	3.04	5.87
	Fluoride	<0.2	0.033 J	0.086 J	0.03 J	<0.1	0.032 J	0.036 J	0.075 J	0.032 J	0.135	<0.0330	0.239
	Sulfate	NA	950	270	410	NA	540	520	870	360	855	209	784
	TDS	NA	1500	480	NA	NA	880	890	1500	600	1290	377	1240
	pH	5.59	5.74	5.84	5.8	6.15	5.75	5.79	5.71	5.86	5.53	5.84	5.94
APPENDIX IV	Antimony	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	0.00139 J
	Arsenic	0.00045 J	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00028	<0.00200	<0.00200	<0.00200
	Barium	0.035	0.042	0.021	NA	0.025	0.024	0.022	0.031	0.018	0.0262	0.0166	0.0299
	Beryllium	<0.001	<0.001	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200
	Cadmium	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300
	Chromium	0.0016 J	<0.002	<0.002	NA	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	<0.00300
	Cobalt	0.00029 J	0.00011 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300
	Lead	<0.001	0.00013 J	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.000500
	Lithium	0.0058	0.0099	0.0036 J	0.0067	0.0042 J	0.0052	0.0054	0.0059	0.0045 J	0.00609 J	0.00436 J	0.00536 J
	Mercury	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670
	Molybdenum	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.00061	<0.000200	<0.000200	<0.000200
	Radium	0.204 U	0.398 U	-0.0414 U	NA	0.38 U	0.403 U	0.394 U	0.475	0.689 U	0.596 U	1.27 U	1.43 U
	Selenium	0.034	0.03	0.0094	NA	0.019	0.021	0.019	0.032	0.013	0.0259	0.00739	0.0279
	Thallium	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600
*	Silver	NA	0.00047 J	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	61	NA	NA	71	74	59	68.2	51.4	64.4
	Bicarbonate Alkalinity	NA	NA	NA	61	NA	NA	71	74	59	68.2	51.4	64.4
	Carbonate Alkalinity	NA	NA	NA	<5	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0193	<0.0193	<0.0193
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	<0.028	NA	NA	0.0789 J
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0330	<0.0330	0.0731 J
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	0.0095	0.0088	NA	NA	0.00551
	Manganese, Total	NA	NA	NA	0.01	NA	NA	0.0066	0.01	NA	0.00657	0.0128	0.0136
	Magnesium	NA	NA	NA	66	NA	NA	77	140	54	118	37.7	130
	Potassium	NA	NA	NA	3.2	NA	NA	3.4	3.8	2.8	3.98	2.70	4.28
	Sodium	NA	NA	NA	14	NA	NA	16	20	13	17.5	11.2	16.6
	Oxidation Reduction Potential	111.70	123.10	111.70	NA	NA	NA	NA	NA	NA	146.67	314.55	122.17
	pH, Field	5.59	5.74	5.84	5.80	6.15	5.75	5.79	5.71	5.86	5.53	5.84	5.94
	RDO Concentration	0.87	0.89	3.40	NA	NA	NA	NA	NA	NA	0.91	3.63	1.5
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	1636.93	590.66	1617.62
	Temperature, Field	20.64	19.60	18.63	NA	NA	NA	NA	NA	NA	18.70	16.30	20.71
	Turbidity, Field	1.0	0.27	1.2	NA	NA	NA	NA	NA	NA	1.0	0.32	0.39

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14
		6/23/2016	8/31/2016	10/25/2016	1/23/2017	4/11/2017	6/20/2017	10/25/2017	4/9/2018	10/16/2018	3/27/2019	8/21/2019	10/7/2019
APPENDIX III	Boron	NA	0.04 J	0.065 J	0.031 J	0.043 J	0.029 J	0.041 J	0.04 J	0.046 J	0.032 J	NA	<0.08
	Calcium	NA	31	38.5	25	33	34	28	30	41	42	NA	36
	Chloride	9	5.4	9.3	5.1	4.1	4.1	3.8	3.9	4.3	4	NA	4
	Fluoride	NA	0.12 J	0.53	0.4	0.31	0.27	0.29	0.25	0.33	0.15 J	0.35	0.12 J
	Sulfate	18	19	42	12	7.1	8.5	9.1	11	14	15	NA	12
	TDS	NA	330	459	340	300	210	280	280	48	330	NA	230
	pH	NA	7.55 o	6.92	6.76	6.72	6.66	6.77	6.6	6.63	6.83	6.94	6.69
APPENDIX IV	Antimony	NA	0.0017 J	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00064 J	<0.002
	Arsenic	0.0026	0.0032	<0.005	0.00088 J	0.00095 J	0.00099 J	<0.0013	<0.0013	0.00083 J	0.0013	0.0013	0.00045 J
	Barium	0.084	0.076	0.039	0.044	0.038	0.057	0.05	0.049	0.06	0.054	0.031	0.033
	Beryllium	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.001	<0.001
	Cadmium	<0.0025	0.00039 J	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	0.00052 J	0.00071 J	<0.0025	0.00015 J	<0.001
	Chromium	NA	<0.0025	<0.01	0.01	<0.0025	<0.0025	<0.0025	0.0019 J	<0.0025	NA	<0.002	<0.002
	Cobalt	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00022 J	<0.0005
	Lead	<0.0013	<0.0013	<0.005	0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00019 J	<0.001
	Lithium	NA	0.0053	<0.05	0.0043 J	<0.005	0.0042 J	0.0061	0.0052	0.0052	NA	<0.005	0.007
	Mercury	NA	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA	<0.0002	NA
	Molybdenum	NA	0.004 J	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	NA	0.002 J	0.00067 J
	Radium	NA	0.949 U	1.13	0.426	0.604	0.974	0.409 U	0.306 U	0.701	NA	0.0663 U	0.447 U
	Selenium	<0.0013	0.00077 J	<0.01	0.00037 J	<0.0013	0.00044 J	0.00038 J	<0.0013	<0.0013	<0.0013	<0.005	<0.005
	Thallium	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.001	<0.001
*	Silver	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	0.00022 J
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	-80.20	-72.80	50.30	65.10	67.10	90.80	82.40	77.90	159.90	130.00	48.50
	pH, Field	NA	7.55	6.92	6.76	6.72	6.66	6.77	6.60	6.63	6.83	6.94	6.69
	RDO Concentration	NA	0.48	0.80	3.32	3.21	3.98	2.35	1.74	2.46	5.57	8.33	5.46
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	NA	27.99	22.89	16.60	18.27	22.44	19.26	15.57	25.63	9.30	23.50	26.16
	Turbidity, Field	NA	1.6	2.7	0.53	0.43	0.87	1.1	2.8	1.5	1.4	8.6	0.63

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-14	ARGWA-24	ARGWA-24	ARGWA-24
		4/6/2020	6/25/2020	8/19/2020	9/29/2020	2/11/2021	9/8/2021	2/2/2022	8/31/2022	2/7/2023	8/10/2023	12/1/2020	2/9/2021	9/8/2021
APPENDIX III	Boron	0.041 J	<0.08	NA	0.039 J	0.062 J	<0.08	<0.060	0.0356	0.0145 J	0.0372	<0.08	<0.08	<0.08
APPENDIX III	Calcium	43	27	NA	29	40	24	48	41.6	19.1	49.5	13	9.7	10
APPENDIX III	Chloride	4.2	4	NA	4.1	4.6	4	4.2	3.92	3.88	4.61	12	11	11
APPENDIX III	Fluoride	0.28	0.17	0.12	0.13	0.25	0.2	0.19	0.155	0.275	0.254	<0.1	0.057 J	0.1
APPENDIX III	Sulfate	10	3.3	NA	4.1	10	3	8.6	2.58	2.52	14.4	7.5	8.5	6.8
APPENDIX III	TDS	280	NA	NA	210	290	170	310	177	144	301	120	110	120
APPENDIX III	pH	6.65	6.38	6.62	6.8	7.02	7.04	6.41	6.80	6.25	6.43	5.85	5.69	5.8
APPENDIX IV	Antimony	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	<0.002	<0.002	<0.002
APPENDIX IV	Arsenic	<0.001	NA	<0.001	0.00038 J	<0.001	0.00034 J	0.00033 J	<0.00200	<0.00200	0.00349 J	<0.001	<0.001	<0.001
APPENDIX IV	Barium	0.051	NA	0.041	0.062	0.066	0.037	0.062	0.0740	0.0376	0.0465	0.038	0.036	0.039
APPENDIX IV	Beryllium	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	<0.0025	<0.0025	<0.0025
APPENDIX IV	Cadmium	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	<0.0025
APPENDIX IV	Chromium	<0.002	NA	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	<0.00300	<0.002	<0.002	<0.002
APPENDIX IV	Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300	0.0058	0.00088 J	0.00019 J
APPENDIX IV	Lead	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	<0.001	<0.001	<0.001
APPENDIX IV	Lithium	<0.005	0.0071	<0.005	0.0044 J	<0.005	<0.005	0.0032 J	0.00399 J	0.00426 J	<0.00300	<0.005	<0.005	<0.005
APPENDIX IV	Mercury	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670	<0.0002	<0.0002	<0.0002
APPENDIX IV	Molybdenum	0.00084 J	<0.015	0.00065 J	<0.015	<0.015	<0.015	<0.00061	0.000862 J	0.000201 J	0.000738 J	<0.015	<0.015	<0.015
APPENDIX IV	Radium	0.286 U	NA	-0.0549 U	0.134 U	0.413 U	0.188 U	0.590 U	0.345 U	1.51 U	0.641 U	-0.0123 U	0.0311 U	0.539
APPENDIX IV	Selenium	<0.005	NA	<0.005	<0.005	<0.005	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	<0.005	<0.005	<0.005
APPENDIX IV	Thallium	<0.001	NA	<0.001	0.00019 J	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	<0.001	<0.001	<0.001
*	Silver	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.001	<0.001	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	140	NA	NA	260	120	260	157	121	259	65	60	56
ADDITIONAL PARAMETERS	Bicarbonate Alkalinity	NA	140	NA	NA	260	120	260	157	121	259	65	60	56
ADDITIONAL PARAMETERS	Carbonate Alkalinity	NA	<5	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725	<5	<5	<5
ADDITIONAL PARAMETERS	Aluminum	NA	NA	NA	NA	NA	NA	NA	0.0344 J	<0.0193	<0.0193	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Dissolved	NA	0.023 J	NA	NA	NA	NA	0.055	NA	NA	NA	0.17	0.079	0.056
ADDITIONAL PARAMETERS	Iron, Total	NA	NA	NA	NA	NA	NA	NA	<0.0330	<0.0330	0.0458 J	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	0.048	NA	NA	NA	0.27	NA	0.013
ADDITIONAL PARAMETERS	Manganese, Total	NA	0.0078	NA	NA	NA	0.0029 J	NA	0.00674	0.00432 J	0.00209 J	NA	0.046	0.013
ADDITIONAL PARAMETERS	Magnesium	NA	5	NA	NA	7.7	4.8	8.4	7.21	4.67	9.40	NA	5.7	5.9
ADDITIONAL PARAMETERS	Potassium	NA	2.2	NA	NA	2.7	2.1	2.9	3.47	1.75	2.82	0.92	0.88	0.83
ADDITIONAL PARAMETERS	Sodium	NA	43	NA	NA	58	32	54	70.9	19.5	46.8	13	13	13
ADDITIONAL PARAMETERS	Oxidation Reduction Potential	101.70	NA	NA	NA	NA	NA	NA	54.74	67.40	64.41	NA	NA	NA
ADDITIONAL PARAMETERS	pH, Field	6.65	6.38	6.62	6.80	7.02	7.04	6.41	6.80	6.25	6.43	5.85	5.69	5.80
ADDITIONAL PARAMETERS	RDO Concentration	3.42	NA	NA	NA	NA	NA	NA	5.78	7.73	6.74	NA	NA	NA
ADDITIONAL PARAMETERS	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	511.13	252.00	251.22	NA	NA	NA
ADDITIONAL PARAMETERS	Temperature, Field	21.42	NA	NA	NA	NA	NA	NA	21.11	17.64	22.41	NA	NA	NA
ADDITIONAL PARAMETERS	Turbidity, Field	0.7	NA	NA	NA	NA	NA	NA	3.0	1.0	0.32	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWA-24	ARGWA-24	ARGWA-24	ARGWA-24	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7
		2/1/2022	8/31/2022	2/2/2023	8/9/2023	6/23/2016	8/31/2016	10/25/2016	1/26/2017	4/12/2017	6/22/2017	10/25/2017	4/10/2018	10/17/2018
APPENDIX III	Boron	<0.060	0.0151 J	0.0140 J	0.0117 J	NA	0.14	0.126	0.14	0.12	0.11	0.12	0.1	0.084
	Calcium	9.6	10.1	10.2	9.31	NA	12	10.9	13	12	13	12	12	11
	Chloride	12	12.3	9.71	8.91	5.4	5.1	6.2	5.1	4.9	5.1	5.1	5	5.8
	Fluoride	0.054 J	0.164	0.125	0.0732 J	NA	<0.2	0.02 J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Sulfate	6.8	6.94	6.22	6.34	61	57	56	57	47	49	49	46	42
	TDS	120	122	90.0	88.0	NA	150	171	120	150	130	130	140	180
	pH	5.77	5.65	5.62	5.7	NA	5.98	5.81	5.73	5.65	5.69	5.99	5.6	5.67
APPENDIX IV	Antimony	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	0.0013 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Arsenic	<0.00028	<0.00200	<0.00200	<0.00200	<0.0013	<0.0013	<0.005	<0.0013	0.00078 J	<0.0013	<0.0013	<0.0013	<0.0013
	Barium	0.040	0.0412	0.0392	0.0390	0.031	0.03	0.0317	0.035	0.034	0.038	0.038	0.038	0.038
	Beryllium	<0.00027	<0.000200	<0.000200	<0.000200	NA	<0.0025	0.0001 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Cadmium	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Chromium	<0.0015	<0.00300	<0.00300	<0.00300	NA	0.0033	0.0029 J	0.0033	0.0036	0.0036	0.0028	0.0038	0.0036
	Cobalt	<0.00026	<0.000300	<0.000300	<0.000300	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Lead	<0.00017	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Lithium	0.0027 J	<0.00300	<0.00300	<0.00300	NA	<0.005	0.0024 J	0.0033 J	<0.005	<0.005	0.005	0.005	0.0025 J
	Mercury	<0.00013	<0.0000670	<0.0000670	<0.0000670 hH	NA	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.00007 J	<0.0002
	Molybdenum	<0.00061	<0.000200	<0.000200	<0.000200	NA	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
	Radium	0.515 U	0.161 U	0.206 U	0.251 U	NA	-0.106 U	0.518 U	0.37	0.316 U	0.229 U	0.281 U	0.492	0.495 U
	Selenium	<0.00074	<0.00150	<0.00150	<0.00150	0.00029 J	<0.0013	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Thallium	<0.00047	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
*	Silver	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013
ADDITIONAL PARAMETERS	Total Alkalinity	54	56.8	55.0	52.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	54	56.8	55.0	52.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	NA	<0.0193	<0.0193	<0.0193	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	<0.028	NA	NA	<0.0330	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	<0.0330	<0.0330	<0.0330	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	0.0051	NA	NA	0.00233 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	0.00382 J	0.00391 J	0.00106 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	6.2	6.48	6.15	5.56	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	0.75	0.809	0.809	0.763	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	14	14.5	13.8	12.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	239.07	137.01	103.46	NA	74.30	206.10	109.20	118.40	83.10	108.60	84.20	112.00
	pH, Field	5.77	5.65	5.62	5.7	NA	5.98	5.81	5.73	5.65	5.69	5.99	5.60	5.67
	RDO Concentration	NA	1.67	1.24	2.44	NA	2.82	2.61	2.83	2.58	2.41	3.78	4.92	4.38
	Specific Conductance, Field	NA	166.12	170.99	151.61	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	NA	19.96	18.03	22.17	NA	20.89	21.33	18.16	18.85	19.45	18.40	18.51	20.11
	Turbidity, Field	NA	0.40	0.26	0.98	NA	1.2	0.3	2.9	3.5	2.4	1.0	3.9	0.7

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7	ARGWC-7
		3/28/2019	8/21/2019	10/9/2019	4/8/2020	6/25/2020	8/18/2020	9/29/2020	2/10/2021	9/10/2021	2/3/2022	8/31/2022	2/2/2023	8/10/2023
APPENDIX III	Boron	0.087	NA	0.076 J	0.086	0.091	NA	0.078 J	0.1	0.093	0.13	0.0815	0.0773	0.116
	Calcium	11	NA	11	11	11	NA	11	9.9	10	11	9.99	10.2	9.75
	Chloride	5.1	NA	4.6	4.4	4.6	NA	4.1	4.5	4.8	3.1	4.59	4.25	4.20
	Fluoride	<0.2	<0.2	0.032 J	0.062 J	<0.1	<0.1	0.027 J	0.033 J	0.032 J	0.074 J	<0.0330	<0.0330	<0.0330
	Sulfate	45	NA	42	39	42	NA	38	43	39	21	36.3	35.0	34.5
	TDS	130	NA	130	130	NA	NA	140	110	130	120	101	106	101
	pH	5.85	5.77	5.76	5.75	5.75	6.7	5.92	5.77	5.83	5.74	5.98	5.85	5.69
APPENDIX IV	Antimony	NA	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100
	Arsenic	<0.0013	<0.001	0.0015	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00028	<0.00200	<0.00200	0.00480 J
	Barium	0.038	0.041	0.046	0.039	NA	0.044	0.042	0.041	0.045	0.051	0.0505	0.0518	0.0540
	Beryllium	NA	<0.001	0.00041 J	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200
	Cadmium	<0.0025	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300
	Chromium	NA	0.0046	0.0042	0.0027	NA	0.0031	0.0031	0.003	0.0032	0.0043	0.00344 J	0.00353 J	0.00353 J
	Cobalt	NA	0.000086 J	0.00034 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300
	Lead	<0.0013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.000500
	Lithium	NA	0.0034 J	0.0083	<0.005	0.0046 J	<0.005	<0.005	<0.005	<0.005	0.0031 J	0.00308 J	<0.00300	<0.00300
	Mercury	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670
	Molybdenum	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.00061	<0.000200	<0.000200	<0.000200
	Radium	NA	0.0805 U	0.552	0.366 U	NA	0.376 U	0.334 U	0.412	0.861	0.490 U	0.804 U	1.76 U	1.27 U
	Selenium	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	0.0028 J	<0.00074	<0.00150	<0.00150	<0.00150
	Thallium	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600
*	Silver	<0.0013	NA	<0.0013	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	24	NA	NA	26	30	22	30.8	25.4	28.0
	Bicarbonate Alkalinity	NA	NA	NA	NA	24	NA	NA	26	30	22	30.8	25.4	28.0
	Carbonate Alkalinity	NA	NA	NA	NA	<5	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0193	0.0219 J	<0.0193
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.028	NA	NA	<0.0330
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0330	0.0519 J	<0.0330
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0013	NA	NA	<0.00100
	Manganese, Total	NA	NA	NA	NA	0.00096 J	NA	NA	<0.005	<0.005	NA	0.00110 J	0.00127 J	<0.00100
	Magnesium	NA	NA	NA	NA	8.6	NA	NA	8.2	8.7	8.6	8.76	8.57	8.63
	Potassium	NA	NA	NA	NA	1	NA	NA	0.96	0.93	1.0	1.01	1.04	1.00
	Sodium	NA	NA	NA	NA	6.2	NA	NA	6.2	5.9	6.2	6.13	6.10	5.93
	Oxidation Reduction Potential	137.70	188.40	121.70	129.00	NA	NA	NA	NA	NA	NA	107.43	127.40	130.07
	pH, Field	5.85	5.77	5.76	5.75	5.75	6.70	5.92	5.77	5.83	5.74	5.98	5.85	5.69
	RDO Concentration	4.31	4.52	3.40	3.90	NA	NA	NA	NA	NA	NA	2.71	2.91	3.57
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	151.09	161.28	162.39
	Temperature, Field	20.16	23.60	19.66	18.71	NA	NA	NA	NA	NA	NA	20.45	17.84	22.96
	Turbidity, Field	2.8	1.3	1.6	1.3	NA	NA	NA	NA	NA	NA	0.7	1.1	0.43

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8
		6/23/2016	8/31/2016	10/26/2016	1/26/2017	4/12/2017	6/21/2017	10/26/2017	4/11/2018	10/17/2018	3/28/2019	3/29/2019	8/21/2019
APPENDIX III	Boron	NA	1.3	1.14	1.5	1.3	1.3	1.5	1	1.3	1.3	NA	NA
	Calcium	NA	46	43.3	51	47	51	55	44	52	52	NA	NA
	Chloride	6.2	5.6	7.1	5.8	5.6	5.8	5.5	5.7	6	5.7	NA	NA
	Fluoride	NA	0.11 J	0.43 o	0.13 J	0.13 J	0.14 J	0.13 J	0.13 J	0.16 J	0.089 J	NA	0.12 J
	Sulfate	78	72	77	75	69	73	72	69	67	66	NA	NA
	TDS	NA	310	283	300	310	300	270	240	120	290	NA	NA
	pH	NA	6.62	6.44	6.34	6.36	6.28	6.47	6.34	6.2	NA	6.55	6.36
APPENDIX IV	Antimony	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	NA	<0.002
	Arsenic	<0.0013	<0.0013	<0.005	<0.0013	0.00072 J	<0.0013	<0.0013	<0.0013	0.00063 J	<0.0013	NA	0.00036 J
	Barium	0.039	0.037	0.0423	0.046	0.041	0.049	0.046	0.048	0.045	0.045	NA	0.052
	Beryllium	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	NA	<0.001
	Cadmium	<0.0025	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.001
	Chromium	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	NA	0.0015 J
	Cobalt	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	NA	0.00021 J
	Lead	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	NA	<0.001
	Lithium	NA	0.0039 J	0.0025 J	0.0035 J	<0.005	<0.005	0.0041 J	0.0041 J	0.0037 J	NA	NA	<0.005
	Mercury	NA	<0.0002	<0.0005	0.000081 J	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA	NA	<0.0002
	Molybdenum	NA	0.034	0.0377	0.04	0.035	0.038	0.041	0.037	0.036	NA	NA	0.051
	Radium	NA	0.218 U	0.335 U	0.345 U	0.37 U	0.144 U	0.51	0.362	0.385 U	NA	NA	0.125 U
	Selenium	<0.0013	<0.0013	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	NA	<0.005
	Thallium	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA	<0.001
*	Silver	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	NA
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	77.10	192.50	94.20	77.50	68.40	121.00	72.20	472.00	NA	41.20	48.90
	pH, Field	NA	6.62	6.44	6.34	6.36	6.28	6.47	6.34	6.20	NA	6.55	6.36
	RDO Concentration	NA	0.18	0.34	0.78	0.20	0.14	0.19	0.22	0.26	NA	0.31	0.43
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	NA	21.48	22.40	17.75	22.46	20.77	19.36	19.86	21.86	NA	16.76	21.86
	Turbidity, Field	NA	0.46	3.7	3.9	4.2	9.3	3.1	9.7	4.1	NA	1.3	1.7

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce
   a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-8	ARGWC-9
		10/9/2019	4/9/2020	6/23/2020	8/20/2020	10/1/2020	2/10/2021	9/9/2021	2/2/2022	8/31/2022	2/2/2023	8/10/2023	6/23/2016
APPENDIX III	Boron	1.2	1.1	1.1	NA	1.2	1.3	1.2	1.1	1.05	1.04	0.980	NA
	Calcium	53	47	52	NA	52	48	49	47	43.0	45.7	44.9	NA
	Chloride	5.7	7.7	7	NA	6	6.4	6.2	6.3	5.86	5.60	5.45	5.6
	Fluoride	0.085 J	0.16	0.12	0.054 J	0.14	0.17	0.18	0.19	0.172	0.217	0.141	NA
	Sulfate	63	59	62	NA	57	60	58	59	54.1	53.2	52.3	1
	TDS	290	270	NA	NA	270	270	270	260	248	249	234	NA
	pH	6.47	6.42	6.37	6.34	6.44	6.45	6.4	6.43	6.38	6.53	6.63	NA
APPENDIX IV	Antimony	<0.002	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA
	Arsenic	0.0014	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00028	<0.00200	<0.00200	0.00337 J	<0.0013
	Barium	0.049	0.045	NA	0.053	0.052	0.049	0.051	0.059	0.0571	0.0554	0.0603	0.043
	Beryllium	0.00047 J	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA
	Cadmium	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025
	Chromium	0.0017 J	<0.002	NA	<0.002	<0.002	<0.002	<0.002	<0.0015	<0.00300	<0.00300	<0.00300	NA
	Cobalt	0.00041 J	0.00013 J	0.00017 J	0.00023 J	0.00021 J	0.00015 J	<0.0025	0.00032 J	<0.000300	<0.000300	<0.000300	NA
	Lead	0.00019 J	<0.001	NA	<0.001	<0.001	<0.001	<0.001	0.00024 J	<0.000500	<0.000500	<0.000500	<0.0013
	Lithium	0.0077	<0.005	0.0042 J	<0.005	0.0035 J	<0.005	0.0037 J	0.0039 J	0.00345 J	0.00337 J	0.00333 J	NA
	Mercury	NA	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670 hH	NA
	Molybdenum	0.049	0.039	0.043	0.042	0.043	0.041	0.043	0.042	0.0437	0.0428	0.0424	NA
	Radium	-0.164 U	0.255 U	NA	0.14 U	0.512 U	0.384	0.616	0.604 U	0.618 U	0.844 U	0.680 U	NA
	Selenium	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	<0.0013
	Thallium	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA
*	Silver	<0.0013	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	170	NA	NA	170	170	160	158	152	158	NA
	Bicarbonate Alkalinity	NA	NA	170	NA	NA	170	170	160	158	152	158	NA
	Carbonate Alkalinity	NA	NA	<5	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	0.157	0.0705	0.0776	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	0.076	NA	NA	<0.0330	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	0.12	NA	0.171	0.0842 J	0.107	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	0.39	0.36	NA	NA	0.339	NA
	Manganese, Total	NA	NA	0.41	NA	NA	0.38	0.39	NA	0.355	0.360	0.356	NA
	Magnesium	NA	NA	23	NA	NA	22	22	20	20.4	19.9	21.1	NA
	Potassium	NA	NA	1.7	NA	NA	1.7	1.6	1.8	1.76	1.80	1.78	NA
	Sodium	NA	NA	14	NA	NA	14	14	13	13.3	13.7	13.6	NA
	Oxidation Reduction Potential	103.70	532.86	NA	NA	NA	NA	NA	NA	117.81	61.14	70.66	NA
	pH, Field	6.47	6.42	6.37	6.34	6.44	6.45	6.40	6.43	6.38	6.53	6.63	NA
	RDO Concentration	0.25	0.29	NA	NA	NA	NA	NA	NA	0.22	1.47	0.15	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	426.86	428.46	444.98	NA
	Temperature, Field	19.73	23.97	NA	NA	NA	NA	NA	NA	21.50	19.86	21.22	NA
	Turbidity, Field	3.8	4.8	NA	NA	NA	NA	NA	NA	3.4	2.6	2.18	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9
		8/31/2016	10/25/2016	1/26/2017	4/12/2017	6/22/2017	10/25/2017	4/11/2018	10/17/2018	3/28/2019	8/21/2019	10/9/2019	4/9/2020
APPENDIX III	Boron	<0.05	0.0071 J	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.044 J	NA	<0.08	<0.08
	Calcium	5.2	4.64	5.5	4.9	5.8	6.1	6	5.8	5.6	NA	5.7	5.3
	Chloride	5.4	6.4	5.3	5.2	5.5	5.3	5.1	5.3	4.8	NA	5.2	5.6
	Fluoride	<0.2	0.2 J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.03 J	0.038 J	0.066 J
	Sulfate	1.1	4.7 o	1.1	0.9 J	0.99 J	0.95 J	0.9 J	0.95 J	1	NA	1.5	1.1
	TDS	74	67	84	88	76	60	24	96	77	NA	75	70
	pH	6.1	5.92	5.82	5.79	5.64	5.7	5.69	5.81	5.97	5.76	5.9	5.9
APPENDIX IV	Antimony	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.002	0.00048 J	<0.002
	Arsenic	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00051 J	<0.001	0.0011	<0.001
	Barium	0.042	0.0455	0.048	0.045	0.055	0.049	0.052	0.046	0.047	0.045	0.041	0.044
	Beryllium	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.001	0.00037 J	<0.0025
	Cadmium	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025
	Chromium	0.011	0.0109	0.011	0.0096	0.011	0.0094	0.01	0.0096	NA	0.0097	0.0084	0.0069
	Cobalt	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.0005	0.00021 J	0.00015 J
	Lead	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.001	0.00016 J	<0.001
	Lithium	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	0.0061	<0.005
	Mercury	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA	<0.0002	NA	<0.0002
	Molybdenum	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	NA	<0.005	<0.005	<0.015
	Radium	0.279 U	0.393 U	0.0879 U	0.219 U	0.552	0.388 U	0.322	0.327 U	NA	0.0554 U	-0.238 U	0.334 U
	Selenium	0.00024 J	<0.01	<0.0013	<0.0013	<0.0013	0.00029 J	<0.0013	<0.0013	<0.0013	<0.005	<0.005	<0.005
	Thallium	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.001	<0.001	<0.001
*	Silver	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	<0.0013	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	78.20	227.60	107.20	130.70	141.90	119.20	80.30	175.40	82.80	73.80	132.60	128.60
	pH, Field	6.10	5.92	5.82	5.79	5.64	5.70	5.69	5.81	5.97	5.76	5.90	5.90
	RDO Concentration	4.01	5.22	5.44	4.94	4.59	4.57	5.15	5.51	5.43	5.77	5.37	6.10
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	22.09	20.49	18.26	21.01	23.65	19.55	19.66	21.11	19.43	22.13	20.28	20.23
	Turbidity, Field	3.4	2.2	4.5	2.2	4.7	4.7	4.9	4.0	4.9	2.6	3.4	4.8

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-9	ARGWC-10	ARGWC-10	ARGWC-10
		6/26/2020	8/19/2020	10/1/2020	2/10/2021	2/11/2021	9/9/2021	2/2/2022	8/31/2022	2/2/2023	8/10/2023	6/23/2016	8/31/2016	9/1/2016
APPENDIX III	Boron	<0.08	NA	0.041 J	0.06 J	NA	<0.08	<0.060	0.00885 J	0.00794 J	0.00623 J	NA	NA	<0.05
	Calcium	5.6	NA	5.7	4.8	NA	4.7	4.7	4.77	4.88	4.75	NA	NA	6.6
	Chloride	5.4	NA	5.5	5.9	NA	6.1	5.3	5.28 J	4.88	4.80	4.3	NA	4
	Fluoride	0.027 J	<0.1	0.041 J	0.051 J	<0.05	0.06 J	0.043 J	0.147	0.182	0.0790 J	NA	NA	<0.2
	Sulfate	0.94 J	NA	0.82 J	1.7	NA	1.2	1.4	1.31	1.46	1.45	<1	NA	<1
	TDS	NA	NA	55	71	NA	70	67	63.0	77.0	50.0	NA	NA	100
	pH	5.85	7.21	5.78	5.91	5.95	5.91	5.95	5.98	6.00	6.1	NA	6.16	NA
APPENDIX IV	Antimony	NA	<0.002	NA	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	NA	<0.0025
	Arsenic	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.00028	<0.00200	<0.00200	0.00457 J	<0.0013	NA	<0.0013
	Barium	NA	0.046	0.045	0.038	NA	0.038	0.040	0.0391	0.0391	0.0401	0.028	NA	0.027
	Beryllium	NA	<0.0025	<0.0025	<0.0025	NA	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA	NA	<0.0025
	Cadmium	NA	<0.0025	NA	<0.0025	NA	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	NA	<0.0025
	Chromium	NA	0.008	0.0075	0.007	NA	0.0071	0.0068	0.00766 J	0.00753 J	0.00775 J	NA	NA	0.0038
	Cobalt	<0.0025	0.00013 J	<0.0025	<0.0025	NA	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300	NA	NA	<0.0025
	Lead	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	<0.0013	NA	<0.0013
	Lithium	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.00083	<0.00300	<0.00300	<0.00300	NA	NA	<0.005
	Mercury	NA	<0.0002	NA	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670 hH	NA	NA	<0.0002
	Molybdenum	<0.015	<0.015	<0.015	<0.015	NA	<0.015	<0.00061	<0.000200	<0.000200	<0.000200	NA	NA	<0.015
	Radium	NA	0.124 U	0.501	0.515	NA	0.57	0.736 U	0.0403 U	0.0399 U	0.492 U	NA	NA	0.153 U
	Selenium	NA	<0.005	<0.005	<0.005	NA	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	<0.0013	NA	<0.0013
	Thallium	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	NA	<0.0005
*	Silver	NA	NA	<0.001	<0.001	NA	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	NA
ADDITIONAL PARAMETERS	Total Alkalinity	29	NA	NA	21	NA	28	25	23.8	15.0	23.9	NA	NA	NA
	Bicarbonate Alkalinity	29	NA	NA	21	NA	28	25	23.8	15.0	23.9	NA	NA	NA
	Carbonate Alkalinity	<5	NA	NA	<5	NA	<5	<5.0	<1.45	<1.45	<0.725	NA	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	0.0540	0.0886	<0.0193	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	<0.028	NA	NA	0.0460 J	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	0.0621 J	0.126	<0.0330	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	<0.0013	NA	NA	0.00227 J	NA	NA	NA
	Manganese, Total	<0.005	NA	NA	NA	<0.005	<0.005	NA	0.00278 J	0.00439 J	<0.00100	NA	NA	NA
	Magnesium	2.4	NA	NA	2.1	NA	2.1	2.0	2.16	2.11	2.18	NA	NA	NA
	Potassium	1.8	NA	NA	1.8	NA	1.6	1.8	1.84	1.86	1.77	NA	NA	NA
	Sodium	6.7	NA	NA	6.5	NA	6.3	6.3	6.72	6.50	6.69	NA	NA	NA
	Oxidation Reduction Potential	NA	NA	NA	NA	NA	NA	NA	122.47	169.68	123.99	NA	87.50	NA
	pH, Field	5.85	7.21	5.78	5.91	5.95	5.91	5.95	5.98	6.00	6.1	NA	6.16	NA
	RDO Concentration	NA	NA	NA	NA	NA	NA	NA	6.89	7.46	6.93	NA	4.17	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	72.22	78.30	79.47	NA	NA	NA
	Temperature, Field	NA	NA	NA	NA	NA	NA	NA	21.25	19.46	20.93	NA	19.72	NA
	Turbidity, Field	NA	NA	NA	NA	NA	NA	NA	2.9	2.3	1.19	NA	44	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce
   a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10
		10/25/2016	1/27/2017	4/12/2017	6/22/2017	10/26/2017	4/11/2018	10/17/2018	3/28/2019	8/21/2019	10/9/2019	4/8/2020	6/23/2020
APPENDIX III	Boron	<0.1	<0.05	<0.05	<0.05	0.026 J	<0.05	<0.05	<0.05	NA	<0.08	<0.08	0.053 J
	Calcium	5.89	7.4	6.7	7.5	7.8	7.4	7.1	7.3	NA	7.7	7.5	7.7
	Chloride	4.6	3.9	3.7	3.9	3.7	3.8	4	3.7	NA	3.8	3.9	4.2
	Fluoride	0.1 J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.03 J	0.047 J	0.053 J	0.071 J	0.04 J
	Sulfate	0.38 J	<1	<1	<1	<1	<1	<1	0.38 J	NA	0.59 J	<1	<1
	TDS	65	86	110	82	38	50	120	82	NA	92	82	NA
	pH	6.02	5.98	5.87	5.68	6.07	5.72	5.9	6.05	5.82	5.94	5.95	5.95
APPENDIX IV	Antimony	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.002	<0.002	0.00094 J	NA
	Arsenic	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.0011 J	0.0004 J	0.0019	<0.001	NA
	Barium	0.0296	0.035	0.031	0.035	0.032	0.034	0.031	0.031	0.035	0.031	0.031	NA
	Beryllium	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.001	<0.001	<0.0025	NA
	Cadmium	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025	NA
	Chromium	0.0042 J	0.005	0.0048	0.0047	0.0043	0.0051	0.0051	NA	0.0073	0.006	0.0046	NA
	Cobalt	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.00017 J	0.00019 J	<0.0025	0.00013 J
	Lead	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.001	<0.001	0.031	NA
	Lithium	<0.05	<0.005	<0.005	<0.005	<0.005	0.0015 J	0.0011 J	NA	<0.005	0.0055	<0.005	<0.005
	Mercury	<0.0005	0.000077 J	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA	<0.0002	NA	<0.0002	NA
	Molybdenum	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	NA	<0.005	<0.005	<0.015	<0.015
	Radium	0.328 U	-0.0761 U	0.112 U	0.414	0.334 U	0.17 U	0.38 U	NA	0.352 U	-0.38 U	-0.0401 U	NA
	Selenium	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA
	Thallium	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.001	<0.001	<0.001	NA
*	Silver	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013	<0.0013	NA	<0.0013	<0.001	NA
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<5
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.005
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.8
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.73
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.7
	Oxidation Reduction Potential	193.20	93.90	125.70	115.30	128.10	89.50	143.60	77.50	63.10	122.60	105.40	NA
	pH, Field	6.02	5.98	5.87	5.68	6.07	5.72	5.90	6.05	5.82	5.94	5.95	5.95
	RDO Concentration	4.15	4.02	4.50	4.13	3.92	4.15	4.02	3.51	4.15	3.85	4.46	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	19.42	18.03	19.36	20.22	19.53	18.79	20.19	19.09	20.46	19.80	19.50	NA
	Turbidity, Field	3.8	4.8	4.9	4.9	3.1	4.8	2.5	8.8	4.9	3.0	4.5	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce
   a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-10	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15
		8/19/2020	10/1/2020	2/9/2021	9/10/2021	2/2/2022	8/31/2022	2/2/2023	8/9/2023	6/23/2016	9/2/2016	10/25/2016	10/26/2016	1/26/2017
APPENDIX III	Boron	NA	0.082	<0.08	<0.08	<0.060	0.00863 J	0.00561 J	<0.00520	NA	<0.05	NA	0.0138 J	<0.05
APPENDIX III	Calcium	NA	8.1	7.7	8.1	8.3	7.65	7.69	7.85	NA	22	NA	23.7	23
APPENDIX III	Chloride	NA	3.9	4.7	4.6	4.4	4.20	4.10	4.11	1.9	2.7	NA	3.3	1.6
APPENDIX III	Fluoride	<0.1	0.048 J	0.051 J	0.067 J	0.063 J	<0.0330	0.134	0.111	NA	0.21	NA	0.21 J	0.097 J
APPENDIX III	Sulfate	NA	<1	1.3	<1	<0.76	0.494	0.529	0.541	6.9	6.1	NA	22	5.1
APPENDIX III	TDS	NA	93	81	100	96	69.0	84.0	72.0	NA	150	NA	125	86
APPENDIX III	pH	7.06	5.83	5.94	6.01	5.95	5.96	5.86	5.99	NA	6.54	6.25	6.23	6.4
APPENDIX IV	Antimony	<0.002	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	NA	<0.003	<0.0025
APPENDIX IV	Arsenic	<0.001	<0.001	<0.001	<0.001	<0.00028	<0.00200	<0.00200	<0.00200	<0.0013	0.00062 J	NA	<0.005	<0.0013
APPENDIX IV	Barium	0.034	0.032	0.031	0.031	0.034	0.0345	0.0340	0.0363	0.028	0.074	NA	0.0408	0.038
APPENDIX IV	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA	<0.0025	NA	<0.003	<0.0025
APPENDIX IV	Cadmium	<0.0025	NA	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	NA	<0.001	<0.0025
APPENDIX IV	Chromium	0.0049	0.0047	0.0046	0.0049	0.0050	0.00550 J	0.00534 J	0.00473 J	NA	0.0087	NA	<0.01	<0.0025
APPENDIX IV	Cobalt	0.00015 J	<0.0025	<0.0025	<0.0025	<0.00026	<0.000300	<0.000300	<0.000300	NA	0.03	NA	0.0036 J	0.011
APPENDIX IV	Lead	0.00013 J	<0.001	<0.001	<0.001	<0.00017	<0.000500	<0.000500	<0.000500	<0.0013	0.0056	NA	0.0003 J	<0.0013
APPENDIX IV	Lithium	<0.005	<0.005	<0.005	<0.005	0.0012 J	<0.00300	<0.00300	<0.00300	NA	0.0045 J	NA	0.0025 J	<0.005
APPENDIX IV	Mercury	<0.0002	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670 hH	NA	<0.0002	NA	<0.0005	<0.0002
APPENDIX IV	Molybdenum	<0.015	<0.015	<0.015	<0.015	<0.00061	<0.000200	<0.000200	<0.000200	NA	0.0015 J	NA	<0.01	<0.015
APPENDIX IV	Radium	-0.0271 U	0.172 U	0.163 U	0.0831 U	0.586 U	0.500 U	2.32 U	2.22	NA	2.11	NA	2.45	0.276 U
APPENDIX IV	Selenium	<0.005	<0.005	<0.005	0.0017 J	<0.00074	<0.00150	<0.00150	<0.00150	<0.0013	0.0005 J	NA	<0.01	<0.0013
APPENDIX IV	Thallium	<0.001	<0.001	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	0.000095 J	NA	<0.001	<0.0005
*	Silver	NA	<0.001	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	NA	<0.01	NA
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	51	53	51	49.4	47.0	49.6	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Bicarbonate Alkalinity	NA	NA	51	53	51	49.4	47.0	49.6	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Carbonate Alkalinity	NA	NA	<5	<5	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Aluminum	NA	NA	NA	NA	NA	0.0861	0.120	0.0917	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Dissolved	NA	NA	NA	NA	<0.028	NA	NA	<0.0330	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Total	NA	NA	NA	NA	NA	0.112	0.162	0.122	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Dissolved	NA	NA	NA	NA	<0.0013	NA	NA	0.00250 J	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Total	NA	NA	<0.005	<0.005	NA	0.00358 J	0.00566	0.00694	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Magnesium	NA	NA	3.6	3.9	3.8	4.01	3.94	3.77	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Potassium	NA	NA	0.76	0.7	0.75	0.756	0.755	0.749	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Sodium	NA	NA	9.3	9.2	10	10.4	9.80	9.15	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Oxidation Reduction Potential	NA	NA	NA	NA	NA	112.15	140.23	194.82	NA	93.10	86.90	114.00	46.80
ADDITIONAL PARAMETERS	pH, Field	7.06	5.83	5.94	6.01	5.95	5.96	5.86	5.99	NA	6.54	6.25	6.23	6.40
ADDITIONAL PARAMETERS	RDO Concentration	NA	NA	NA	NA	NA	4.04	4.22	3.6	NA	5.38	4.09	5.42	1.95
ADDITIONAL PARAMETERS	Specific Conductance, Field	NA	NA	NA	NA	NA	104.90	114.92	102.74	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Temperature, Field	NA	NA	NA	NA	NA	20.32	16.60	20.93	NA	20.61	19.08	21.18	17.67
ADDITIONAL PARAMETERS	Turbidity, Field	NA	NA	NA	NA	NA	3.9	4.2	4.17	NA	60	NA	11	4.8

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15
		4/12/2017	6/21/2017	10/26/2017	4/10/2018	10/17/2018	3/27/2019	8/21/2019	10/8/2019	4/8/2020	6/25/2020	8/19/2020	9/29/2020
APPENDIX III	Boron	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.08	<0.08	<0.08	NA	<0.08
	Calcium	17	18	19	24	21	28	NA	24	21	23	NA	25
	Chloride	1.5	1.6	1.6	1.8	2.1	1.8	NA	9.4 o	1.9	1.9	NA	2.5
	Fluoride	<0.2	<0.2	<0.2	<0.2	0.1 J	0.05 J	0.1 J	0.33 J	0.12	0.067 J	0.081 J	0.089 J
	Sulfate	4	4.6	5.4	6.7	6.8	7.2	NA	31	5.9	5.6	NA	7.7
	TDS	140	120	96	130	160	150	NA	130	130	NA	NA	130
	pH	6.1	6.11	6.2	6.17	6.34	6.6	6.3	6.38	6.26	6.32	6.47	7.11
APPENDIX IV	Antimony	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA
	Arsenic	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00036 J	<0.001	<0.001	NA	<0.001	<0.001
	Barium	0.03	0.028	0.029	0.032	0.028	0.032	0.033	0.031	0.03	NA	0.028	0.03
	Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.001	<0.001	<0.0025	NA	<0.0025	<0.0025
	Cadmium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025	NA	<0.0025	NA
	Chromium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	0.0017 J	<0.002	<0.002	NA	<0.002	<0.002
	Cobalt	<0.0025	<0.0025	<0.0025	0.00045 J	<0.0025	NA	0.00048 J	0.00019 J	0.00026 J	0.00022 J	0.0004 J	0.0003 J
	Lead	<0.0013	<0.0013	<0.0013	<0.0013	0.0016	<0.0013	<0.001	<0.001	<0.001	NA	<0.001	<0.001
	Lithium	<0.005	<0.005	<0.005	0.0029 J	<0.005	NA	<0.005	0.004 J	<0.005	0.004 J	<0.005	<0.005
	Mercury	<0.0002	<0.0002	<0.0002	0.000071 J	<0.0002	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA
	Molybdenum	<0.015	<0.015	<0.015	0.00097 J	<0.015	NA	0.0017 J	0.0011 J	0.00075 J	0.00086 J	0.0016 J	0.0019 J
	Radium	0.387 U	0.194 U	0.519	0.604	0.46 U	NA	0.491	0.421 U	0.309 U	NA	0.538	0.394 U
	Selenium	<0.0013	<0.0013	0.0004 J	0.00044 J	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005
	Thallium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.001
*	Silver	<0.00025	NA	0.00037 J	<0.0013	<0.0013	<0.0013	NA	0.00018 J	<0.001	NA	NA	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	98	NA	NA
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	98	NA	NA
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	<5	NA	NA
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0091	NA	NA
	Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	8	NA	NA
	Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5	NA	NA
	Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.2	NA	NA
	Oxidation Reduction Potential	124.50	104.70	91.80	86.40	94.40	119.40	95.20	140.10	93.76	NA	NA	NA
	pH, Field	6.10	6.11	6.20	6.17	6.34	6.60	6.30	6.38	6.26	6.32	6.47	7.11
	RDO Concentration	3.88	5.15	3.61	2.91	2.06	1.36	1.04	1.64	1.71	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	19.59	22.53	15.17	20.14	20.24	18.15	26.69	27.33	20.32	NA	NA	NA
	Turbidity, Field	0.50	1.5	0.97	2.4	1.1	2.3	2.8	1.6	1.3	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-15	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16
		2/9/2021	9/8/2021	2/3/2022	8/31/2022	2/3/2023	8/10/2023	6/24/2016	9/1/2016	10/25/2016	1/26/2017	4/11/2017	6/21/2017	10/26/2017
APPENDIX III	Boron	<0.08	<0.08	<0.060	0.0137 J	0.0113 J	0.00806 J	NA	0.049 J	0.042 J	0.059	0.045 J	0.045 J	0.054
APPENDIX III	Calcium	23	27	22	25.0	20.5	30.9	NA	21	29.8	23	28	22	21
APPENDIX III	Chloride	2.7	2.9	2.9	3.01 J	2.71	2.88	5	4.8	5.4	5.2	4.8	5.2	4.7
APPENDIX III	Fluoride	0.094 J	0.15	0.068 J	0.169	0.136 J	0.131	NA	<0.2	0.08 J	<0.2	<0.2	<0.2	<0.2
APPENDIX III	Sulfate	7.1	6.2	5.6	5.64	4.35	6.91	170	130	200	130	150	130	110
APPENDIX III	TDS	140	150	150	125	117	142	NA	240	304	170	260	230	170
APPENDIX III	pH	6.43	6.48	6.39	6.46	6.73	6.36	NA	5.49	5.29	5.29	5.21	5.21	5.2
APPENDIX IV	Antimony	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Arsenic	<0.001	<0.001	<0.00028	<0.00200	<0.00200	0.00240 J	<0.0013	<0.0013	<0.005	<0.0013	0.00067 J	<0.0013	<0.0013
APPENDIX IV	Barium	0.029	0.043	0.030	0.0325	0.0287	0.0370	0.056	0.051	0.0637	0.055	0.055	0.054	0.046
APPENDIX IV	Beryllium	<0.0025	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Cadmium	<0.0025	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	0.0001 J	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Chromium	<0.002	0.0027	<0.0015	<0.00300	<0.00300	<0.00300	NA	0.0017 J	0.0023 J	0.0017 J	0.0019 J	0.0017 J	0.0013 J
APPENDIX IV	Cobalt	<0.0025	0.004	<0.00026	<0.000300	<0.000300	0.00439	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025
APPENDIX IV	Lead	<0.001	0.0016	<0.00017	<0.000500	<0.000500	0.000841 J	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013
APPENDIX IV	Lithium	<0.005	<0.005	0.0020 J	<0.00300	<0.00300	<0.00300	NA	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005
APPENDIX IV	Mercury	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670	NA	0.000088 J	<0.0005	0.000079 J	<0.0002	0.00011 J	0.000094 J
APPENDIX IV	Molybdenum	0.0012 J	0.0017 J	0.0011 J	0.00179	0.000959 J	0.00212	NA	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015
APPENDIX IV	Radium	0.669	1.62	0.609	0.510 U	0.376 U	2.75	NA	0.568	1.57	0.255 U	0.334 U	0.518	0.79
APPENDIX IV	Selenium	<0.005	<0.005	<0.00074	<0.00150	<0.00150	<0.00150	0.0014	0.0014	0.0015 J	0.00071 J	0.0011 J	0.00075 J	0.0012 J
APPENDIX IV	Thallium	<0.001	<0.001	<0.00047	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
*	Silver	<0.001	<0.001	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	0.00026 J
ADDITIONAL PARAMETERS	Total Alkalinity	110	110	110	109	99.0	121	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Bicarbonate Alkalinity	110	110	110	109	99.0	121	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Carbonate Alkalinity	<5	<5	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Aluminum	NA	NA	NA	<0.0193	0.0380 J	2.16	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Dissolved	0.11	0.14	0.045 J	NA	NA	0.0574 J	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Iron, Total	NA	NA	NA	<0.0330	0.0428 J	2.56	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Dissolved	NA	NA	0.0013 J	NA	NA	0.123	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Manganese, Total	0.0035 J	0.0048 J	NA	0.0200	0.00106 J	0.121	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Magnesium	7.7	8.6	7.8	9.11	8.87	10.0	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Potassium	7.2	7.3	7.3	7.53	7.70	6.90	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Sodium	9	8.3	8.3	9.01	9.24	9.22	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Oxidation Reduction Potential	NA	NA	NA	132.21	109.12	62.14	NA	172.70	296.00	205.00	171.40	145.40	153.70
ADDITIONAL PARAMETERS	pH, Field	6.43	6.48	6.39	6.46	6.73	6.36	NA	5.49	5.29	5.29	5.21	5.21	5.20
ADDITIONAL PARAMETERS	RDO Concentration	NA	NA	NA	3.02	2.14	3.24	NA	0.30	1.00	0.42	0.78	0.35	0.57
ADDITIONAL PARAMETERS	Specific Conductance, Field	NA	NA	NA	251.72	238.46	240.28	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Temperature, Field	NA	NA	NA	21.56	16.53	23.44	NA	20.36	20.93	18.98	20.94	20.39	20.00
ADDITIONAL PARAMETERS	Turbidity, Field	NA	NA	NA	2.8	1.5	4.45	NA	0.2	0.4	0.75	0.33	1.2	0.7

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16
		4/10/2018	10/16/2018	3/28/2019	8/20/2019	10/9/2019	4/8/2020	6/24/2020	8/19/2020	9/29/2020	2/9/2021	2/11/2021	9/8/2021
APPENDIX III	Boron	0.048 J	0.048 J	0.08	NA	0.065 J	0.059 J	0.11	NA	0.081	0.076 J	NA	0.13
	Calcium	25	16	41	NA	39	40	47	NA	39	38	NA	32
	Chloride	4.8	4.5	4.6	NA	4.7	5.1	5.9	NA	5.2	5.7	NA	5.6
	Fluoride	<0.2	<0.2	<0.2	0.033 J	0.031 J	0.051 J	0.038 J	<0.1	0.026 J	0.056 J	<0.05	0.044 J
	Sulfate	130	84	220	NA	210	200	310	NA	200	190	NA	160
	TDS	260	140	370	NA	350	350	NA	NA	340	310	NA	280
	pH	5.34	5.47	5.31	5.35	5.22	5.07	5.2	5.24	5.5	5.24	5.23	5.32
APPENDIX IV	Antimony	<0.0025	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	NA	<0.002
	Arsenic	<0.0013	<0.0013	0.00057 J	<0.001	0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	0.00031 J
	Barium	0.056	0.039	0.054	0.046	0.057	0.042	NA	0.045	0.042	0.044	NA	0.035
	Beryllium	<0.0025	<0.0025	NA	<0.001	0.00027 J	<0.0025	NA	<0.0025	<0.0025	<0.0025	NA	<0.0025
	Cadmium	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	NA	<0.0025
	Chromium	0.0019 J	0.0013 J	NA	0.0025	0.0027	0.0021	NA	0.0021	0.002	0.0018 J	NA	0.0016 J
	Cobalt	<0.0025	<0.0025	NA	0.00016 J	0.00026 J	<0.0025	0.00013 J	<0.0025	<0.0025	<0.0025	NA	<0.0025
	Lead	<0.0013	<0.0013	<0.0013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	<0.001
	Lithium	0.0031 J	0.0016 J	NA	<0.005	0.0076	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005
	Mercury	0.000099 J	0.00007 J	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	NA	<0.0002
	Molybdenum	<0.015	<0.015	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	NA	<0.015
	Radium	0.394	0.0598 U	NA	0.227 U	-0.0245 U	0.28 U	NA	0.306 U	-0.0246 U	0.46	NA	-0.108 U
	Selenium	0.0013	0.00072 J	0.0017	<0.005	0.0018 J	0.0022 J	NA	0.0029 J	0.0025 J	0.0019 J	NA	0.0024 J
	Thallium	<0.0005	<0.0005	NA	<0.001	<0.001	<0.001	NA	0.00027 J	0.00025 J	<0.001	NA	0.00025 J
*	Silver	<0.0013	<0.0013	<0.0013	NA	<0.0013	<0.001	NA	NA	<0.001	<0.001	NA	<0.001
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	NA	37	NA	NA	39	NA	21
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	NA	37	NA	NA	39	NA	21
	Carbonate Alkalinity	NA	NA	NA	NA	NA	NA	<5	NA	NA	<5	NA	<5
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.29
	Manganese, Total	NA	NA	NA	NA	NA	NA	0.2	NA	NA	NA	0.28	0.3
	Magnesium	NA	NA	NA	NA	NA	NA	37	NA	NA	26	NA	22
	Potassium	NA	NA	NA	NA	NA	NA	3.8	NA	NA	3.5	NA	3.2
	Sodium	NA	NA	NA	NA	NA	NA	16	NA	NA	15	NA	13
	Oxidation Reduction Potential	1105.80	188.30	152.80	339.10	136.10	130.01	NA	NA	NA	NA	NA	NA
	pH, Field	5.34	5.47	5.31	5.35	5.22	5.07	5.20	5.24	5.50	5.24	5.23	5.32
	RDO Concentration	0.48	0.32	0.72	3.16	1.20	2.08	NA	NA	NA	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	20.13	21.31	19.49	22.45	20.11	19.18	NA	NA	NA	NA	NA	NA
	Turbidity, Field	0.74	0.28	1.6	1.1	0.3	1.6	NA	NA	NA	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID											
		ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-16	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17
		2/3/2022	8/31/2022	2/2/2023	8/10/2023	6/24/2016	9/1/2016	10/25/2016	1/26/2017	4/11/2017	6/21/2017	10/26/2017	4/10/2018
APPENDIX III	Boron	0.13	0.101	0.194	0.224	NA	0.022 J	0.0219 J	<0.05	<0.05	<0.05	0.023 J	0.026 J
	Calcium	50	42.4	66.5	63.4	NA	16	13.5	21	16	15	13	13
	Chloride	5.9	5.67	6.12	5.85	5	4.4	5.1	4.2	3.9	4.1	4	4.1
	Fluoride	0.027 J	<0.0330	<0.0330	0.0335 J	NA	<0.2	0.08 J	<0.2	<0.2	<0.2	<0.2	<0.2
	Sulfate	250	243	348	328	79	94	73	110	77	75	61	58
	TDS	400	375	545	537	NA	220	114	170	160	140	120	110
	pH	5.26	5.18	5.18	5.15	NA	5.52	5.45	5.43	5.33	5.3	5.29	5.46
APPENDIX IV	Antimony	<0.00051	<0.00100	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Arsenic	<0.00028	<0.00200	<0.00200	0.00431 J	<0.0013	<0.0013	<0.005	<0.0013	0.00084 J	<0.0013	0.00087 J	<0.0013
	Barium	0.047	0.0383	0.0468	0.0381	0.044	0.046	0.0436	0.051	0.043	0.043	0.038	0.046
	Beryllium	<0.00027	<0.000200	<0.000200	<0.000200	NA	0.00034 J	0.0002 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Cadmium	<0.00022	<0.000300	<0.000300	<0.000300	<0.0025	<0.0025	0.0001 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Chromium	0.0018 J	<0.00300	<0.00300	<0.00300	NA	<0.0025	<0.01	0.0016 J	0.0013 J	<0.0025	<0.0025	<0.0025
	Cobalt	<0.00026	<0.000300	<0.000300	<0.000300	NA	0.037	0.0144	0.022	0.026	0.027	0.021	0.021
	Lead	0.00021 J	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Lithium	0.0020 J	<0.00300	<0.00300	<0.00300	NA	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	0.0023 J
	Mercury	<0.00013	<0.0000670	<0.0000670	<0.0000670	NA	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Molybdenum	<0.00061	<0.000200	<0.000200	<0.000200	NA	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015
	Radium	0.712	0.493 U	1.31 U	0.340 U	NA	-0.081 U	0.675 U	0.18 U	0.547	0.38	1.48	0.39
	Selenium	0.0032 J	0.00287 J	0.00466 J	0.00421 J	<0.0013	<0.0013	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Thallium	<0.00047	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
*	Silver	<0.00022	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013
ADDITIONAL PARAMETERS	Total Alkalinity	16	19.0	18.4	15.3	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	16	19.0	18.4	15.3	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	<5.0	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	NA	<0.0193	0.0291 J	0.0241 J	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	<0.028	NA	NA	<0.0330	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	NA	<0.0330	<0.0330	0.0404 J	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	0.30	NA	NA	0.370	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	NA	0.327	0.325	0.380	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	33	31.9	44.0	44.1	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	3.9	3.71	4.31	4.24	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	16	15.0	16.9	16.6	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	NA	217.25	170.18	93.96	NA	66.70	187.50	124.80	128.50	99.80	132.60	1071.00
	pH, Field	5.26	5.18	5.18	5.15	NA	5.52	5.45	5.43	5.33	5.30	5.29	5.46
	RDO Concentration	NA	0.32	0.91	2.03	NA	0.24	0.39	1.67	0.48	0.54	0.54	0.36
	Specific Conductance, Field	NA	589.44	759.44	716.53	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	NA	20.01	18.85	24.56	NA	25.46	23.48	18.85	20.35	21.32	18.52	21.42
	Turbidity, Field	NA	2.8	0.5	0.58	NA	0.22	2.0	3.5	0.81	2.6	2.3	2.2

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID										
		ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-17
		10/17/2018	3/28/2019	8/21/2019	10/9/2019	4/8/2020	6/24/2020	8/18/2020	9/29/2020	2/9/2021	9/8/2021	2/2/2022
APPENDIX III	Boron	<0.05	0.022 J	NA	<0.08	<0.08	0.059 J	NA	0.045 J	0.042 J	0.074 J	0.11
	Calcium	10	10	NA	10	8.3	11	NA	12	12	15	14
	Chloride	4	3.4	NA	3.3	3.7	4	NA	3.4	3.1	2.9	3.0
	Fluoride	<0.2	<0.2	0.031 J	0.03 J	0.053 J	<0.1	<0.1	0.029 J	<0.1	0.055 J	0.028 J
	Sulfate	47	59	NA	57	47	67	NA	66	73	79	74 F1
	TDS	140	120	NA	120	91	NA	NA	140	120	150	150
	pH	5.32	5.36	5.07	5.27	5.02	5.11	5.07	5.75	5.17	5.15	5.15
APPENDIX IV	Antimony	<0.0025	NA	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	<0.002	<0.00051
	Arsenic	<0.0013	<0.0013	0.00044 J	0.0015	<0.001	NA	<0.001	<0.001	<0.001	0.00039 J	0.00044 J
	Barium	0.043	0.045	0.05	0.049	0.045	NA	0.062	0.056	0.051	0.058	0.062
	Beryllium	<0.0025	NA	0.00025 J	0.00076 J	0.00025 J	NA	0.00039 J	0.0004 J	<0.0025	0.00037 J	0.00051 J
	Cadmium	<0.0025	<0.0025	0.00013 J	0.00018 J	<0.0025	NA	<0.0025	NA	<0.0025	<0.0025	0.00030 J
	Chromium	<0.0025	NA	<0.002	0.0021	<0.002	NA	<0.002	<0.002	<0.002	<0.002	<0.0015
	Cobalt	0.014	NA	0.018	0.017	0.016	0.024	0.03	0.027	0.025	0.032	0.033
	Lead	<0.0013	<0.0013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.00022 J	<0.00017
	Lithium	0.0014 J	NA	<0.005	0.0071	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0014 J
	Mercury	<0.0002	NA	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	<0.0002	<0.00013
	Molybdenum	<0.015	NA	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.00061
	Radium	0.781	NA	-0.0366 U	0.118 U	0.402 U	NA	0.423	0.175 U	0.332 U	-0.015 U	0.613 U
	Selenium	<0.0013	<0.0013	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	<0.005	0.00076 J
	Thallium	<0.0005	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.00063 J	<0.00047
*	Silver	<0.0013	<0.0013	NA	<0.0013	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.00022
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	NA	NA	12	NA	NA	30	15	12
	Bicarbonate Alkalinity	NA	NA	NA	NA	NA	12	NA	NA	30	15	12
	Carbonate Alkalinity	NA	NA	NA	NA	NA	<5	NA	NA	<5	<5	<5.0
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	NA	NA	NA	0.057	NA	NA	0.075	0.14	0.16
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.85	0.83
	Manganese, Total	NA	NA	NA	NA	NA	0.5	NA	NA	0.66	0.86	NA
	Magnesium	NA	NA	NA	NA	NA	11	NA	NA	9.6	12	11
	Potassium	NA	NA	NA	NA	NA	1.1	NA	NA	1.1	1.2	1.2
	Sodium	NA	NA	NA	NA	NA	9.2	NA	NA	7.5	8.8	8.6
	Oxidation Reduction Potential	128.30	128.40	115.80	179.70	115.07	NA	NA	NA	NA	NA	NA
	pH, Field	5.32	5.36	5.07	5.27	5.02	5.11	5.07	5.75	5.17	5.15	5.15
	RDO Concentration	0.81	6.03	0.90	0.26	1.61	NA	NA	NA	NA	NA	NA
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	22.07	17.30	25.73	18.93	21.93	NA	NA	NA	NA	NA	NA
	Turbidity, Field	3.4	2.2	1.8	3.6	4.8	NA	NA	NA	NA	NA	NA

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-17	ARGWC-17	ARGWC-17	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18
		9/2/2022	2/3/2023	8/9/2023	6/24/2016	9/1/2016	10/26/2016	1/27/2017	4/12/2017	6/21/2017	10/25/2017	4/11/2018	10/17/2018	3/27/2019
APPENDIX III	Boron	0.0555	0.0510	0.0534	NA	2.4	1.97	2.6	2.4	2.2	2.5	2.7	2.2	2.3
	Calcium	23.7	18.8	37.4	NA	42	44.3	49	45	49	49	44	49	47
	Chloride	2.74	2.68	2.72	8.4	7.8	8.9	7.3	7	7.2	7	6.9	7.1	6.6
	Fluoride	0.0820 J	<0.0330	0.137	NA	0.083 J	0.32 o	0.097 J	0.088 J	0.096 J	0.092 J	0.09 J	0.11 J	0.05 J
	Sulfate	151	118	237	200	200	200	200	190	200	190	200	190	190
	TDS	240	174	360	NA	450	404	460	430	430	380	430	470	430
	pH	5.11	5.22	4.99	NA	6.19	6.03	6.01	5.97	5.9	5.97	5.87	5.9	6.06
APPENDIX IV	Antimony	<0.00100	<0.00100	<0.00100	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
	Arsenic	<0.00200	<0.00200	<0.00200	<0.0013	<0.0013	<0.005	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	0.00066 J	<0.0013
	Barium	0.0727	0.0572	0.0861	0.034	0.033	0.0339	0.037	0.032	0.036	0.041	0.04	0.039	0.033
	Beryllium	0.000417 J	0.000440 J	0.000490 J	NA	<0.0025	<0.003	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
	Cadmium	<0.000300	<0.000300	0.000445 J	<0.0025	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
	Chromium	<0.00300	<0.00300	<0.00300	NA	<0.0025	<0.01	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA
	Cobalt	0.0516	0.0332	0.0689	NA	0.0014 J	0.0013 J	0.0021 J	0.0015 J	0.0018 J	0.0013 J	0.0014 J	0.0012 J	NA
	Lead	<0.000500	<0.000500	<0.000500	<0.0013	<0.0013	0.0002 J	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Lithium	<0.00300	<0.00300	<0.00300	NA	0.0033 J	0.0037 J	0.0048 J	0.0039 J	0.0037 J	0.0047 J	0.0062	0.0049 J	NA
	Mercury	<0.0000670	<0.0000670	<0.0000670	NA	<0.0002	<0.0005	0.000074 J	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA
	Molybdenum	<0.000200	<0.000200	<0.000200	NA	<0.015	<0.01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	NA
	Radium	1.75 U	0.751 U	1.05 U	NA	0.495 U	0.606 U	0.641	-0.0936 U	0.5	0.345 U	0.331 U	0.62	NA
	Selenium	<0.00150	<0.00150	0.00231 J	<0.0013	<0.0013	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
	Thallium	<0.000600	<0.000600	<0.000600	NA	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA
*	Silver	<0.000300	<0.000300	<0.000300	<0.00025	NA	<0.01	NA	<0.00025	NA	<0.0013	<0.0013	<0.0013	<0.0013
ADDITIONAL PARAMETERS	Total Alkalinity	14.2	12.0	9.50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bicarbonate Alkalinity	14.2	12.0	9.50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Alkalinity	<1.45	<1.45	<0.725	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Aluminum	0.0558	0.0604	0.0523	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Dissolved	NA	NA	0.0660 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, Total	0.171	0.147	0.0613 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Dissolved	NA	NA	2.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, Total	1.55	1.16	2.67	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium	23.5	17.7	34.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Potassium	1.40	1.32	1.54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sodium	10.5	9.92	10.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oxidation Reduction Potential	156.63	151.97	89.95	NA	32.20	84.50	82.30	69.20	51.40	39.80	67.30	63.80	4.50
	pH, Field	5.11	5.22	4.99	NA	6.19	6.03	6.01	5.97	5.90	5.97	5.87	5.90	6.06
	RDO Concentration	0.38	1.88	0.31	NA	0.07	0.09	0.45	0.29	0.22	0.25	0.29	0.28	0.21
	Specific Conductance, Field	382.80	317.07	549.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Temperature, Field	19	19	20.35	NA	22	23	17	23	22	21	20	21	19
	Turbidity, Field	1.0	0.89	1.44	NA	3.9	11	16	14	7.1	4.7	9.1	4.7	3.9

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID												
		ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18	ARGWC-18
		8/21/2019	10/9/2019	4/9/2020	6/24/2020	8/20/2020	9/30/2020	2/10/2021	2/11/2021	9/9/2021	2/3/2022	9/2/2022	2/2/2023	8/10/2023
APPENDIX III	Boron	NA	2.1	2.3	2.2	NA	2.6	2.4	NA	2.4	2.4	2.53	2.61	2.54
	Calcium	NA	49	46	44	NA	52	52	NA	55	55	52.4	52.4	52.1
	Chloride	NA	6.7	7.3	7.2	NA	6.9	7.8	NA	8.1	7.1	6.52	6.70	6.62
	Fluoride	0.079 J	0.068 J	0.11	0.094 J	<0.1	0.082 J	0.12	1.3	0.17	0.078 J	0.141	0.176	0.129
	Sulfate	NA	180	190	190	NA	170	220	NA	190	200	198	195	194
	TDS	NA	420	440	NA	NA	390	460	NA	480	450	444	446	444
	pH	5.94	6.01	5.98	5.91	6.43	5.98	5.99	6.03	6.04	6.00	6.03	6.12	6.09
APPENDIX IV	Antimony	<0.002	<0.002	<0.002	NA	<0.002	NA	NA	NA	<0.002	<0.00051	<0.00100	<0.00100	<0.00100
	Arsenic	0.00033 J	0.0016	<0.001	NA	<0.001	<0.001	<0.001	NA	0.0004 J	<0.00028	<0.00200	<0.00200	<0.00200
	Barium	0.036	0.039	0.041	NA	0.041	0.041	0.038	NA	0.046	0.043	0.0369	0.0387	0.0415
	Beryllium	<0.001	0.00034 J	<0.0025	NA	<0.0025	<0.0025	<0.0025	NA	<0.0025	<0.00027	<0.000200	<0.000200	<0.000200
	Cadmium	<0.001	<0.001	<0.0025	NA	<0.0025	NA	<0.0025	NA	<0.0025	<0.00022	<0.000300	<0.000300	<0.000300
	Chromium	<0.002	<0.002	<0.002	NA	<0.002	<0.002	<0.002	NA	<0.002	<0.0015	<0.00300	<0.00300	<0.00300
	Cobalt	0.0012	0.00099	0.00091 J	0.0012 J	0.0015 J	0.0013 J	0.0011 J	NA	0.0016 J	0.0013 J	0.00111	0.00109	0.00110
	Lead	<0.001	<0.001	<0.001	NA	0.00028 J	0.0002 J	<0.001	NA	0.00031 J	<0.00017	<0.000500	<0.000500	<0.000500
	Lithium	0.0036 J	0.013	<0.005	0.0047 J	<0.005	0.0048 J	0.0041 J	NA	0.0047 J	0.0046 J	0.00380 J	0.00391 J	0.00430 J
	Mercury	<0.0002	NA	<0.0002	NA	<0.0002	NA	NA	NA	<0.0002	<0.00013	<0.0000670	<0.0000670	<0.0000670
	Molybdenum	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.015	NA	<0.015	<0.00061	<0.000200	0.000288 J	<0.000200
	Radium	0.693	0.0684 U	0.419 U	NA	0.191 U	0.0811 U	0.568	NA	0.669	0.503	2.67 U	2.04	1.65 U
	Selenium	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.005	NA	<0.005	<0.00074	<0.00150	<0.00150	<0.00150
	Thallium	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	0.00028 J	<0.00047	<0.000600	<0.000600	<0.000600
*	Silver	NA	<0.0013	<0.001	NA	NA	<0.001	<0.001	NA	<0.001	<0.00022	<0.000300	<0.000300	<0.000300
ADDITIONAL PARAMETERS	Total Alkalinity	NA	NA	NA	110	NA	NA	120	NA	120	120	111	114	120
	Bicarbonate Alkalinity	NA	NA	NA	110	NA	NA	120	NA	120	120	111	114	120
	Carbonate Alkalinity	NA	NA	NA	<5	NA	NA	<5	NA	<5	<5.0	<1.45	<1.45	<0.725
	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.174	0.0734	1.31
	Iron, Dissolved	NA	NA	NA	0.86	NA	NA	NA	1.3	1.9	2.0	NA	NA	0.993
	Iron, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.37	2.13	1.96
	Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	0.98	0.90	NA	NA	0.855
	Manganese, Total	NA	NA	NA	0.82	NA	NA	NA	0.92	1	NA	0.889	0.982	0.878
	Magnesium	NA	NA	NA	42	NA	NA	42	NA	45	43	44.3	41.3	41.7
	Potassium	NA	NA	NA	2.2	NA	NA	2.3	NA	2.4	2.4	2.34	2.38	2.23
	Sodium	NA	NA	NA	12	NA	NA	13	NA	13	13	12.8	12.7	11.6
	Oxidation Reduction Potential	29.10	79.00	46.94	NA	NA	NA	NA	NA	NA	NA	56.73	14.78	51.49
	pH, Field	5.94	6.01	5.98	5.91	6.43	5.98	5.99	6.03	6.04	6.00	6.03	6.12	6.09
	RDO Concentration	0.23	0.23	0.19	NA	NA	NA	NA	NA	NA	NA	0.17	1.40	0.35
	Specific Conductance, Field	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	624.25	642.73	618.76
	Temperature, Field	21.40	19.25	20.04	NA	NA	NA	NA	NA	NA	NA	21.14	19.69	23.12
	Turbidity, Field	2.5	2.7	4.1	NA	NA	NA	NA	NA	NA	NA	6.5	4.4	11

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX A
SUMMARY OF RELEVANT GROUNDWATER AND CCR PORE WATER ANALYTICAL AND FIELD DATA (2016-2023)
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

	Substance	Well ID															
		AP3PZ-1A	AP3PZ-1A	AP3PZ-1A	AP3PZ-2A	AP3PZ-2A	AP3PZ-2A	AP3PZ-3A	AP3PZ-3A	AP3PZ-3A	AP3PZ-4A	AP3PZ-4A	AP3PZ-4A	AP3PZ-5A	AP3PZ-5A	AP3PZ-5A	ARK-STN-TW37
		6/1/2020	9/27/2022	8/21/2023	6/1/2020	9/27/2022	8/21/2023	6/1/2020	9/27/2022	8/21/2023	6/1/2020	9/28/2022	8/21/2023	6/1/2020	9/28/2022	8/21/2023	4/26/2023
APPENDIX III	Boron	0.62	0.413	0.475	0.4	0.577	0.565	1.8	1.84	1.93	2.1	2.48	2.42	2.5	3.07	3.31	2.85
	Calcium	180	87.3	80.5	77	96.7	85.2	250	246	237	200	224	202	350	557	615	534
	Chloride	8.5	5.20	5.10	5.5	5.16	4.77	8.5	8.21	8.04	7	7.38	7.20	6	8.42	9.27	3.21
	Fluoride	0.23	0.281	0.409	0.4	0.382	0.537	0.77	0.709	0.655	0.57	0.558	0.563	0.49	0.293	0.487 J	NA
	Sulfate	360	144	155	95	190	163	230	265	287	130	174	181	560	1100	1490	1880
	TDS	820	415	425	340	520	433	930	896	896	590	751	746	1300	2250	2790	NA
	pH	6.51	6.15	NA	7.08	6.78	NA	7.05	6.98	NA	7.29	7.14	NA	7.6	7.35	NA	6.04
APPENDIX IV	Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0243
	Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cobalt	0.033	0.0199	0.0176	<0.00013	<0.000300	<0.000300	0.0012 J	0.00116	0.000978 J	0.00097 J	0.00119	0.00126	0.0038	0.0102	0.0162	0.0441
	Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lithium	0.25	NA	NA	0.14	NA	NA	0.62	NA	NA	0.75	NA	NA	0.91	NA	NA	0.236
	Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Molybdenum	0.27	NA	NA	0.017	NA	NA	0.25	NA	NA	0.4	NA	NA	0.49	NA	NA	0.0297
	Radium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
*	Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ADDITIONAL PARAMETERS	Total Alkalinity	240	154	167	180	192	209	430	452	461	390	429	435	440	536	490	68.6
	Bicarbonate Alkalinity	240	154	167	180	192	209	430	452	461	390	429	435	440	536	490	68.6
	Carbonate Alkalinity	<5.0	<1.45	<0.725	<5.0	<1.45	<0.725	<5.0	<1.45	<0.725	<5.0	<1.45	<0.725	<5.0	<1.45	<0.725	<1.45
	Aluminum	NA	<0.0193	<0.0193	NA	<0.0193	<0.0193	NA	0.0428 J	0.0422 J	NA	0.0279 J	<0.0193	NA	0.0324 J	0.0226 J	0.143
	Iron, Dissolved	NA	NA	16.2	NA	NA	42.4	NA	NA	23.9	NA	NA	10.2	NA	NA	28.0	NA
	Iron, Total	22	19.9	17.8	39	52.5	42.0	20	22.8	24.1	9.2	12.3	10.4	13	22.9	28.4	68.1
	Manganese, Dissolved	NA	NA	1.85	NA	NA	2.48	NA	NA	1.56	NA	NA	0.527	NA	NA	4.00	NA
	Manganese, Total	6	2.22	2.10	2.8	3.16	2.64	1.2	1.46	1.60	0.37	0.469	0.525	1.1	2.67	4.05	6.38
	Magnesium	44	19.2	21.1	18	28.6	21.3	31	41.5	36.4	24	33.1	28.1	37	104	125	45.0
	Potassium	24	17.0	17.9	11	14.8	13.1	20	25.1	24.7	16	18.5	17.3	18	26.4	27.0	93.9
	Sodium	23	15.0	NA	12	16.4	NA	13	18.0	NA	9.5	12.1	NA	22	29.8	NA	37.8
	Oxidation Reduction Potential	NA	2.84	NA	NA	-132.74	NA	NA	-146.47	NA	NA	-162.59	NA	NA	-174.97	NA	-2.90
	pH, Field	6.51	6.15	NA	7.08	6.78	NA	7.05	6.98	NA	7.29	7.14	NA	7.60	7.35	NA	6.04
	RDO Concentration	NA	0.11	NA	NA	0.08	NA	NA	0.03	NA	NA	0.17	NA	NA	0.10	NA	4.98
	Specific Conductance, Field	NA	609.75	NA	NA	845.41	NA	NA	1287.95	NA	NA	1157.78	NA	NA	2746.88	NA	2812.70
	Temperature, Field	NA	23.34	NA	NA	22.35	NA	NA	21.60	NA	NA	21.29	NA	NA	20.86	NA	20.26
	Turbidity, Field	NA	4.2	NA	NA	19	NA	NA	4.6	NA	NA	4.6	NA	NA	3.7	NA	7.33

Notes:

1. Results for constituents are reported in milligrams per liter (mg/L). Radium results are reported in picocuries per liter (pCi/L).
   Temperature reported in (deg C). Specific Conductance reported in microsiemens per centimeter (uS/cm). Turbidity reported in (NTU). ORP reported in millivolts (mV).
2. < indicates the constituent was not detected above the analytical method detection limit (MDL).
3. J indicates the constituent was detected at such low levels that the precision of the laboratory instrument could not produce a reliable value.
   Therefore, the value displayed (value J) is qualified by the laboratory as an estimated number.
4. TDS indicates total dissolved solids.
5. U indicates the constituent was detected below the Minimum Detection Concentration (MDC) and the precision of the laboratory instruments could not produce a reliable value.Therefore, the value followed by U is qualified by the laboratory as estimated.
6. * - Georgia Appendix I constituent that is not also included in Appendix IV.
7. NA indicates constituent was not analyzed
8. Oxidation Reduction Potential values measured on 4/10/2018 for ARGWC-17 and ARGWA-12 are not representative and may indicate an instrument malfunction

APPENDIX B
LABORATORY REPORTS

Analytical Report

Laboratory Job ID: 180-126602-1

September 2021

Eurofins

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

Laboratory Job ID: 180-126602-1
Client Project/Site: Plant Arkwright MNA AP-3

For:
Southern Company
241 Ralph McGill Blvd SE
B10185
Atlanta, Georgia 30308

Attn: Joju Abraham

Authorized for release by:
10/19/2021 6:07:19 PM

Shali Brown, Project Manager II
(615)301-5031
Shali.Brown@Eurofinset.com

PA Lab ID: 02-00416

Table of Contents

Job ID: 180-126602-1

Laboratory: Eurofins TestAmerica, Pittsburgh

Narrative

Job Narrative
180-126602-1

Comments
No additional comments.

Receipt
The samples were received on 9/2/2021 9:30 AM. 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 2.8º C.

GC Semi VOA
Method Lloyd Kahn: Please note that the reporting limit for Lloyd Kahn TOC analysis is a nominal value and does not reflect adjustments in sample mass processed on an individual basis. SB-6-17-25 (180-126602-1), SB-7-20-30 (180-126602-2), SB-8-20.6-30.6 (180-126602-3) and SB-9-29.6-39.6 (180-126602-4)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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.

Geotechnical
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

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

Accreditation/Certification Summary

Client: Southern Company
Job ID: 180-126602-1
Project/Site: Plant Arkwright MNA AP-3

Laboratory: Eurofins TestAmerica, Pittsburgh

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Arkansas DEQ	State	19-033-0	06-27-21 *
California	State	2891	04-30-22
Connecticut	State	PH-0688	09-30-22
Florida	NELAP	E871008	09-14-21
Georgia	State	PA 02-00416	09-14-21
Illinois	NELAP	004375	09-14-21
Kansas	NELAP	E-10350	09-14-21
Kentucky (UST)	State	162013	04-30-22
Kentucky (WW)	State	KY98043	12-31-21
Louisiana	NELAP	04041	09-14-21
Maine	State	PA00164	03-06-22
Minnesota	NELAP	042-999-482	09-14-21
Nevada	State	PA00164	08-31-22
New Hampshire	NELAP	2030	04-05-22
New Jersey	NELAP	PA005	09-14-21
New York	NELAP	11182	09-14-21
North Carolina (WW/SW)	State	434	12-31-21
North Dakota	State	R-227	09-14-21
Oregon	NELAP	PA-2151	02-06-22
Pennsylvania	NELAP	02-00416	09-14-21
Rhode Island	State	LAO00362	12-31-21
South Carolina	State	89014	04-30-22
Texas	NELAP	T104704528	09-14-21
USDA	Federal	P-Soil-01	06-26-22
USDA	US Federal Programs	P330-16-00211	06-26-22
Utah	NELAP	PA001462019-8	09-14-21
Virginia	NELAP	10043	09-14-21
West Virginia DEP	State	142	09-14-21
Wisconsin	State	998027800	08-31-22

Laboratory: Eurofins TestAmerica, Burlington

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
ANAB	Dept. of Defense ELAP	L2336	02-25-23
Connecticut	State	PH-0751	09-30-21
DE Haz. Subst. Cleanup Act (HSCA)	State	N/A	05-17-22
Florida	NELAP	E87467	06-30-22
Minnesota	NELAP	050-999-436	12-31-21
New Hampshire	NELAP	2006	12-18-21
New Jersey	NELAP	VT972	06-30-22
New York	NELAP	10391	04-01-22
Pennsylvania	NELAP	68-00489	04-30-22
Rhode Island	State	LAO00298	12-30-21
US Fish & Wildlife	US Federal Programs	058448	07-31-22
USDA	US Federal Programs	P330-17-00272	10-30-23
Vermont	State	VT4000	02-10-22
Virginia	NELAP	460209	12-14-21
Wisconsin	State	399133350	08-31-22

Laboratory: Eurofins Xenco, Corpus Christi

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: Southern Company
Job ID: 180-126602-1
Project/Site: Plant Arkwright MNA AP-3

Laboratory: Eurofins Xenco, Corpus Christi (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Louisiana	NELAP	05094	06-30-22
Oklahoma	State	2021-016	08-31-22
Texas	NELAP	T104704210-21-28	03-31-22

Sample Summary

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-126602-1	SB-6-17-25	Solid	09/01/21 09:30	09/02/21 09:30
180-126602-2	SB-7-20-30	Solid	09/01/21 16:00	09/02/21 09:30
180-126602-3	SB-8-20.6-30.6	Solid	09/01/21 10:40	09/02/21 09:30
180-126602-4	SB-9-29.6-39.6	Solid	09/01/21 13:55	09/02/21 09:30

Method Summary

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Method	Method Description	Protocol	Laboratory
9081	Cation Exchange Capacity (CEC)	SW846	XEN CC
EPA-Lloyd Kahn	Organic Carbon, Total (TOC)	EPA	TAL PIT
D422	Grain Size	ASTM	TAL BUR
9081	Cation Exchange Capacity (CEC)	SW846	XEN CC

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 BUR = Eurofins TestAmerica, Burlington, 530 Community Drive, Suite 11, South Burlington, VT 05403, TEL (802)660-1990

TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

XEN CC = Eurofins Xenco, Corpus Christi, 1733 N. Padre Island Drive, Corpus Christi, TX 78408, TEL (361)289-2471

Lab Chronicle

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-6-17-25
Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D422		1			171536	09/16/21 19:59	CPF	TAL BUR
	Instrument ID: D422_import									

Client Sample ID: SB-6-17-25
Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1
Matrix: Solid
Percent Solids: 71.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9081			4.037 g	100 mL	188958	09/15/21 10:15	LR	XEN CC
Total/NA	Analysis	9081		1			188999	09/16/21 14:18	AKM	XEN CC
	Instrument ID: NOEQUIP									
Total/NA	Analysis	EPA-Lloyd Kahn		1			370742	09/08/21 18:28	DLF	TAL PIT
	Instrument ID: FLASHEA									

Client Sample ID: SB-7-20-30
Date Collected: 09/01/21 16:00
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D422		1			171536	09/16/21 20:01	CPF	TAL BUR
	Instrument ID: D422_import									

Client Sample ID: SB-7-20-30
Date Collected: 09/01/21 16:00
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-2
Matrix: Solid
Percent Solids: 85.4

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9081			4.211 g	100 mL	188958	09/15/21 10:15	LR	XEN CC
Total/NA	Analysis	9081		1			188999	09/16/21 14:18	AKM	XEN CC
	Instrument ID: NOEQUIP									
Total/NA	Analysis	EPA-Lloyd Kahn		1			370742	09/08/21 18:45	DLF	TAL PIT
	Instrument ID: FLASHEA									

Client Sample ID: SB-8-20.6-30.6
Date Collected: 09/01/21 10:40
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D422		1			171536	09/16/21 20:03	CPF	TAL BUR
	Instrument ID: D422_import									

Lab Chronicle

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-8-20.6-30.6
Date Collected: 09/01/21 10:40
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-3
Matrix: Solid
Percent Solids: 77.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9081			4.288 g	100 mL	188958	09/15/21 10:15	LR	XEN CC
Total/NA	Analysis	9081		1			188999	09/16/21 14:18	AKM	XEN CC
	Instrument ID: NOEQUIP									
Total/NA	Analysis	EPA-Lloyd Kahn		1			370742	09/08/21 19:12	DLF	TAL PIT
	Instrument ID: FLASHEA									

Client Sample ID: SB-9-29.6-39.6
Date Collected: 09/01/21 13:55
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D422		1			171536	09/16/21 20:05	CPF	TAL BUR
	Instrument ID: D422_import									

Client Sample ID: SB-9-29.6-39.6
Date Collected: 09/01/21 13:55
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-4
Matrix: Solid
Percent Solids: 74.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9081			4.107 g	100 mL	188958	09/15/21 10:15	LR	XEN CC
Total/NA	Analysis	9081		1			188999	09/16/21 14:18	AKM	XEN CC
	Instrument ID: NOEQUIP									
Total/NA	Analysis	EPA-Lloyd Kahn		1			370742	09/08/21 19:29	DLF	TAL PIT
	Instrument ID: FLASHEA									

Laboratory References:

TAL BUR = Eurofins TestAmerica, Burlington, 530 Community Drive, Suite 11, South Burlington, VT 05403, TEL (802)660-1990
TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058
XEN CC = Eurofins Xenco, Corpus Christi, 1733 N. Padre Island Drive, Corpus Christi, TX 78408, TEL (361)289-2471

Analyst References:

Lab: TAL BUR
  Batch Type: Analysis
    CPF = Fred Cota
Lab: TAL PIT
  Batch Type: Analysis
    DLF = Donald Ferguson
Lab: XEN CC
  Batch Type: Prep
    LR = Lucas Risner
  Batch Type: Analysis
    AKM = Andrea Martinez

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-6-17-25
Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1
Matrix: Solid

Method: D422 - Grain Size

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gravel	1.1				%			09/16/21 19:59	1
Sieve Size 3 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Sand	71.1				%			09/16/21 19:59	1
Sieve Size 2 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Coarse Sand	3.4				%			09/16/21 19:59	1
Sieve Size 1.5 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Medium Sand	25.2				%			09/16/21 19:59	1
Sieve Size 1 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Fine Sand	42.5				%			09/16/21 19:59	1
Sieve Size 0.75 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Sieve Size 0.375 inch - Percent Finer	100.0				% Passing			09/16/21 19:59	1
Silt	22.2				%			09/16/21 19:59	1
Clay	5.6				%			09/16/21 19:59	1
Sieve Size #4 - Percent Finer	98.9				% Passing			09/16/21 19:59	1
Sieve Size #10 - Percent Finer	95.5				% Passing			09/16/21 19:59	1
Sieve Size #20 - Percent Finer	86.1				% Passing			09/16/21 19:59	1
Sieve Size #40 - Percent Finer	70.3				% Passing			09/16/21 19:59	1
Sieve Size #60 - Percent Finer	55.5				% Passing			09/16/21 19:59	1
Sieve Size #80 - Percent Finer	46.1				% Passing			09/16/21 19:59	1
Sieve Size #100 - Percent Finer	41.0				% Passing			09/16/21 19:59	1
Sieve Size #200 - Percent Finer	27.8				% Passing			09/16/21 19:59	1
Hydrometer Reading 1 - Percent Finer	20.6				% Passing			09/16/21 19:59	1
Hydrometer Reading 2 - Percent Finer	18.2				% Passing			09/16/21 19:59	1
Hydrometer Reading 3 - Percent Finer	11.2				% Passing			09/16/21 19:59	1
Hydrometer Reading 4 - Percent Finer	9.6				% Passing			09/16/21 19:59	1
Hydrometer Reading 5 - Percent Finer	5.6				% Passing			09/16/21 19:59	1
Hydrometer Reading 6 - Percent Finer	4.9				% Passing			09/16/21 19:59	1
Hydrometer Reading 7 - Percent Finer	3.3				% Passing			09/16/21 19:59	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-6-17-25
Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1
Matrix: Solid
Percent Solids: 71.3

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cation Exchange Capacity	19		0.070	0.070	meq/100gm	☼	09/15/21 10:15	09/16/21 14:18	1
Total Organic Carbon - Duplicates	<1000		1400	1000	mg/Kg	☼		09/08/21 18:28	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-7-20-30
Date Collected: 09/01/21 16:00
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-2
Matrix: Solid

Method: D422 - Grain Size

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gravel	0.0				%			09/16/21 20:01	1
Sieve Size 3 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Sand	76.7				%			09/16/21 20:01	1
Sieve Size 2 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Coarse Sand	4.4				%			09/16/21 20:01	1
Sieve Size 1.5 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Medium Sand	29.1				%			09/16/21 20:01	1
Sieve Size 1 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Fine Sand	43.2				%			09/16/21 20:01	1
Sieve Size 0.75 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Sieve Size 0.375 inch - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Silt	19.8				%			09/16/21 20:01	1
Clay	3.5				%			09/16/21 20:01	1
Sieve Size #4 - Percent Finer	100.0				% Passing			09/16/21 20:01	1
Sieve Size #10 - Percent Finer	95.6				% Passing			09/16/21 20:01	1
Sieve Size #20 - Percent Finer	84.8				% Passing			09/16/21 20:01	1
Sieve Size #40 - Percent Finer	66.5				% Passing			09/16/21 20:01	1
Sieve Size #60 - Percent Finer	50.6				% Passing			09/16/21 20:01	1
Sieve Size #80 - Percent Finer	41.5				% Passing			09/16/21 20:01	1
Sieve Size #100 - Percent Finer	36.6				% Passing			09/16/21 20:01	1
Sieve Size #200 - Percent Finer	23.3				% Passing			09/16/21 20:01	1
Hydrometer Reading 1 - Percent Finer	18.3				% Passing			09/16/21 20:01	1
Hydrometer Reading 2 - Percent Finer	15.6				% Passing			09/16/21 20:01	1
Hydrometer Reading 3 - Percent Finer	10.9				% Passing			09/16/21 20:01	1
Hydrometer Reading 4 - Percent Finer	6.9				% Passing			09/16/21 20:01	1
Hydrometer Reading 5 - Percent Finer	3.5				% Passing			09/16/21 20:01	1
Hydrometer Reading 6 - Percent Finer	2.8				% Passing			09/16/21 20:01	1
Hydrometer Reading 7 - Percent Finer	2.1				% Passing			09/16/21 20:01	1

Client Sample Results

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-7-20-30
Date Collected: 09/01/21 16:00
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-2
Matrix: Solid
Percent Solids: 85.4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cation Exchange Capacity	**9.9**		0.059	0.059	meq/100gm	☼	09/15/21 10:15	09/16/21 14:18	1
Total Organic Carbon - Duplicates	<870		1200	870	mg/Kg	☼		09/08/21 18:45	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-8-20.6-30.6
Date Collected: 09/01/21 10:40
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-3
Matrix: Solid

Method: D422 - Grain Size

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gravel	1.7				%			09/16/21 20:03	1
Sieve Size 3 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Sand	81.2				%			09/16/21 20:03	1
Sieve Size 2 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Coarse Sand	0.9				%			09/16/21 20:03	1
Sieve Size 1.5 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Medium Sand	22.1				%			09/16/21 20:03	1
Sieve Size 1 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Fine Sand	58.2				%			09/16/21 20:03	1
Sieve Size 0.75 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Sieve Size 0.375 inch - Percent Finer	100.0				% Passing			09/16/21 20:03	1
Silt	13.4				%			09/16/21 20:03	1
Clay	3.7				%			09/16/21 20:03	1
Sieve Size #4 - Percent Finer	98.3				% Passing			09/16/21 20:03	1
Sieve Size #10 - Percent Finer	97.4				% Passing			09/16/21 20:03	1
Sieve Size #20 - Percent Finer	92.3				% Passing			09/16/21 20:03	1
Sieve Size #40 - Percent Finer	75.3				% Passing			09/16/21 20:03	1
Sieve Size #60 - Percent Finer	53.2				% Passing			09/16/21 20:03	1
Sieve Size #80 - Percent Finer	39.4				% Passing			09/16/21 20:03	1
Sieve Size #100 - Percent Finer	32.3				% Passing			09/16/21 20:03	1
Sieve Size #200 - Percent Finer	17.1				% Passing			09/16/21 20:03	1
Hydrometer Reading 1 - Percent Finer	13.9				% Passing			09/16/21 20:03	1
Hydrometer Reading 2 - Percent Finer	11.0				% Passing			09/16/21 20:03	1
Hydrometer Reading 3 - Percent Finer	8.8				% Passing			09/16/21 20:03	1
Hydrometer Reading 4 - Percent Finer	5.9				% Passing			09/16/21 20:03	1
Hydrometer Reading 5 - Percent Finer	3.7				% Passing			09/16/21 20:03	1
Hydrometer Reading 6 - Percent Finer	3.0				% Passing			09/16/21 20:03	1
Hydrometer Reading 7 - Percent Finer	2.3				% Passing			09/16/21 20:03	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-8-20.6-30.6
Date Collected: 09/01/21 10:40
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-3
Matrix: Solid
Percent Solids: 77.2

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cation Exchange Capacity	13		0.065	0.065	meq/100gm	☼	09/15/21 10:15	09/16/21 14:18	1
Total Organic Carbon - Duplicates	<970		1300	970	mg/Kg	☼		09/08/21 19:12	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-9-29.6-39.6
Date Collected: 09/01/21 13:55
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-4
Matrix: Solid

Method: D422 - Grain Size

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gravel	0.0				%			09/16/21 20:05	1
Sieve Size 3 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Sand	72.9				%			09/16/21 20:05	1
Sieve Size 2 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Coarse Sand	6.5				%			09/16/21 20:05	1
Sieve Size 1.5 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Medium Sand	27.1				%			09/16/21 20:05	1
Sieve Size 1 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Fine Sand	39.3				%			09/16/21 20:05	1
Sieve Size 0.75 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Sieve Size 0.375 inch - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Silt	21.6				%			09/16/21 20:05	1
Clay	5.5				%			09/16/21 20:05	1
Sieve Size #4 - Percent Finer	100.0				% Passing			09/16/21 20:05	1
Sieve Size #10 - Percent Finer	93.5				% Passing			09/16/21 20:05	1
Sieve Size #20 - Percent Finer	81.3				% Passing			09/16/21 20:05	1
Sieve Size #40 - Percent Finer	66.4				% Passing			09/16/21 20:05	1
Sieve Size #60 - Percent Finer	52.8				% Passing			09/16/21 20:05	1
Sieve Size #80 - Percent Finer	44.2				% Passing			09/16/21 20:05	1
Sieve Size #100 - Percent Finer	39.5				% Passing			09/16/21 20:05	1
Sieve Size #200 - Percent Finer	27.1				% Passing			09/16/21 20:05	1
Hydrometer Reading 1 - Percent Finer	19.0				% Passing			09/16/21 20:05	1
Hydrometer Reading 2 - Percent Finer	15.6				% Passing			09/16/21 20:05	1
Hydrometer Reading 3 - Percent Finer	10.9				% Passing			09/16/21 20:05	1
Hydrometer Reading 4 - Percent Finer	7.5				% Passing			09/16/21 20:05	1
Hydrometer Reading 5 - Percent Finer	5.5				% Passing			09/16/21 20:05	1
Hydrometer Reading 6 - Percent Finer	4.2				% Passing			09/16/21 20:05	1
Hydrometer Reading 7 - Percent Finer	2.8				% Passing			09/16/21 20:05	1

Client Sample Results

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Client Sample ID: SB-9-29.6-39.6
Date Collected: 09/01/21 13:55
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-4
Matrix: Solid
Percent Solids: 74.7

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cation Exchange Capacity	22		0.067	0.067	meq/100gm	☼	09/15/21 10:15	09/16/21 14:18	1
Total Organic Carbon - Duplicates	<1000		1300	1000	mg/Kg	☼		09/08/21 19:29	1

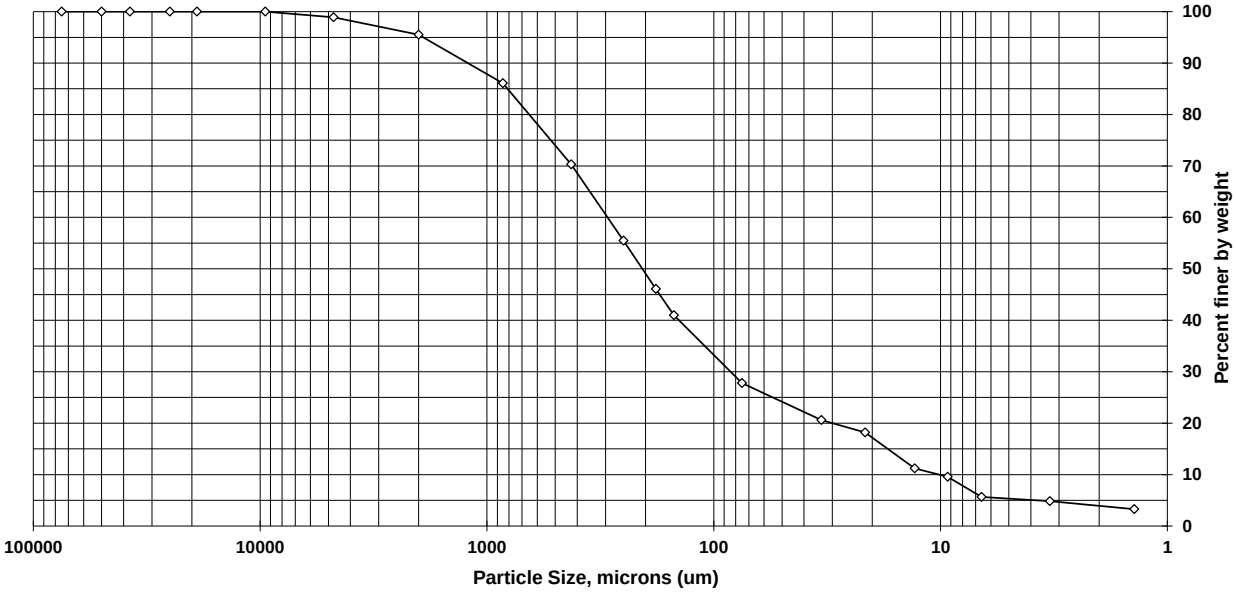
Particle Size of Soils by ASTM D422

Sample ID: SB-6-17-25
Lab ID: 180-126602-A-1

Percent Solids: 72.7%
Specific Gravity: 2.650

Date Received: 9/2/2021
Start Date: 9/16/2021
End Date: 9/20/2021

Shape (> #10): surounded
Non-soil material: na
Hardness (> #10): hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	98.9	1.1
#10	2000	95.5	3.4
#20	850	86.1	9.4
#40	425	70.3	15.8
#60	250	55.5	14.8
#80	180	46.1	9.4
#100	150	41.0	5.1
#200	75	27.8	13.2
Hyd1	33.5	20.6	7.2
Hyd2	21.5	18.2	2.4
Hyd3	13	11.2	7.0
Hyd4	9.3	9.6	1.6
Hyd5	6.6	5.6	3.9
Hyd6	3.3	4.9	0.8
Hyd7	1.4	3.3	1.6

Soil Classification	Percent of sample
Gravel	1.1
Sand	71.1
Coarse Sand	3.4
Medium Sand	25.2
Fine Sand	42.5
Silt	22.2
Clay	5.6

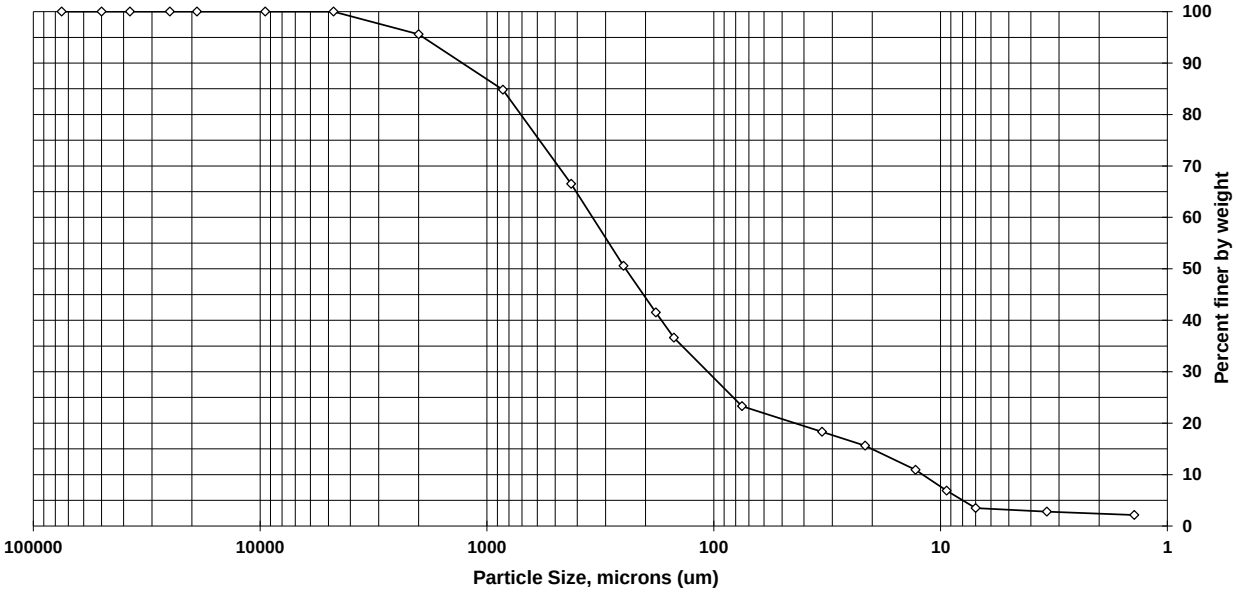
Particle Size of Soils by ASTM D422

Sample ID: SB-7-20-30
Lab ID: 180-126602-A-2

Percent Solids: 84.7%
Specific Gravity: 2.650

Date Received: 9/2/2021
Start Date: 9/16/2021
End Date: 9/20/2021

Shape (> #10): subrounded
Non-soil material: na
Hardness (> #10): hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	95.6	4.4
#20	850	84.8	10.8
#40	425	66.5	18.3
#60	250	50.6	15.9
#80	180	41.5	9.1
#100	150	36.6	4.9
#200	75	23.3	13.3
Hyd1	33.3	18.3	5.0
Hyd2	21.5	15.6	2.7
Hyd3	12.9	10.9	4.7
Hyd4	9.4	6.9	4.0
Hyd5	7	3.5	3.4
Hyd6	3.4	2.8	0.7
Hyd7	1.4	2.1	0.7

Soil Classification	Percent of sample
Gravel	0.0
Sand	76.7
Coarse Sand	4.4
Medium Sand	29.1
Fine Sand	43.2
Silt	19.8
Clay	3.5

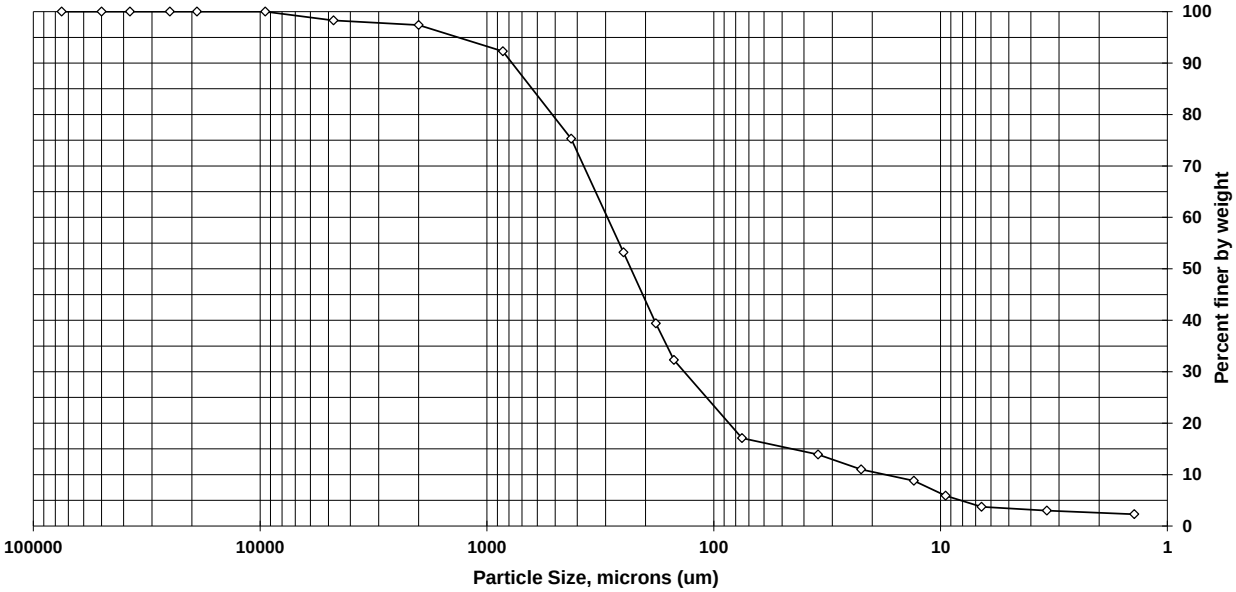
Particle Size of Soils by ASTM D422

Sample ID: SB-8-20.6-30.6
Lab ID: 180-126602-A-3

Percent Solids: 77.9%
Specific Gravity: 2.650

Date Received: 9/2/2021
Start Date: 9/16/2021
End Date: 9/20/2021

Shape (> #10): subrounded
Non-soil material: na
Hardness (> #10): hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	98.3	1.7
#10	2000	97.4	0.9
#20	850	92.3	5.1
#40	425	75.3	17.0
#60	250	53.2	22.1
#80	180	39.4	13.8
#100	150	32.3	7.1
#200	75	17.1	15.2
Hyd1	34.7	13.9	3.2
Hyd2	22.4	11.0	2.9
Hyd3	13.1	8.8	2.2
Hyd4	9.5	5.9	2.9
Hyd5	6.6	3.7	2.2
Hyd6	3.4	3.0	0.7
Hyd7	1.4	2.3	0.7

Soil Classification	Percent of sample
Gravel	1.7
Sand	81.2
Coarse Sand	0.9
Medium Sand	22.1
Fine Sand	58.2
Silt	13.4
Clay	3.7

Particle Size of Soils by ASTM D422

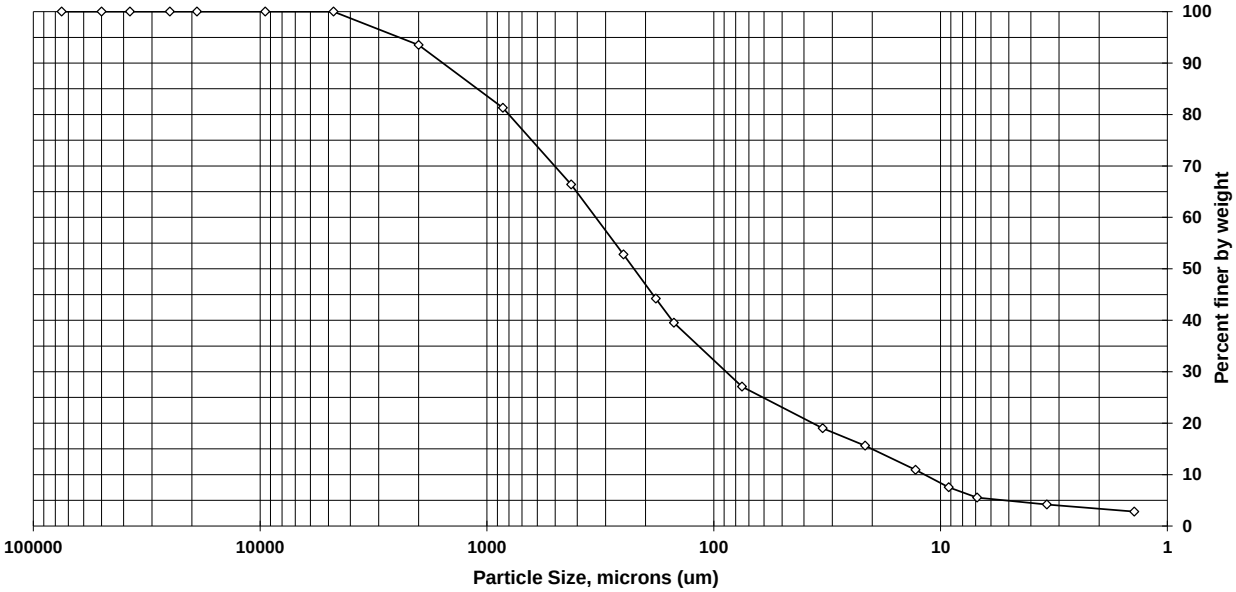
Sample ID: SB-9-29.6-39.6
Lab ID: 180-126602-A-4

Percent Solids: 75.8%
Specific Gravity: 2.650

Date Received: 9/2/2021
Start Date: 9/16/2021
End Date: 9/20/2021

Shape (> #10): subrounded

Non-soil material: na
Hardness (> #10): hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	93.5	6.5
#20	850	81.3	12.2
#40	425	66.4	14.9
#60	250	52.8	13.6
#80	180	44.2	8.6
#100	150	39.5	4.7
#200	75	27.1	12.4
Hyd1	33.1	19.0	8.1
Hyd2	21.5	15.6	3.4
Hyd3	12.9	10.9	4.7
Hyd4	9.2	7.5	3.4
Hyd5	6.9	5.5	2.0
Hyd6	3.4	4.2	1.4
Hyd7	1.4	2.8	1.3

Soil Classification	Percent of sample
Gravel	0.0
Sand	72.9
Coarse Sand	6.5
Medium Sand	27.1
Fine Sand	39.3
Silt	21.6
Clay	5.5

Sediment Grain Size - D422

Client	
Client Sample ID	SB-6-17-25
Lab Sample ID	180-126602-A-1

Date Received	9/2/2021
Start Date	09/16/2021 19:59
End Date	09/20/2021 9:54

Dry Weight Determination

Tin Weight	1.01	g
Wet Sample + Tin	20.60	g
Dry Sample + Tin	15.25	g
% Moisture	27.31	%

Non-soil material:	na
Shape (> #10):	surounded
Hardness (> #10):	hard

Date/Time in oven	09/16/2021 20:01
Date/Time out of oven	09/17/2021 14:04

Sample Weights	Tare (g)	Pan+Samp (g)	Samp (g)
Sample Weight (Wet)	44.63	185.06	140.43
Sample Weight (Oven Dried)			102

Sample Split (oven dried)	Tare (g)	Pan+Samp (g)	Samp (g)
Sample >=#10			4.67
Sample <#10			97.3
% Passing #10			69.3

Hydrometer Data	
Serial Number	542325
Calib. Date (mm/dd/yyyy)	12/18/2019
Low Temp (C)	17.0
Reading at Low Temp	1.0030
High Temp (C)	23.0
Reading at High Temp	1.0020
Hydrometer Cal Slope	-0.000166667
Hydrometer Cal Intercept	1.005833333
Default Soil Gravity	2.6500

Gravel/Sand Fraction (Sieves)

Sample Fraction	Size (um)	Pan Tare (g)	Pan+Sample (g)	Sample		% Finer	Classification	Sub Class
3 inch	75000			0.00	g	100.0	Gravel	
2 inch	50000			0.00	g	100.0	Gravel	
1.5 inch	37500			0.00	g	100.0	Gravel	
1 inch	25000			0.00	g	100.0	Gravel	
3/4 inch	19000			0.00	g	100.0	Gravel	
3/8 inch	9500			0.00	g	100.0	Gravel	
#4	4750	487.98	489.15	1.17	g	98.9	Gravel	
#10	2000	462.59	466.09	3.50	g	95.5	Sand	Coarse
#20	850	378.17	387.71	9.54	g	86.1	Sand	Medium
#40	425	366.54	382.69	16.15	g	70.3	Sand	Medium
#60	250	348.07	363.18	15.11	g	55.5	Sand	Fine
#80	180	337.47	347.05	9.58	g	46.1	Sand	Fine
#100	150	327.66	332.91	5.25	g	41.0	Sand	Fine
#200	75	312.57	325.99	13.42	g	27.8	Sand	Fine
				0.00	g	27.8		

Adjusted Hydrometer Sample Mass

Hydrometer Sample Mass (g)	102

Silt/Clay Fraction (Hydrometer Test)

Hydrometer Test Time (min)	Actual	Spec. Gravity	Temp C	Particle Size (Micron)	% Finer	Classification	Sub Class
2	2	1.0155	20.5	33.5	20.6	Silt	
5	5	1.0140	20.5	21.5	18.2	Silt	
15	15	1.0095	20.5	13	11.2	Silt	
30	30	1.0085	20.5	9.3	9.58	Silt	
60	63	1.0060	20.5	6.6	5.64	Silt	
250	253	1.0055	20.5	3.3	4.85	Clay	
1440	1400	1.0045	20.5	1.4	3.28	Clay	

Sediment Grain Size - D422

Client	
Client Sample ID	SB-7-20-30
Lab Sample ID	180-126602-A-2

Date Received	9/2/2021
Start Date	09/16/2021 20:01
End Date	09/20/2021 9:58

Dry Weight Determination

Tin Weight	1.00	g
Wet Sample + Tin	18.65	g
Dry Sample + Tin	15.95	g
% Moisture	15.30	%

Non-soil material:	na
Shape (> #10):	subrounded
Hardness (> #10):	hard

Date/Time in oven	09/16/2021 20:02
Date/Time out of oven	09/17/2021 14:04

Sample Weights	Tare (g)	Pan+Samp (g)	Samp (g)
Sample Weight (Wet)	47.83	188.59	140.76
Sample Weight (Oven Dried)			119

Sample Split (oven dried)	Tare (g)	Pan+Samp (g)	Samp (g)
Sample >=#10			5.2
Sample <#10			114
% Passing #10			81

Hydrometer Data

Serial Number	542325
Calib. Date (mm/dd/yyyy)	12/18/2019
Low Temp (C)	17.0
Reading at Low Temp	1.0030
High Temp (C)	23.0
Reading at High Temp	1.0020
Hydrometer Cal Slope	-0.000166667
Hydrometer Cal Intercept	1.005833333
Default Soil Gravity	2.6500

Gravel/Sand Fraction (Sieves)

Sample Fraction	Size (um)	Pan Tare (g)	Pan+Sample (g)	Sample		% Finer	Classification	Sub Class
3 inch	75000			0.00	g	100.0	Gravel	
2 inch	50000			0.00	g	100.0	Gravel	
1.5 inch	37500			0.00	g	100.0	Gravel	
1 inch	25000			0.00	g	100.0	Gravel	
3/4 inch	19000			0.00	g	100.0	Gravel	
3/8 inch	9500			0.00	g	100.0	Gravel	
#4	4750			0.00	g	100.0	Gravel	
#10	2000	462.59	467.79	5.20	g	95.6	Sand	Coarse
#20	850	373.41	386.22	12.81	g	84.8	Sand	Medium
#40	425	361.84	383.65	21.81	g	66.5	Sand	Medium
#60	250	351.94	370.89	18.95	g	50.6	Sand	Fine
#80	180	318.93	329.81	10.88	g	41.5	Sand	Fine
#100	150	328.25	334.12	5.87	g	36.6	Sand	Fine
#200	75	313.99	329.85	15.86	g	23.3	Sand	Fine
				0.00	g	23.3		

Adjusted Hydrometer Sample Mass

Hydrometer Sample Mass (g)	119

Silt/Clay Fraction (Hydrometer Test)

Hydrometer Test Time (min)	Actual	Spec. Gravity	Temp C	Particle Size (Micron)	% Finer	Classification	Sub Class
2	2	1.0160	20.5	33.3	18.3	Silt	
5	5	1.0140	20.5	21.5	15.6	Silt	
15	15	1.0105	20.5	12.9	10.9	Silt	
30	30	1.0075	20.5	9.4	6.86	Silt	
60	57	1.0050	20.5	7	3.49	Silt	
250	247	1.0045	20.5	3.4	2.81	Clay	
1440	1394	1.0040	20.5	1.4	2.14	Clay	

Sediment Grain Size - D422

Client	
Client Sample ID	SB-8-20.6-30.6
Lab Sample ID	180-126602-A-3

Date Received	9/2/2021
Start Date	09/16/2021 20:03
End Date	09/20/2021 10:07

Dry Weight Determination

Tin Weight	1.02	g
Wet Sample + Tin	19.31	g
Dry Sample + Tin	15.26	g
% Moisture	22.14	%

Non-soil material:	na
Shape (> #10):	subrounded
Hardness (> #10):	hard

Date/Time in oven	09/16/2021 20:04
Date/Time out of oven	09/17/2021 14:05

Sample Weights	Tare (g)	Pan+Samp (g)	Samp (g)
Sample Weight (Wet)	47.84	190.51	142.67
Sample Weight (Oven Dried)			111

Sample Split (oven dried)	Tare (g)	Pan+Samp (g)	Samp (g)
Sample >=#10			2.96
Sample <#10			108
% Passing #10			75.7

Hydrometer Data

Serial Number	542325
Calib. Date (mm/dd/yyyy)	12/18/2019
Low Temp (C)	17.0
Reading at Low Temp	1.0030
High Temp (C)	23.0
Reading at High Temp	1.0020
Hydrometer Cal Slope	-0.000166667
Hydrometer Cal Intercept	1.005833333
Default Soil Gravity	2.6500

Gravel/Sand Fraction (Sieves)

Sample Fraction	Size (um)	Pan Tare (g)	Pan+Sample (g)	Sample		% Finer	Classification	Sub Class
3 inch	75000			0.00	g	100.0	Gravel	
2 inch	50000			0.00	g	100.0	Gravel	
1.5 inch	37500			0.00	g	100.0	Gravel	
1 inch	25000			0.00	g	100.0	Gravel	
3/4 inch	19000			0.00	g	100.0	Gravel	
3/8 inch	9500			0.00	g	100.0	Gravel	
#4	4750	487.98	489.91	1.93	g	98.3	Gravel	
#10	2000	462.59	463.62	1.03	g	97.4	Sand	Coarse
#20	850	378.17	383.81	5.64	g	92.3	Sand	Medium
#40	425	366.54	385.36	18.82	g	75.3	Sand	Medium
#60	250	348.07	372.62	24.55	g	53.2	Sand	Fine
#80	180	337.47	352.83	15.36	g	39.4	Sand	Fine
#100	150	327.66	335.59	7.93	g	32.3	Sand	Fine
#200	75	312.57	329.43	16.86	g	17.1	Sand	Fine
				0.00	g	17.1		

Adjusted Hydrometer Sample Mass

Hydrometer Sample Mass (g)	111

Silt/Clay Fraction (Hydrometer Test)

Hydrometer Test Time (min)	Actual	Spec. Gravity	Temp C	Particle Size (Micron)	% Finer	Classification	Sub Class
2	2	1.0120	20.5	34.7	13.9	Silt	
5	5	1.0100	20.5	22.4	11	Silt	
15	15	1.0085	20.5	13.1	8.8	Silt	
30	30	1.0065	20.5	9.5	5.91	Silt	
60	63	1.0050	20.5	6.6	3.74	Silt	
250	241	1.0045	20.5	3.4	3.01	Clay	
1440	1388	1.0040	20.5	1.4	2.29	Clay	

Sediment Grain Size - D422

Client	
Client Sample ID	SB-9-29.6-39.6
Lab Sample ID	180-126602-A-4

Date Received	9/2/2021
Start Date	09/16/2021 20:05
End Date	09/20/2021 10:11

Dry Weight Determination

Tin Weight	1.01	g
Wet Sample + Tin	21.15	g
Dry Sample + Tin	16.28	g
% Moisture	24.18	%

Non-soil material:	na
Shape (> #10):	subrounded
Hardness (> #10):	hard

Date/Time in oven	09/16/2021 20:06
Date/Time out of oven	09/17/2021 14:05

Sample Weights	Tare (g)	Pan+Samp (g)	Samp (g)
Sample Weight (Wet)	47.83	204.42	156.59
Sample Weight (Oven Dried)			119

Sample Split (oven dried)	Tare (g)	Pan+Samp (g)	Samp (g)
Sample >=#10			7.69
Sample <#10			111
% Passing #10			70.9

Hydrometer Data	
Serial Number	542325
Calib. Date (mm/dd/yyyy)	12/18/2019
Low Temp (C)	17.0
Reading at Low Temp	1.0030
High Temp (C)	23.0
Reading at High Temp	1.0020
Hydrometer Cal Slope	-0.000166667
Hydrometer Cal Intercept	1.005833333
Default Soil Gravity	2.6500

Gravel/Sand Fraction (Sieves)

Sample Fraction	Size (um)	Pan Tare (g)	Pan+Sample (g)	Sample		% Finer	Classification	Sub Class
3 inch	75000			0.00	g	100.0	Gravel	
2 inch	50000			0.00	g	100.0	Gravel	
1.5 inch	37500			0.00	g	100.0	Gravel	
1 inch	25000			0.00	g	100.0	Gravel	
3/4 inch	19000			0.00	g	100.0	Gravel	
3/8 inch	9500			0.00	g	100.0	Gravel	
#4	4750			0.00	g	100.0	Gravel	
#10	2000	462.59	470.28	7.69	g	93.5	Sand	Coarse
#20	850	373.41	387.91	14.50	g	81.3	Sand	Medium
#40	425	361.84	379.52	17.68	g	66.4	Sand	Medium
#60	250	351.94	368.16	16.22	g	52.8	Sand	Fine
#80	180	318.93	329.21	10.28	g	44.2	Sand	Fine
#100	150	328.25	333.82	5.57	g	39.5	Sand	Fine
#200	75	313.99	328.71	14.72	g	27.1	Sand	Fine
				0.00	g	27.1		

Adjusted Hydrometer Sample Mass

Hydrometer Sample Mass (g)	119

Silt/Clay Fraction (Hydrometer Test)

Hydrometer Test Time (min)	Actual	Spec. Gravity	Temp C	Particle Size (Micron)	% Finer	Classification	Sub Class
2	2	1.0165	20.5	33.1	19	Silt	
5	5	1.0140	20.5	21.5	15.6	Silt	
15	15	1.0105	20.5	12.9	10.9	Silt	
30	31	1.0080	20.5	9.2	7.54	Silt	
60	57	1.0065	20.5	6.9	5.51	Silt	
250	235	1.0055	20.5	3.4	4.16	Clay	
1440	1382	1.0045	20.5	1.4	2.81	Clay	

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

Method: 9081 - Cation Exchange Capacity (CEC)

Lab Sample ID: MB 560-188958/1-A
Matrix: Solid
Analysis Batch: 188999

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 188958

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cation Exchange Capacity	<0.050		0.050	0.050	meq/100gm		09/15/21 10:15	09/16/21 14:18	1

Method: EPA-Lloyd Kahn - Organic Carbon, Total (TOC)

Lab Sample ID: MB 180-370742/4
Matrix: Solid
Analysis Batch: 370742

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon - Duplicates	<750		1000	750	mg/Kg			09/08/21 13:17	1

Lab Sample ID: LCS 180-370742/5
Matrix: Solid
Analysis Batch: 370742

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon - Duplicates	38200	33500		mg/Kg		88	75 - 125

QC Association Summary

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-1

General Chemistry

Prep Batch: 188958

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	9081	
180-126602-2	SB-7-20-30	Total/NA	Solid	9081	
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	9081	
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	9081	
MB 560-188958/1-A	Method Blank	Total/NA	Solid	9081	

Analysis Batch: 188999

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	9081	188958
180-126602-2	SB-7-20-30	Total/NA	Solid	9081	188958
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	9081	188958
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	9081	188958
MB 560-188958/1-A	Method Blank	Total/NA	Solid	9081	188958

Analysis Batch: 370742

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	EPA-Lloyd Kahn	
180-126602-2	SB-7-20-30	Total/NA	Solid	EPA-Lloyd Kahn	
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	EPA-Lloyd Kahn	
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	EPA-Lloyd Kahn	
MB 180-370742/4	Method Blank	Total/NA	Solid	EPA-Lloyd Kahn	
LCS 180-370742/5	Lab Control Sample	Total/NA	Solid	EPA-Lloyd Kahn	

Geotechnical

Analysis Batch: 171536

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	D422	
180-126602-2	SB-7-20-30	Total/NA	Solid	D422	
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	D422	
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	D422	

ive RIDC Park
PA 15238
+12) 963-7058 Phone (412) 963-2468

Chain of Custody Record

eurofins | Environment Testing America

ent Information	Sampler: Shoredits, Andreas	Lab PM: Brown, Shali	Carrier Tracking No(s):	COC No: 180-73918-14290.2
Client Contact: Joju Abraham	Phone: (770) 380-0861	E-Mail: Shali.Brown@Eurofinset.com	State of Origin: Georgia	Page:
Company: Southern Company	PWSID:			Job #:
Address: 241 Ralph McGill Blvd SE B10185	Due Date Requested:			
City: Atlanta	TAT Requested (days): STANDARD			
State, Zip: GA, 30308	Compliance Project: Δ Yes Δ No			
Phone:	PO #: 6122201429.2109			
Email: JAbraham@southernco.com	WO #:			
Project Name: Arkwright MNA - AP-3	Project #: 18020201			
Site: Georgia	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010D_SEP_Calc - SEP - As Co Li Mo (Knoxville)	6010D_Total AsCo Li Mo (Knowville)	SEP on HOLD pending Total Metals	Lloyd_Kahn_Mod - Lloyd Kahn	D422 - Grain Size (Sieve&Hydrometer) (sub Burlington)	9081 - Cation Exchange Capacity (CEC) (sub Xenco CC)	Arsenic Speciation (Pittsburgh)	Moisture - Moisture/Solids for dry weight	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N	N	I	N	I	I	N	X	
SB-6-17-25	9/1/21	09:30	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-7-20-30	9/1/21	16:00	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-8-20.6-30.6	9/1/21	10:40	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-9-29.6-39.6	9/1/21	13:55	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis

180-126602 Chain of Custody

Possible Hazard Identification
■ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ■ Disposal By Lab ☐ Archive For Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method of Shipment:

Relinquished by: Andreas Shoredits	Date/Time: 09/01/2021 18:30	Company: Wood E&IS	Received by: D Watson	Date/Time: 9-2-21	Company: ETAP/T
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 930	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

(412) 963-7058
REF: S180-73954
RMA:

FedEx Express

FedEx
TRK# 0221 1516 9332 3599

THU - 02 SEP 10:30
PRIORITY OVERNIGH

NA AGCA

15238
PA-US PI

Uncorrected temp 2.8 °C
Thermometer ID 14
CF 0 Initials 8
PT-WI-SR-001 effective 11/8/18

#5138334 09/01 56DJ3/169A/FE4A

RT 36

180-126602 Waybill

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record

eurofins Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Brown, Shali	Carrier Tracking No(s):	COC No: 180-443234.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Shali.Brown@Eurofinset.com	State of Origin: Georgia	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note):		Job #: 180-126602-1
Address: 5815 Middlebrook Pike, ,	Due Date Requested: 9/16/2021			
City: Knoxville	TAT Requested (days):			
State, Zip: TN, 37921				
Phone: 865-291-3000(Tel) 865-584-4315(Fax)	PO #:			
Email:	WO #:			
Project Name: Plant Arkwright MNA AP-3	Project #: 18020201			
Site: Arkwright	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010B/SEP_Tot_Prep (MOD) Total	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SB-6-17-25 (180-126602-1)	9/1/21	09:30 Eastern		Solid			X	1	SEP pending Total results
SB-7-20-30 (180-126602-2)	9/1/21	16:00 Eastern		Solid			X	1	SEP pending Total results
SB-8-20.6-30.6 (180-126602-3)	9/1/21	10:40 Eastern		Solid			X	1	SEP pending Total results
SB-9-29.6-39.6 (180-126602-4)	9/1/21	13:55 Eastern		Solid			X	1	SEP pending Total results

180-126602 Chain of Custody

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. ... chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins TestAmerica.

Possible Hazard Identification

Unconfirmed

Deliverable Requested: I, II, III, IV, Other (specify) — Primary Deliverable Rank: 2

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:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: Mo	Date/Time: 9/3/21 1200	Company: TA Pitt	Received by: [signature]	Date/Time: 9-4-21 09:45	Company: ETA KNX
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Ver: 06/08/2021

EUROFINS/TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST

Log In Number:

Review Items	Yes	No	NA	If No, what was the problem?
1. Are the shipping containers intact?	✓			☐ Containers, Broken
2. Were ambient air containers received intact?			✓	☐ Checked in lab
3. The coolers/containers custody seal if present, is it intact?	✓			☐ Yes ☐ NA
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID : SC71 Correction factor: +0.1°C	✓			☐ Cooler Out of Temp, Client Contacted, Proceed/Cancel ☐ Cooler Out of Temp, Same Day Receipt
5. Were all of the sample containers received intact?	✓			☐ Containers, Broken
6. Were samples received in appropriate containers?	✓			☐ Containers, Improper; Client Contacted; Proceed/Cancel
7. Do sample container labels match COC? (IDs, Dates, Times)	✓			☐ COC & Samples Do Not Match ☐ COC Incorrect/Incomplete ☐ COC Not Received
8. Were all of the samples listed on the COC received?	✓			☐ Sample Received, Not on COC ☐ Sample on COC, Not Received
9. Is the date/time of sample collection noted?	✓			☐ COC; No Date/Time; Client Contacted
10. Was the sampler identified on the COC?			✓	☐ Sampler Not Listed on COC
11. Is the client and project name/# identified?	✓			☐ COC Incorrect/Incomplete
12. Are tests/parameters listed for each sample?	✓			☐ COC No tests on COC
13. Is the matrix of the samples noted?	✓			☐ COC Incorrect/Incomplete
14. Was COC relinquished? (Signed/Dated/Timed)	✓			☐ COC Incorrect/Incomplete
15. Were samples received within holding time?	✓			☐ Holding Time - Receipt
16. Were samples received with correct chemical preservative (excluding Encore)?			✓	☐ pH Adjusted, pH Included (See box 16A) ☐ Incorrect Preservative
17. Were VOA samples received without headspace?			✓	☐ Headspace (VOA only)
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:			✓	☐ Residual Chlorine
19. For 1613B water samples is pH<9?			✓	☐ If no, notify lab to adjust
20. For rad samples was sample activity info. Provided?			✓	☐ Project missing info

Comments/Actions Taken

CUSTODY SEALS INTACT
RECEIVED AT RT 0.3 / CT 0.4°C
BAD 9-4-21
1 COOLER FEDEX 1689 5109 2040 PRS

Labeling Verified by: **Date:**

pH test strip lot number:

	Box 16A: pH Preservation	Box 18A: Residual Chlorine
Preservative:		
Lot Number:		
Exp Date:		
Analyst:		
Date:		
Time:		

Project #: PM Instructions:

Sample Receiving Associate: [signature] Date: 9-4-21

QA026R32.doc, 062719

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record

180-126602 Chain of Custody

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Brown, Shali	COC No: 43236.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Shali.Brown@Eurofinset.com; State of Origin: Georgia	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note):	Job #: 180-126602-1
Address: 530 Community Drive, Suite 11,	Due Date Requested: 9/16/2021		
City: South Burlington	TAT Requested (days):		
State, Zip: VT, 05403			
Phone: 802-660-1990(Tel) 802-660-1919(Fax)	PO #:		
Email:	WO #:		
Project Name: Plant Arkwright MNA AP-3	Project #: 18020201		
Site: Arkwright	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	D422/ Grain Size (Sieve and Hydrometer)	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SB-6-17-25 (180-126602-1)	9/1/21	09:30 Eastern		Solid			X	1	
SB-7-20-30 (180-126602-2)	9/1/21	16:00 Eastern		Solid			X	1	
SB-8-20.6-30.6 (180-126602-3)	9/1/21	10:40 Eastern		Solid			X	1	
SB-9-29.6-39.6 (180-126602-4)	9/1/21	13:55 Eastern		Solid			X	1	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins TestAmerica.

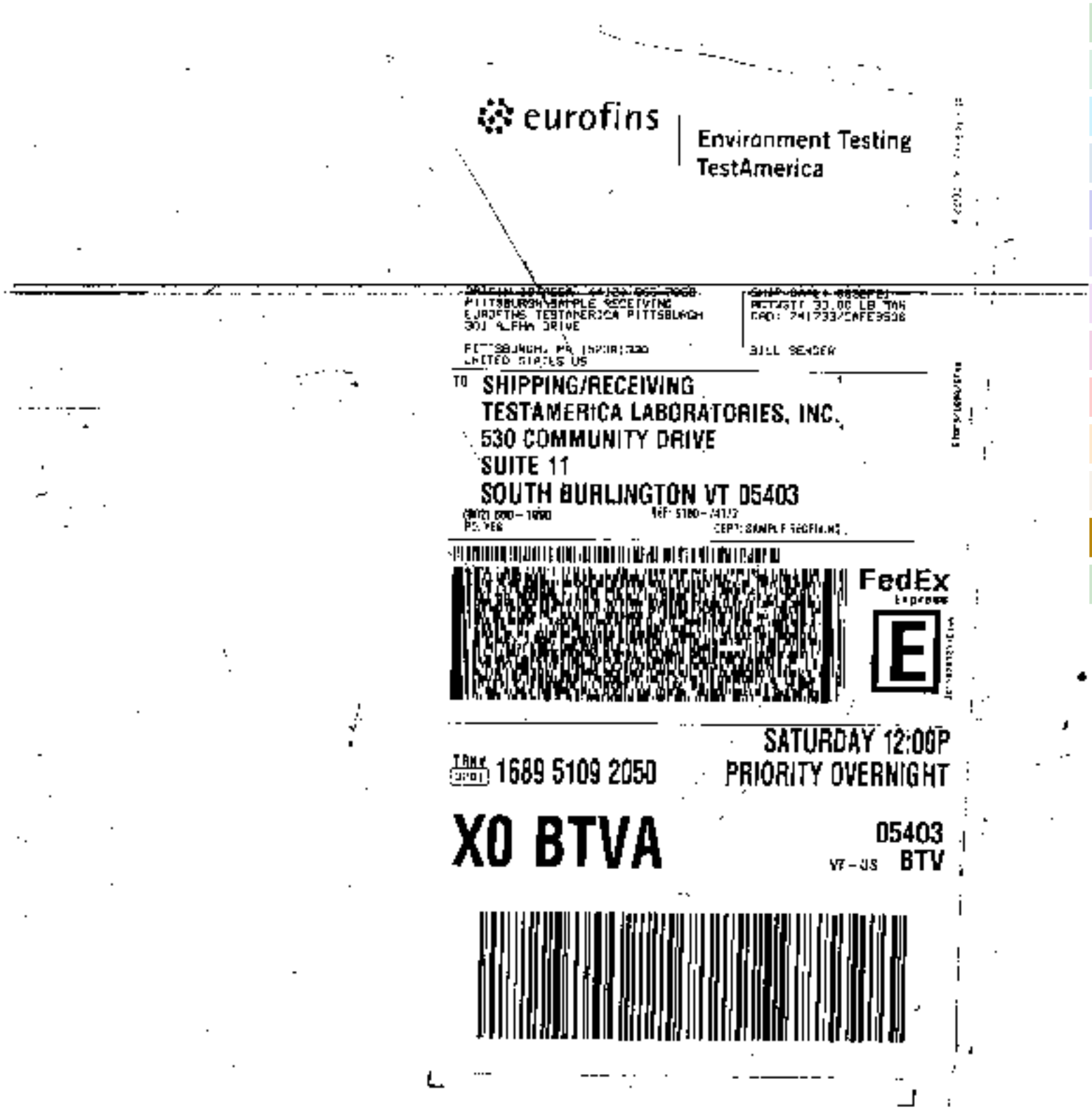
Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:		Method of Shipment:	
Relinquished by: MO	Date/Time: 9/3/21 1200	Company: TARAS	Received by: M. Lowell Soil-0	Date/Time: 9/4/21 0955	Company: BAA341
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Ver: 06/08/2021


eurofins
Environment Testing
TestAmerica
PITTSBURGH SAMPLE RECEIVING
EUROFINS TESTAMERICA PITTSBURGH
301 ALPHA DRIVE
UNITED STATES US
BILL SENDER
TO SHIPPING/RECEIVING
TESTAMERICA LABORATORIES, INC.
530 COMMUNITY DRIVE
SUITE 11
SOUTH BURLINGTON VT 05403
FedEx
Express
TRK# 1689 5109 2050
SATURDAY 12:00P
PRIORITY OVERNIGHT
XO BTVA
05403
VT-US BTV

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record

eurofins Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Brown, Shali	Carrier Tracking No(s):	COC No: 180-443227.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Shali.Brown@Eurofinset.com	State of Origin: Georgia	Page: Page 1 of 1
Company: Eurofins Xenco		Accreditations Required (See note):		Job #: 180-126602-1
Address: 1733 N. Padre Island Drive,	Due Date Requested: 9/16/2021			
City: Corpus Christi	TAT Requested (days):			
State, Zip: TX, 78408				
Phone: 361-289-2471(Tel) 361-289-2673(Fax)	PO #:			
Email:	WO #:			
Project Name: Plant Arkwright MNA AP-3	Project #: 18020201			
Site: Arkwright	SSOW#:			

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	9081/9081_Prep (MOD) Cation Exchange Capacity (CEC)	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SB-6-17-25 (180-126602-1)	9/1/21	09:30 Eastern		Solid			X	1	
SB-7-20-30 (180-126602-2)	9/1/21	16:00 Eastern		Solid			X	1	
SB-8-20.6-30.6 (180-126602-3)	9/1/21	10:40 Eastern		Solid			X	1	
SB-9-29.6-39.6 (180-126602-4)	9/1/21	13:55 Eastern		Solid			X	1	

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins TestAmerica.

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Unconfirmed	☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1	MO	9/3/21 1700	TAL-C		9/4/21 1025	Eurofins
2	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: Temp= 0.2/0.1 C6 FR10

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: Southern Company

Job Number: 180-126602-1

Login Number: 126602
List Number: 1
Creator: Watson, Debbie

List Source: Eurofins TestAmerica, Pittsburgh

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.	True	
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	

Login Sample Receipt Checklist

Client: Southern Company

Job Number: 180-126602-1

Login Number: 126602
List Number: 4
Creator: Sofio, Michael G

List Source: Eurofins TestAmerica, Burlington
List Creation: 09/04/21 12:38 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	N/A	
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	0.3ºC
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?	N/A	Received project as a subcontract.
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.	N/A	
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	

Login Sample Receipt Checklist

Client: Southern Company

Job Number: 180-126602-1

Login Number: 126602
List Number: 3
Creator: Hunter, Jeffery A

List Source: Eurofins Xenco, Corpus Christi
List Creation: 09/04/21 11:16 AM

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.	True	
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	Check done at department level as required.

Analytical Report

Laboratory Job ID: 180-126602-2

September 2021

Eurofins

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

Laboratory Job ID: 180-126602-2
Client Project/Site: Plant Arkwright MNA AP-3

For:
Southern Company
241 Ralph McGill Blvd SE
B10185
Atlanta, Georgia 30308

Attn: Joju Abraham

Authorized for release by:
2/9/2022 6:32:19 PM

Shali Brown, Project Manager II
(615)301-5031
Shali.Brown@Eurofinset.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.

PA Lab ID: 02-00416

Table of Contents

Job ID: 180-126602-2

Laboratory: Eurofins Pittsburgh

Narrative

Job Narrative
180-126602-2

Comments
No additional comments.

Receipt
The samples were received on 9/2/2021 9:30 AM. 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 2.8º C.

Metals
7 Step Sequential Extraction Procedure

These soil samples were prepared and analyzed using Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0008, "7 Step Sequential Extraction Procedure". SW-846 Method 6010B as incorporated in Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrument analyses.

An aliquot of each sample was sequentially extracted using the steps listed below:

· Step 1 - Exchangeable Fraction: A 5 gram aliquot of sample was extracted with 25 mL of 1M magnesium sulfate (MgSO4), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 2 - Carbonate Fraction: The sample residue from step 1 was extracted with 25 mL of 1M sodium acetate/acetic acid (NaOAc/HOAc) at pH 5, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 3 - Non-crystalline Materials Fraction: The sample residue from step 2 was extracted with 25 mL of 0.2M ammonium oxalate (pH 3), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 4 - Metal Hydroxide Fraction: The sample residue from step 3 was extracted with 25 mL of 1M hydroxylamine hydrochloride solution in 25% v/v acetic acid, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 5 - Organic-bound Fraction: The sample residue from step 4 was extracted three times with 25 mL of 5% sodium hypochlorite (NaClO) at pH 9.5, centrifuged and filtered. The resulting leachates were combined and 5 mL were digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 6 - Acid/Sulfide Fraction: The sample residue from step 5 was extracted with 25 mL of a 3:1:2 v/v solution of HCl-HNO3-H2O, centrifuged and filtered. 5 mL of the resulting leachate was diluted to 50 mL with reagent water and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 7 - Residual Fraction: A 1.0 g aliquot of the sample residue from step 6 was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Results are reported in mg/kg on a dry weight basis.

In addition, a 1.0 g aliquot of the original sample was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Total metal results are reported in mg/kg on a dry weight basis.

Results were calculated using the following equation:

Result, µg/g or mg/Kg, dry weight = (C × V × V1 × D) / (W × S × V2)

Where:
C = Concentration from instrument readout, µg/mL
V = Final volume of digestate, mL
D = Instrument dilution factor
V1 = Total volume of leachate, mL
V2 = Volume of leachate digested, mL
W = Wet weight of sample, g
S = Percent solids/100

Job ID: 180-126602-2 (Continued)

Laboratory: Eurofins Pittsburgh (Continued)

A method blank, laboratory control sample and laboratory control sample duplicate were prepared and analyzed with each SEP step in order to provide information about both the presence of elements of interest in the extraction solutions, and the recovery of elements of interest from the extraction solutions. Results outside of laboratory QC limits do not reflect out of control performance, but rather the effect of the extraction solution upon the analyte.

A laboratory sample duplicate was prepared and analyzed with each batch of samples in order to provide information regarding the reproducibility of the procedure.

SEP Report Notes:

The final report lists the results for each step, the result for the total digestion of the sample, and a sum of the results of steps 1 through 7 by element.

Magnesium was not reported for step 1 because the extraction solution for this step (magnesium sulfate) contains high levels of magnesium. Sodium was not reported for steps 2 and 5 since the extraction solutions for these steps contain high levels of sodium. The sum of steps 1 through 7 is much higher than the total result for sodium and magnesium due to the magnesium and sodium introduced by the extraction solutions.

The digestates for steps 1, 2 and 5 were analyzed at a dilution due to instrument problems caused by the high solids content of the digestates. The reporting limits were adjusted accordingly.

Method 6010B: Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following samples: SB-7-20-30 (180-126602-2) and SB-8-20.6-30.6 (180-126602-3).

Method 6010B: The following samples were diluted due to the presence of titanium which interferes with Cobalt: SB-6-17-25 (180-126602-1), SB-7-20-30 (180-126602-2), SB-8-20.6-30.6 (180-126602-3), SB-9-29.6-39.6 (180-126602-4) and (180-126602-A-4-B DU). Elevated reporting limits (RLs) are provided.

Method 6010B: The serial dilution performed for the following sample associated with batch 140-53946 was outside control limits: (180-126602-A-4-A SD)

Method 6010B SEP: The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for preparation batch 140-56928 and 140-57077 and analytical batch 140-58388 recovered outside control limits for the following analytes: Lithium. These analytes were biased high in the LCS and LCSD.

Method 6010B SEP: The laboratory control sample duplicate (LCSD) precision or %RPD for preparation batch 140-56928 and 140-57077 and analytical batch 140-58388 was outside control limits for Cobalt.
(LCSD 140-56928/3-B ^5)

Method 6010B SEP: The laboratory control sampled duplicate (LCS) for preparation batch 140-56928 and 140-57077 and analytical batch 140-58388 recovered less than 10% for the following analyte: Cobalt. This analyte was biased low in the LCS. (LCSD 140-56928/3-B ^5)

Method 6010B SEP: The following samples were diluted due to the presence of Titanium which interferes with Cobalt: SB-6-17-25 (180-126602-1) and SB-8-20.6-30.6 (180-126602-3) Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Definitions/Glossary

Client: Southern Company
Job ID: 180-126602-2
Project/Site: Plant Arkwright MNA AP-3

Qualifiers

Metals

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
*1	LCS/LCSD RPD exceeds control limits.
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Accreditation/Certification Summary

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Laboratory: Eurofins Knoxville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
	AFCEE	N/A	
ANAB	Dept. of Defense ELAP	L2311	02-13-25
ANAB	Dept. of Energy	L2311.01	02-13-25
ANAB	ISO/IEC 17025	L2311	02-13-25
Arkansas DEQ	State	88-0688	06-17-22
California	State	2423	06-30-22
Colorado	State	TN00009	02-28-22
Connecticut	State	PH-0223	09-30-23
Florida	NELAP	E87177	06-30-22
Georgia (DW)	State	906	12-11-22
Hawaii	State	NA	12-11-22
Kansas	NELAP	E-10349	10-31-22
Kentucky (DW)	State	90101	12-31-22
Louisiana	NELAP	83979	06-30-22
Louisiana (DW)	State	LA019	12-31-22
Maryland	State	277	03-31-22
Michigan	State	9933	12-11-22
Nevada	State	TN00009	07-31-22
New Hampshire	NELAP	299919	01-17-23
New Jersey	NELAP	TN001	06-30-22
New York	NELAP	10781	03-31-22
North Carolina (DW)	State	21705	07-31-22
North Carolina (WW/SW)	State	64	12-31-22
Ohio VAP	State	CL0059	06-02-23
Oklahoma	State	9415	08-31-22
Oregon	NELAP	TNI0189	12-31-22
Pennsylvania	NELAP	68-00576	12-31-22
Tennessee	State	02014	12-11-22
Texas	NELAP	T104704380-18-12	08-31-22
US Fish & Wildlife	US Federal Programs	058448	07-31-22
USDA	US Federal Programs	P330-19-00236	08-20-22
Utah	NELAP	TN00009	07-31-22
Virginia	NELAP	460176	09-14-22
Washington	State	C593	01-19-23
West Virginia (DW)	State	9955C	12-31-22
West Virginia DEP	State	345	04-30-22
Wisconsin	State	998044300	08-31-22

Sample Summary

Client: Southern Company
Job ID: 180-126602-2
Project/Site: Plant Arkwright MNA AP-3

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-126602-1	SB-6-17-25	Solid	09/01/21 09:30	09/02/21 09:30
180-126602-2	SB-7-20-30	Solid	09/01/21 16:00	09/02/21 09:30
180-126602-3	SB-8-20.6-30.6	Solid	09/01/21 10:40	09/02/21 09:30
180-126602-4	SB-9-29.6-39.6	Solid	09/01/21 13:55	09/02/21 09:30

Method Summary

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Method	Method Description	Protocol	Laboratory
6010B	SEP Metals (ICP) - Total	SW846	TAL KNX
6010B SEP	SEP Metals (ICP)	SW846	TAL KNX
3010A	Preparation, Total Metals	SW846	TAL KNX
Acid/Sulfide	Sequential Extraction Procedure, Acid/Sulfide Fraction	TAL-KNOX	TAL KNX
Carbonate	Sequential Extraction Procedure, Carbonate Fraction	TAL-KNOX	TAL KNX
Exchangeable	Sequential Extraction Procedure, Exchangeable Fraction	TAL-KNOX	TAL KNX
Metal Hydroxide	Sequential Extraction Procedure, Metal Hydroxide Fraction	TAL-KNOX	TAL KNX
Non-Crystalline	Sequential Extraction Procedure, Non-crystalline Materials	TAL-KNOX	TAL KNX
Organic-Bound	Sequential Extraction Procedure, Organic Bound Fraction	TAL-KNOX	TAL KNX
Residual	Sequential Extraction Procedure, Residual Fraction	TAL-KNOX	TAL KNX
Total	Preparation, Total Material	TAL-KNOX	TAL KNX

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-KNOX = TestAmerica Laboratories, Knoxville, Facility Standard Operating Procedure.

Laboratory References:

TAL KNX = Eurofins Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Lab Chronicle

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-6-17-25

Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58727	02/09/22 13:27	DKW	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: SB-6-17-25

Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1

Matrix: Solid
Percent Solids: 71.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		1			53865	09/17/21 11:31	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		5			53946	09/20/21 14:33	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	56505	11/30/21 13:59	JGT	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56615	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			58382	01/29/22 12:41	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56605	12/02/21 13:40	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56636	12/03/21 11:00	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58382	01/29/22 14:29	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56750	12/07/21 09:48	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56796	12/08/21 09:00	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58382	01/29/22 16:09	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56869	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56877	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58388	01/30/22 10:34	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56928	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57077	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58388	01/30/22 12:22	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57111	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58429	01/31/22 21:12	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57111	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		2			58429	01/31/22 22:37	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57212	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58657	02/07/22 11:27	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57212	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		5			58657	02/07/22 14:02	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-7-20-30

Lab Sample ID: 180-126602-2

Date Collected: 09/01/21 16:00
Matrix: Solid
Date Received: 09/02/21 09:30
Percent Solids: 85.4

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		1			53865	09/17/21 11:37	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		2			53946	09/20/21 13:16	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		10			53946	09/20/21 13:21	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: SB-8-20.6-30.6

Lab Sample ID: 180-126602-3

Date Collected: 09/01/21 10:40
Matrix: Solid
Date Received: 09/02/21 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58727	02/09/22 13:27	DKW	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: SB-8-20.6-30.6

Lab Sample ID: 180-126602-3

Date Collected: 09/01/21 10:40
Matrix: Solid
Date Received: 09/02/21 09:30
Percent Solids: 77.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		5			53946	09/20/21 13:31	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	56505	11/30/21 13:59	JGT	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56615	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			58382	01/29/22 12:46	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56605	12/02/21 13:40	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56636	12/03/21 11:00	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58382	01/29/22 14:34	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56750	12/07/21 09:48	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56796	12/08/21 09:00	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58382	01/29/22 16:24	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56869	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56877	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58388	01/30/22 10:39	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56928	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57077	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58388	01/30/22 12:28	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-8-20.6-30.6

Lab Sample ID: 180-126602-3

Date Collected: 09/01/21 10:40
Matrix: Solid
Date Received: 09/02/21 09:30
Percent Solids: 77.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57111	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58429	01/31/22 21:17	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57111	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		2			58429	01/31/22 22:42	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57212	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58657	02/07/22 11:32	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57212	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		5			58657	02/07/22 14:07	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: SB-9-29.6-39.6

Lab Sample ID: 180-126602-4

Date Collected: 09/01/21 13:55
Matrix: Solid
Date Received: 09/02/21 09:30
Percent Solids: 74.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		1			53865	09/17/21 11:58	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		1			53946	09/20/21 11:45	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	53804	09/16/21 08:10	KNC	TAL KNX
Total/NA	Analysis	6010B		5			53946	09/20/21 13:42	KNC	TAL KNX
	Instrument ID: DUO									

Laboratory References:

TAL KNX = Eurofins Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Analyst References:

Lab: TAL KNX

Batch Type: SEP

JGT = Joshua Taylor
MAC = Michael Campbell

Batch Type: Prep

KNC = Kerry Collins
MAC = Michael Campbell

Batch Type: Analysis

DKW = Donna Wilburn
JMD = Jenny Do
KNC = Kerry Collins

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-6-17-25
Date Collected: 09/01/21 09:30
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-1
Matrix: Solid
Percent Solids: 71.3

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.25		14	0.25	mg/Kg	☼	12/02/21 12:30	01/29/22 12:41	4
Lithium	<0.84		14	0.84	mg/Kg	☼	12/02/21 12:30	01/29/22 12:41	4
Molybdenum	<0.46		11	0.46	mg/Kg	☼	12/02/21 12:30	01/29/22 12:41	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.26		11	0.26	mg/Kg	☼	12/03/21 11:00	01/29/22 14:29	3
Lithium	<0.63		11	0.63	mg/Kg	☼	12/03/21 11:00	01/29/22 14:29	3
Molybdenum	<0.34		8.4	0.34	mg/Kg	☼	12/03/21 11:00	01/29/22 14:29	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**35**		3.5	0.063	mg/Kg	☼	12/08/21 09:00	01/29/22 16:09	1
Lithium	<0.21		3.5	0.21	mg/Kg	☼	12/08/21 09:00	01/29/22 16:09	1
Molybdenum	<0.11		2.8	0.11	mg/Kg	☼	12/08/21 09:00	01/29/22 16:09	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**27**		3.5	0.074	mg/Kg	☼	12/13/21 09:30	01/30/22 10:34	1
Lithium	**1.6**	**J**	3.5	0.21	mg/Kg	☼	12/13/21 09:30	01/30/22 10:34	1
Molybdenum	<0.11		2.8	0.11	mg/Kg	☼	12/13/21 09:30	01/30/22 10:34	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.84	*1	53	0.84	mg/Kg	☼	12/15/21 10:40	01/30/22 12:22	5
Lithium	**25**	**J B *+**	53	3.1	mg/Kg	☼	12/15/21 10:40	01/30/22 12:22	5
Molybdenum	<1.8		42	1.8	mg/Kg	☼	12/15/21 10:40	01/30/22 12:22	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**13**		7.0	0.13	mg/Kg	☼	12/15/21 17:10	01/31/22 22:37	2
Lithium	**10**		3.5	0.21	mg/Kg	☼	12/15/21 17:10	01/31/22 21:12	1
Molybdenum	<0.14		2.8	0.14	mg/Kg	☼	12/15/21 17:10	01/31/22 21:12	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**18**		18	0.18	mg/Kg	☼	12/18/21 15:38	02/07/22 14:02	5
Lithium	**8.9**		3.5	0.21	mg/Kg	☼	12/18/21 15:38	02/07/22 11:27	1
Molybdenum	<0.11		2.8	0.11	mg/Kg	☼	12/18/21 15:38	02/07/22 11:27	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**93**		2.5	0.023	mg/Kg			02/09/22 13:27	1
Lithium	**46**		2.5	0.15	mg/Kg			02/09/22 13:27	1
Molybdenum	<0.082		2.0	0.082	mg/Kg			02/09/22 13:27	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**18**		18	0.18	mg/Kg	☼	09/16/21 08:10	09/20/21 14:33	5
Lithium	**19**		3.5	0.21	mg/Kg	☼	09/16/21 08:10	09/17/21 11:31	1
Molybdenum	<0.11		2.8	0.11	mg/Kg	☼	09/16/21 08:10	09/17/21 11:31	1

Client Sample Results

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-7-20-30
Date Collected: 09/01/21 16:00
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-2
Matrix: Solid
Percent Solids: 85.4

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**16**	**J**	29	0.30	mg/Kg	☼	09/16/21 08:10	09/20/21 13:21	10
Lithium	**8.7**		5.9	0.35	mg/Kg	☼	09/16/21 08:10	09/20/21 13:16	2
Molybdenum	<0.096		2.3	0.096	mg/Kg	☼	09/16/21 08:10	09/17/21 11:37	1

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-8-20.6-30.6

Date Collected: 09/01/21 10:40
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-3

Matrix: Solid
Percent Solids: 77.2

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.23		13	0.23	mg/Kg	☼	12/02/21 12:30	01/29/22 12:46	4
Lithium	<0.78		13	0.78	mg/Kg	☼	12/02/21 12:30	01/29/22 12:46	4
Molybdenum	<0.42		10	0.42	mg/Kg	☼	12/02/21 12:30	01/29/22 12:46	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.24		9.7	0.24	mg/Kg	☼	12/03/21 11:00	01/29/22 14:34	3
Lithium	<0.58		9.7	0.58	mg/Kg	☼	12/03/21 11:00	01/29/22 14:34	3
Molybdenum	<0.32		7.8	0.32	mg/Kg	☼	12/03/21 11:00	01/29/22 14:34	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**12**		3.2	0.058	mg/Kg	☼	12/08/21 09:00	01/29/22 16:24	1
Lithium	**0.34**	**J**	3.2	0.19	mg/Kg	☼	12/08/21 09:00	01/29/22 16:24	1
Molybdenum	<0.11		2.6	0.11	mg/Kg	☼	12/08/21 09:00	01/29/22 16:24	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**3.0**	**J**	3.2	0.069	mg/Kg	☼	12/13/21 09:30	01/30/22 10:39	1
Lithium	**0.83**	**J**	3.2	0.19	mg/Kg	☼	12/13/21 09:30	01/30/22 10:39	1
Molybdenum	<0.11		2.6	0.11	mg/Kg	☼	12/13/21 09:30	01/30/22 10:39	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.78	*1	49	0.78	mg/Kg	☼	12/15/21 10:40	01/30/22 12:28	5
Lithium	**22**	**J B *+**	49	2.8	mg/Kg	☼	12/15/21 10:40	01/30/22 12:28	5
Molybdenum	<1.6		39	1.6	mg/Kg	☼	12/15/21 10:40	01/30/22 12:28	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**6.3**	**J**	6.5	0.12	mg/Kg	☼	12/15/21 17:10	01/31/22 22:42	2
Lithium	**4.6**		3.2	0.19	mg/Kg	☼	12/15/21 17:10	01/31/22 21:17	1
Molybdenum	<0.13		2.6	0.13	mg/Kg	☼	12/15/21 17:10	01/31/22 21:17	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**6.3**	**J**	16	0.17	mg/Kg	☼	12/18/21 15:38	02/07/22 14:07	5
Lithium	**3.3**		3.2	0.19	mg/Kg	☼	12/18/21 15:38	02/07/22 11:32	1
Molybdenum	<0.11		2.6	0.11	mg/Kg	☼	12/18/21 15:38	02/07/22 11:32	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**27**		2.5	0.023	mg/Kg			02/09/22 13:27	1
Lithium	**31**		2.5	0.15	mg/Kg			02/09/22 13:27	1
Molybdenum	<0.082		2.0	0.082	mg/Kg			02/09/22 13:27	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**34**		16	0.17	mg/Kg	☼	09/16/21 08:10	09/20/21 13:31	5
Lithium	**8.9**	**J**	16	0.97	mg/Kg	☼	09/16/21 08:10	09/20/21 13:31	5
Molybdenum	<0.53		13	0.53	mg/Kg	☼	09/16/21 08:10	09/20/21 13:31	5

Client Sample Results

Client: Southern Company
Project/Site: Plant Arkwright MNA AP-3

Job ID: 180-126602-2

Client Sample ID: SB-9-29.6-39.6

Date Collected: 09/01/21 13:55
Date Received: 09/02/21 09:30

Lab Sample ID: 180-126602-4

Matrix: Solid
Percent Solids: 74.7

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**11**	**J**	17	0.17	mg/Kg	☼	09/16/21 08:10	09/20/21 13:42	5
Lithium	**7.3**		3.3	0.20	mg/Kg	☼	09/16/21 08:10	09/20/21 11:45	1
Molybdenum	<0.11		2.7	0.11	mg/Kg	☼	09/16/21 08:10	09/17/21 11:58	1

Method: 6010B - SEP Metals (ICP) - Total

Lab Sample ID: MB 140-53804/11-A
Matrix: Solid
Analysis Batch: 53865

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 53804

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.026		2.5	0.026	mg/Kg		09/16/21 08:10	09/17/21 10:54	1
Lithium	<0.15		2.5	0.15	mg/Kg		09/16/21 08:10	09/17/21 10:54	1
Molybdenum	<0.082		2.0	0.082	mg/Kg		09/16/21 08:10	09/17/21 10:54	1

Lab Sample ID: LCS 140-53804/12-A
Matrix: Solid
Analysis Batch: 53865

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 53804

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Cobalt			5.00	5.09		mg/Kg		102	80 - 125		
Lithium			5.00	4.82		mg/Kg		96	80 - 120		
Molybdenum			25.0	25.7		mg/Kg		103	80 - 125		

Lab Sample ID: LCSD 140-53804/13-A
Matrix: Solid
Analysis Batch: 53865

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 53804

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt			5.00	5.12		mg/Kg		102	80 - 125	1	30
Lithium			5.00	4.83		mg/Kg		97	80 - 120	0	30
Molybdenum			25.0	25.7		mg/Kg		103	80 - 125	0	30

Lab Sample ID: 180-126602-4 DU
Matrix: Solid
Analysis Batch: 53865

Client Sample ID: SB-9-29.6-39.6
Prep Type: Total/NA
Prep Batch: 53804

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Molybdenum	<0.11			<0.11		mg/Kg	☼			NC	30

Lab Sample ID: 180-126602-4 DU
Matrix: Solid
Analysis Batch: 53946

Client Sample ID: SB-9-29.6-39.6
Prep Type: Total/NA
Prep Batch: 53804

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Lithium	7.3			5.95		mg/Kg	☼			20	30

Lab Sample ID: 180-126602-4 DU
Matrix: Solid
Analysis Batch: 53946

Client Sample ID: SB-9-29.6-39.6
Prep Type: Total/NA
Prep Batch: 53804

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Cobalt	11	J		11.0	J	mg/Kg	☼			0.7	30

Method: 6010B SEP - SEP Metals (ICP)

Lab Sample ID: MB 140-56505/1-B ^4
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Method Blank
Prep Type: Step 1
Prep Batch: 56615

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.18		10	0.18	mg/Kg		12/02/21 12:30	01/29/22 12:27	4
Lithium	<0.60		10	0.60	mg/Kg		12/02/21 12:30	01/29/22 12:27	4
Molybdenum	<0.33		8.0	0.33	mg/Kg		12/02/21 12:30	01/29/22 12:27	4

Lab Sample ID: LCS 140-56505/2-B ^5
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 56615

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	5.18	J	mg/Kg		104	80 - 120
Lithium	5.00	5.25	J	mg/Kg		105	80 - 120
Molybdenum	25.0	25.8		mg/Kg		103	80 - 120

Lab Sample ID: LCSD 140-56505/3-B ^5
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 1
Prep Batch: 56615

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	4.96	J	mg/Kg		99	80 - 120	4	30
Lithium	5.00	5.10	J	mg/Kg		102	80 - 120	3	30
Molybdenum	25.0	24.8		mg/Kg		99	80 - 120	4	30

Lab Sample ID: MB 140-56605/1-B ^3
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Method Blank
Prep Type: Step 2
Prep Batch: 56636

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.19		7.5	0.19	mg/Kg		12/03/21 11:00	01/29/22 14:04	3
Lithium	<0.45		7.5	0.45	mg/Kg		12/03/21 11:00	01/29/22 14:04	3
Molybdenum	<0.25		6.0	0.25	mg/Kg		12/03/21 11:00	01/29/22 14:04	3

Lab Sample ID: LCS 140-56605/2-B ^5
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample
Prep Type: Step 2
Prep Batch: 56636

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	4.17	J	mg/Kg		83	80 - 120
Lithium	5.00	4.23	J	mg/Kg		85	80 - 120
Molybdenum	25.0	21.9		mg/Kg		88	70 - 120

Lab Sample ID: LCSD 140-56605/3-B ^5
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 2
Prep Batch: 56636

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	4.68	J	mg/Kg		94	80 - 120	11	30
Lithium	5.00	4.78	J	mg/Kg		96	80 - 120	12	30
Molybdenum	25.0	24.9		mg/Kg		100	70 - 120	13	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-56750/1-B
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Method Blank
Prep Type: Step 3
Prep Batch: 56796

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.045		2.5	0.045	mg/Kg		12/08/21 09:00	01/29/22 15:55	1
Lithium	<0.15		2.5	0.15	mg/Kg		12/08/21 09:00	01/29/22 15:55	1
Molybdenum	<0.082		2.0	0.082	mg/Kg		12/08/21 09:00	01/29/22 15:55	1

Lab Sample ID: LCS 140-56750/2-B
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample
Prep Type: Step 3
Prep Batch: 56796

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	4.99		mg/Kg		100	80 - 120
Lithium	5.00	4.91		mg/Kg		98	80 - 120
Molybdenum	25.0	25.4		mg/Kg		102	80 - 120

Lab Sample ID: LCSD 140-56750/3-B
Matrix: Solid
Analysis Batch: 58382

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 3
Prep Batch: 56796

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	5.07		mg/Kg		101	80 - 120	1	30
Lithium	5.00	4.87		mg/Kg		97	80 - 120	1	30
Molybdenum	25.0	26.1		mg/Kg		104	80 - 120	3	30

Lab Sample ID: MB 140-56869/1-B
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Method Blank
Prep Type: Step 4
Prep Batch: 56877

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.053		2.5	0.053	mg/Kg		12/13/21 09:30	01/30/22 10:20	1
Lithium	<0.15		2.5	0.15	mg/Kg		12/13/21 09:30	01/30/22 10:20	1
Molybdenum	<0.082		2.0	0.082	mg/Kg		12/13/21 09:30	01/30/22 10:20	1

Lab Sample ID: LCS 140-56869/2-B
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Lab Control Sample
Prep Type: Step 4
Prep Batch: 56877

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	4.94		mg/Kg		99	80 - 120
Lithium	5.00	5.09		mg/Kg		102	80 - 120
Molybdenum	25.0	26.0		mg/Kg		104	80 - 120

Lab Sample ID: LCSD 140-56869/3-B
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 4
Prep Batch: 56877

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	5.54		mg/Kg		111	80 - 120	11	30
Lithium	5.00	5.57		mg/Kg		111	80 - 120	9	30
Molybdenum	25.0	29.1		mg/Kg		117	80 - 120	11	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-56928/1-B ^5
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Method Blank
Prep Type: Step 5
Prep Batch: 57077

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.60		38	0.60	mg/Kg		12/15/21 10:40	01/30/22 11:58	5
Lithium	15.0	J	38	2.2	mg/Kg		12/15/21 10:40	01/30/22 11:58	5
Molybdenum	<1.3		30	1.3	mg/Kg		12/15/21 10:40	01/30/22 11:58	5

Lab Sample ID: LCS 140-56928/2-B ^5
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Lab Control Sample
Prep Type: Step 5
Prep Batch: 57077

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	15.0	1.57	J	mg/Kg		10	1 - 60
Lithium	15.0	31.7	J *+	mg/Kg		212	80 - 150
Molybdenum	75.0	54.5		mg/Kg		73	60 - 100

Lab Sample ID: LCSD 140-56928/3-B ^5
Matrix: Solid
Analysis Batch: 58388

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 5
Prep Batch: 57077

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	15.0	1.03	J *1	mg/Kg		7	1 - 60	42	30
Lithium	15.0	27.1	J *+	mg/Kg		181	80 - 150	16	30
Molybdenum	75.0	55.7		mg/Kg		74	60 - 100	2	30

Lab Sample ID: MB 140-57111/1-A
Matrix: Solid
Analysis Batch: 58429

Client Sample ID: Method Blank
Prep Type: Step 6
Prep Batch: 57111

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.046		2.5	0.046	mg/Kg		12/15/21 17:10	01/31/22 20:48	1
Lithium	<0.15		2.5	0.15	mg/Kg		12/15/21 17:10	01/31/22 20:48	1
Molybdenum	<0.099		2.0	0.099	mg/Kg		12/15/21 17:10	01/31/22 20:48	1

Lab Sample ID: LCS 140-57111/2-A
Matrix: Solid
Analysis Batch: 58429

Client Sample ID: Lab Control Sample
Prep Type: Step 6
Prep Batch: 57111

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	5.31		mg/Kg		106	80 - 120
Lithium	5.00	5.00		mg/Kg		100	80 - 120
Molybdenum	25.0	26.2		mg/Kg		105	80 - 120

Lab Sample ID: LCSD 140-57111/3-A
Matrix: Solid
Analysis Batch: 58429

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 6
Prep Batch: 57111

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	5.31		mg/Kg		106	80 - 120	0	30
Lithium	5.00	5.05		mg/Kg		101	80 - 120	1	30
Molybdenum	25.0	26.1		mg/Kg		104	80 - 120	0	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-57212/1-A
Matrix: Solid
Analysis Batch: 58657

Client Sample ID: Method Blank
Prep Type: Step 7
Prep Batch: 57212

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	<0.026		2.5	0.026	mg/Kg		12/18/21 15:38	02/07/22 11:12	1
Lithium	<0.15		2.5	0.15	mg/Kg		12/18/21 15:38	02/07/22 11:12	1
Molybdenum	<0.082		2.0	0.082	mg/Kg		12/18/21 15:38	02/07/22 11:12	1

Lab Sample ID: LCS 140-57212/2-A
Matrix: Solid
Analysis Batch: 58657

Client Sample ID: Lab Control Sample
Prep Type: Step 7
Prep Batch: 57212

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	5.00	5.10		mg/Kg		102	80 - 125
Lithium	5.00	5.00		mg/Kg		100	80 - 120
Molybdenum	25.0	25.5		mg/Kg		102	80 - 125

Lab Sample ID: LCSD 140-57212/3-A
Matrix: Solid
Analysis Batch: 58657

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 7
Prep Batch: 57212

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	5.00	5.19		mg/Kg		104	80 - 125	2	30
Lithium	5.00	5.06		mg/Kg		101	80 - 120	1	30
Molybdenum	25.0	26.2		mg/Kg		105	80 - 125	3	30

Metals

Prep Batch: 53804

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	Total	
180-126602-2	SB-7-20-30	Total/NA	Solid	Total	
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	Total	
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	Total	
MB 140-53804/11-A	Method Blank	Total/NA	Solid	Total	
LCS 140-53804/12-A	Lab Control Sample	Total/NA	Solid	Total	
LCSD 140-53804/13-A	Lab Control Sample Dup	Total/NA	Solid	Total	
180-126602-4 DU	SB-9-29.6-39.6	Total/NA	Solid	Total	

Analysis Batch: 53865

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	6010B	53804
180-126602-2	SB-7-20-30	Total/NA	Solid	6010B	53804
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804
MB 140-53804/11-A	Method Blank	Total/NA	Solid	6010B	53804
LCS 140-53804/12-A	Lab Control Sample	Total/NA	Solid	6010B	53804
LCSD 140-53804/13-A	Lab Control Sample Dup	Total/NA	Solid	6010B	53804
180-126602-4 DU	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804

Analysis Batch: 53946

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Total/NA	Solid	6010B	53804
180-126602-2	SB-7-20-30	Total/NA	Solid	6010B	53804
180-126602-2	SB-7-20-30	Total/NA	Solid	6010B	53804
180-126602-3	SB-8-20.6-30.6	Total/NA	Solid	6010B	53804
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804
180-126602-4	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804
180-126602-4 DU	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804
180-126602-4 DU	SB-9-29.6-39.6	Total/NA	Solid	6010B	53804

SEP Batch: 56505

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 1	Solid	Exchangeable	
180-126602-3	SB-8-20.6-30.6	Step 1	Solid	Exchangeable	
MB 140-56505/1-B ^4	Method Blank	Step 1	Solid	Exchangeable	
LCS 140-56505/2-B ^5	Lab Control Sample	Step 1	Solid	Exchangeable	
LCSD 140-56505/3-B ^5	Lab Control Sample Dup	Step 1	Solid	Exchangeable	

SEP Batch: 56605

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 2	Solid	Carbonate	
180-126602-3	SB-8-20.6-30.6	Step 2	Solid	Carbonate	
MB 140-56605/1-B ^3	Method Blank	Step 2	Solid	Carbonate	
LCS 140-56605/2-B ^5	Lab Control Sample	Step 2	Solid	Carbonate	
LCSD 140-56605/3-B ^5	Lab Control Sample Dup	Step 2	Solid	Carbonate	

Prep Batch: 56615

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 1	Solid	3010A	56505
180-126602-3	SB-8-20.6-30.6	Step 1	Solid	3010A	56505
MB 140-56505/1-B ^4	Method Blank	Step 1	Solid	3010A	56505

Metals (Continued)

Prep Batch: 56615 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 140-56505/2-B ^5	Lab Control Sample	Step 1	Solid	3010A	56505
LCSD 140-56505/3-B ^5	Lab Control Sample Dup	Step 1	Solid	3010A	56505

Prep Batch: 56636

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 2	Solid	3010A	56605
180-126602-3	SB-8-20.6-30.6	Step 2	Solid	3010A	56605
MB 140-56605/1-B ^3	Method Blank	Step 2	Solid	3010A	56605
LCS 140-56605/2-B ^5	Lab Control Sample	Step 2	Solid	3010A	56605
LCSD 140-56605/3-B ^5	Lab Control Sample Dup	Step 2	Solid	3010A	56605

SEP Batch: 56750

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 3	Solid	Non-Crystalline	
180-126602-3	SB-8-20.6-30.6	Step 3	Solid	Non-Crystalline	
MB 140-56750/1-B	Method Blank	Step 3	Solid	Non-Crystalline	
LCS 140-56750/2-B	Lab Control Sample	Step 3	Solid	Non-Crystalline	
LCSD 140-56750/3-B	Lab Control Sample Dup	Step 3	Solid	Non-Crystalline	

Prep Batch: 56796

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 3	Solid	3010A	56750
180-126602-3	SB-8-20.6-30.6	Step 3	Solid	3010A	56750
MB 140-56750/1-B	Method Blank	Step 3	Solid	3010A	56750
LCS 140-56750/2-B	Lab Control Sample	Step 3	Solid	3010A	56750
LCSD 140-56750/3-B	Lab Control Sample Dup	Step 3	Solid	3010A	56750

SEP Batch: 56869

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 4	Solid	Metal Hydroxide	
180-126602-3	SB-8-20.6-30.6	Step 4	Solid	Metal Hydroxide	
MB 140-56869/1-B	Method Blank	Step 4	Solid	Metal Hydroxide	
LCS 140-56869/2-B	Lab Control Sample	Step 4	Solid	Metal Hydroxide	
LCSD 140-56869/3-B	Lab Control Sample Dup	Step 4	Solid	Metal Hydroxide	

Prep Batch: 56877

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 4	Solid	3010A	56869
180-126602-3	SB-8-20.6-30.6	Step 4	Solid	3010A	56869
MB 140-56869/1-B	Method Blank	Step 4	Solid	3010A	56869
LCS 140-56869/2-B	Lab Control Sample	Step 4	Solid	3010A	56869
LCSD 140-56869/3-B	Lab Control Sample Dup	Step 4	Solid	3010A	56869

SEP Batch: 56928

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 5	Solid	Organic-Bound	
180-126602-3	SB-8-20.6-30.6	Step 5	Solid	Organic-Bound	
MB 140-56928/1-B ^5	Method Blank	Step 5	Solid	Organic-Bound	
LCS 140-56928/2-B ^5	Lab Control Sample	Step 5	Solid	Organic-Bound	
LCSD 140-56928/3-B ^5	Lab Control Sample Dup	Step 5	Solid	Organic-Bound	

Metals

Prep Batch: 57077

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 5	Solid	3010A	56928
180-126602-3	SB-8-20.6-30.6	Step 5	Solid	3010A	56928
MB 140-56928/1-B ^5	Method Blank	Step 5	Solid	3010A	56928
LCS 140-56928/2-B ^5	Lab Control Sample	Step 5	Solid	3010A	56928
LCSD 140-56928/3-B ^5	Lab Control Sample Dup	Step 5	Solid	3010A	56928

SEP Batch: 57111

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 6	Solid	Acid/Sulfide	
180-126602-3	SB-8-20.6-30.6	Step 6	Solid	Acid/Sulfide	
MB 140-57111/1-A	Method Blank	Step 6	Solid	Acid/Sulfide	
LCS 140-57111/2-A	Lab Control Sample	Step 6	Solid	Acid/Sulfide	
LCSD 140-57111/3-A	Lab Control Sample Dup	Step 6	Solid	Acid/Sulfide	

Prep Batch: 57212

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 7	Solid	Residual	
180-126602-3	SB-8-20.6-30.6	Step 7	Solid	Residual	
MB 140-57212/1-A	Method Blank	Step 7	Solid	Residual	
LCS 140-57212/2-A	Lab Control Sample	Step 7	Solid	Residual	
LCSD 140-57212/3-A	Lab Control Sample Dup	Step 7	Solid	Residual	

Analysis Batch: 58382

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 1	Solid	6010B SEP	56615
180-126602-1	SB-6-17-25	Step 2	Solid	6010B SEP	56636
180-126602-1	SB-6-17-25	Step 3	Solid	6010B SEP	56796
180-126602-3	SB-8-20.6-30.6	Step 1	Solid	6010B SEP	56615
180-126602-3	SB-8-20.6-30.6	Step 2	Solid	6010B SEP	56636
180-126602-3	SB-8-20.6-30.6	Step 3	Solid	6010B SEP	56796
MB 140-56505/1-B ^4	Method Blank	Step 1	Solid	6010B SEP	56615
MB 140-56605/1-B ^3	Method Blank	Step 2	Solid	6010B SEP	56636
MB 140-56750/1-B	Method Blank	Step 3	Solid	6010B SEP	56796
LCS 140-56505/2-B ^5	Lab Control Sample	Step 1	Solid	6010B SEP	56615
LCS 140-56605/2-B ^5	Lab Control Sample	Step 2	Solid	6010B SEP	56636
LCS 140-56750/2-B	Lab Control Sample	Step 3	Solid	6010B SEP	56796
LCSD 140-56505/3-B ^5	Lab Control Sample Dup	Step 1	Solid	6010B SEP	56615
LCSD 140-56605/3-B ^5	Lab Control Sample Dup	Step 2	Solid	6010B SEP	56636
LCSD 140-56750/3-B	Lab Control Sample Dup	Step 3	Solid	6010B SEP	56796

Analysis Batch: 58388

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 4	Solid	6010B SEP	56877
180-126602-1	SB-6-17-25	Step 5	Solid	6010B SEP	57077
180-126602-3	SB-8-20.6-30.6	Step 4	Solid	6010B SEP	56877
180-126602-3	SB-8-20.6-30.6	Step 5	Solid	6010B SEP	57077
MB 140-56869/1-B	Method Blank	Step 4	Solid	6010B SEP	56877
MB 140-56928/1-B ^5	Method Blank	Step 5	Solid	6010B SEP	57077
LCS 140-56869/2-B	Lab Control Sample	Step 4	Solid	6010B SEP	56877
LCS 140-56928/2-B ^5	Lab Control Sample	Step 5	Solid	6010B SEP	57077
LCSD 140-56869/3-B	Lab Control Sample Dup	Step 4	Solid	6010B SEP	56877

Metals (Continued)

Analysis Batch: 58388 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCSD 140-56928/3-B ^5	Lab Control Sample Dup	Step 5	Solid	6010B SEP	57077

Analysis Batch: 58429

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 6	Solid	6010B SEP	57111
180-126602-1	SB-6-17-25	Step 6	Solid	6010B SEP	57111
180-126602-3	SB-8-20.6-30.6	Step 6	Solid	6010B SEP	57111
180-126602-3	SB-8-20.6-30.6	Step 6	Solid	6010B SEP	57111
MB 140-57111/1-A	Method Blank	Step 6	Solid	6010B SEP	57111
LCS 140-57111/2-A	Lab Control Sample	Step 6	Solid	6010B SEP	57111
LCSD 140-57111/3-A	Lab Control Sample Dup	Step 6	Solid	6010B SEP	57111

Analysis Batch: 58657

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Step 7	Solid	6010B SEP	57212
180-126602-1	SB-6-17-25	Step 7	Solid	6010B SEP	57212
180-126602-3	SB-8-20.6-30.6	Step 7	Solid	6010B SEP	57212
180-126602-3	SB-8-20.6-30.6	Step 7	Solid	6010B SEP	57212
MB 140-57212/1-A	Method Blank	Step 7	Solid	6010B SEP	57212
LCS 140-57212/2-A	Lab Control Sample	Step 7	Solid	6010B SEP	57212
LCSD 140-57212/3-A	Lab Control Sample Dup	Step 7	Solid	6010B SEP	57212

Analysis Batch: 58727

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-126602-1	SB-6-17-25	Sum of Steps 1-7	Solid	6010B SEP	
180-126602-3	SB-8-20.6-30.6	Sum of Steps 1-7	Solid	6010B SEP	

Chain of Custody Record

eurofins | Environment Testing America

ive RIDC Park
PA 15238
+12) 963-7058 Phone (412) 963-2468

ent Information	Sampler: Shoredits, Andreas	Lab PM: Brown, Shali	Carrier Tracking No(s):	COC No: 180-73918-14290.2
Client Contact: Joju Abraham	Phone: (770) 380-0861	E-Mail: Shali.Brown@Eurofinset.com	State of Origin: Georgia	Page:
Company: Southern Company	PWSID:			Job #:
Address: 241 Ralph McGill Blvd SE B10185	Due Date Requested:			
City: Atlanta	TAT Requested (days): STANDARD			
State, Zip: GA, 30308	Compliance Project: Δ Yes Δ No			
Phone:	PO #: 6122201429.2109			
Email: JAbraham@southernco.com	WO #:			
Project Name: Arkwright MNA - AP-3	Project #: 18020201			
Site: Georgia	SSOW#:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010D_SEP_Calc - SEP - As Co Li Mo (Knoxville)	6010D_Total AsCo Li Mo (Knowville)	SEP on HOLD pending Total Metals	Lloyd_Kahn_Mod - Lloyd Kahn	D422 - Grain Size (Sieve&Hydrometer) (sub Burlington)	9081 - Cation Exchange Capacity (CEC) (sub Xenco CC)	Arsenic Speciation (Pittsburgh)	Moisture - Moisture/Solids for dry weight	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N	N	I	N	I	I	N	X	
SB-6-17-25	9/1/21	09:30	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-7-20-30	9/1/21	16:00	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-8-20.6-30.6	9/1/21	10:40	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis
SB-9-29.6-39.6	9/1/21	13:55	C	S			X	X	X	X	X	X		X	5	Co Li Mo for Total Metal and Pending SEP analysis

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

180-126602 Chain of Custody

Possible Hazard Identification
■ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ■ Disposal By Lab ☐ Archive For Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method of Shipment:

Relinquished by: Andreas Shoredits	Date/Time: 09/01/2021 18:30	Company: Wood E&IS	Received by: D Watson	Date/Time: 9-2-21 9 30	Company: ETAP/T
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

(412) 963-7058
REF: S180-73954
RMA:

FedEx Express

FedEx
TRK# 0221 1516 9332 3599

THU - 02 SEP 10:30
PRIORITY OVERNIGH

NA AGCA

15238
PA-US PI

Uncorrected temp 2.8 °C
Thermometer ID 16
CF 0 Initials
PT-WI-SR-001 effective 11/8/18

#5138334 09/01 56DJ3/169A/FE4A

180-126602 Waybill

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive RIDC Park
Pittsburgh, PA 15238
Phone: 412-963-7058 Fax: 412-963-2468

Chain of Custody Record

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Brown, Shali	Carrier Tracking No(s):	COC No: 180-443234.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Shali.Brown@Eurofinset.com	State of Origin: Georgia	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note):		Job #: 180-126602-1
Address: 5815 Middlebrook Pike, ,	Due Date Requested: 9/16/2021			
City: Knoxville	TAT Requested (days):			
State, Zip: TN, 37921				
Phone: 865-291-3000(Tel) 865-584-4315(Fax)	PO #:			
Email:	WO #:			
Project Name: Plant Arkwright MNA AP-3	Project #: 18020201			
Site: Arkwright	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010B/SEP_Tot_Prep (MOD) Total	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SB-6-17-25 (180-126602-1)	9/1/21	09:30 Eastern		Solid			X	1	SEP pending Total results
SB-7-20-30 (180-126602-2)	9/1/21	16:00 Eastern		Solid			X	1	SEP pending Total results
SB-8-20.6-30.6 (180-126602-3)	9/1/21	10:40 Eastern		Solid			X	1	SEP pending Total results
SB-9-29.6-39.6 (180-126602-4)	9/1/21	13:55 Eastern		Solid			X	1	SEP pending Total results

180-126602 Chain of Custody

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins TestAmerica.

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Unconfirmed	☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1	Mo	9/3/21 1700	DAPT		9-4-21 09:45	EAXW
2	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 06/08/2021

Loc: 180
126602

EUROFINS/TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST

Log In Number:

Review Items	Yes	No	NA	If No, what was the problem?	Comments/Actions Taken
1. Are the shipping containers intact?	✓			☐ Containers, Broken	CUSTODY SEALS INTACT
2. Were ambient air containers received intact?			✓	☐ Checked in lab	RECEIVED AT RT 0.3 / CT 0.4°C
3. The coolers/containers custody seal if present, is it intact?	✓			☐ Yes ☐ NA	AFD 9-4-21 1 COOLER FED EX # 1689 5109 2040 PRS
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID : SC71 Correction factor: +0.1°C	✓			☐ Cooler Out of Temp, Client Contacted, Proceed/Cancel ☐ Cooler Out of Temp, Same Day Receipt	
5. Were all of the sample containers received intact?	✓			☐ Containers, Broken	
6. Were samples received in appropriate containers?	✓			☐ Containers, Improper; Client Contacted; Proceed/Cancel	
7. Do sample container labels match COC? (IDs, Dates, Times)	✓			☐ COC & Samples Do Not Match ☐ COC Incorrect/Incomplete ☐ COC Not Received	
8. Were all of the samples listed on the COC received?	✓			☐ Sample Received, Not on COC ☐ Sample on COC, Not Received	
9. Is the date/time of sample collection noted?	✓			☐ COC; No Date/Time; Client Contacted	**Labeling Verified by:** **Date:**
10. Was the sampler identified on the COC?			✓	☐ Sampler Not Listed on COC	
11. Is the client and project name/# identified?	✓			☐ COC Incorrect/Incomplete	**pH test strip lot number:**
12. Are tests/parameters listed for each sample?	✓			☐ COC No tests on COC	
13. Is the matrix of the samples noted?	✓			☐ COC Incorrect/Incomplete	
14. Was COC relinquished? (Signed/Dated/Timed)	✓			☐ COC Incorrect/Incomplete	
15. Were samples received within holding time?	✓			☐ Holding Time - Receipt	
16. Were samples received with correct chemical preservative (excluding Encore)?			✓	☐ pH Adjusted, pH Included (See box 16A) ☐ Incorrect Preservative	
17. Were VOA samples received without headspace?			✓	☐ Headspace (VOA only)	
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:			✓	☐ Residual Chlorine	
19. For 1613B water samples is pH<9?			✓	☐ If no, notify lab to adjust	
20. For rad samples was sample activity info. Provided?			✓	☐ Project missing info	

	Box 16A: pH Preservation	Box 18A: Residual Chlorine
Preservative:		
Lot Number:		
Exp Date:		
Analyst:		
Date:		
Time:		

Project #: ____________ PM Instructions: ____________

Sample Receiving Associate: [signature] Date: 9-4-21

QA026R32.doc, 062719

Login Sample Receipt Checklist

Client: Southern Company

Job Number: 180-126602-2

Login Number: 126602

List Source: Eurofins Pittsburgh

List Number: 1

Creator: Watson, Debbie

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.	True	
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	

Quantitative XRD Analysis

October 2021

Ellington Geological Services, LLC

Ellington Geological Services

Quantitative XRD Analysis

Bulk and Clay

8 Samples

by

Yingqian (Chan) Xiong

18 October 2021

Ellington Geological Services, LLC
1414 Lumpkin Road
Houston, TX 77040 USA
T: +1 281-888-9154
www.ellingtongeo.com

1. Samples

Well/Sample ID	Depth (m/ft)	Number of Samples	Study
SB-1,SB-3 – SB-9	N/A	8	XRD

2. Methods

X-Ray Diffraction (XRD)

X-ray diffraction (XRD) analysis was utilized to identify minerals and quantify weight percentage. In XRD analysis, a focused X-ray beam interacts with the electrons in minerals' atomic crystal structure, recording regular and diagnostic patterns indicative of mineral crystal dimensions. Characteristic diffraction peaks were used by the interpreters to identify individual mineral phases. Our software allows for the careful selection of experimental parameters in modeling the experimental patterns to determine mineral weight percentages.

Instrument

Bruker D2

Sample Preparation

These bulk samples were disaggregated with a mortar and pestle and then micronized. The samples were spray dried and fine powder of each sample was carefully top loaded into an XRD sample holder for maximize random grain orientation and an even surface. Then each sample was run at 0.020 degree/step. The clay fractions were separated after dispersed in distilled water with dispersant (Sodium Hexametaphosphate). Clay suspensions were then deposited to glass slides. Each clay sample was dried at low temperature (60 degree Celcius) prior to XRD analysis and then saturated overnight by ethylene glycol for subsequent analysis. Occasionally, a heat treatment is necessary, in which case the slides are heated for 1 hour at 550°C prior to further XRD analysis.

Data Processing

Mineral identification was performed with JADE version 9.5 software. This version is equipped with the International Centre for Diffraction Data's (ICDD) PDF-2 Minerals Database, containing over 298,000 reference-XRD patterns. Quantitative analysis of

minerals was performed by the Rietveld method with no accounting for any amorphous phases. The results are normalized to 100% based on the assumption that the complete mineral content of the sample is accounted for in the XRD patterns.

3. Summary of Results

- There are no carbonates in this set of samples.
- Maghemite and goethite present in the first sample SB-1, in which kaolinite is the major mineral.
- Quartz and plagioclase are the major minerals in all other samples SB-3 to SB-9. Smectite presents in sample SB-6 and SB-9.

4. Data File

The data are in .xlsx format with file name “2021-1124_Wood_Arkwright AP2 DAS & AP3_XRD B+C_XRF_ICP Results” Tab “XRD”.

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Sample Type: **Soil**

Results of XRF Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **XRF**

Displayed as Elements Only

Project	Sample	Al (ppm)	Si (ppm)	Ti (ppm)	Fe (ppm)	Mn (ppm)	Mg (ppm)	Ca (ppm)	K (ppm)	P (ppm)	Na (ppm)	S (ppm)	As (ppm)	Ba (ppm)	Bi (ppm)	Cd (ppm)	Co (ppm)	Cl (%)	Cr (ppm)	Cu (ppm)	Hg (ppm)	La (ppm)	Mo (ppm)
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	98,000	146,000	8,700	241,200	3,124	41,900	5,661	ND	661	ND	ND	ND	852	ND	ND	ND	ND	727	ND	ND	ND	ND
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	75,500	294,100	ND	53,700	1,104	60,300	22,218	ND	ND	ND	ND	ND	590	ND	ND	ND	ND	574	ND	ND	ND	12
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	73,200	307,300	ND	58,700	929	66,400	27,371	ND	ND	ND	ND	ND	381	ND	ND	ND	ND	ND	ND	ND	ND	7
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	96,300	287,300	4,500	71,600	1,150	66,800	28,758	ND	ND	ND	ND	ND	405	ND	ND	ND	ND	853	ND	ND	ND	9
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	124,100	201,600	5,700	150,400	2,891	68,100	36,546	ND	ND	ND	ND	ND	221	ND	ND	ND	ND	898	ND	ND	ND	ND
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	80,700	259,000	4,000	81,600	2,130	61,700	36,547	ND	ND	ND	ND	ND	182	ND	ND	ND	ND	766	ND	ND	ND	15
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	112,300	222,800	4,300	107,200	2,225	63,900	27,048	ND	ND	ND	ND	ND	301	ND	ND	ND	ND	597	ND	ND	ND	5
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	85,800	277,200	ND	72,300	1,459	59,800	30,903	ND	ND	ND	ND	ND	197	ND	ND	ND	ND	670	ND	ND	ND	8

Displayed with Major Oxides

Project	Sample	Al2O3 (%)	SiO2 (%)	TiO2 (%)	Fe2O3 (%)	MnO (%)	MgO (%)	CaO (%)	K2O (%)	P2O5 (%)	Na2O (%)	S (ppm)	As (ppm)	Ba (ppm)	Bi (ppm)	Cd (ppm)	Co (ppm)	Cl (%)	Cr (ppm)	Cu (ppm)	Hg (ppm)	La (ppm)	Mo (ppm)
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	18.5	31.2	1.5	34.5	0.4	6.9	0.8	ND	0.2	ND	ND	ND	852	ND	ND	ND	ND	727	ND	ND	ND	ND
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	14.3	62.9	ND	7.7	0.1	10.0	3.1	ND	ND	ND	ND	ND	590	ND	ND	ND	ND	574	ND	ND	ND	12
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	13.8	65.7	ND	8.4	0.1	11.0	3.8	ND	ND	ND	ND	ND	381	ND	ND	ND	ND	ND	ND	ND	ND	7
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	18.2	61.5	0.8	10.2	0.1	11.1	4.0	ND	ND	ND	ND	ND	405	ND	ND	ND	ND	853	ND	ND	ND	9
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	23.4	43.1	1.0	21.5	0.4	11.3	5.1	ND	ND	ND	ND	ND	221	ND	ND	ND	ND	898	ND	ND	ND	ND
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	15.2	55.4	0.7	11.7	0.3	10.2	5.1	ND	ND	ND	ND	ND	182	ND	ND	ND	ND	766	ND	ND	ND	15
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	21.2	47.7	0.7	15.3	0.3	10.6	3.8	ND	ND	ND	ND	ND	301	ND	ND	ND	ND	597	ND	ND	ND	5
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	16.2	59.3	ND	10.3	0.2	9.9	4.3	ND	ND	ND	ND	ND	197	ND	ND	ND	ND	670	ND	ND	ND	8

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Sample Type: **Soil**

Results of XRF Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **XRF**

Displayed as Elements Only

Project	Sample	Nb (ppm)	Ni (ppm)	Pb (ppm)	Se (ppm)	Sn (ppm)	Sr (ppm)	Ta (ppm)	Th (ppm)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	ND	ND	ND	ND	ND	81	ND	ND	ND	ND	ND	35	204	77
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	10	ND	ND	ND	ND	244	ND	ND	ND	ND	ND	29	71	155
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	4	ND	ND	ND	ND	229	ND	ND	ND	ND	ND	16	64	95
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	12	ND	24	ND	ND	324	99	18	ND	ND	ND	24	85	196
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	7	ND	ND	ND	ND	85	ND	ND	ND	ND	ND	55	172	95
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	7	ND	ND	ND	ND	195	ND	ND	ND	ND	ND	41	122	122
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	9	ND	ND	ND	ND	149	ND	ND	ND	ND	ND	62	143	94
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	4	ND	ND	ND	ND	284	ND	ND	ND	ND	ND	34	116	87

Displayed with Major Oxides

Project	Sample	Nb (ppm)	Ni (ppm)	Pb (ppm)	Se (ppm)	Sn (ppm)	Sr (ppm)	Ta (ppm)	Th (ppm)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	ND	ND	ND	ND	ND	81	ND	ND	ND	ND	ND	35	204	77
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	10	ND	ND	ND	ND	244	ND	ND	ND	ND	ND	29	71	155
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	4	ND	ND	ND	ND	229	ND	ND	ND	ND	ND	16	64	95
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	12	ND	24	ND	ND	324	99	18	ND	ND	ND	24	85	196
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	7	ND	ND	ND	ND	85	ND	ND	ND	ND	ND	55	172	95
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	7	ND	ND	ND	ND	195	ND	ND	ND	ND	ND	41	122	122
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	9	ND	ND	ND	ND	149	ND	ND	ND	ND	ND	62	143	94
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	4	ND	ND	ND	ND	284	ND	ND	ND	ND	ND	34	116	87

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Soil

Results of X-Ray Diffraction (XRD) Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **XRD**

		wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%
		CLAYS					CARBONATES			OTHER MINERALS												TOTALS	
Project	Sample	Smectite	Chlorite	Kaolinite	Illite/Mica	Mx IS	Calcite	Dolomite	Siderite	Quartz	K-Feldspar	Plagioclase	Pyroxene	Maghemite	Hematite	Pyrite	Goethite	Sepiolite	Apatite	Amphibole	Clays	Carbonates	Other
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	3.3	-	66.3	1.5	10.3	-	-	-	-	-	7.0	1.2	6.4	-	-	3.4	-	-	0.6	81.4	-	18.6
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	-	-	-	3.7	1.9	-	-	-	46.4	7.3	35.5	-	-	-	-	-	-	-	5.2	5.6	-	94.4
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	-	-	-	6.3	2.6	-	-	-	52.3	1.7	31.2	-	-	-	0.6	-	-	-	5.3	8.9	-	91.1
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	-	-	-	11.1	1.8	-	-	-	39.2	-	47.9	-	-	-	-	-	-	-	-	12.9	-	87.1
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	2.4	-	12.5	0.4	4.3	-	-	-	22.7	2.4	13.1	-	-	-	-	-	1.8	-	40.4	19.6	-	80.4
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	-	-	-	3.5	2.1	-	-	-	32.1	1.6	41.4	2.4	-	-	-	-	-	-	16.9	5.6	-	94.4
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	-	-	8.9	18.9	1.3	-	-	-	16.9	-	40.8	1.7	-	-	-	-	-	-	11.5	29.1	-	70.9
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	0.9	-	2.0	1.4	2.7	-	-	-	48.6	-	32.8	1.0	-	-	-	-	-	-	10.6	7.0	-	93.0
																						-	

Notes: Due to detection limits for minerals quantified at less than 1%, the level of uncertainty dictates that presence is not necessarily definitive.

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Sample Type: **Soil**

Results of ICP Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **ICP (ME-MS41L)**

Project	Sample	Au ppm	Ag ppm	Al %	As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	0	0	4.0	1	<10	1,495	2	0	0.5	0	27	114	126	4	141	16.2	15	0	1	<0.004	0	0.1
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	0	0	1.1	0	<10	181	0	0	0.3	0	15	8	194	2	38	2.2	5	0	0	0	0	0.4
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	0	0	1.5	1	<10	172	0	0	0.3	0	12	15	223	2	31	2.4	5	0	0	<0.004	0	0.7
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	0	0	1.6	0	<10	280	0	0	0.2	0	22	17	236	2	53	3.6	8	0	0	<0.004	0	0.9
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	0	0	3.0	0	<10	284	2	0	0.4	0	24	82	202	3	115	5.0	11	0	0	<0.004	0	0.4
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	<0.0002	0	1.6	0	<10	147	0	0	0.8	0	21	16	317	2	53	3.4	6	0	0	<0.004	0	0.5
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	0	0	2.5	0	<10	294	1	0	0.4	0	21	30	161	3	42	4.5	10	0	0	<0.004	0	1.0
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	0	0	1.4	0	<10	157	1	0	0.3	0	20	11	191	1	61	2.1	5	0	0	<0.004	0	0.4

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Sample Type: **Soil**

Results of ICP Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **ICP (ME-MS41L)**

Project	Sample	La ppm	Li ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm	Ni ppm	P %	Pb ppm	Pd ppm	Pt ppm	Rb ppm	Re ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Te ppm
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	10	14	1.3	2,530	1	0.0	0	95	0.1	4	0	<0.002	7	0	0.0	0	34	0	2	62	<0.005	0
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	8	8	0.5	359	6	0.0	0	26	0.0	4	<0.001	<0.002	28	0	0.0	0	6	0	2	14	<0.005	<0.003
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	5	12	0.9	264	5	0.0	0	38	0.0	4	0	<0.002	53	0	0.0	0	5	0	3	20	<0.005	0
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	11	13	1.0	397	6	0.0	0	40	0.0	2	<0.001	<0.002	59	0	<0.01	0	13	0	1	30	<0.005	0
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	17	18	1.1	1,040	2	0.1	0	50	0.0	10	<0.001	<0.002	38	0	0.0	0	22	0	1	8	<0.005	0
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	8	6	0.8	898	10	0.1	0	38	0.1	3	<0.001	<0.002	23	0	<0.01	0	13	0	1	14	<0.005	0
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	9	8	1.0	1,310	5	0.1	0	23	0.0	4	0	<0.002	70	0	0.0	0	18	0	1	9	<0.005	<0.003
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	11	5	0.6	519	4	0.0	0	34	0.0	4	<0.001	<0.002	24	0	<0.01	0	9	0	1	16	<0.005	0

Ellington Geological Services, LLC

1414 Lumpkin Rd.
Houston, TX 77043
https://www.ellingtongeo.com

Client: **Wood Environment and Infrastructure Solutions**
Client Project Name: **GPC Arkwright AP2 DAS and AP3**
Client Project Number: **6122201429 Phase 2109**
Depth Interval: **N/A**
Sample Type: **Soil**

Results of ICP Analysis

EA Project #: **2021-1124**
Report Date: **18 October 2021**
Sample Number: **8**
Data Type(s): **ICP (ME-MS41L)**

Project	Sample	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
GPC Arkwright AP2 DAS and AP3	SB-1-24.6-34.6	0	1.1	0	1	493	0	44	198	38
GPC Arkwright AP2 DAS and AP3	SB-3-15-25	2	0.2	0	1	56	0	11	49	2
GPC Arkwright AP2 DAS and AP3	SB-4-12-22	2	0.2	0	1	72	0	5	42	1
GPC Arkwright AP2 DAS and AP3	SB-5-15-25	4	0.2	0	0	93	0	6	64	0
GPC Arkwright AP2 DAS and AP3	SB-6-17-25	3	0.4	0	2	182	0	31	90	5
GPC Arkwright AP2 DAS and AP3	SB-7-20-30	2	0.3	0	1	93	0	18	65	2
GPC Arkwright AP2 DAS and AP3	SB-8-20.6-30.6	2	0.3	0	1	156	0	29	82	2
GPC Arkwright AP2 DAS and AP3	SB-9-29.6-39.6	3	0.2	0	1	50	0	15	59	1

Analytical Report

Laboratory Job ID: CA19337-NOV22

September 2022

SGS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

21-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19337-NOV22**
Reference: Tessier Leach

Copy: #2

CERTIFICATE OF ANALYSIS
Final Report - Revised

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	6: ARK-SO-GWC-124SB-A-15.0/23.9-20221018
Sample Date & Time					13-Sep-22 15:30	18-Oct-22 13:45
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	11	8
As [µg/g]	19-Jan-23	23:42	13-Feb-23	16:26	< 0.5	< 0.5
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	0.09	0.01
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	21	16
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	2.4	1.0
Mo [µg/g]	19-Jan-23	23:42	21-Feb-23	15:08	< 0.1	< 0.1

Analysis	7: ARAMW-9-41.0/41.63-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-20221018
Sample Date & Time	18-Oct-22 16:00	18-Oct-22 16:16
Al [µg/g]	63	89
As [µg/g]	< 0.5	< 0.5
Co [µg/g]	< 0.01	0.02
Fe [µg/g]	25	59
Li [µg/g]	< 2	< 2
Mn [µg/g]	0.6	1.6
Mo [µg/g]	< 0.1	< 0.1

Water Soluble Fraction

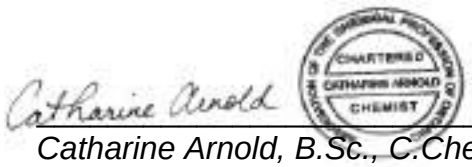
Revised with As and Mo added.

OnLine LIMS

0003237325

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA19337-NOV22**



Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

21-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19338-NOV22**
Reference: Tessier Leach

Copy: #3

CERTIFICATE OF ANALYSIS

Final Report - Revised

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17 SB-A/E-20.0/30.0-20220913	6: ARK-SO-GWC-12 4SB-A-15.0/23.9-20221018
Sample Date & Time					13-09-22 15:30	18-10-22 13:45
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	15	13
As [µg/g]	19-Jan-23	23:42	13-Feb-23	16:27	< 0.5	< 0.5
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	0.43	0.06
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	27	26
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	10:02	13	8.7
Mo [µg/g]	19-Jan-23	23:42	21-Feb-23	15:08	< 0.1	< 0.1

Analysis	7: ARAMW-9-41.0/41.3-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-20221018
Sample Date & Time	18-10-22 16:00	18-10-22 16:16
Al [µg/g]	50	81
As [µg/g]	< 0.5	< 0.5
Co [µg/g]	0.01	0.04
Fe [µg/g]	30	72
Li [µg/g]	< 2	< 2
Mn [µg/g]	6.0	9.5
Mo [µg/g]	< 0.1	< 0.1

Fraction 2 Exchangeable Metals

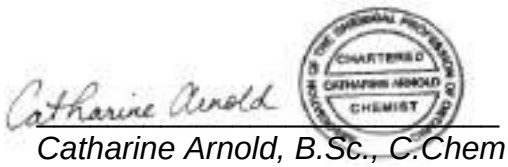
Revised with As and Mo added.

OnLine LIMS

0003237446

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA19338-NOV22**



Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

22-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19339-NOV22**

Copy: #3

CERTIFICATE OF ANALYSIS

Final Report - Revised

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17S B-A/E-20.0/30.0-20220913	6: ARK-SO-GWC-124 SB-A-15.0/23.9-20221018	7: ARAMW-9-41.0/41.3-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-20221018
Sample Date & Time					13-09-22 15:30	18-10-22 13:45	18-10-22 16:00	18-10-22 16:16
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	10:03	35	31	580	570
As [µg/g]	19-Jan-23	23:42	13-Feb-23	16:27	< 0.5	< 0.5	< 0.5	< 0.5
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	10:03	0.13	0.05	0.28	0.46
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	10:03	24	46	1200	1100
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	10:03	< 2	< 2	2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	10:03	5.1	5.3	32	45
Mo [µg/g]	19-Jan-23	23:42	21-Feb-23	15:09	< 0.1	< 0.1	< 0.1	< 0.1

Fraction 3 Metals Bound to Carbonates

Revised with As and Mo added.

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003239117

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

22-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19340-NOV22**
Reference: Tessier Leach

Copy: #3

CERTIFICATE OF ANALYSIS

Final Report - Revised

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17SB-A/E-20.0/30.0-220913	6: ARK-SO-GWC-124SB-A-15.0/23.9-21018	7: ARAMW-9-41.0/43-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-221018
Sample Date & Time			13-09-22 15:30	18-10-22 13:45	18-10-22 16:00	18-10-22 16:16
Al [µg/g]	31-Jan-23	10:03	410	220	1700	1800
As [µg/g]	13-Feb-23	16:28	< 0.5	< 0.5	< 0.5	< 0.5
Co [µg/g]	31-Jan-23	10:03	30	5.8	0.60	0.60
Fe [µg/g]	31-Jan-23	10:03	2700	2300	3500	4200
Li [µg/g]	31-Jan-23	10:03	< 2	< 2	2	3
Mn [µg/g]	31-Jan-23	10:03	950	340	56	75
Mo [µg/g]	21-Feb-23	15:09	< 0.1	< 0.1	< 0.1	< 0.1

Fraction 4 Metals Bound to Fe and Mn Oxides

Revised with As added.

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003239121

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

22-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19341-NOV22**
Reference: Tessier Leach

Copy: #3

CERTIFICATE OF ANALYSIS

Final Report - Revised

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17SB-A/E-20.0/30.0-220913	6: ARK-SO-GWC-124SB-A-15.0/23.9-20221018	7: ARAMW-9-41.0/41.3-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-20221018
Sample Date & Time			13-09-22 15:30	18-10-22 13:45	18-10-22 16:00	18-10-22 16:16
Al [µg/g]	31-Jan-23	10:03	510	540	730	940
As [µg/g]	13-Feb-23	16:28	< 0.5	< 0.5	< 0.5	< 0.5
Co [µg/g]	31-Jan-23	10:03	3.2	1.9	1.5	2.8
Fe [µg/g]	31-Jan-23	10:03	130	160	280	310
Li [µg/g]	31-Jan-23	10:03	< 2	< 2	2	3
Mn [µg/g]	31-Jan-23	10:03	88	91	23	47
Mo [µg/g]	21-Feb-23	15:09	0.3	0.1	< 0.1	< 0.1

Fraction 5 Bound to Organic Material

Revised with As and Mo added.

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003239130

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

22-February-2023

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 29 November 2022
LR Report: **CA19342-NOV22**
Reference: Tessier Leach

Copy: #3

CERTIFICATE OF ANALYSIS

Final Report - Revised

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	6: ARK-SO-GWC-124SB-A-15.0/23.9-20221018	7: ARAMW-9-41.0/41.3-20221018	8: ARAMW-9-9.5/96.6-100.7/1002.0-20221018
Sample Date & Time			13-09-22 15:30	18-10-22 13:45	18-10-22 16:00	18-10-22 16:16
Al [µg/g]	31-Jan-23	10:04	84000	58000	59000	61000
As [µg/g]	13-Feb-23	16:28	< 0.5	1.1	< 0.5	< 0.5
Co [µg/g]	31-Jan-23	10:04	15	12	3.9	3.6
Fe [µg/g]	31-Jan-23	10:04	69000	55000	17000	24000
Li [µg/g]	31-Jan-23	10:04	9	8	7	11
Mn [µg/g]	31-Jan-23	10:04	600	570	250	560
Mo [µg/g]	21-Feb-23	15:09	0.4	0.7	0.3	2.1

Fraction 6 Residual metals

Revised with As and Mo added.

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003239133

SGS

Request for Laboratory Services and CHAIN OF CUSTODY (General)

SGS Environmental Services - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365 Web: www.ca.sgs.com (4)

SGS Environmental Services - London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8066 Fax: 519-672-0361 Web: www.ca.sgs.com (4)

Laboratory Information Section

Received Date (mm/dd/yyyy): 10,24,2022 BF

LAB LIMS #: 19327 - 30-OCT22 & 19331-33-OCT22

Received Time (After Hours Only): __:__

Temperature Upon Receipt (°C): 18x3

Billing & Reporting Information

Invoice/Receipt to (3):

Company: Stantec

Attention: Shannon Zahuranec

Address: 3052 Beaumont Centre Circle, Lexington, KY 40513

Email: shannon.zahuranec@stantec.com

Project Name/Number: Arkwright Plant/175569434

P.O. #:

Quote #: 2022 1020

Attached Parameter List: ☐ YES ☐ NO

Turnaround Time

Is *Rush Turnaround Time Required? ☐ YES ☒ NO

Specify:

* Rush TA Requests Require Lab Approval

Client Information/Report To:

Client Lab #:

Company Name:	Stantec	Phone Number:	859-422-3122
Contact Name:	Shannon Zahuranec	Fax Number:	
Address:	3052 Beaumont Centre Circle, Lexington, KY 40513	E-mail:	shannon.zahuranec@stantec.com
Copy to:			

Sample Information

Analysis Requested

(please enter the analysis required below and check off which analysis applies to each sample)

Sample Identifier		Date Sampled (mm/dd/yy)	Time Sampled	# of Bottles	GSD	Total Metals – Sb,Al,As,B,Ba,Be,Ca,Cd,Cr,Co,F,Fe,Pb,Li,Hg,Mn,Mo,Mg,Na,Se,Tl	SEP Metals – Co,Li,Mn,Fe,Al	XRD				
ARK-SO-GWC-17SB-A/E-20.0/30.0-20220913	pulp/50:1	09/13/22	15:30	2		X	X					
ARK-SO-GWC-124SB-A-15.0/23.9-20221018	pulp/50:1	10/18/22	13:45	1	X	X	X	X				
ARAMW-9-41.0/41.3-20221018	Rock	10/18/22	16:00	1		X	X	X				
ARAMW-9-95.0/96.6-100.7/1002.0-20221018	Rock	10/18/22	16:16	1		X	X	X				

19327-30
19331-33

Notes:

Total Metals – Sb,Al,As,B,Ba,Be,Ca,Cd,Cr,Co,F,Fe,Pb,Li,Hg,Mn,Mo,Mg,Na,Se,Tl

SEP Metals – Co,Li,Mn,Fe,Al

Please perform total metals analyses and report results for review prior to conducting SEP metal analyses

Sampled By (1):	David Schroder	(Signature) David Schroder	Date:	10	18	22	(mm/dd/yy)
Relinquished by (2):	David Schroder	(Signature) David Schroder	Date:	10	19	22	(mm/dd/yy)

Note: (1) Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. (2) Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). (3) Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. (4) Completion of work may require the subcontracting of samples between the London and Lakefield laboratories.

12:30
FedEx BF

Analytical Report

Laboratory Job ID: CA19328-OCT22

September 2022

SGS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

29-November-2022

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

Phone: 859-422-3122
Fax:

Date Rec. : 27 October 2022
LR Report: **CA19328-OCT22**
Reference: Arkwright Plant/175569434

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: ARK-SO-GWC-17S B-A/E-20.0/30.0-20220913	6: ARK-SO-GWC-124S B-A-15.0/23.9-20221018
Sample Date & Time					13-Sep-22 15:30	18-Oct-22 13:45
Prep-Env AR [Prep]	01-Nov-22	13:02	04-Nov-22	16:55	1	1
Hg MS [ug/g]	03-Nov-22	19:56	04-Nov-22	16:55	< 0.05	< 0.05
As [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	13	4.1
Al [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	20000	15000
B [µg/g]	03-Nov-22	19:56	07-Nov-22	12:15	< 1	< 1
Ba [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	210	170
Be [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	2.6	0.45
Cd [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	0.13	0.05
Co [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	48	17
Cr [µg/g]	03-Nov-22	19:56	04-Nov-22	16:55	12	14
Fe [µg/g]	03-Nov-22	19:56	07-Nov-22	12:15	51000	35000
Li [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	7	6
Mn [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	1400	690
Mo [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	0.5	0.3
Pb [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	12	5.9
Sb [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	< 6	< 6
Se [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	< 0.7	< 0.7
Tl [µg/g]	03-Nov-22	19:56	04-Nov-22	16:56	0.20	0.11

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003139319

Analytical Report

Laboratory Job ID: CA19329-OCT22

October 2022

SGS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

29-November-2022

Stantec Consulting Ltd.
Attn : Shannon Zahuranec

3052 Beaumont Centre Circle
Lexington, Kentucky
40513, USA

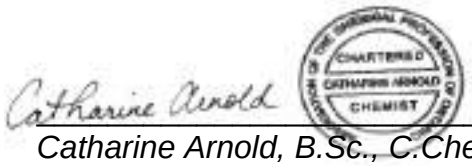
Phone: 859-422-3122
Fax:

Date Rec. : 27 October 2022
LR Report: **CA19329-OCT22**
Reference: Arkwright Plant/175569434

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	6: ARK-SO-GWC-124S B-A-15.0/23.9-20221018
Sample Date & Time					18-Oct-22 13:45
SiO2 [%]	01-Nov-22	03:31	02-Nov-22	13:50	53.2
Al2O3 [%]	01-Nov-22	03:31	02-Nov-22	13:50	17.9
Fe2O3 [%]	01-Nov-22	03:31	02-Nov-22	13:50	9.96
MgO [%]	01-Nov-22	03:31	02-Nov-22	13:50	2.51
CaO [%]	01-Nov-22	03:31	02-Nov-22	13:50	4.60
Na2O [%]	01-Nov-22	03:31	02-Nov-22	13:50	2.80
K2O [%]	01-Nov-22	03:31	02-Nov-22	13:50	1.20
TiO2 [%]	01-Nov-22	03:31	02-Nov-22	13:50	1.50
P2O5 [%]	01-Nov-22	03:31	02-Nov-22	13:50	0.33
MnO [%]	01-Nov-22	03:31	02-Nov-22	13:50	0.16
Cr2O3 [%]	01-Nov-22	03:31	02-Nov-22	13:50	0.02
V2O5 [%]	01-Nov-22	03:31	02-Nov-22	13:50	0.04
LOI [%]	01-Nov-22	03:31	02-Nov-22	13:50	5.53
Sum [%]	01-Nov-22	03:31	02-Nov-22	13:50	99.7



Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003139334

Quantitative X-Ray Diffraction by Rietveld Refinement

November 2022

SGS

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for:	*Environmental Services*
Project Number/ LIMS No.	*Custom XRD/MI4504-NOV22*
Sample Receipt:	*November 2, 2022*
Sample Analysis:	*November 4, 2022*
Reporting Date:	*December 16, 2022*

Instrument:	BRUKER AXS D8 Advance Diffractometer
Test Conditions:	Co radiation, 35 kV, 40 mA; Detector: LYNXEYE Regular Scanning: Step: 0.02°, Step time: 0.75s, 2θ range: 6-80°
Interpretations :	PDF2/PDF4 powder diffraction databases issued by the International Center for Diffraction Data (ICDD). DiffracPlus Eva and Topas software.
Detection Limit :	0.5-2%. Strongly dependent on crystallinity.

Contents:

Kim Gibbs, H.B.Sc., P.Geo.
Senior Mineralogist

Huyun Zhou, Ph.D., P.Geo.
Senior Mineralogist

ACCREDITATION: SGS Natural Resources Lakefield is accredited to the requirements of ISO/IEC 17025 for specific tests as listed on our scope of accreditation, including geochemical, mineralogical and trade mineral tests. To view a list of the accredited methods, please visit the following website and search SGS Canada Inc. - Minerals: https://www.scc.ca/en/search/palcan.

Method Summary

The Rietveld Method of Mineral Identification by XRD (ME-LR-MIN-MET-MN-D05) method used by SGS Natural Resources is accredited to the requirements of ISO/IEC 17025.

Mineral Identification and Interpretation:

Mineral identification and interpretation involves matching the diffraction pattern of an unknown material to patterns of single-phase reference materials. The reference patterns are compiled by the Joint Committee on Powder Diffraction Standards - International Center for Diffraction Data (JCPDS-ICDD) database and released on software as Powder Diffraction Files (PDF).

Interpretations do not reflect the presence of non-crystalline and/or amorphous compounds, except when internal standards have been added by request. Mineral proportions may be strongly influenced by crystallinity, crystal structure and preferred orientations. Mineral or compound identification and quantitative analysis results should be accompanied by supporting chemical assay data or other additional tests.

Quantitative Rietveld Analysis:

Quantitative Rietveld Analysis is performed by using Topas 4.2 (Bruker AXS), a graphics based profile analysis program built around a non-linear least squares fitting system, to determine the amount of different phases present in a multicomponent sample. Whole pattern analyses are predicated by the fact that the X-ray diffraction pattern is a total sum of both instrumental and specimen factors. Unlike other peak intensity-based methods, the Rietveld method uses a least squares approach to refine a theoretical line profile until it matches the obtained experimental patterns.

Rietveld refinement is completed with a set of minerals specifically identified for the sample. Zero values indicate that the mineral was included in the refinement calculations, but the calculated concentration was less than 0.05wt%. Minerals not identified by the analyst are not included in refinement calculations for specific samples and are indicated with a dash.

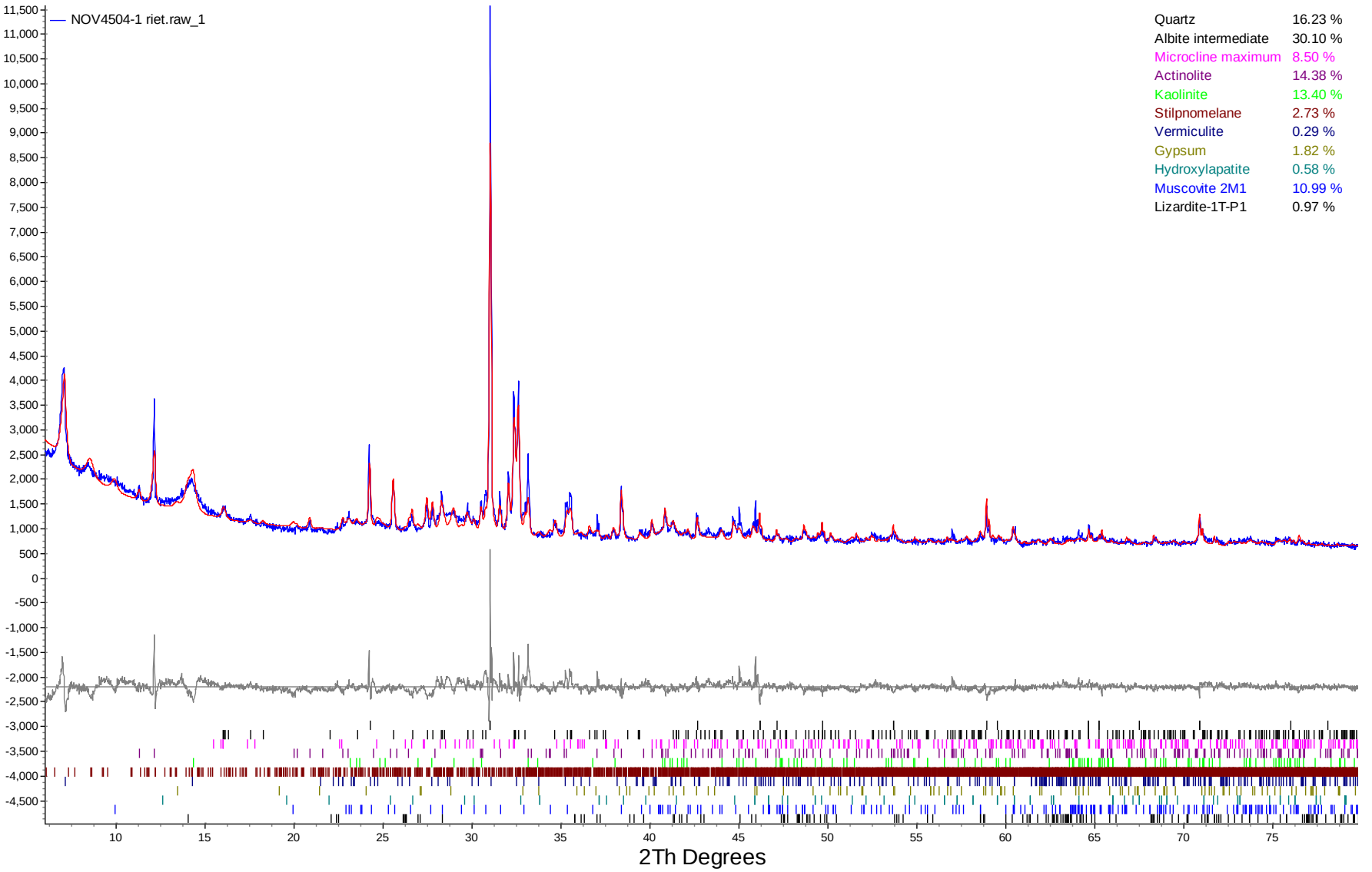
Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	ARK-SO-GWC-124SB-A-15.0/23.9-20221018 NOV4504-01 (wt %)
Quartz	16.2
Albite	30.1
Microcline	8.5
Actinolite	14.4
Kaolinite	13.4
Stilpnomelane	2.7
Vermiculite	0.3
Gypsum	1.8
Hydroxylapatite	0.6
Muscovite	11.0
Lizardite	1.0
TOTAL	100

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Mineral/Compound	Formula
Quartz	SiO_2
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
Kaolinite	$Al_2Si_2O_5(OH)_4$
Stilpnomelane	$K(Fe^{2+},Mg,Fe^{3+})_8(Si,Al)_{12}(O,OH)_{27}\cdot n(H_2O)$
Vermiculite	$(Mg,Al)_3(Si,Al)_4O_{10}(OH)_2\cdot 4H_2O$
Gypsum	$CaSO_4\cdot 2H_2O$
Hydroxylapatite	$Ca_5(PO_4)_3(OH)$
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Lizardite	$Mg_3Si_2O_5(OH)_4$

ARK-SO-GWC-124SB-A-15.0/23.9-20221018



Quartz	16.23 %
Albite intermediate	30.10 %
Microcline maximum	8.50 %
Actinolite	14.38 %
Kaolinite	13.40 %
Stilpnomelane	2.73 %
Vermiculite	0.29 %
Gypsum	1.82 %
Hydroxylapatite	0.58 %
Muscovite 2M1	10.99 %
Lizardite-1T-P1	0.97 %

APPENDIX C
TREATABILITY TESTING REPORTS

July 19, 2023

Angus McGrath
Stantec

TERRA SYSTEMS, INC. FINAL REPORT TO STANTEC FOR COAL ASH RESIDUE BATCH TREATABILITY STUDIES FOR PLANT ARKWRIGHT AP3

1.0 INTRODUCTION

Coal ash residue (CCR) landfill may generate acidic conditions which allow metals such as cobalt, arsenic, iron, lithium, molybdenum, and selenium to accumulate to levels above regulatory limits. This bench-scale treatability will evaluate neutralization/precipitation with three reagents to be chosen by Stantec to treat cobalt, arsenic, iron, lithium, molybdenum, and selenium. The Georgia groundwater protection standard (GWPS) for arsenic is 0.010 mg/L, cobalt is 0.006 mg/L, lithium is 0.04 mg/L, molybdenum is 0.1 mg/L, and selenium is 0.05 mg/L.

2.0 BENCH-SCALE STUDY SCOPE

The following phases were conducted for the treatability study:

Initial Characterization
The groundwater was analyzed for

- Field parameters pH, oxidation reduction potential (ORP), dissolved oxygen (DO), specific conductivity (SC), Hach ferrous iron, Hach sulfide, Hach alkalinity, and Hach hardness,
- Anions (chloride, fluoride, and sulfate)
- Major dissolved cations (calcium, magnesium, potassium, and sodium)
- Trace dissolved metals (arsenic, cobalt, iron, molybdenum, manganese, and selenium)
- Dissolved lithium
- Dissolved organic carbon (DOC)
- Total dissolved solids (TDS)

The soil was analyzed for percent moisture, soil density, and field holding capacity by TSI.

Batch Tests

- One location with site soil and ARAGWC-17 groundwater
- Evaluate up to five reagents at three dosages each
- Titrations with each reagent (with and without soil to evaluate buffer capacity)
- Include control samples
  - Groundwater, no reagent, no soil
  - Groundwater and soil, no reagent
  - Reagent blanks (up to 3, as needed)
- Measure six select dissolved metals (ICP-MS) and general chemistry (pH, ORP, SC) in treated samples and control samples
- 48-hour reaction time

- Soil pH (one sample)
  - Soil/water ratio is 40% soil to 60% water, reagent ratio to be determined

2.1 Previous Investigations for Cobalt from Coal Combustion Residual Impacted Groundwaters

Table 1 shows the results from treatability studies from seven groundwaters from other coal combustion residual sites that have elevated levels of cobalt. In these studies, four dosages (1, 2, 5, and 10 g/L) of potassium bicarbonate and four dosages (1, 2, 5, and 10 g/L) of sodium bicarbonate were used to raise the pH. In addition, zero valent iron (ZVI) at three loadings (0.5, 1.0, and 1.5 g/L) was evaluated for adsorption and precipitation of the cobalt. The initial dissolved cobalt levels ranged from 0.038 to 3.3 mg/L. The Groundwater Protection Standard (GWPS) for cobalt was 0.006 mg/L. No treatment was able to reach the GWPS. The higher 5 and 10 g/L loadings of potassium bicarbonate and sodium bicarbonate were able to reduce the dissolved cobalt levels by 50% or more. Sodium bicarbonate performed slightly better than potassium bicarbonate. ZVI had little impact on the dissolved cobalt levels.

2.2 Bench-scale Groundwater and Soil Collection

Groundwater samples were collected from monitoring well ARAGWC-17 in eight 2.5-gallon cubicontainers (total of 89.9 kg including containers or 20 gallons) on September 6 to 7, 2022. The groundwater samples were received at Terra Systems, Inc. (TSI) on September 9, 2022. Saturated zone soil (20.8 kg) was collected from ARK-SO-GWC-17SB-A/E-20/30-09132022 on September 13, 2022, and received at TSI on September 14, 2022. Additional saturated zone soil was collected from ARK-SO-GWC-17SB-F (21.8 kg) and ARAMW-9 30-40 (38.6 kg) on October 2-3, 2022, and received at TSI on October 6, 2022. Fractured bedrock samples were collected from ARAMW-9 at 41-43’ (2.8 kg), 95-96.5’ (2.0 kg), 100.7-102’ (2.3 kg) on October 4, 2022, and received at TSI on October 6, 2022. Copies of the chain-of-custody forms are attached in Appendix I.

2.3 Baseline Characterization

At the beginning of the bench-scale treatability test, baseline characterization was performed to verify contaminant concentrations in the samples. Homogenized groundwater samples were analyzed for dissolved ions including calcium, magnesium, potassium, sodium and sulfate; DOC, and TDS by the Eurofins Lancaster Laboratories. Each cubicontainer was analyzed for dissolved metals including: arsenic, cobalt, iron, lithium, molybdenum, manganese, and selenium. The volume of samples for each analysis in the initial characterization are shown in Table 2. The analytical methods and detection limits followed by Eurofins Lancaster Laboratory are shown in Table 3. TSI measured pH in the soil and groundwater, ORP, DO, total suspended solids, specific conductivity, total and bicarbonate alkalinity, total hardness, ferrous iron, and sulfide in the aqueous phase using calibrated meters and Hach procedures.

Table 1. Percent Removal of Dissolved Cobalt from Previous CCR Investigations

Well	IC/Con 0 Conc mg/L	% Rem from IC	Control	1 g/L $KHCO_3$	2 g/L $KHCO_3$	5 g/L $KHCO_3$	10 g/L $KHCO_3$	1 g/L $NaHCO_3$	2 g/L $NaHCO_3$	5 g/L $NaHCO_3$	10 g/L $NaHCO_3$	0.5 g/L ZVI	1.0 g/L ZVI	1.5 g/L ZVI
GW-1	0.038	% Rem from IC	-10.5	2.6	0.0	2.6	5.3	2.6	-2.6	2.6	10.5	0.0	2.6	34.2
GW-2	0.33	% Rem from IC	-6.1	0.0	0.0	3.0	63.6	3.0	6.1	39.4	57.6	6.1	-3.0	15.2
GW-3	0.96	% Rem from IC	-14.6	0.0	6.2	54.2	75.0	4.2	6.2	60.4	76.0	-14.6	-4.2	-4.2
GW-4	3.3	% Rem from IC	-3.0	-12.1	-3.0	18.2	48.5	-12.1	-21.2	57.6	48.5	3.0	-3.0	-6.1
GW-5	0.46	% Rem from IC	2.2	6.5	13.0	21.7	71.7	8.7	13.0	45.7	71.7	4.3	10.9	15.2
GW-6	1.3	% Rem from IC	-7.7	0.0	0.0	66.9	75.4	0.0	-7.7	70.0	90.8	-15.4	0.0	0.0
GW-7	1.4	% Rem from IC	-14.3	-7.1	-7.1	-7.1	39.3	-21.4	-21.4	-7.1	57.9	-14.3	-14.3	-7.1

95.7 Dissolved metal reduced by more than 50%

Table 2. Analyses and Volumes for Initial Characterization

Analyses	GW Volume
	L
Cations in GW Total Mg, Na, K, Ca	0.25
GW Dissolved As, Co, Fe, Mo, Mn, Se	0.25
GW Dissolved Li	0.25
DOC	0.05
Sulfate, Chloride, and Fluoride	0.05
Total Dissolved Solids	0.5
Field Parameters	0.05
Soil Total As, Co, Fe, Mo, Mn, Se, % Moisture	
Total	1.75

Table 3. Analytes, Methods, and Detection Limits

Analyte	Method	Detection Limit mg/L
Arsenic	6020B ICP/MS	0.00070
Calcium	6010D ICP	0.096
Chloride	EPA 300.0 R2.1	0.6
Cobalt	6020B ICP/MS	0.000161
Fluoride	EPA 300.0 R2.1	0.090
Iron	6020B ICP/MS	0.0206
Lithium	6010D ICP	0.0113
Magnesium	6020B ICP/MS	0.040
Manganese	6020B ICP/MS	0.0000979
Molybdenum	6020B ICP/MS	0.000134
Potassium	6020B ICP/MS	0.204
Selenium	6020B ICP/MS	0.000286
Sodium	6020B ICP/MS	0.239
Sulfate	EPA 300.0 R2.1	0.5
TDS	2540C	48

2.4 Initial Characterization Results

As shown in Table 4, the composite groundwater was sampled for sulfate (162 mg/L), fluoride (<0.45 mg/L), chloride (3.1 mg/L), DOC (<0.5 mg/L), calcium (28.5 mg/L), magnesium (21.9 mg/L), potassium (1.79 mg/L), sodium (10.4 mg/L) and TDS (274 mg/L). Groundwater samples collected at 8:00, 8:40, 9:15, 9:50, 10:35, 14:00, 14:30, and 15:05 were analyzed for dissolved arsenic, cobalt, iron, lithium, manganese, molybdenum, and selenium. Lithium and molybdenum were non-detect (<0.000134 mg/L) in all samples There were low levels of dissolved arsenic below the GA GWPS of 0.010 mg/L (0.00125 to 0.0043 mg/L with an average of 0.00236 mg/L). Dissolved cobalt exceeded the GA GWPS of 0.006 mg/L with concentrations between 0.0547 and 0.0596 mg/L and an average of 0.0576 mg/L. Dissolved selenium was below the GA GWPS of 0.005 mg/L with concentrations between 0.000423 and 0.00122 mg/L and an average of 0.000597 mg/L. Dissolved iron ranged from 0.0919 and 0.192 mg/L with an average of 0.148 mg/L. Dissolved manganese ranged from 1.7 and 1.79 mg/L with an average of 1.74 mg/L.

The pH in the eight samples ranged from 5.2 to 5.8 SU, ORP (182 to 207 mV), DO (7.4 to 9.1 mg/L), specific conductivity (376 to 445 µS/cm), and total suspended solids (0 to 6.9 mg/L). The composite groundwater had a bicarbonate alkalinity of 40 mg/L as CaCO3, hardness of 180 mg/L as CaCO3, with no detected ferrous iron or sulfide; Hach procedures were used for these analyses.

Table 5 has the results for the soil samples. The ARK-SO-GWC-17SB-A/E-20/30-09132022 soil had a density of 1.64 g/cm^3 (about 102 pounds/cubic feet), field holding capacity of 0.10 g/g soil, and soil dry weight of 70.7%. A composite soil sample had 0.54 mg/kg arsenic, 31.3 mg/kg cobalt, 6.783 mg/kg lithium, 0.279 mg/kg molybdenum, and <0.104 mg/kg selenium. Other metals including 2,930 mg/kg calcium, 46,600 mg/kg iron, 999 mg/kg manganese, 6,140 mg/kg potassium, and 302 mg/kg sodium were detected. The soil contained 30.3 % moisture.

The composite ARK-SO-GWC-17SB-F and ARAMW-9 30-40’ soil had a density of 1.73 g/cm^3 (about 108 pounds/cubic feet), field holding capacity of 0.14 g/g soil, and soil dry weight of 82.3%. The composite soil sample saturated with groundwater contained 31.2% moisture (total porosity).

2.5 Titration Tests

Titrations were performed with the following:

- 100 g of composite groundwater and 25% sodium hydroxide
- 40 g soil plus 60 mL distilled water and 25% sodium hydroxide
- 40 g soil plus 60 g GW and 25% sodium hydroxide
- 100 g of composite groundwater and 0, 2, 5, and 10 g/L sodium bicarbonate
- 40 g soil plus 60 mL distilled water and 0, 2, 5, and 10 g/L sodium bicarbonate
- 40 g soil plus 60 g GW and 0, 2, 5, and 10 g/L sodium bicarbonate.

Table 4. Initial Groundwater Characterization Results

Well		GA GWPS	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17 Avg	GW Composite
Time Collected			8:00	8:40	9:15	9:50	10:35	14:00	14:30	15:05		
GW pH	SU		5.8	5.6	5.3	5.2	5.2	5.2	5.2	5.2		
GW ORP	mV		207	184	191	189	194	182	184	185		
GW DO	mg/L		7.5	9.1	7.8	7.6	7.4	8.0	8.2	7.9		
Specific Conductivity	µS/cm		445	409	385	380	376	381	389	386		
GW TSS	mg/L		6.9	0	2.0	1.0	1.2	0	0	0		
GW Hach Bicarbonate Alkalinity	mg/L											40
GW Hach Hardness as CaCO3	mg/L											180
GW Hach Ferrous Iron	mg/L											<0.01
GW Hach Sulfide	mg/L											<0.01
ELLE Results												
Sulfate	mg/L											162
Fluoride	mg/L											<0.45
Chloride	mg/L											3.1
Dissolved Organic Carbon	mg/L											<0.5
Dissolved Arsenic	mg/L	0.010	0.00377	0.00125	0.0043	0.00233	0.00209	0.00127	0.00218	0.00249	0.00246	
Dissolved Cobalt	mg/L	0.0060	**0.0583**	**0.0575**	**0.0575**	**0.0592**	**0.0596**	**0.0547**	**0.0579**	**0.0557**	**0.0576**	
Dissolved Iron	mg/L		0.113	0.162	0.0919	0.141	0.133	0.18	0.192	0.175	0.148	
Dissolved Lithium	mg/L	0.040	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	
Dissolved Manganese	mg/L		1.72	1.79	1.75	1.74	1.70	1.74	1.79	1.70	1.74	
Dissolved Molybdenum	mg/L	0.10	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	
Dissolved Selenium	mg/L	0.050	0.000504	0.000446	0.000505	0.000724	0.000423	0.000469	0.000484	0.00122	0.000597	
Total Calcium	mg/L											28.5
Total Magnesium	mg/L											21.9
Total Potassium	mg/L											1.79
Total Sodium	mg/L											10.5
Total Dissolved Solids	mg/L											274
GWPS = Georgia Groundwater Protection Standard												
123	Compound above GWPS											
	J Value, compound detected above method detection limit by below method calibration											
	Compound detected in laboratory blank associated with these samples											

Table 5. Soil Characterization

ARK-SO-GWC-17SB-A/E-20/30-09132022 Soil		
Total Arsenic	mg/kg	0.54
Total Calcium	mg/kg	2930
Total Cobalt	mg/kg	31.3
Total Iron	mg/kg	46600
Total Lithium	mg/kg	6.73
Total Magnesium	mg/kg	7440
Total Manganese	mg/kg	999
Total Molybdenum	mg/kg	0.279
Total Potassium	mg/kg	6140
Total Selenium	mg/kg	<0.104
Total Sodium	mg/kg	302
Moisture	%	30.3
Soil Density	g/cm^3	1.64
Soil Field Holding Capacity	g/g	0.10
Soil Dry Weight	%	70.7
Composite ARK-SO-GWC-17SB-F and ARAMW-9 30-40		
Composite Soil Dry Weight	%	82.3
Saturated Composite Soil Density	g/cm^3	1.73
Saturated Composite Soil Dry Weight	%	68.8
Porosity	%	31.2

Table 6. Titration Results

Treatment		Groundwater Only			Soil + DI			Soil + Groundwater		
		mL 25% NaOH	g/L NaOH	GW Composite pH	Soil mL 25% NaOH	g/kg soil NaOH	40 g Soil + 60 g DI pH	mL 25% NaOH	mg/kg 40% Soil Slurry NaOH	40 g Soil + 60 g GW pH
Soil pH	SU						6.4			6.1
250 g/L Sodium Hydroxide Titrations										
Groundwater	g	100								60
Soil	g				40					40
Distilled Water					60					
mL 250 g/L NaOH	pH	0	0	5.8	0		6.6	0	0	6.1
		0.01	0.025	6.7	0.04	0.250	6.7	0.015	0.0375	6.6
		0.02	0.0500	8.2	0.06	0.375	7.6	0.05	0.125	8.2
		0.03	0.075	9.4	0.08	0.500	7.7	0.07	0.175	8.5
					0.10	0.625	8.0	0.08	0.200	8.9
					0.12	0.750	8.8	0.09	0.225	9.0
					0.14	0.875	8.6			
					0.16	1.000	9.5			
Sodium Bicarbonate Titrations		Groundwater Only			Soil + DI			Soil + Groundwater		
Groundwater	g		100						40	
Soil	g					40			60	
Distilled Water	g					60				
g/L NaHCO3										
0			5.5			6.4			6.1	
2			7.4			7.0			7.0	
5			7.8			7.5			7.4	
10			8.1			7.6			7.7	

The groundwater had a pH of 5.8 SU. Adding 0.01 mL of 25% sodium hydroxide (0.025 g/L) increased the pH to 6.7, 0.05 g/L increased the pH to 8.2, and 0.075 g/L increased the pH to 9.4. With soil and distilled water (DI), the initial pH was 6.6. Additions of 0.25 g/kg NaOH increased the pH to 6.7, 0.625 g/kg to 8.0, and 1 g/kg to 9.5. With soil and groundwater (DI), the initial pH was 6.1. Additions of 0.0375 g NaOH/kg slurry increased the pH to 6.6, 0.125 g/kg to 8.2, and 0.225 g/kg to 9.0.

For the sodium bicarbonate titrations, 0, 2, 5, and 10 g/L sodium bicarbonate were added to the groundwater, soil and distilled water, and soil and groundwater. With the groundwater only, the pH was 5.5, 2 g/L increased the pH to 7.4, 5 g/L to 7.8, and 10 g/L to 8.1. With the soil and distilled water, the pH was 6.4, 2 g/L increased the pH to 7.0, 5 g/L to 7.5, and 10 g/L to 7.6. With the soil and groundwater, the pH was 6.1, 2 g/L increased the pH to 7.0, 5 g/L to 7.4, and 10 g/L to 7.7.

These titrations were used in the batch tests to determine the loadings of sodium hydroxide and sodium bicarbonate.

3.0 BATCH TESTS

3.1 Batch Reagent Selection

The bench-scale treatability study assumes that one of the following technologies can be used for in-situ remediation of the metals:

- elevated pH sorption/co-precipitation with sodium bicarbonate
- reduction with ferrous sulfide
- elevated pH sorption/co-precipitation with sodium hydroxide
- treatment with alkaline buffered ferrous sulfate (two formulations) and sorption onto iron precipitate

All reagents used for the bench-scale test were commercially available products. The reagent usages and their dosages could be adjusted according to the results of the activities and observations during the execution of the bench-scale treatability study. The following provides more detail on each of the reagents proposed for the bench-scale treatability testing:

- Sodium Bicarbonate: Sodium bicarbonate can increase the pH up to about 8.3 SU. Five loadings of 2, 5, 10, 20, and 50 g/L sodium bicarbonate were evaluated in the tests to determine the influence of pH on sorption/co-precipitation of the metals of interest in the groundwater and soil.
- Ferrous sulfide solution. Ferrous sulfide (FeS) is insoluble in water and has a pH of 9.5-12.5. Three loadings (30, 50, and 70 g/kg) of ferrous sulfide solution with suspended ferrous sulfide particles from (Ferroblack from Redox Technologies of Carmel, IN) were evaluated for the precipitation of the metals of interest.
- 25% Sodium Hydroxide. Three loadings of sodium hydroxide to achieve pHs of 6.5., 7.5, and 8.5 were evaluated in the tests to determine the sorption/co-precipitation of the metals of interest in the groundwater and soil.
- CERES 73MF2 – alkaline buffered ferrous sulfate. May include zeolite ion exchange, calcium carbonate, magnesium oxide, magnesium hydroxide, ferrous sulfate, iron powder, activated carbon, sulfide complex, and phosphate complex which generate iron oxyhydroxides that at neutral pH will sorb the metals of interest.

- CERES 73MF3 – alkaline buffered ferrous sulfate. May include zeolite ion exchange, calcium carbonate, magnesium oxide, magnesium hydroxide, ferrous sulfate, iron powder, activated carbon, sulfide complex, and phosphate complex.

3.2 Reagent Screening

The purpose of this step is to select the most appropriate reagent for the groundwater and soil samples.

The reagent dosages were determined from the baseline characterization and titration tests. A total of 24 reactors were set up.

- Control – 3 with first soil and one with the new composite soil
- Sodium Bicarbonate: 5 dosages 2, 5, 10, 20, and 50 g/L
- Sodium Hydroxide: 3 Dosages to achieve pH 6.5 (0.032 g), 7.5 (0.13 g), and 8.5 (0.23 g)
- Ferroblack: 3 Dosages of 30, 50, and 70 g/kg based upon recommendations from Redox Solutions
- CERES MTS 73MF2: 3 Dosages of 10, 30, and 50 g/kg based upon recommendations from CERES
- CERES MTS 73MF3: 3 Dosages of 10, 30, and 50 g/kg based upon recommendations from CERES

The first group batch studies used 720 g soil per bottle. The groundwater solutions were prepared with 0.7 L of composited groundwater and the reagents at the chosen dosages. The bottles were filled with the solutions. The volumes of solution needed to fill the bottles was recorded. The pH and ORP of the remaining solutions were recorded. All containers were mixed and turned daily for two days. Based on the recommendations from Redox Solutions (the supplier of the Ferroblack), these treatments were incubated for seven days. The Ferroblack treatments were also started a day later because the reagent was not delivered on time by Federal Express.
Groundwater samples (the supernatants in the reactors) were analyzed for:

- dissolved arsenic, cobalt, iron, molybdenum, and manganese
- dissolved lithium
- dissolved selenium in selected samples

The next group of batch studies with the CERES reagents used 382 g soil and 303 to 319 g groundwater. Analytical methods were the same as previous.

Eurofins Lancaster Laboratories (ELLE) conducted the metals analyses. The pH, ORP, dDO), bicarbonate alkalinity, total hardness, ferrous iron, total suspended solids, total dissolved solids, specific conductivity, and sulfide were conducted by TSI using calibrated meters and Hach procedures. The volumes were adjusted to account for required dilutions and volumes of water available.

Table 7. Batch Treatments Results

Treatment		GA GWPS	IC	Control	2 g/L NaHCO3	5 g/L NaHCO3	10 g/L NaHCO3	20 g/L NaHCO3	50 g/L NaHCO3	6.5 pH NaOH	7.5 pH NaOH	8.5 pH NaOH	30 g/L FeB	50 g/L FeB	70 g/L FeB
Soil	g			720	720	720	720	720	720	720	720.1	720	720	720	720
Groundwater for Solution	g			583	699	697	693	684	665	700	700	700	658	638	604
Reagent	g			0	1.4	3.5	7.0	14.0	35.0	0.033	0.13	0.224	45.4	68.6	96.7
Day				0	0	0	0	0	0	0	0	0	0	0	0
Solution pH	SU				7.5	7.9	8.1	8.2	8.2	7.5	10.1	11.3	12.1	12.5	12.7
Solution ORP	mV				164	146	157	187	168	144	144	97	-215	-293	-310
Volume Solution	g				588.0	595.9	599.8	601.7	618.2	650.6	602.4	602.6	562.7	660.8	609.3
Reagent Concentration	g/kg			0	0.90	2.26	4.54	16.71	42.93	0.022	0.085	0.146	28.5	46.9	63.3
Reagent Concentration	g/L				2.0	5.0	10.1	20.5	52.6	0.0	0.2	0.3	69.0	107.6	160.1
Soil + Groundwater pH	SU			6.0	7.5	7.4	7.7	8.0	8.0	6.4	7.6	8.5	9.1	10.2	10.5
Soil + Groundwater ORP	mV			215	149	156	180	190	161	175	160	130	-143	-148	-241
Day				2	2	2	2	2	2	2	2	2	7	7	7
pH	SU		6.1	6.1	6.9	7.1	7.4	7.8	8.0	6.1	6.4	7.0	8.5	8.6	8.6
ORP	mV		185	198	129	123	106	199	137	177	125	143	180	139	133
DO	mg/L		7.9	9.5	9.1	8.7	8.3	10.0	10.3	9.6	9.2	9.3	4.5	3.5	5.4
Specific Conductivity	µS/cm		386	471	1386	5880	10220	20200	37600	605	636	635	17380	24500	31300
Bicarbonate Alkalinity as CaCO3	mg/L		40	40	1080	2400	5400	10800	26400	120	120	120	60	40	40
Hardness as CaCO3	mg/L		180	240	240	360	480	480	4800	240	240	120	480	120	240
Ferrous Iron	mg/L		<0.01	0.52	0.30	0.35	0.48	0.08	0.06	0.42	0.50	0.32	0.32	1.4	3.4
Sulfide	mg/L		<0.01	<0.01	0.07	<0.01	0.01	0	0	<0.01	0.01	0.01	0.01	<0.01	0.03
Total Dissolved Solids	mg/L		274	5795	1047	2633	2077	12255	28895	0	515	0	7270	10637	14504
ELLE Results															
Dissolved Arsenic	mg/L	0.010	0.00246	**0.276**	**0.0506**	**0.0351**	**0.0277**	**0.0271**	**0.0936**	**0.0317**	**0.0257**	**0.0652**	**0.0438**	**0.0155**	0.00989
Dissolved Cobalt	mg/L	0.0060	**0.0576**	**0.0202**	0.00352	0.00169	0.00147	<0.00161	0.00165	**0.013**	0.00436	0.000521	0.00293	0.000492	0.000584
Dissolved Iron	mg/L		0.148	<0.0206	0.0495	<0.0206	0.0244	<0.206	<0.206	<0.0206	<0.0206	<0.0206	0.0553	<0.0206	<0.0206
Dissolved Lithium	mg/L	0.04	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	**<0.113**	**<0.113**	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113
Dissolved Manganese	mg/L		1.74	0.769	0.238	0.126	0.0862	0.0454	0.0301	0.541	0.257	0.0342	3.43	0.521	0.487
Dissolved Molybdenum	mg/L	0.100	<0.000134	0.0001880	0.000795	0.00184	0.00351	0.00431	0.00766	<0.000134	<0.000134	0.00111	0.0438	0.0655	**0.154**
Dissolved Selenium	mg/L	0.05	0.000597					0.00349	0.00421						

GA GWPS = Georgia Groundwater Performance Standard

0.022 Exceeds GA GWPS

0.039J value. Compound detected above method detection limit but below method calibration limit.

28 Compound detected in blank

Table 7. Batch Treatments Results

Sample		GA GWPS	New Soil Control	Control 2	MTS 73MF2 1%	MTS 73MF2 3%	MTS 73MF2 5%	MTS 73MF3 1%	MTS 73MF3 3%	MTS 73MF3 5%
Soil	g		720	382	382	382	382	382	382	382
Groundwater for Solution	g									
Reagent	g		0		3.8	11.5	19.1	3.8	11.5	19.1
Day			0	0	0	0	0	0	0	0
Solution pH	SU		6.3							
Solution ORP	mV		218							
Volume Solution	g		666.2	313.5	318.6	317.3	311.2	313.7	309.8	303.1
Reagent Concentration	g/kg				10	30	50	10	30	50
Reagent Concentration	g/L				12.0	36.1	61.4	12.2	37.0	63.0
Soil + Groundwater pH	SU		5.5	7.3	6.2	7.6	6.8	9.0	9.4	9.4
Soil + Groundwater ORP	mV		260	256	-11	-214	-274	-9	15	21
Day			2	5	5	5	5	5	5	5
pH	SU		7.3	6.1	6.9	8.3	7.6	9.0	9.6	9.6
ORP	mV		125	118	106	91	91	99	90	88
DO	mg/L		9.7	9.8	2.9	3.2	3.0	9.9	9.3	7.3
Specific Conductivity	µS/cm		466	486	1509	5790	8070	1781	7990	10620
Bicarbonate Alkalinity as CaCO3	mg/L		120	20	40	40	40	60	80	100
Hardness as CaCO3	mg/L		220	180	1080	2400	3840	1320	3600	6240
Ferrous Iron	mg/L		0.11	0.15	<0.025	0.1	5.18	0.15	<0.025	<0.025
Sulfide	mg/L		0.06	0.01	0.01	0.02	0.06	0.11	0.07	0.03
Total Dissolved Solids	mg/L		477	451	2384	5855	6667	3132	7608	13036
ELLE Results										
Dissolved Arsenic	mg/L	0.010	**0.0212**	**0.0117**	**0.0142**	0.00775	**0.0122**	**0.0341**	0.00561	**0.0452**
Dissolved Cobalt	mg/L	0.0060	**0.0303**	**0.0145**	0.000845	0.00116	0.00146	<0.000161	0.000247	0.000388
Dissolved Iron	mg/L		0.0448	0.169	0.0378	0.0327	0.0504	0.0448	0.0449	0.0387
Dissolved Lithium	mg/L	0.04	<0.0113		.					
Dissolved Manganese	mg/L		1.25	0.694	0.0352	0.267	1.77	0.0158	0.00902	0.00886
Dissolved Molybdenum	mg/L	0.100	<0.000134	0.000197	0.00157	0.000947	0.00227	0.00606	0.00788	0.00997
Dissolved Selenium	mg/L	0.05	0.000759	0.00053	0.000609	0.000407	0.000303	0.000923	0.00086	0.00129

GA GWPS = Georgia Groundwater Performance Standard

0.022 Exceeds GA GWPS

0.039 J value. Compound detected above method detection limit but below method calibration limit.

28 Compound detected in blank

3.3 Batch Results

Table 7 presents the results of the batch testing. The initial control on Day 0 had a pH of 6.0 SU and ORP of 215 mV. On Day 2, the control pH was 6.1 SU, ORP was 198 mV, DO of 9.5 mg/L, specific conductivity of 471 µS/cm, bicarbonate alkalinity of 40 mg/L as CaCO3, hardness of 240 mg/L as CaCO3, 0.52 mg/L ferrous iron, <0.01 mg/L sulfide, and TDS of 5,795 mg/L. Dissolved arsenic was 0.276 mg/L (likely leached from soil as the initial groundwater had only 0.00246 mg/L). There were trace levels of dissolved cobalt and molybdenum but below the GA GWPS. Dissolved manganese was 0.769 mg/L. Lithium and iron were non-detect.

With the sodium bicarbonate, the loadings in the solutions ranged from 2 to 50 g/L or 0.90 to 42.9 g/kg combined soil and groundwater. The solution pHs increased from 7.5 to 8.2 SU with ORPs of 146 to 187 mV. The Day 0 pH with the soil and groundwater increased from 7.4 to 8.0 SU. The Day 0 ORPs with the soil and groundwater were mildly oxidizing (149 to 190 mV). By Day 2, the pH had fallen to between 6.9 and 8.0 SU. Mildly oxidizing conditions were found (106 to 199 mV). The DO ranged from 8.3 to 10.0 mg/L. Specific conductivity increased to between 1,386 to 37,600 µS/cm due to the sodium and bicarbonate ions. Bicarbonate alkalinity ranged from 1,080 to 26,400 mg/L as $CaCO_3$. Hardness was elevated at between 240 and 4,800 mg/L as $CaCO_3$. Ferrous iron persisted at 0.06 to 0.48 mg/L. Only trace levels of sulfide were detected. The TDS were lower than the control from 2 to 10 g/L and increased with the higher sodium bicarbonate loadings. Dissolved arsenic decreased from 0.276 mg/L in the Control to between 0.0271 to 0.0936 mg/L but remained above the GA GWPS in all sodium bicarbonate loadings. Cobalt ranged from <0.00161 to 0.00352 mg/L, well below the GW GWPS. Little dissolved iron or molybdenum were detected. Lithium was not detected. Due to the matrix, lithium detection limits were elevated in the 20 and 50 g/L $NaHCO_3$ treatments. Dissolved manganese decreased from 0.238 to 0.0301 mg/L as the sodium bicarbonate loadings increased. Traces of selenium were detected in the 20 and 50 g/L $NaHCO_3$ treatments.

With the sodium hydroxide, the loadings in the solutions ranged from 0.047 to 0.32 g/L or 0.022 to 0.146 g/kg combined soil and groundwater. The solution pH increased from 7.5 to 11.3 SU with ORPs of 97 to 144 mV (the higher pHs impacted the ORP readings). The Day 0 pH with the soil and groundwater increased from 6.4 to 8.5 SU (close to the targets). The Day 0 ORPs were mildly oxidizing (130 to 175 mV). By Day 2, the pH had fallen to between 6.1 and 7.0 SU. Mildly oxidizing conditions were found (125 to 177 mV). The DO ranged from 9.2 to 9.6 mg/L. Specific conductivity increased to between 605 to 636 µS/cm due to the sodium and hydroxide ions. Bicarbonate alkalinity was 120 mg/L as $CaCO_3$. Hardness ranged between 120 and 240 mg/L as $CaCO_3$. Ferrous iron persisted at 0.32 to 0.50 mg/L. Only trace levels of sulfide were detected. The TDS were lower than the control and ranged from 0 to 515 mg/L. Dissolved arsenic decreased from 0.0317 to 0.0257 mg/L in the pH 6.5 and 7.5 treatments but was higher at the highest sodium hydroxide loading, 0.0652 mg/L. Dissolved arsenic remained above the GA GWPS. Cobalt ranged from 0.000521 to 0.013 mg/L, with only the 6.5 pH NaOH above the GW GWPS. No dissolved iron and little molybdenum were detected. Lithium was not detected. Dissolved manganese decreased from 0.541 to 0.0342 mg/L as the sodium hydroxide loadings increased.

Ferroblack was incubated for seven days and the loadings ranged from 30 to 70 g/L or 28.5 to 63.3 g/kg soil and groundwater. The solution pH increased from 12.1 to 12.7 SU with ORPs of -215 to -310 mV. The Day 0 pH with the soil and groundwater increased from 9.1 to 10.5 SU. The Day 0

ORPs were reducing (-143 to -241 mV). By Day 7, the pH had fallen to between 8.5 and 8.6 SU. Mildly oxidizing conditions were found (133 to 180 mV). The DO ranged from 3.5 to 5.4 mg/L. The ferrous sulfide solution had precipitated and the DO was measured in the supernatant in centrifuge tubes exposed to the atmosphere. Specific conductivity increased to between 17,380 to 21,300 µS/cm due to the ferrous sulfide. Bicarbonate alkalinity was low; 40-60 mg/L as $CaCO_3$. Hardness ranged between 120 and 480 mg/L as $CaCO_3$. Ferrous iron increased from 0.32 to 3.4 mg/L. If the Hach ferrous iron samples were turbid, they were filtered. However, color could still interfere with the colorimetric analyses. Only trace levels of sulfide were detected. The TDS were much higher than the control and ranged from 7,270 to 14,504 mg/L. Dissolved arsenic decreased from 0.0438 to 0.00989 mg/L. Only the 70 g/L FB treatment had dissolved arsenic below the GA GWPS. Cobalt ranged from 0.00492 to 0.00293 mg/L, well below the GA GWPS. Little dissolved iron was detected. Lithium was not detected. Dissolved manganese decreased from 3.43 mg/L to 0.487 mg/L. However, dissolved molybdenum increased from 0.0418 mg/L at the 30 g/L FB loading to 0.154 mg/L (above the GA GWPS) at the 70 g/L Ferroblack loading. The Ferroblack may have mobilized molybdenum from the soil where it was detected at 0.279 mg/kg although the Ferroblack solution contains molybdenum.

Additional controls were prepared with a composite of the ARK-SO-GWC-17SB-F and ARAMW-9 30-40' soils (new composite) and another control with the ARK-SO-GWC-17SB-A/E-20/30-09132022 soil. The groundwater used for the new composite on Day 0 had a solution pH of 6.3 SU and ORP of 218 mV. With the soil and groundwater, the pH was 5.5 SU and the ORP was 260 mV. On Day 2, the new composite control pH was 7.3 SU, ORP was 125 mV, DO of 9.7 mg/L, specific conductivity of 466 µS/cm, bicarbonate alkalinity of 120 mg/L as CaCO3, hardness of 220 mg/L as CaCO3, 0.11 mg/L ferrous iron, 0.06 mg/L sulfide, and TDS of 477 mg/L. Dissolved arsenic was 0.0212 mg/L (likely leached from soil as the initial groundwater had only 0.00246 mg/L). There was 0.0303 mg/L of dissolved cobalt (above the GA GWPS) and trace molybdenum but below the GA GWPS. Dissolved manganese was 1.25 mg/L and dissolved iron was 0.0448 mg/L. Lithium was non-detect.

The control with the ARK-SO-GWC-17SB-A/E-20/30-09132022 soil and groundwater had a pH was 7.3 SU and the ORP was 256 mV. On Day 2, the second control pH was 6.1 SU, ORP was 118 mV, DO of 9.8 mg/L, specific conductivity of 486 µS/cm, bicarbonate alkalinity of 20 mg/L as CaCO3, hardness of 180 mg/L as CaCO3, 0.15 mg/L ferrous iron, 0.01 mg/L sulfide, and TDS of 451 mg/L. Dissolved arsenic was 0.0117 mg/L (likely leached from soil as the initial groundwater had only 0.00246 mg/L). There was 0.0145 mg/L of dissolved cobalt (above the GA GWPS) and trace molybdenum and selenium but below the GA GWPS. Dissolved manganese was 0.694 mg/L and dissolved iron was 0.169 mg/L.

With the CERES MTS 73MF2 reagent incubated for five days, the loadings ranged from 12.0 to 61.4 g/L or 10 to 50 g/kg soil and groundwater. These reagents were added directly to the soil and groundwater and the solution pH and ORP were not measured. The Day 0 pH with the soil and groundwater ranged from 6.2 to 7.2 SU. The Day 0 ORPs were reducing (-11 to -274 mV). By Day 5, the pH ranged between 6.9 and 8.3 SU. Mildly oxidizing conditions were found (91 to 106 mV). The DO ranged from 2.9 to 3.2 mg/L but are likely lower due to measurement process allowing for oxygen entry. Specific conductivity increased to between 1,509 to 8,070 µS/cm due to the reagent. Bicarbonate alkalinity was low; 40 mg/L as $CaCO_3$. Hardness increased from 1,080

to 3,840 mg/L as $CaCO_3$. Ferrous iron as measured by the colorimetric Hach method increased from <0.02 to 5.18 mg/L which may suffer from interferences with colored samples. Only trace levels of sulfide were detected. The TDS were much higher than the control and ranged from 2,384 to 6,667 mg/L. Dissolved arsenic decreased from 0.0142 at the 10 g/kg loading to 0.00775 mg/L at the 30 g/kg loading but the 50 g/kg 73MTS MF2 loading was elevated at 0.0122 mg/L. Only the 30 g/L treatment had dissolved arsenic below the GA GWPS. Cobalt ranged from 0.000855 to 0.00146 mg/L, well below the GA GWPS. Little dissolved iron was detected. Lithium was not analyzed. Dissolved manganese increased from 0.0352 mg/L to 1.77 mg/L. Dissolved molybdenum ranged from 0.000947 mg/L to 0.00277 mg/L (below the GA GWPS). Trace levels of selenium were detected also.

With the CERES MTS 73MF3 reagent incubated for five days, the loadings ranged from 12.2 to 63 g/L or 10 to 50 g/kg soil and groundwater. These reagents were added directly to the soil and groundwater and the solution pH and ORP were not measured. The Day 0 pH with the soil and groundwater ranged from 9.0 to 9.4 SU. The Day 0 ORPs were mildly reducing (-9 to 21 mV). By Day 5, the pHs had ranged between 9.0 and 9.6 SU. Mildly oxidizing conditions were found (88 to 99 mV). The DO ranged from 7.3 to 9.9 mg/L. Specific conductivity increased to between 1,781 to 10,620 µS/cm due to the reagent. Bicarbonate alkalinity was low; 60 to 1000 mg/L as $CaCO_3$. Hardness increased from 1,320 to 6,240 mg/L as $CaCO_3$. Ferrous iron was low, <0.02 to 0.15 mg/L. Only trace levels of sulfide (0.03 to 0.11 mg/L) were detected. The TDS were much higher than the control and ranged from 3,132 to 13,036 mg/L. Dissolved arsenic decreased from 0.0341 mg/L at the 10 g/kg loading to 0.00561 mg/L at the 30 g/kg loading but the 50 g/kg 73MTS MF3 loading was elevated at 0.0452 mg/L. Only the 30 g/L treatment had dissolved arsenic below the GA GWPS. Cobalt ranged from <0.000161 to 0.000388 mg/L, well below the GA GWPS. Little dissolved iron was detected. Lithium was not analyzed. Dissolved manganese decreased from 0.0158 mg/L to 0.00886 mg/L. Dissolved molybdenum ranged from 0.00606 mg/L to 0.00997 mg/L (below the GA GWPS). Trace levels of selenium were detected also

Table 8 summarizes the percent removal from the Control Day 2. The initial characterization of the groundwater is not representative as it appears that some metals dissolved from the soil phase into the groundwater during incubation. Negative numbers mean increases from Control Day 2. > means the compound was not detected at Day 2 or 7 in the Control Day 2 with the detection limit used to calculate the percent removals. < means the compound was not detected in the Control at Day 0 but was detected at Day 2 or 7 in the treatment; the detection limit was used in calculation. Results in green were reduced to below the GA GWPS. Results in gray show metals where the Control was below the GA GWPS but the treatment was above the GA GWPS. The only treatments that reduced arsenic, which leached from the soil into the groundwater, below the GA GWPS were the 70 g/L FB, 3% MTS73MF2, and 3% MTS73MF3. All amended treatments reduced cobalt to below the GA GWPS. Dissolved molybdenum was below the GA GWPS except with the 70 g/L FB.

Table 9 summarizes the analyses of the sodium hydroxide, sodium bicarbonate, and Ferroblack reagents for total metals. The 10 g/L sodium bicarbonate and 0.5 g/L sodium hydroxide did not have any metals above the GA GWPS although there was detectable iron, manganese, and molybdenum and cobalt in the 10 g/L NaHCO3 treatment. The Ferroblack reagent at 50 g/L showed a moderate level of total arsenic (0.00197 mg/L, below the GA GWPS), cobalt of 0.0749

mg/L (above the GA GWPS), 15.5 mg/L total manganese, 2,070 mg/L total iron, 15.5 mg/L total manganese, and 0.357 mg/L total molybdenum. It is presumed that the acid used as a preservative extracted these metals from the Ferroblack matrix.

Please let me know if you have any questions about this final report.

Sincerely,
TERRA SYSTEMS, INC.

Michael D. Lee, Ph.D.
Vice-President Research and Development

Table 8. Percent Removals of Dissolved Metals from Day 2 Controls

Treatments	2 g/L $NaHCO_3$	5 g/L $NaHCO_3$	10 g/L NaHCO3	20 g/L $NaHCO_3$	50 g/L $NaHCO_3$	6.5 pH NaOH	7.5 pH NaOH	8.5 pH NaOH	30 g/L FeB	50 g/L FeB	70 g/L FeB
Dissolved Arsenic	81.7	87.3	90.0	90.2	66.1	88.5	90.7	76.4	84.1	94.4	96.4
Dissolved Cobalt	82.6	91.6	92.7	>92.0	91.8	35.6	78.4	97.4	85.5	97.6	97.1
Dissolved Iron	>-140.3		>-18.4								
Dissolved Lithium											
Dissolved Manganese	69.1	83.6	88.8	94.1	96.1	29.6	66.6	95.6	-346.0	32.2	36.7
Dissolved Molybdenum	-322.9	-878.7	-1767.0	-2192.6	-3974.5	<28.7	<28.7	-490.4	-23197.9	-34740.4	-81814.9

Treatments	New Control	Control 2	MTS 73MF2 1%	MTS 73MF2 3%	MTS 73MF2 5%	MTS 73MF3 1%	MTS 73MF3 3%	MTS 73MF3 5%			
Dissolved Arsenic	92.3	95.8	94.9	97.2	95.6	87.6	98.0	83.6			
Dissolved Cobalt	-50.0	28.2	95.8	94.3	92.8	>99.2	98.8	98.1			
Dissolved Iron											
Dissolved Lithium											
Dissolved Manganese	-62.5	9.8	95.4	65.3	-130.2	97.9	98.8	98.8			
Dissolved Molybdenum	>-13.6	-4.8	-735.1	-403.7	-1107.4	-3123.4	-4091.5	-5203.2			

< Compound not detected in Control Day 2. Detection limit used as Day 2 concentration.

< Compound not detected in Treatment Day 2 or 7. Detection limit used as Day 2 or 7 concentration for treatment.

Compound reduced to below GA GWPS

Compound increased to above GA GWPS

Table 9. Reagent Total Metals

Reagent		GA GWPS	0.5 g/L NaOH	10 g/L NaHCO3	50 g/L FB
Total Arsenic	mg/L	0.010	<0.00068	<0.00068	0.00917
Total Cobalt	mg/L	0.0060	<0.000156	0.000259	**0.0749**
Total Iron	mg/L		0.433	0.367	2,070
Total Lithium	mg/L	0.040	<0.011	<0.011	<0.110
Total Manganese	mg/L		0.0143	0.00948	15.5
Total Molybdenum	mg/L	0.10	0.000149	0.000584	**0.357**

0.039 J value. Compound detected above method detection limit but below method calibration limit.

0.022 Exceeds GA GWPS

APPENDIX I
SAMPLE RECEIPT CHAIN-OF-CUSTODIES

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

TERRA SYSTEMS, INC.

Chain of Custody

130 Hickman Road, Suite 1, Claymont, DE 19703 phone 302-798-9553 fax 302-798-9554

Client:	Stantec	Project Name:	GPC - Plant Arkwright Treatability		
Project Description:	Treatability Study	Project Manager /Contact:	Edgar Smith edgar.smithii@stantec.com Shannon Zahuranec shannon.zahuranec@stantec.com	Lot:	
Location:	Macon, Ga	Phone:	770-656-2676 / 859-619-6086		
Sampler:	Jackson Bankston				

Date	Time	Sample Identification	Sample Technique	Matrix	Preser-vative	Container Type	Number of Containers	Parameters for Analysis: Treatability								Remarks
9/6/2022	14:00	GWC17-09062022-01	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1400-1425
9/6/2022	14:30	GWC17-09062022-02	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1430-1457
9/6/2022	15:05	GWC17-09062022-03	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1505-1532
9/7/2022	8:00	GWC17-09062022-04	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0800-0835
9/7/2022	8:40	GWC17-09062022-05	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0840-0910
9/7/2022	9:15	GWC17-09062022-06	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0915-0945
9/7/2022	9:50	GWC17-09062022-07	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 950-1030
9/7/2022	10:35	GWC17-09062022-08	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1035-1100

Relinquished by (signature)	Date/time	Received by (signature)	Date/time
Jackson Bankston	9/8/2022 1500	Michael D Lee	9/9/22 10:00

Shipped to: Dr. Mike Lee

Terra Systems Incorporated

130 Hickman Road, Suite 1, Claymont, Delaware 19703

Date/time: 09/08/2022 / 15:00

Carrier/Airbill number: FedEx

Cooler Temperature: °C pH: Comments:

Cooler 1 of 4

CHAIN OF CUSTODY ENVIRONMENTAL SERVICES FORM

Stantec

Stantec Consulting Services, Inc.
4035 King Road
Suite D
Sylvania, Ohio 43560
Phone: (419) 843-1518

Client: Stantec / Southern Company	Client Project Name: Stantec / Southern Company
Contact: Shannon Zahuranec	Client Project Number: 175569434
Address:	Location: Plant Arkwright
City: Lexington	Sampled By: J. Schroder
State: KY Zip Code:	
Tel. (859) 422-3112	Stantec Work Order #:
~~Fax~~ Cell (859) 619-6089	
Email: Shannon.Zahuranec@Stantec.com	Results Due: ASAP
Client Purchase Order #:	

SAMPLE NUMBER	DATE	TIME	Client Sample Identification	MATRIX	COMPOSITE / GRAB	NO. OF CONTAINERS	Analytical Request: Treatability Testing
	9/13/22	1530	ARK-SO-GWC-1758-A/E-20230-09132022	S	C	3	X

9/13/22

Relinquished by:	Date	Time	Received By:	Remarks / Possible Hazards:
David Schroder Stantec	9/13/22	1700	~~Michael Lee~~	
Relinquished by:	Date	Time	Received By:	
	9/14/22	10:20	Michael Lee	
Relinquished by:	Date	Time	Received for Laboratory By:	Samples Received Intact (circle one): Yes / No Cooler Temperature:

TERRA SYSTEMS, INC.

Chain of Custody

130 Hickman Road, Suite 1, Claymont, DE 19703 phone 302-798-9553 fax 302-798-9554

Client:	Stantec	Project Name:	GPC - Plant Arkwright Treatability		
Project Description:	Treatability Study	Project Manager /Contact:	Edgar Smith edgar.smithii@stantec.com Shannon Zahuranec shannon.zahuranec@stantec.com	Lot:	
Location:	Macon, Ga	Phone:	770-656-2676 / 859-619-6086		
Sampler:	Jackson Bankston				

Date	Time	Sample Identification	Sample Technique	Matrix	Preser-vative	Container Type	Number of Containers	Parameters for Analysis: Treatability	Remarks
10/2/2022	16:10	ARK-SO-GWC-17SB-F	Rotary Sonic	SO	Ice/None	2 G Bucket	2	X	

Relinquished by (signature)	Date/time	Received by (signature)	Date/time
		Michael D Lee	10/6/22 10:00

Shipped to: Dr. Mike Lee

Terra Systems Incorporated

130 Hickman Road, Suite 1, Claymont, Delaware 19703

Date/time: 10/5/2022 / 1930

Carrier/Airbill number: FedEx

Cooler Temperature: °C pH: Comments:

Cooler of

Terra Systems
INCORPORATED

APPENDIX II
ELLE ANALYTICAL REPORTS

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster, PA 17601
Tel: (717)656-2300

Laboratory Job ID: 410-98086-1
Client Project/Site: Stantec CCR TS

For:
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Attn: Dr. Michael D Lee

Authorized for release by:
10/6/2022 3:29:03 AM

Marrissa Williams, Project Manager
(717)556-7246
Marrissa.Williams@et.eurofinsus.com

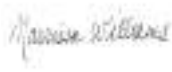
Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.



Marrissa Williams
Project Manager
10/6/2022 3:29:03 AM

Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-98086-1
Project/Site: Stantec CCR TS

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^3+	Reporting Limit Check Standard is outside acceptance limits, high biased
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
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

Job ID: 410-98086-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-98086-1

Receipt
The samples were received on 9/15/2022 5:16 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 time was 0.1°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Client Sample ID: GW Composite — Lab Sample ID: 410-98086-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	162		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.10	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	28.5		0.500	0.0960	mg/L	1		6010D	Total Recoverable
Magnesium	21.9		0.100	0.0400	mg/L	1		6010D	Total Recoverable
Potassium	1.79		0.500	0.204	mg/L	1		6010D	Total Recoverable
Sodium	10.5		1.00	0.239	mg/L	1		6010D	Total Recoverable
Total Dissolved Solids	274		33.3	13.3	mg/L	1		SM 2540C	Total/NA

Client Sample ID: GWC17-8:00 — Lab Sample ID: 410-98086-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00377		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0583		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.113		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.72		0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000504	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-8:40 — Lab Sample ID: 410-98086-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00125	J	0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0575		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.162		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.79		0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000446	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-9:15 — Lab Sample ID: 410-98086-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00430		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0575		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.0919		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.75	B	0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000505	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-9:50 — Lab Sample ID: 410-98086-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00233		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0592		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.141		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.74	B	0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000724	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-10:35 — Lab Sample ID: 410-98086-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00209		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0596		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.133		0.0515	0.0206	mg/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: GWC17-10:35 (Continued) — Lab Sample ID: 410-98086-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Manganese	1.70		0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000423	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-14:00 — Lab Sample ID: 410-98086-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00127	J	0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0547		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.180		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.74	B	0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000469	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-14:30 — Lab Sample ID: 410-98086-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00218		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0579		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.192		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.79	B	0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.000484	J	0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: GWC17-15:05 — Lab Sample ID: 410-98086-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00249		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0557		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.175		0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	1.70		0.00206	0.000979	mg/L	1		6020B	Dissolved
Selenium	0.00122		0.00103	0.000286	mg/L	1		6020B	Dissolved

Client Sample ID: Soil Composite — Lab Sample ID: 410-98086-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Lithium	6.73		5.20	1.46	mg/L	1	☼	6010D	Total/NA
Arsenic	0.540		0.416	0.139	mg/Kg	2	☼	6020B	Total/NA
Calcium	2930		41.6	20.4	mg/Kg	2	☼	6020B	Total/NA
Cobalt	31.3		0.208	0.0607	mg/Kg	2	☼	6020B	Total/NA
Iron	46600		104	47.9	mg/Kg	10	☼	6020B	Total/NA
Magnesium	7440		10.4	3.26	mg/Kg	2	☼	6020B	Total/NA
Manganese	999		2.08	1.04	mg/Kg	10	☼	6020B	Total/NA
Molybdenum	0.279		0.208	0.0956	mg/Kg	2	☼	6020B	Total/NA
Potassium	6140		41.6	13.1	mg/Kg	2	☼	6020B	Total/NA
Sodium	302		52.0	20.8	mg/Kg	2	☼	6020B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: GW Composite

Lab Sample ID: 410-98086-1

Date Collected: 09/15/22 08:00

Matrix: Water

Date Received: 09/15/22 17:16

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			09/27/22 14:31	5
Sulfate	162		75.0	25.0	mg/L			09/27/22 14:42	50
Chloride	3.10	J	7.50	3.00	mg/L			09/27/22 14:31	5

Method: SW846 6010D - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	28.5		0.500	0.0960	mg/L		09/20/22 21:48	09/22/22 07:19	1
Magnesium	21.9		0.100	0.0400	mg/L		09/20/22 21:48	09/22/22 07:19	1
Potassium	1.79		0.500	0.204	mg/L		09/20/22 21:48	09/23/22 05:22	1
Sodium	10.5		1.00	0.239	mg/L		09/20/22 21:48	09/22/22 07:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	274		33.3	13.3	mg/L			09/19/22 17:09	1

General Chemistry - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Organic Carbon (MCAWW 415.1)	<0.500		1.00	0.500	mg/L			09/22/22 20:07	1

Client Sample ID: GWC17-8:00

Lab Sample ID: 410-98086-2

Date Collected: 09/15/22 08:15

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:34	09/27/22 06:47	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00377		0.00206	0.000700	mg/L		09/20/22 20:34	10/04/22 16:19	1
Cobalt	0.0583		0.000515	0.000161	mg/L		09/20/22 20:34	10/04/22 16:19	1
Iron	0.113		0.0515	0.0206	mg/L		09/20/22 20:34	10/04/22 16:19	1
Manganese	1.72		0.00206	0.000979	mg/L		09/20/22 20:34	10/04/22 16:19	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:34	10/04/22 16:19	1
Selenium	0.000504	J	0.00103	0.000286	mg/L		09/20/22 20:34	10/04/22 16:19	1

Client Sample ID: GWC17-8:40

Lab Sample ID: 410-98086-3

Date Collected: 09/15/22 08:30

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:34	09/27/22 06:34	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00125	J	0.00206	0.000700	mg/L		09/20/22 20:34	10/04/22 15:52	1
Cobalt	0.0575		0.000515	0.000161	mg/L		09/20/22 20:34	10/04/22 15:52	1
Iron	0.162		0.0515	0.0206	mg/L		09/20/22 20:34	10/04/22 15:52	1
Manganese	1.79		0.00206	0.000979	mg/L		09/20/22 20:34	10/04/22 15:52	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:34	10/04/22 15:52	1

Client Sample ID: GWC17-8:40

Lab Sample ID: 410-98086-3

Date Collected: 09/15/22 08:30

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	0.000446	J	0.00103	0.000286	mg/L		09/20/22 20:34	10/04/22 15:52	1

Client Sample ID: GWC17-9:15

Lab Sample ID: 410-98086-4

Date Collected: 09/15/22 08:45

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:42	09/30/22 01:31	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00430		0.00206	0.000700	mg/L		09/20/22 20:42	09/29/22 12:04	1
Cobalt	0.0575		0.000515	0.000161	mg/L		09/20/22 20:42	09/29/22 12:04	1
Iron	0.0919		0.0515	0.0206	mg/L		09/20/22 20:42	09/29/22 12:04	1
Manganese	1.75	B	0.00206	0.000979	mg/L		09/20/22 20:42	09/29/22 12:04	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:42	09/29/22 12:04	1
Selenium	0.000505	J	0.00103	0.000286	mg/L		09/20/22 20:42	09/30/22 11:46	1

Client Sample ID: GWC17-9:50

Lab Sample ID: 410-98086-5

Date Collected: 09/15/22 09:00

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:42	09/30/22 01:25	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00233		0.00206	0.000700	mg/L		09/20/22 20:42	09/29/22 11:56	1
Cobalt	0.0592		0.000515	0.000161	mg/L		09/20/22 20:42	09/29/22 11:56	1
Iron	0.141		0.0515	0.0206	mg/L		09/20/22 20:42	09/29/22 11:56	1
Manganese	1.74	B	0.00206	0.000979	mg/L		09/20/22 20:42	09/29/22 11:56	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:42	09/29/22 11:56	1
Selenium	0.000724	J	0.00103	0.000286	mg/L		09/20/22 20:42	09/30/22 11:36	1

Client Sample ID: GWC17-10:35

Lab Sample ID: 410-98086-6

Date Collected: 09/15/22 09:15

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:34	09/27/22 06:44	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00209		0.00206	0.000700	mg/L		09/20/22 20:34	10/04/22 16:17	1
Cobalt	0.0596		0.000515	0.000161	mg/L		09/20/22 20:34	10/04/22 16:17	1
Iron	0.133		0.0515	0.0206	mg/L		09/20/22 20:34	10/04/22 16:17	1
Manganese	1.70		0.00206	0.000979	mg/L		09/20/22 20:34	10/04/22 16:17	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:34	10/04/22 16:17	1
Selenium	0.000423	J	0.00103	0.000286	mg/L		09/20/22 20:34	10/04/22 16:17	1

Client Sample ID: GWC17-14:00

Lab Sample ID: 410-98086-7

Date Collected: 09/15/22 09:30

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:42	09/30/22 01:37	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00127	J	0.00206	0.000700	mg/L		09/20/22 20:42	09/29/22 12:08	1
Cobalt	0.0547		0.000515	0.000161	mg/L		09/20/22 20:42	09/29/22 12:08	1
Iron	0.180		0.0515	0.0206	mg/L		09/20/22 20:42	09/29/22 12:08	1
Manganese	1.74	B	0.00206	0.000979	mg/L		09/20/22 20:42	09/29/22 12:08	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:42	09/29/22 12:08	1
Selenium	0.000469	J	0.00103	0.000286	mg/L		09/20/22 20:42	09/30/22 11:48	1

Client Sample ID: GWC17-14:30

Lab Sample ID: 410-98086-8

Date Collected: 09/15/22 09:45

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:42	09/30/22 01:28	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00218		0.00206	0.000700	mg/L		09/20/22 20:42	09/29/22 12:00	1
Cobalt	0.0579		0.000515	0.000161	mg/L		09/20/22 20:42	09/29/22 12:00	1
Iron	0.192		0.0515	0.0206	mg/L		09/20/22 20:42	09/29/22 12:00	1
Manganese	1.79	B	0.00206	0.000979	mg/L		09/20/22 20:42	09/29/22 12:00	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:42	09/29/22 12:00	1
Selenium	0.000484	J	0.00103	0.000286	mg/L		09/20/22 20:42	09/30/22 11:44	1

Client Sample ID: GWC17-15:05

Lab Sample ID: 410-98086-9

Date Collected: 09/15/22 10:00

Matrix: Water

Date Received: 09/15/22 17:16

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:30	09/27/22 20:31	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00249		0.00206	0.000700	mg/L		09/20/22 20:30	09/21/22 08:49	1
Cobalt	0.0557		0.000515	0.000161	mg/L		09/20/22 20:30	09/21/22 08:49	1
Iron	0.175		0.0515	0.0206	mg/L		09/20/22 20:30	09/21/22 08:49	1
Manganese	1.70		0.00206	0.000979	mg/L		09/20/22 20:30	09/21/22 08:49	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:30	09/21/22 08:49	1
Selenium	0.00122		0.00103	0.000286	mg/L		09/20/22 20:30	09/21/22 08:49	1

Client Sample ID: Soil Composite

Lab Sample ID: 410-98086-10

Date Collected: 09/15/22 10:15

Matrix: Solid

Date Received: 09/15/22 17:16

Percent Solids: 69.7

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	6.73		5.20	1.46	mg/L	☼	09/17/22 03:40	09/28/22 03:39	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Client Sample ID: Soil Composite

Date Collected: 09/15/22 10:15
Date Received: 09/15/22 17:16

Lab Sample ID: 410-98086-10

Matrix: Solid
Percent Solids: 69.7

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.540**		0.416	0.139	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Calcium	**2930**		41.6	20.4	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Cobalt	**31.3**		0.208	0.0607	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Iron	**46600**		104	47.9	mg/Kg	☼	09/17/22 03:40	10/04/22 08:54	10
Magnesium	**7440**		10.4	3.26	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Manganese	**999**		2.08	1.04	mg/Kg	☼	09/17/22 03:40	10/04/22 08:54	10
Molybdenum	**0.279**		0.208	0.0956	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Potassium	**6140**		41.6	13.1	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Selenium	<0.104		0.416	0.104	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2
Sodium	**302**		52.0	20.8	mg/Kg	☼	09/17/22 03:40	10/04/22 08:52	2

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture (EPA Moisture)	**30.3**		1.0	1.0	%			09/16/22 13:51	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-300433/5
Matrix: Water
Analysis Batch: 300433

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			09/27/22 11:27	1
Sulfate	<0.500		1.50	0.500	mg/L			09/27/22 11:27	1
Chloride	<0.600		1.50	0.600	mg/L			09/27/22 11:27	1

Lab Sample ID: LCS 410-300433/3
Matrix: Water
Analysis Batch: 300433

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7100		mg/L		95	90 - 110
Sulfate	7.51	7.597		mg/L		101	90 - 110
Chloride	3.00	3.061		mg/L		102	90 - 110

Lab Sample ID: LCSD 410-300433/4
Matrix: Water
Analysis Batch: 300433

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7078		mg/L		94	90 - 110	0	20
Sulfate	7.51	7.540		mg/L		100	90 - 110	1	20
Chloride	3.00	3.014		mg/L		100	90 - 110	2	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-296952/1-A
Matrix: Solid
Analysis Batch: 300680

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 296952

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<1.40		5.00	1.40	mg/L		09/17/22 03:40	09/28/22 02:51	1

Lab Sample ID: LCS 410-296952/2-A
Matrix: Solid
Analysis Batch: 300680

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 296952

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	50.0	49.83		mg/L		100	80 - 120

Lab Sample ID: MB 410-297992/1-A
Matrix: Water
Analysis Batch: 300547

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297992

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:30	09/27/22 19:28	1

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-297992/2-A
Matrix: Water
Analysis Batch: 300547

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297992

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5216		mg/L		104	80 - 120

Lab Sample ID: MB 410-297993/1-A
Matrix: Water
Analysis Batch: 300150

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297993

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:34	09/27/22 06:06	1

Lab Sample ID: LCS 410-297993/2-A
Matrix: Water
Analysis Batch: 300150

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297993

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5276		mg/L		106	80 - 120

Lab Sample ID: MB 410-297995/1-A
Matrix: Water
Analysis Batch: 301743

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297995

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		09/20/22 20:42	09/30/22 00:50	1

Lab Sample ID: LCS 410-297995/2-A
Matrix: Water
Analysis Batch: 301743

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297995

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5050		mg/L		101	80 - 120

Lab Sample ID: MB 410-298016/1-A
Matrix: Water
Analysis Batch: 298724

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 298016

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	<0.0960		0.500	0.0960	mg/L		09/20/22 21:48	09/22/22 06:01	1
Magnesium	<0.0400		0.100	0.0400	mg/L		09/20/22 21:48	09/22/22 06:01	1
Potassium	<0.204	^3+	0.500	0.204	mg/L		09/20/22 21:48	09/22/22 06:01	1
Sodium	<0.239		1.00	0.239	mg/L		09/20/22 21:48	09/22/22 06:01	1

Lab Sample ID: LCS 410-298016/2-A
Matrix: Water
Analysis Batch: 298724

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 298016

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Calcium	5.00	5.508		mg/L		110	80 - 120
Magnesium	5.00	4.958		mg/L		99	80 - 120
Sodium	5.00	4.895		mg/L		98	80 - 120

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-298016/2-A
Matrix: Water
Analysis Batch: 299161

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 298016

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Potassium	5.00	5.253		mg/L		105	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-296952/1-A ^2
Matrix: Solid
Analysis Batch: 302934

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 296952

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.134		0.400	0.134	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Calcium	<19.6		40.0	19.6	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Cobalt	<0.0584		0.200	0.0584	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Iron	<9.22		20.0	9.22	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Magnesium	<3.13		10.0	3.13	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Manganese	<0.200		0.400	0.200	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Molybdenum	<0.0920		0.200	0.0920	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Potassium	<12.6		40.0	12.6	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Selenium	<0.100		0.400	0.100	mg/Kg		09/17/22 03:40	10/04/22 07:49	2
Sodium	<20.0		50.0	20.0	mg/Kg		09/17/22 03:40	10/04/22 07:49	2

Lab Sample ID: LCS 410-296952/2-A ^2
Matrix: Solid
Analysis Batch: 302934

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 296952

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	50.0	47.69		mg/Kg		95	80 - 120
Calcium	500	507.4		mg/Kg		101	80 - 120
Cobalt	50.0	48.79		mg/Kg		98	80 - 120
Iron	500	489.7		mg/Kg		98	80 - 120
Magnesium	500	471.6		mg/Kg		94	80 - 120
Manganese	50.0	49.95		mg/Kg		100	80 - 120
Molybdenum	5.00	4.770		mg/Kg		95	80 - 120
Potassium	500	494.9		mg/Kg		99	80 - 120
Selenium	10.0	9.793		mg/Kg		98	80 - 120
Sodium	500	469.9		mg/Kg		94	80 - 120

Lab Sample ID: MB 410-297992/1-A
Matrix: Water
Analysis Batch: 298277

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297992

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000700		0.00206	0.000700	mg/L		09/20/22 20:30	09/21/22 08:21	1
Cobalt	<0.000161		0.000515	0.000161	mg/L		09/20/22 20:30	09/21/22 08:21	1
Iron	<0.0206		0.0515	0.0206	mg/L		09/20/22 20:30	09/21/22 08:21	1
Manganese	<0.000979		0.00206	0.000979	mg/L		09/20/22 20:30	09/21/22 08:21	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:30	09/21/22 08:21	1
Selenium	<0.000286		0.00103	0.000286	mg/L		09/20/22 20:30	09/21/22 08:21	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-297992/2-A
Matrix: Water
Analysis Batch: 298277

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297992

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.500	0.4962		mg/L		99	85 - 120
Cobalt	0.500	0.5066		mg/L		101	90 - 113
Iron	5.00	5.049		mg/L		101	88 - 119
Manganese	0.500	0.5118		mg/L		102	89 - 120
Molybdenum	0.0500	0.04914		mg/L		98	85 - 115
Selenium	0.100	0.1036		mg/L		104	80 - 120

Lab Sample ID: MB 410-297993/1-A
Matrix: Water
Analysis Batch: 303128

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297993

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000700		0.00206	0.000700	mg/L		09/20/22 20:34	10/04/22 15:24	1
Cobalt	<0.000161		0.000515	0.000161	mg/L		09/20/22 20:34	10/04/22 15:24	1
Iron	<0.0206		0.0515	0.0206	mg/L		09/20/22 20:34	10/04/22 15:24	1
Manganese	<0.000979		0.00206	0.000979	mg/L		09/20/22 20:34	10/04/22 15:24	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:34	10/04/22 15:24	1
Selenium	<0.000286		0.00103	0.000286	mg/L		09/20/22 20:34	10/04/22 15:24	1

Lab Sample ID: LCS 410-297993/2-A
Matrix: Water
Analysis Batch: 303128

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297993

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.500	0.5123		mg/L		102	85 - 120
Cobalt	0.500	0.5052		mg/L		101	90 - 113
Iron	5.00	5.214		mg/L		104	88 - 119
Manganese	0.500	0.5206		mg/L		104	89 - 120
Molybdenum	0.0500	0.05325		mg/L		106	85 - 115
Selenium	0.100	0.1074		mg/L		107	80 - 120

Lab Sample ID: MB 410-297995/1-A
Matrix: Water
Analysis Batch: 301341

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297995

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000700		0.00206	0.000700	mg/L		09/20/22 20:42	09/29/22 11:33	1
Cobalt	<0.000161		0.000515	0.000161	mg/L		09/20/22 20:42	09/29/22 11:33	1
Iron	<0.0206		0.0515	0.0206	mg/L		09/20/22 20:42	09/29/22 11:33	1
Manganese	0.002371		0.00206	0.000979	mg/L		09/20/22 20:42	09/29/22 11:33	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		09/20/22 20:42	09/29/22 11:33	1

Lab Sample ID: MB 410-297995/1-A
Matrix: Water
Analysis Batch: 301849

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 297995

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	<0.000286		0.00103	0.000286	mg/L		09/20/22 20:42	09/30/22 11:16	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-297995/2-A
Matrix: Water
Analysis Batch: 301341

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297995

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.500	0.5120		mg/L		102	85 - 120
Cobalt	0.500	0.5046		mg/L		101	90 - 113
Iron	5.00	5.276		mg/L		106	88 - 119
Manganese	0.500	0.5204		mg/L		104	89 - 120
Molybdenum	0.0500	0.05093		mg/L		102	85 - 115

Lab Sample ID: LCS 410-297995/2-A
Matrix: Water
Analysis Batch: 301849

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 297995

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Selenium	0.100	0.1096		mg/L		110	80 - 120

Method: 415.1 - DOC

Lab Sample ID: MB 410-299132/6
Matrix: Water
Analysis Batch: 299132

Client Sample ID: Method Blank
Prep Type: Dissolved

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Organic Carbon	<0.500		1.00	0.500	mg/L			09/22/22 13:57	1

Lab Sample ID: LCS 410-299132/5
Matrix: Water
Analysis Batch: 299132

Client Sample ID: Lab Control Sample
Prep Type: Dissolved

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Dissolved Organic Carbon	22.0	22.12		mg/L		101	86 - 114

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 410-297482/1
Matrix: Water
Analysis Batch: 297482

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<12.0		30.0	12.0	mg/L			09/19/22 17:09	1

Lab Sample ID: LCS 410-297482/2
Matrix: Water
Analysis Batch: 297482

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Dissolved Solids	200	192.0		mg/L		96	72 - 127

HPLC/IC

Analysis Batch: 300433

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Total/NA	Water	EPA 300.0 R2.1	
410-98086-1	GW Composite	Total/NA	Water	EPA 300.0 R2.1	
MB 410-300433/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-300433/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-300433/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 296952

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-10	Soil Composite	Total/NA	Solid	3050B	
MB 410-296952/1-A	Method Blank	Total/NA	Solid	3050B	
MB 410-296952/1-A ^2	Method Blank	Total/NA	Solid	3050B	
LCS 410-296952/2-A	Lab Control Sample	Total/NA	Solid	3050B	
LCS 410-296952/2-A ^2	Lab Control Sample	Total/NA	Solid	3050B	

Prep Batch: 297992

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-9	GWC17-15:05	Dissolved	Water	Non-Digest Prep	
MB 410-297992/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-297992/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 297993

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-2	GWC17-8:00	Dissolved	Water	Non-Digest Prep	
410-98086-3	GWC17-8:40	Dissolved	Water	Non-Digest Prep	
410-98086-6	GWC17-10:35	Dissolved	Water	Non-Digest Prep	
MB 410-297993/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-297993/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 297995

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-4	GWC17-9:15	Dissolved	Water	Non-Digest Prep	
410-98086-5	GWC17-9:50	Dissolved	Water	Non-Digest Prep	
410-98086-7	GWC17-14:00	Dissolved	Water	Non-Digest Prep	
410-98086-8	GWC17-14:30	Dissolved	Water	Non-Digest Prep	
MB 410-297995/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-297995/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 298016

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Total Recoverable	Water	3005A	
MB 410-298016/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 410-298016/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Analysis Batch: 298277

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-9	GWC17-15:05	Dissolved	Water	6020B	297992
MB 410-297992/1-A	Method Blank	Total/NA	Water	6020B	297992
LCS 410-297992/2-A	Lab Control Sample	Total/NA	Water	6020B	297992

Metals

Analysis Batch: 298724

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Total Recoverable	Water	6010D	298016
MB 410-298016/1-A	Method Blank	Total Recoverable	Water	6010D	298016
LCS 410-298016/2-A	Lab Control Sample	Total Recoverable	Water	6010D	298016

Analysis Batch: 299161

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Total Recoverable	Water	6010D	298016
LCS 410-298016/2-A	Lab Control Sample	Total Recoverable	Water	6010D	298016

Analysis Batch: 300150

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-2	GWC17-8:00	Dissolved	Water	6010D	297993
410-98086-3	GWC17-8:40	Dissolved	Water	6010D	297993
410-98086-6	GWC17-10:35	Dissolved	Water	6010D	297993
MB 410-297993/1-A	Method Blank	Total/NA	Water	6010D	297993
LCS 410-297993/2-A	Lab Control Sample	Total/NA	Water	6010D	297993

Analysis Batch: 300547

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-9	GWC17-15:05	Dissolved	Water	6010D	297992
MB 410-297992/1-A	Method Blank	Total/NA	Water	6010D	297992
LCS 410-297992/2-A	Lab Control Sample	Total/NA	Water	6010D	297992

Analysis Batch: 300680

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-10	Soil Composite	Total/NA	Solid	6010D	296952
MB 410-296952/1-A	Method Blank	Total/NA	Solid	6010D	296952
LCS 410-296952/2-A	Lab Control Sample	Total/NA	Solid	6010D	296952

Analysis Batch: 301341

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-4	GWC17-9:15	Dissolved	Water	6020B	297995
410-98086-5	GWC17-9:50	Dissolved	Water	6020B	297995
410-98086-7	GWC17-14:00	Dissolved	Water	6020B	297995
410-98086-8	GWC17-14:30	Dissolved	Water	6020B	297995
MB 410-297995/1-A	Method Blank	Total/NA	Water	6020B	297995
LCS 410-297995/2-A	Lab Control Sample	Total/NA	Water	6020B	297995

Analysis Batch: 301743

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-4	GWC17-9:15	Dissolved	Water	6010D	297995
410-98086-5	GWC17-9:50	Dissolved	Water	6010D	297995
410-98086-7	GWC17-14:00	Dissolved	Water	6010D	297995
410-98086-8	GWC17-14:30	Dissolved	Water	6010D	297995
MB 410-297995/1-A	Method Blank	Total/NA	Water	6010D	297995
LCS 410-297995/2-A	Lab Control Sample	Total/NA	Water	6010D	297995

Analysis Batch: 301849

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-4	GWC17-9:15	Dissolved	Water	6020B	297995
410-98086-5	GWC17-9:50	Dissolved	Water	6020B	297995

Metals (Continued)

Analysis Batch: 301849 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-7	GWC17-14:00	Dissolved	Water	6020B	297995
410-98086-8	GWC17-14:30	Dissolved	Water	6020B	297995
MB 410-297995/1-A	Method Blank	Total/NA	Water	6020B	297995
LCS 410-297995/2-A	Lab Control Sample	Total/NA	Water	6020B	297995

Analysis Batch: 302934

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-10	Soil Composite	Total/NA	Solid	6020B	296952
410-98086-10	Soil Composite	Total/NA	Solid	6020B	296952
MB 410-296952/1-A ^2	Method Blank	Total/NA	Solid	6020B	296952
LCS 410-296952/2-A ^2	Lab Control Sample	Total/NA	Solid	6020B	296952

Analysis Batch: 303128

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-2	GWC17-8:00	Dissolved	Water	6020B	297993
410-98086-3	GWC17-8:40	Dissolved	Water	6020B	297993
410-98086-6	GWC17-10:35	Dissolved	Water	6020B	297993
MB 410-297993/1-A	Method Blank	Total/NA	Water	6020B	297993
LCS 410-297993/2-A	Lab Control Sample	Total/NA	Water	6020B	297993

Analysis Batch: 303394

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-2	GWC17-8:00	Dissolved	Water	6020B	297993
410-98086-3	GWC17-8:40	Dissolved	Water	6020B	297993
410-98086-6	GWC17-10:35	Dissolved	Water	6020B	297993
LCS 410-297993/2-A	Lab Control Sample	Total/NA	Water	6020B	297993

General Chemistry

Analysis Batch: 296771

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-10	Soil Composite	Total/NA	Solid	Moisture	

Analysis Batch: 297482

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Total/NA	Water	SM 2540C	
MB 410-297482/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 410-297482/2	Lab Control Sample	Total/NA	Water	SM 2540C	

Analysis Batch: 299132

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-98086-1	GW Composite	Dissolved	Water	415.1	
MB 410-299132/6	Method Blank	Dissolved	Water	415.1	
LCS 410-299132/5	Lab Control Sample	Dissolved	Water	415.1	

Client Sample ID: GW Composite

Lab Sample ID: 410-98086-1

Date Collected: 09/15/22 08:00

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	300433	L4QM	ELLE	09/27/22 14:31
Total/NA	Analysis	EPA 300.0 R2.1		50	300433	L4QM	ELLE	09/27/22 14:42
Total Recoverable	Prep	3005A			298016	UJLA	ELLE	09/20/22 21:48
Total Recoverable	Analysis	6010D		1	298724	T8CQ	ELLE	09/22/22 07:19
Total Recoverable	Prep	3005A			298016	UJLA	ELLE	09/20/22 21:48
Total Recoverable	Analysis	6010D		1	299161	T8CQ	ELLE	09/23/22 05:22
Dissolved	Analysis	415.1		1	299132	P684	ELLE	09/22/22 20:07
Total/NA	Analysis	SM 2540C		1	297482	UOCA	ELLE	09/19/22 17:09

Client Sample ID: GWC17-8:00

Lab Sample ID: 410-98086-2

Date Collected: 09/15/22 08:15

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6010D		1	300150	T8CQ	ELLE	09/27/22 06:47
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303128	UCIG	ELLE	10/04/22 16:19
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303394	UCIG	ELLE	10/04/22 16:19

Client Sample ID: GWC17-8:40

Lab Sample ID: 410-98086-3

Date Collected: 09/15/22 08:30

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6010D		1	300150	T8CQ	ELLE	09/27/22 06:34
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303128	UCIG	ELLE	10/04/22 15:52
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303394	UCIG	ELLE	10/04/22 15:52

Client Sample ID: GWC17-9:15

Lab Sample ID: 410-98086-4

Date Collected: 09/15/22 08:45

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6010D		1	301743	T8CQ	ELLE	09/30/22 01:31
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301849	F7JF	ELLE	09/30/22 11:46
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301341	F7JF	ELLE	09/29/22 12:04

Client Sample ID: GWC17-9:50

Lab Sample ID: 410-98086-5

Date Collected: 09/15/22 09:00

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6010D		1	301743	T8CQ	ELLE	09/30/22 01:25
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301849	F7JF	ELLE	09/30/22 11:36
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301341	F7JF	ELLE	09/29/22 11:56

Client Sample ID: GWC17-10:35

Lab Sample ID: 410-98086-6

Date Collected: 09/15/22 09:15

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6010D		1	300150	T8CQ	ELLE	09/27/22 06:44
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303128	UCIG	ELLE	10/04/22 16:17
Dissolved	Prep	Non-Digest Prep			297993	UJLA	ELLE	09/20/22 20:34
Dissolved	Analysis	6020B		1	303394	UCIG	ELLE	10/04/22 16:17

Client Sample ID: GWC17-14:00

Lab Sample ID: 410-98086-7

Date Collected: 09/15/22 09:30

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6010D		1	301743	T8CQ	ELLE	09/30/22 01:37
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301849	F7JF	ELLE	09/30/22 11:48
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301341	F7JF	ELLE	09/29/22 12:08

Client Sample ID: GWC17-14:30

Lab Sample ID: 410-98086-8

Date Collected: 09/15/22 09:45

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6010D		1	301743	T8CQ	ELLE	09/30/22 01:28
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301849	F7JF	ELLE	09/30/22 11:44
Dissolved	Prep	Non-Digest Prep			297995	UJLA	ELLE	09/20/22 20:42
Dissolved	Analysis	6020B		1	301341	F7JF	ELLE	09/29/22 12:00

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Client Sample ID: GWC17-15:05

Lab Sample ID: 410-98086-9

Date Collected: 09/15/22 10:00

Matrix: Water

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			297992	UJLA	ELLE	09/20/22 20:30
Dissolved	Analysis	6010D		1	300547	T8CQ	ELLE	09/27/22 20:31
Dissolved	Prep	Non-Digest Prep			297992	UJLA	ELLE	09/20/22 20:30
Dissolved	Analysis	6020B		1	298277	F7JF	ELLE	09/21/22 08:49

Client Sample ID: Soil Composite

Lab Sample ID: 410-98086-10

Date Collected: 09/15/22 10:15

Matrix: Solid

Date Received: 09/15/22 17:16

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	296771	UVJN	ELLE	09/16/22 13:51

Client Sample ID: Soil Composite

Lab Sample ID: 410-98086-10

Date Collected: 09/15/22 10:15

Matrix: Solid

Date Received: 09/15/22 17:16

Percent Solids: 69.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3050B			296952	UAMX	ELLE	09/17/22 03:40
Total/NA	Analysis	6010D		1	300680	T8CQ	ELLE	09/28/22 03:39
Total/NA	Prep	3050B			296952	UAMX	ELLE	09/17/22 03:40
Total/NA	Analysis	6020B		2	302934	F7JF	ELLE	10/04/22 08:52
Total/NA	Prep	3050B			296952	UAMX	ELLE	09/17/22 03:40
Total/NA	Analysis	6020B		10	302934	F7JF	ELLE	10/04/22 08:54

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-22
A2LA	ISO/IEC 17025	0001.01	11-30-22
Alaska	State	PA00009	07-01-23
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-22
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-23
Georgia (DW)	State	C048	01-31-23
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-22
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	1.01	11-30-22
Kentucky (WW)	State	KY90088	01-01-23
Louisiana	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	10-06-22
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Mississippi	State	022	01-31-23
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-22-43	08-31-23
USDA	US Federal Programs	P330-19-00197	08-09-23
Vermont	State	VT - 36037	10-28-22
Virginia	NELAP	460182	06-15-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-22

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-98086-1
Project/Site: Stantec CCR TS

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
West Virginia DEP	State	055	10-31-22
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	1.01	11-30-22

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
415.1	DOC	MCAWW	ELLE
Moisture	Percent Moisture	EPA	ELLE
SM 2540C	Solids, Total Dissolved (TDS)	SM	ELLE
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	ELLE
3050B	Preparation, Metals	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-98086-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-98086-1	GW Composite	Water	09/15/22 08:00	09/15/22 17:16
410-98086-2	GWC17-8:00	Water	09/15/22 08:15	09/15/22 17:16
410-98086-3	GWC17-8:40	Water	09/15/22 08:30	09/15/22 17:16
410-98086-4	GWC17-9:15	Water	09/15/22 08:45	09/15/22 17:16
410-98086-5	GWC17-9:50	Water	09/15/22 09:00	09/15/22 17:16
410-98086-6	GWC17-10:35	Water	09/15/22 09:15	09/15/22 17:16
410-98086-7	GWC17-14:00	Water	09/15/22 09:30	09/15/22 17:16
410-98086-8	GWC17-14:30	Water	09/15/22 09:45	09/15/22 17:16
410-98086-9	GWC17-15:05	Water	09/15/22 10:00	09/15/22 17:16
410-98086-10	Soil Composite	Solid	09/15/22 10:15	09/15/22 17:16

410-98086 Chain of Custody

Environmental Analysis Request/Chain of Custody

Acct. # ______ Group # ______ Sample # ______

Client: Terra Systems, Inc.	
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA
Project Manager: Michael D. Lee	P.O. #: 222538-9-15-22
Sampler: Michael D. Lee	PWSID #:
Phone #: 302-798-9553	Quote #: 41011818
State where samples were collected: GA	For Compliance: Yes ☐ No ☑

Matrix: Soil ☐ Sediment ☐ Tissue ☐ Water: Potable ☐ Ground ☑ Surface ☐ NPDES ☐ Other:

For Lab Use Only
SF #: ______
SCR #: ______

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Sample Identification	Collection Date	Collection Time	Grab	Composite	Soil/Sediment/Tissue	Water	Other	Total # of Containers	Ca, K, Mg, and Na (N)	DOC (field filtered) (P)	Total Dissolved Solids (-)	Sulfate, Chloride, Fluoride (-)	Dis (field fil) As, Co, Fe, Mg, Mo, & Se (N)	Dis (field fil) Li (N)	As, Ca, Co, Fe, Li, Mg, Mo, Mn, (-)	K, Se & Na & % Moisture (-)			Remarks
GW Composite	9/15/2022	8:00		X		X		4	X	X	X	X							
GWC17-8:00	9/15/2022	8:15		X		X		2					X	X					
GWC17-8:40	9/15/2022	8:30		X		X		2					X	X					
GWC17-9:15	9/15/2022	8:45		X		X		2					X	X					
GWC17-9:50	9/15/2022	9:00		X		X		2					X	X					
GWC17-10:35	9/15/2022	9:15		X		X		2					X	X					
GWC17-14:00	9/15/2022	9:30		X		X		2					X	X					
GWC17-14:30	9/15/2022	9:45		X		X		2					X	X					
GWC17-15:05	9/15/2022	10:00		X		X		2					X	X					
Soil Composite	9/15/2022	10:15		X		X		1							X	X			

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 9/29/22

Rush results requested by (please check): E-Mail ☐ Phone ☐
E-mail Address: mlee@terrasystems.net
Phone: 302-798-9553

Data Package Options (please check if required)
Type I (Validation/non-CLP) ☐ MA MCP ☐
Type III (Reduced non-CLP) ☐ CT RCP ☐
Type VI (Raw Data Only) ☐ TX TRRP-13 ☐
NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☐ If yes, format: ______

Relinquished by:	Date	Time	Received by:	Date	Time
			[signature]	9/16/22	1101

Relinquished by Commercial Carrier:
UPS ______ FedEx ______ Other X

Temperature upon receipt 0.1 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

(B) MR 25GEH 9/16/22

7045 0216

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Golder CCR TS II	Site ID #: Srymna, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-9-15-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil ☐ Sediment ☐ Tissue	Water: Potable ☐ Ground ☑ Surface ☐ NPDES ☐	Other:	Total # of Containers	Analyses Requested / Preservation Codes: Ca, K, Mg, and Na (N)	DOC (field filtered) (P)	Total Dissolved Solids (-)	Sulfate, Chloride, Fluoride (-)	Dis (field fil) As, Co, Fe, Mg, Mo, & Se (N)	Dis (field fil) Li (N)	As, Ca, Co, Fe, Li, Mg, Mo, Mn, (-)	K, Se & Na & % Moisture (-)	Remarks
GW Composite	9/15/2022	8:00		X		X		4	X	X	X	X					
GWC17-8:00	9/15/2022	8:15		X		X		2					X	X			
GWC17-8:40	9/15/2022	8:30		X		X		2					X	X			
GWC17-9:15	9/15/2022	8:45		X		X		2					X	X			
GWC17-9:50	9/15/2022	9:00		X		X		2					X	X			
GWC17-10:35	9/15/2022	9:15		X		X		2					X	X			
GWC17-14:00	9/15/2022	9:30		X		X		2					X	X			
GWC17-14:30	9/15/2022	9:45		X		X		2					X	X			
GWC17-15:05	9/15/2022	10:00		X		X		2					X	X			
Soil Composite	9/15/2022	10:15		X		X		1							X	X	

For Lab Use Only
SF #: _____
SCR #: _____

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 9/29/22

Rush results requested by (please check): E-Mail ☐ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP) ☐ MA MCP ☐
Type III (Reduced non-CLP) ☐ CT RCP ☐
Type VI (Raw Data Only) ☐ TX TRRP-13 ☐
NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☐ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	9/15/22	12:05	Bob Lee	9/15/22	1205
Bob Lee	9/15/22	1650			
			(3) AP 9/15/22	9/15/22	
				9/17	1716

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other X

Temperature upon receipt 0.1 °C

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

Client: **Terra Systems, Inc.**			
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-9-15-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ____ GA	For Compliance: Yes ☐ No ☐		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Ca, K, Mg, and Na	DOC (field filtered)	Total Dissolved Solids	Sulfate, Chloride, Fluoride	Dis (field fil) As, Co, Fe, Mn, Mo, & Se	Dis (field fil) Li	As, Ca, Co, Fe, Li, Mg, Mo, Mn	K, Se & Na & % Moisture			Remarks
Analyses Requested – Preservation Codes														N	P	-	-	N	N	-	-			
GW Composite	9/15/2022	8:00		X				X					4	X	X	X	X							
GWC17-8:00	9/15/2022	8:15		X				X					2					X	X					
GWC17-8:40	9/15/2022	8:30		X				X					2					X	X					
GWC17-9:15	9/15/2022	8:45		X				X					2					X	X					
GWC17-9:50	9/15/2022	9:00		X				X					2					X	X					
GWC17-10:35	9/15/2022	9:15		X				X					2					X	X					
GWC17-14:00	9/15/2022	9:30		X				X					2					X	X					
GWC17-14:30	9/15/2022	9:45		X				X					2					X	X					
GWC17-15:05	9/15/2022	10:00		X				X					2					X	X					
Soil Composite	9/15/2022	10:15		X				X					1							X	X			

For Lab Use Only

SF #: _____

SCR #: _____

Preservation Codes

H = HCl; T = Thiosulfate; N = HNO_3; B = NaOH; S = H_2SO_4; P = H_3PO_4; O = Other

Turnaround Time Requested (TAT) (please check): Standard ☐ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 9/29/22

Rush results requested by (please check): E-Mail ☐ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP) ☐ MA MCP ☐

Type III (Reduced non-CLP) ☐ CT RCP ☐

Type VI (Raw Data Only) ☐ TX TRRP-13 ☐

NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☐ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt _____ °C

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-98086-1

Login Number: 98086
List Number: 1
Creator: Reiff, Nicole L

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster, PA 17601
Tel: (717)656-2300

Laboratory Job ID: 410-103672-1
Client Project/Site: Stantec CCR TS

For:
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Attn: Dr. Michael D Lee

Authorized for release by:
11/4/2022 9:13:56 AM

Marrissa Williams, Project Manager
(717)556-7246
Marrissa.Williams@et.eurofinsus.com

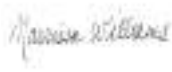
Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.



Marrissa Williams
Project Manager
11/4/2022 9:13:56 AM

Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-103672-1
Project/Site: Stantec CCR TS

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
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

Case Narrative

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Job ID: 410-103672-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-103672-1

Receipt

The samples were received on 10/28/2022 3:52 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 time was 0.9°C

Metals

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Client Sample ID: Control Day 2 — Lab Sample ID: 410-103672-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.276		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0202		0.000515	0.000161	mg/L	1		6020B	Dissolved
Manganese	0.769		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.000188	J	0.000515	0.000134	mg/L	1		6020B	Dissolved

Client Sample ID: 2 g/L NaHCO3 Day 2 — Lab Sample ID: 410-103672-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0506		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.00352		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.0495	J	0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	0.238		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.000795		0.000515	0.000134	mg/L	1		6020B	Dissolved

Client Sample ID: 5 g/L NaHCO3 Day 2 — Lab Sample ID: 410-103672-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0351		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.00169		0.000515	0.000161	mg/L	1		6020B	Dissolved
Manganese	0.126		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.00184		0.000515	0.000134	mg/L	1		6020B	Dissolved

Client Sample ID: 10 g/L NaHCO3 Day 2 — Lab Sample ID: 410-103672-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0277		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.00147		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.0244	J	0.0515	0.0206	mg/L	1		6020B	Dissolved
Manganese	0.0862		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.00351		0.000515	0.000134	mg/L	1		6020B	Dissolved

Client Sample ID: 6.5 NaOH Day 2 — Lab Sample ID: 410-103672-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0317		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0130		0.000515	0.000161	mg/L	1		6020B	Dissolved
Manganese	0.541		0.00206	0.000979	mg/L	1		6020B	Dissolved

Client Sample ID: 7.5 NaOH Day 2 — Lab Sample ID: 410-103672-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0257		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.00436		0.000515	0.000161	mg/L	1		6020B	Dissolved
Manganese	0.257		0.00206	0.000979	mg/L	1		6020B	Dissolved

Client Sample ID: 8.5 NaOH Day 2 — Lab Sample ID: 410-103672-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.0652		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.000521		0.000515	0.000161	mg/L	1		6020B	Dissolved
Manganese	0.0342		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.00111		0.000515	0.000134	mg/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Control Day 2

Lab Sample ID: 410-103672-1

Date Collected: 10/28/22 08:00

Matrix: Water

Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:23	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.276**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 20:44	1
Cobalt	**0.0202**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 20:44	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 20:44	1
Manganese	**0.769**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 20:44	1
Molybdenum	**0.000188**	**J**	0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 20:44	1

Client Sample ID: 2 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-2

Date Collected: 10/28/22 08:20

Matrix: Water

Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:26	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0506**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 20:46	1
Cobalt	**0.00352**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 20:46	1
Iron	**0.0495**	**J**	0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 20:46	1
Manganese	**0.238**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 20:46	1
Molybdenum	**0.000795**		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 20:46	1

Client Sample ID: 5 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-3

Date Collected: 10/28/22 08:40

Matrix: Water

Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:39	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0351**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 20:48	1
Cobalt	**0.00169**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 20:48	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 20:48	1
Manganese	**0.126**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 20:48	1
Molybdenum	**0.00184**		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 20:48	1

Client Sample ID: 10 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-4

Date Collected: 10/28/22 09:00

Matrix: Water

Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:43	1

Client Sample ID: 10 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-4

Date Collected: 10/28/22 09:00
Matrix: Water
Date Received: 10/28/22 15:52

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0277**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 20:56	1
Cobalt	**0.00147**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 20:56	1
Iron	**0.0244**	**J**	0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 20:56	1
Manganese	**0.0862**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 20:56	1
Molybdenum	**0.00351**		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 20:56	1

Client Sample ID: 6.5 NaOH Day 2

Lab Sample ID: 410-103672-5

Date Collected: 10/28/22 09:20
Matrix: Water
Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:46	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0317**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 20:58	1
Cobalt	**0.0130**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 20:58	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 20:58	1
Manganese	**0.541**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 20:58	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 20:58	1

Client Sample ID: 7.5 NaOH Day 2

Lab Sample ID: 410-103672-6

Date Collected: 10/28/22 09:40
Matrix: Water
Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:49	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0257**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 21:00	1
Cobalt	**0.00436**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 21:00	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 21:00	1
Manganese	**0.257**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 21:00	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 21:00	1

Client Sample ID: 8.5 NaOH Day 2

Lab Sample ID: 410-103672-7

Date Collected: 10/28/22 10:00
Matrix: Water
Date Received: 10/28/22 15:52

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 04:53	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0652**		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 21:02	1
Cobalt	**0.000521**		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 21:02	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 21:02	1
Manganese	**0.0342**		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 21:02	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Client Sample ID: 8.5 NaOH Day 2
Date Collected: 10/28/22 10:00
Date Received: 10/28/22 15:52

Lab Sample ID: 410-103672-7
Matrix: Water

Method: SW846 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Molybdenum	0.00111		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 21:02	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-312720/1-A
Matrix: Water
Analysis Batch: 313594

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 312720

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		11/01/22 13:57	11/03/22 03:50	1

Lab Sample ID: LCS 410-312720/2-A
Matrix: Water
Analysis Batch: 313594

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 312720

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5932		mg/L		119	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-312720/1-A
Matrix: Water
Analysis Batch: 313341

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 312720

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000700		0.00206	0.000700	mg/L		11/01/22 13:57	11/02/22 19:40	1
Cobalt	<0.000161		0.000515	0.000161	mg/L		11/01/22 13:57	11/02/22 19:40	1
Iron	<0.0206		0.0515	0.0206	mg/L		11/01/22 13:57	11/02/22 19:40	1
Manganese	<0.000979		0.00206	0.000979	mg/L		11/01/22 13:57	11/02/22 19:40	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		11/01/22 13:57	11/02/22 19:40	1

Lab Sample ID: LCS 410-312720/2-A
Matrix: Water
Analysis Batch: 313341

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 312720

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.500	0.5484		mg/L		110	85 - 120
Cobalt	0.500	0.5395		mg/L		108	90 - 113
Iron	5.00	5.572		mg/L		111	88 - 119
Manganese	0.500	0.5584		mg/L		112	89 - 120
Molybdenum	0.0500	0.05681		mg/L		114	85 - 115

QC Association Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Metals

Prep Batch: 312720

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-103672-1	Control Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-2	2 g/L NaHCO3 Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-3	5 g/L NaHCO3 Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-4	10 g/L NaHCO3 Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-5	6.5 NaOH Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-6	7.5 NaOH Day 2	Dissolved	Water	Non-Digest Prep	
410-103672-7	8.5 NaOH Day 2	Dissolved	Water	Non-Digest Prep	
MB 410-312720/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-312720/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 313341

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-103672-1	Control Day 2	Dissolved	Water	6020B	312720
410-103672-2	2 g/L NaHCO3 Day 2	Dissolved	Water	6020B	312720
410-103672-3	5 g/L NaHCO3 Day 2	Dissolved	Water	6020B	312720
410-103672-4	10 g/L NaHCO3 Day 2	Dissolved	Water	6020B	312720
410-103672-5	6.5 NaOH Day 2	Dissolved	Water	6020B	312720
410-103672-6	7.5 NaOH Day 2	Dissolved	Water	6020B	312720
410-103672-7	8.5 NaOH Day 2	Dissolved	Water	6020B	312720
MB 410-312720/1-A	Method Blank	Total/NA	Water	6020B	312720
LCS 410-312720/2-A	Lab Control Sample	Total/NA	Water	6020B	312720

Analysis Batch: 313594

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-103672-1	Control Day 2	Dissolved	Water	6010D	312720
410-103672-2	2 g/L NaHCO3 Day 2	Dissolved	Water	6010D	312720
410-103672-3	5 g/L NaHCO3 Day 2	Dissolved	Water	6010D	312720
410-103672-4	10 g/L NaHCO3 Day 2	Dissolved	Water	6010D	312720
410-103672-5	6.5 NaOH Day 2	Dissolved	Water	6010D	312720
410-103672-6	7.5 NaOH Day 2	Dissolved	Water	6010D	312720
410-103672-7	8.5 NaOH Day 2	Dissolved	Water	6010D	312720
MB 410-312720/1-A	Method Blank	Total/NA	Water	6010D	312720
LCS 410-312720/2-A	Lab Control Sample	Total/NA	Water	6010D	312720

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Client Sample ID: Control Day 2

Lab Sample ID: 410-103672-1

Date Collected: 10/28/22 08:00
Matrix: Water
Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:23
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 20:44

Client Sample ID: 2 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-2

Date Collected: 10/28/22 08:20
Matrix: Water
Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:26
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 20:46

Client Sample ID: 5 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-3

Date Collected: 10/28/22 08:40
Matrix: Water
Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:39
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 20:48

Client Sample ID: 10 g/L NaHCO3 Day 2

Lab Sample ID: 410-103672-4

Date Collected: 10/28/22 09:00
Matrix: Water
Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:43
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 20:56

Client Sample ID: 6.5 NaOH Day 2

Lab Sample ID: 410-103672-5

Date Collected: 10/28/22 09:20
Matrix: Water
Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:46
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 20:58

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Client Sample ID: 7.5 NaOH Day 2

Lab Sample ID: 410-103672-6

Date Collected: 10/28/22 09:40

Matrix: Water

Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:49
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 21:00

Client Sample ID: 8.5 NaOH Day 2

Lab Sample ID: 410-103672-7

Date Collected: 10/28/22 10:00

Matrix: Water

Date Received: 10/28/22 15:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6010D		1	313594	T8CQ	ELLE	11/03/22 04:53
Dissolved	Prep	Non-Digest Prep			312720	UAMX	ELLE	11/01/22 13:57
Dissolved	Analysis	6020B		1	313341	UCIG	ELLE	11/02/22 21:02

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-22
A2LA	ISO/IEC 17025	0001.01	11-30-22
Alaska	State	PA00009	07-01-23
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-22
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-23
Georgia (DW)	State	C048	01-31-23
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-22 *
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	1.01	11-30-22
Kentucky (WW)	State	KY90088	01-01-23
Louisiana	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	11-10-22
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Mississippi	State	022	01-31-23
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-22-43	08-31-23
USDA	US Federal Programs	P330-19-00197	08-09-23
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-15-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-22

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-103672-1
Project/Site: Stantec CCR TS

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	1.01	11-30-22

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Method	Method Description	Protocol	Laboratory
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-103672-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-103672-1	Control Day 2	Water	10/28/22 08:00	10/28/22 15:52
410-103672-2	2 g/L NaHCO3 Day 2	Water	10/28/22 08:20	10/28/22 15:52
410-103672-3	5 g/L NaHCO3 Day 2	Water	10/28/22 08:40	10/28/22 15:52
410-103672-4	10 g/L NaHCO3 Day 2	Water	10/28/22 09:00	10/28/22 15:52
410-103672-5	6.5 NaOH Day 2	Water	10/28/22 09:20	10/28/22 15:52
410-103672-6	7.5 NaOH Day 2	Water	10/28/22 09:40	10/28/22 15:52
410-103672-7	8.5 NaOH Day 2	Water	10/28/22 10:00	10/28/22 15:52

Environ [barcode] equest/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. 410-103672 Chain of Custody Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-10-28-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil ☐ Sediment ☐ Tissue ☐	Water: Potable ☐ Ground ☑ Surface ☐ NPDES ☐	Other:	Total # of Containers	Analyses Requested: Preservation Codes N	P	-	-	N	N	-	-		
									Dis (field filt) As, Co, Fe, Mn, & Mo	Dis (field filtered) Li								
Control Day 2	10/28/2022	8:00		X		X		2	X	X								
~~2 g/L NaHCO3 Day 2~~	~~10/28/2022~~	~~8:20~~		~~X~~		~~X~~		~~2~~	~~X~~	~~X~~								
5 g/L NaHCO3 Day 2	10/28/2022	8:40		X		X		2	X	X								
10 g/L NaHCO3 Day 2	10/28/2022	9:00		X		X		2	X	X								
6.5 NaOH Day 2	10/28/2022	9:20		X		X		2	X	X								
7.5 NaOH Day 2	10/28/2022	9:40		X		X		2	X	X								
8.5 NaOH Day 2	10/28/2022	10:00		X		X		2	X	X								

For Lab Use Only
SF #: _____
SCR #: _____

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Remarks

Turnaround Time Requested (TAT) (please check): Standard ☐ Rush ☑
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 11/4/22/2022

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	10/28/22	11:14	Bob LQ	10/28/14	1114
Bob LQ	10/28/22	1552			

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other _____

Temperature upon receipt 0.9 °C

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-103672-1

Login Number: 103672

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: Kanagy, Nicholas

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster, PA 17601
Tel: (717)656-2300

Laboratory Job ID: 410-104297-1
Client Project/Site: Stantec CCR TS

For:
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Attn: Dr. Michael D Lee

Authorized for release by:
11/11/2022 4:54:30 PM

Marrissa Williams, Project Manager
(717)556-7246
Marrissa.Williams@et.eurofinsus.com

The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

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.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

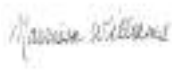
Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.



Marrissa Williams
Project Manager
11/11/2022 4:54:30 PM

Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-104297-1
Project/Site: Stantec CCR TS

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
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

Case Narrative

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Job ID: 410-104297-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-104297-1

Receipt

The samples were received on 11/3/2022 3:45 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 time was 0.1°C

Metals

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Client Sample ID: 30 g/kg FB Day 7 — Lab Sample ID: 410-104297-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	43.8		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	2.93		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	55.3		51.5	20.6	ug/L	1		6020B	Dissolved
Manganese	3430		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	43.8		0.515	0.134	ug/L	1		6020B	Dissolved

Client Sample ID: 50 g/kg FB Day 7 — Lab Sample ID: 410-104297-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	15.5		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.492	J	0.515	0.161	ug/L	1		6020B	Dissolved
Manganese	521		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	65.5		0.515	0.134	ug/L	1		6020B	Dissolved

Client Sample ID: 70 g/kg FB Day 7 — Lab Sample ID: 410-104297-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	9.89		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.584		0.515	0.161	ug/L	1		6020B	Dissolved
Manganese	487		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	154		0.515	0.134	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Client Sample ID: 30 g/kg FB Day 7

Lab Sample ID: 410-104297-1

Date Collected: 11/03/22 10:40

Matrix: Water

Date Received: 11/03/22 15:45

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.3		51.5	11.3	ug/L		11/04/22 07:25	11/10/22 02:38	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**43.8**		2.06	0.700	ug/L		11/04/22 07:25	11/07/22 09:35	1
Cobalt	**2.93**		0.515	0.161	ug/L		11/04/22 07:25	11/07/22 09:35	1
Iron	**55.3**		51.5	20.6	ug/L		11/04/22 07:25	11/07/22 09:35	1
Manganese	**3430**		2.06	0.979	ug/L		11/04/22 07:25	11/07/22 09:35	1
Molybdenum	**43.8**		0.515	0.134	ug/L		11/04/22 07:25	11/07/22 09:35	1

Client Sample ID: 50 g/kg FB Day 7

Lab Sample ID: 410-104297-2

Date Collected: 11/03/22 11:00

Matrix: Water

Date Received: 11/03/22 15:45

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.3		51.5	11.3	ug/L		11/04/22 07:25	11/10/22 19:32	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**15.5**		2.06	0.700	ug/L		11/04/22 07:25	11/07/22 09:33	1
Cobalt	**0.492**	**J**	0.515	0.161	ug/L		11/04/22 07:25	11/07/22 09:33	1
Iron	<20.6		51.5	20.6	ug/L		11/04/22 07:25	11/07/22 09:33	1
Manganese	**521**		2.06	0.979	ug/L		11/04/22 07:25	11/07/22 09:33	1
Molybdenum	**65.5**		0.515	0.134	ug/L		11/04/22 07:25	11/07/22 09:33	1

Client Sample ID: 70 g/kg FB Day 7

Lab Sample ID: 410-104297-3

Date Collected: 11/03/22 11:20

Matrix: Water

Date Received: 11/03/22 15:45

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.3		51.5	11.3	ug/L		11/04/22 07:25	11/10/22 19:26	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**9.89**		2.06	0.700	ug/L		11/04/22 07:25	11/07/22 09:31	1
Cobalt	**0.584**		0.515	0.161	ug/L		11/04/22 07:25	11/07/22 09:31	1
Iron	<20.6		51.5	20.6	ug/L		11/04/22 07:25	11/07/22 09:31	1
Manganese	**487**		2.06	0.979	ug/L		11/04/22 07:25	11/07/22 09:31	1
Molybdenum	**154**		0.515	0.134	ug/L		11/04/22 07:25	11/07/22 09:31	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-313846/1-A
Matrix: Water
Analysis Batch: 316055

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 313846

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.3		51.5	11.3	ug/L		11/04/22 07:25	11/10/22 02:01	1

Lab Sample ID: LCS 410-313846/2-A
Matrix: Water
Analysis Batch: 316055

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 313846

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	500	503.7		ug/L		101	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-313846/1-A
Matrix: Water
Analysis Batch: 314758

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 313846

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		11/04/22 07:25	11/07/22 09:09	1
Cobalt	<0.161		0.515	0.161	ug/L		11/04/22 07:25	11/07/22 09:09	1
Iron	<20.6		51.5	20.6	ug/L		11/04/22 07:25	11/07/22 09:09	1
Manganese	<0.979		2.06	0.979	ug/L		11/04/22 07:25	11/07/22 09:09	1
Molybdenum	<0.134		0.515	0.134	ug/L		11/04/22 07:25	11/07/22 09:09	1

Lab Sample ID: LCS 410-313846/2-A
Matrix: Water
Analysis Batch: 314758

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 313846

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	497.1		ug/L		99	85 - 120
Cobalt	500	490.4		ug/L		98	90 - 113
Iron	5000	5171		ug/L		103	88 - 119
Manganese	500	515.3		ug/L		103	89 - 120
Molybdenum	50.0	50.01		ug/L		100	85 - 115

Metals

Prep Batch: 313846

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-104297-1	30 g/kg FB Day 7	Dissolved	Water	Non-Digest Prep	
410-104297-2	50 g/kg FB Day 7	Dissolved	Water	Non-Digest Prep	
410-104297-3	70 g/kg FB Day 7	Dissolved	Water	Non-Digest Prep	
MB 410-313846/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-313846/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 314758

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-104297-1	30 g/kg FB Day 7	Dissolved	Water	6020B	313846
410-104297-2	50 g/kg FB Day 7	Dissolved	Water	6020B	313846
410-104297-3	70 g/kg FB Day 7	Dissolved	Water	6020B	313846
MB 410-313846/1-A	Method Blank	Total/NA	Water	6020B	313846
LCS 410-313846/2-A	Lab Control Sample	Total/NA	Water	6020B	313846

Analysis Batch: 316055

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-104297-1	30 g/kg FB Day 7	Dissolved	Water	6010D	313846
MB 410-313846/1-A	Method Blank	Total/NA	Water	6010D	313846
LCS 410-313846/2-A	Lab Control Sample	Total/NA	Water	6010D	313846

Analysis Batch: 316436

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-104297-2	50 g/kg FB Day 7	Dissolved	Water	6010D	313846
410-104297-3	70 g/kg FB Day 7	Dissolved	Water	6010D	313846

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Client Sample ID: 30 g/kg FB Day 7

Lab Sample ID: 410-104297-1

Date Collected: 11/03/22 10:40

Matrix: Water

Date Received: 11/03/22 15:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6010D		1	316055	VYB8	ELLE	11/10/22 02:38
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6020B		1	314758	F7JF	ELLE	11/07/22 09:35

Client Sample ID: 50 g/kg FB Day 7

Lab Sample ID: 410-104297-2

Date Collected: 11/03/22 11:00

Matrix: Water

Date Received: 11/03/22 15:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6010D		1	316436	T8CQ	ELLE	11/10/22 19:32
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6020B		1	314758	F7JF	ELLE	11/07/22 09:33

Client Sample ID: 70 g/kg FB Day 7

Lab Sample ID: 410-104297-3

Date Collected: 11/03/22 11:20

Matrix: Water

Date Received: 11/03/22 15:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6010D		1	316436	T8CQ	ELLE	11/10/22 19:26
Dissolved	Prep	Non-Digest Prep			313846	UAMX	ELLE	11/04/22 07:25
Dissolved	Analysis	6020B		1	314758	F7JF	ELLE	11/07/22 09:31

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-22
A2LA	ISO/IEC 17025	0001.01	11-30-22
Alaska	State	PA00009	07-01-23
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-22
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-23
Georgia (DW)	State	C048	01-31-23
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-22 *
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	1.01	11-30-22
Kentucky (WW)	State	KY90088	01-01-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	11-10-22
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Mississippi	State	022	01-31-23
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-22-43	08-31-23
USDA	US Federal Programs	P330-19-00197	08-09-23
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-15-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-22

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	1.01	11-30-22

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Method	Method Description	Protocol	Laboratory
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-104297-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-104297-1	30 g/kg FB Day 7	Water	11/03/22 10:40	11/03/22 15:45
410-104297-2	50 g/kg FB Day 7	Water	11/03/22 11:00	11/03/22 15:45
410-104297-3	70 g/kg FB Day 7	Water	11/03/22 11:20	11/03/22 15:45

Environ ... equest/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # 410-104297 Chain of Custody Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-11-3-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water	Ground	Surface	Potable	NPDES	Other:	Total # of Containers	Analyses Requested: Dis (field fil) As, Co, Fe, Mn, & Mo	Dis (field filtered) Li	Remarks
Preservation Codes															N	P	
30 g/kg FB Day 7	11/3/2022	10:40		X				X						2	X	X	
50 g/kg FB Day 7	11/3/2022	11:00		X				X						2	X	X	
70 g/kg FB Day 7	11/3/2022	11:20		X				X						2	X	X	

Preservation Codes: H = HCl; T = Thiosulfate; N = HNO_3; B = NaOH; S = H_2SO_4; P = H_3PO_4; O = Other

For Lab Use Only: SF #: _____ SCR #: _____

Turnaround Time Requested (TAT) (please check): Standard ☐ Rush ☑
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 11/4/22/2022

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

	Relinquished by:	Date	Time	Received by:	Date	Time
1	Michael Lee	11/3/22	1127	[illegible]	11/3/22	1127
2	[illegible]	11/3/22	1545			
3						
4						
5						

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other _____

Temperature upon receipt 0.1 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0216

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-104297-1

Login Number: 104297
List Number: 1
Creator: Knoedler, Christine M

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 1/4/2023 9:48:19 AM

JOB DESCRIPTION

Stantec CCR TS

JOB NUMBER

410-107798-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
1/4/2023 9:48:19 AM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

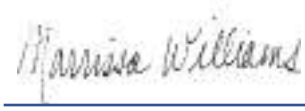


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-107798-1
Project/Site: Stantec CCR TS

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
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

Case Narrative

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Job ID: 410-107798-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-107798-1

Receipt
The samples were received on 12/2/2022 4:35 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 time was -0.1°C

Metals
Method 6010D: Due to the matrix, the initial volume(s) used for the following samples deviated from the standard procedure: 20 g/L NaHCO3 Day 2 (410-107798-2) and 50 g/L NaHCO3 Day 2 (410-107798-3). The reporting limits (RLs) have been adjusted proportionately.

Method 6020B: Due to the matrix, the initial volume(s) used for the following samples deviated from the standard procedure: 20 g/L NaHCO3 Day 2 (410-107798-2) and 50 g/L NaHCO3 Day 2 (410-107798-3). The reporting limits (RLs) have been adjusted proportionately.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Client Sample ID: New Composite Soil Control Day 2 — Lab Sample ID: 410-107798-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	21.2		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	30.3		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	44.8	J	51.5	20.6	ug/L	1		6020B	Dissolved
Manganese	1250		2.06	0.979	ug/L	1		6020B	Dissolved
Selenium	0.759	J	1.03	0.286	ug/L	1		6020B	Dissolved

Client Sample ID: 20 g/L NaHCO3 Day 2 — Lab Sample ID: 410-107798-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	27.1		20.6	7.00	ug/L	1		6020B	Dissolved
Manganese	45.4		20.6	9.79	ug/L	1		6020B	Dissolved
Molybdenum	4.31	J	5.15	1.34	ug/L	1		6020B	Dissolved
Selenium	3.49	J	10.3	2.86	ug/L	1		6020B	Dissolved

Client Sample ID: 50 g/L NaHCO3 Day 2 — Lab Sample ID: 410-107798-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	93.6		20.6	7.00	ug/L	1		6020B	Dissolved
Cobalt	1.65	J	5.15	1.61	ug/L	1		6020B	Dissolved
Manganese	30.1		20.6	9.79	ug/L	1		6020B	Dissolved
Molybdenum	7.66		5.15	1.34	ug/L	1		6020B	Dissolved
Selenium	4.21	J	10.3	2.86	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Client Sample ID: New Composite Soil Control Day 2

Lab Sample ID: 410-107798-1

Date Collected: 12/02/22 09:00
Matrix: Water
Date Received: 12/02/22 16:35

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		12/29/22 14:20	12/29/22 18:32	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**21.2**		2.06	0.700	ug/L		12/29/22 14:20	12/30/22 18:52	1
Cobalt	**30.3**		0.515	0.161	ug/L		12/29/22 14:20	12/30/22 18:52	1
Iron	**44.8**	**J**	51.5	20.6	ug/L		12/29/22 14:20	12/30/22 18:52	1
Manganese	**1250**		2.06	0.979	ug/L		12/29/22 14:20	12/30/22 18:52	1
Molybdenum	<0.134		0.515	0.134	ug/L		12/29/22 14:20	12/30/22 18:52	1
Selenium	**0.759**	**J**	1.03	0.286	ug/L		12/29/22 14:20	12/30/22 18:52	1

Client Sample ID: 20 g/L NaHCO3 Day 2

Lab Sample ID: 410-107798-2

Date Collected: 12/02/22 09:30
Matrix: Water
Date Received: 12/02/22 16:35

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.113		0.515	0.113	mg/L		12/29/22 14:20	12/29/22 18:29	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**27.1**		20.6	7.00	ug/L		12/29/22 14:20	12/30/22 18:50	1
Cobalt	<1.61		5.15	1.61	ug/L		12/29/22 14:20	12/30/22 18:50	1
Iron	<206		515	206	ug/L		12/29/22 14:20	12/30/22 18:50	1
Manganese	**45.4**		20.6	9.79	ug/L		12/29/22 14:20	12/30/22 18:50	1
Molybdenum	**4.31**	**J**	5.15	1.34	ug/L		12/29/22 14:20	12/30/22 18:50	1
Selenium	**3.49**	**J**	10.3	2.86	ug/L		12/29/22 14:20	12/30/22 18:50	1

Client Sample ID: 50 g/L NaHCO3 Day 2

Lab Sample ID: 410-107798-3

Date Collected: 12/02/22 10:00
Matrix: Water
Date Received: 12/02/22 16:35

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.113		0.515	0.113	mg/L		12/29/22 14:20	12/29/22 18:26	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**93.6**		20.6	7.00	ug/L		12/29/22 14:20	12/30/22 18:47	1
Cobalt	**1.65**	**J**	5.15	1.61	ug/L		12/29/22 14:20	12/30/22 18:47	1
Iron	<206		515	206	ug/L		12/29/22 14:20	12/30/22 18:47	1
Manganese	**30.1**		20.6	9.79	ug/L		12/29/22 14:20	12/30/22 18:47	1
Molybdenum	**7.66**		5.15	1.34	ug/L		12/29/22 14:20	12/30/22 18:47	1
Selenium	**4.21**	**J**	10.3	2.86	ug/L		12/29/22 14:20	12/30/22 18:47	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-331241/1-A
Matrix: Water
Analysis Batch: 331396

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 331241

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		12/29/22 14:20	12/29/22 17:48	1

Lab Sample ID: LCS 410-331241/2-A
Matrix: Water
Analysis Batch: 331396

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 331241

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5762		mg/L		115	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-331241/1-A
Matrix: Water
Analysis Batch: 331814

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 331241

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		12/29/22 14:20	12/30/22 18:23	1
Cobalt	<0.161		0.515	0.161	ug/L		12/29/22 14:20	12/30/22 18:23	1
Iron	<20.6		51.5	20.6	ug/L		12/29/22 14:20	12/30/22 18:23	1
Manganese	<0.979		2.06	0.979	ug/L		12/29/22 14:20	12/30/22 18:23	1
Molybdenum	<0.134		0.515	0.134	ug/L		12/29/22 14:20	12/30/22 18:23	1
Selenium	<0.286		1.03	0.286	ug/L		12/29/22 14:20	12/30/22 18:23	1

Lab Sample ID: LCS 410-331241/2-A
Matrix: Water
Analysis Batch: 331814

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 331241

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	529.2		ug/L		106	85 - 120
Cobalt	500	533.9		ug/L		107	90 - 113
Iron	5000	5503		ug/L		110	88 - 119
Manganese	500	543.6		ug/L		109	89 - 120
Molybdenum	50.0	52.80		ug/L		106	85 - 115
Selenium	100	104.9		ug/L		105	80 - 120

QC Association Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Metals

Prep Batch: 331241

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-107798-1	New Composite Soil Control Day 2	Dissolved	Water	Non-Digest Prep	
410-107798-2	20 g/L NaHCO3 Day 2	Dissolved	Water	Non-Digest Prep	
410-107798-3	50 g/L NaHCO3 Day 2	Dissolved	Water	Non-Digest Prep	
MB 410-331241/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-331241/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 331396

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-107798-1	New Composite Soil Control Day 2	Dissolved	Water	6010D	331241
410-107798-2	20 g/L NaHCO3 Day 2	Dissolved	Water	6010D	331241
410-107798-3	50 g/L NaHCO3 Day 2	Dissolved	Water	6010D	331241
MB 410-331241/1-A	Method Blank	Total/NA	Water	6010D	331241
LCS 410-331241/2-A	Lab Control Sample	Total/NA	Water	6010D	331241

Analysis Batch: 331814

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-107798-1	New Composite Soil Control Day 2	Dissolved	Water	6020B	331241
410-107798-2	20 g/L NaHCO3 Day 2	Dissolved	Water	6020B	331241
410-107798-3	50 g/L NaHCO3 Day 2	Dissolved	Water	6020B	331241
MB 410-331241/1-A	Method Blank	Total/NA	Water	6020B	331241
LCS 410-331241/2-A	Lab Control Sample	Total/NA	Water	6020B	331241

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Client Sample ID: New Composite Soil Control Day 2

Lab Sample ID: 410-107798-1

Date Collected: 12/02/22 09:00
Matrix: Water
Date Received: 12/02/22 16:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6010D		1	331396	T8CQ	ELLE	12/29/22 18:32
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6020B		1	331814	S4PD	ELLE	12/30/22 18:52

Client Sample ID: 20 g/L NaHCO3 Day 2

Lab Sample ID: 410-107798-2

Date Collected: 12/02/22 09:30
Matrix: Water
Date Received: 12/02/22 16:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6010D		1	331396	T8CQ	ELLE	12/29/22 18:29
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6020B		1	331814	S4PD	ELLE	12/30/22 18:50

Client Sample ID: 50 g/L NaHCO3 Day 2

Lab Sample ID: 410-107798-3

Date Collected: 12/02/22 10:00
Matrix: Water
Date Received: 12/02/22 16:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6010D		1	331396	T8CQ	ELLE	12/29/22 18:26
Dissolved	Prep	Non-Digest Prep			331241	UAMX	ELLE	12/29/22 14:20
Dissolved	Analysis	6020B		1	331814	S4PD	ELLE	12/30/22 18:47

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-22 *
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-23
Georgia (DW)	State	C048	01-31-23
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-22
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	022	01-31-23
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	P330-19-00197	08-09-23
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-22

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-107798-1
Project/Site: Stantec CCR TS

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Method	Method Description	Protocol	Laboratory
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-107798-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-107798-1	New Composite Soil Control Day 2	Water	12/02/22 09:00	12/02/22 16:35
410-107798-2	20 g/L NaHCO3 Day 2	Water	12/02/22 09:30	12/02/22 16:35
410-107798-3	50 g/L NaHCO3 Day 2	Water	12/02/22 10:00	12/02/22 16:35

410-107798 Chain of Custody

Environmental Analysis Request/Chain of Custody

Environmental

Acct. # _____ Group # _____ Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-12-2-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil ☐ Sediment ☐ Tissue	Matrix: Water ☑ Potable ☐ Ground ☐ NPDES ☐ Surface	Matrix: Other:	Total # of Containers	Analyses Requested: Total As, Co, Fe, Mn, Mo, Se	Analyses Requested: Total Li	Preservation Codes: N / P / - / - / N / N / - / -	Remarks
											N P - - N N - -	
New Composite Soil Control Day 2	12/2/2022	9:00		X		X		2	X	X		
20 g/L NaHCO3 Day 2	12/2/2022	9:30		X		X		2	X	X		
50 g/L NaHCO3 Day 2	12/2/2022	10:00		X		X		2	X	X		

For Lab Use Only

SF #: _____

SCR #: _____

Preservation Codes

H = HCl T = Thiosulfate

N = HNO_3 B = NaOH

S = H_2SO_4 P = H_3PO_4

O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 12/16/22

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

	Relinquished by:	Date	Time	Received by:	Date	Time
1	[signature]	12/2/22		[signature]	12/2/22	1350
2	[signature]	12/2/22	1635			
3						
4						
5				[signature]	12/2/22	1635

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other N/A

Temperature upon receipt ~0.1 °C

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-107798-1

Login Number: 107798

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: Kanagy, Nicholas

Question	Answer	Comment
The cooler's custody seal is intact.	True	
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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 12/11/2022 3:47:58 PM

JOB DESCRIPTION

Stantec CCR TS

JOB NUMBER

410-105428-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
12/11/2022 3:47:58 PM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

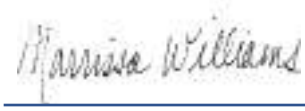


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-105428-1
Project/Site: Stantec CCR TS

Qualifiers

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
cn	Refer to Case Narrative for further detail
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
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

Job ID: 410-105428-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-105428-1

Receipt

The samples were received on 11/11/2022 2:32 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 time was 0.0°C

Metals

Method 6010D: The following sample was diluted due to the nature of the sample matrix: 50 g/L FB (410-105428-1). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Client Sample ID: 50 g/L FB — Lab Sample ID: 410-105428-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	9.17	cn	2.00	0.680	ug/L	1		6020B	Total Recoverable
Cobalt	74.9	cn	0.500	0.156	ug/L	1		6020B	Total Recoverable
Iron	2070000	^2 cn	2500	1000	ug/L	50		6020B	Total Recoverable
Manganese	15500	cn	20.0	9.50	ug/L	10		6020B	Total Recoverable
Molybdenum	357	cn	0.500	0.130	ug/L	1		6020B	Total Recoverable

Client Sample ID: 0.5 g/L NaOH — Lab Sample ID: 410-105428-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Iron	433		50.0	20.0	ug/L	1		6020B	Total Recoverable
Manganese	14.3		2.00	0.950	ug/L	1		6020B	Total Recoverable
Molybdenum	0.149	J	0.500	0.130	ug/L	1		6020B	Total Recoverable

Client Sample ID: 10 g/L NaHCO3 — Lab Sample ID: 410-105428-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	0.259	J	0.500	0.156	ug/L	1		6020B	Total Recoverable
Iron	367	^2	50.0	20.0	ug/L	1		6020B	Total Recoverable
Manganese	9.48		2.00	0.950	ug/L	1		6020B	Total Recoverable
Molybdenum	0.584		0.500	0.130	ug/L	1		6020B	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Client Sample ID: 50 g/L FB

Lab Sample ID: 410-105428-1

Date Collected: 11/11/22 10:30
Matrix: Water
Date Received: 11/11/22 14:32

Method: SW846 6010D - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<110	cn	500	110	ug/L		11/21/22 14:07	11/29/22 05:42	10

Method: SW846 6020B - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	9.17	cn	2.00	0.680	ug/L		11/21/22 14:07	12/11/22 08:24	1
Cobalt	74.9	cn	0.500	0.156	ug/L		11/21/22 14:07	12/11/22 08:24	1
Iron	2070000	^2 cn	2500	1000	ug/L		11/21/22 14:07	12/11/22 10:21	50
Manganese	15500	cn	20.0	9.50	ug/L		11/21/22 14:07	12/11/22 08:26	10
Molybdenum	357	cn	0.500	0.130	ug/L		11/21/22 14:07	12/11/22 08:24	1

Client Sample ID: 0.5 g/L NaOH

Lab Sample ID: 410-105428-2

Date Collected: 11/11/22 10:40
Matrix: Water
Date Received: 11/11/22 14:32

Method: SW846 6010D - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.0		50.0	11.0	ug/L		11/15/22 04:52	11/29/22 03:45	1

Method: SW846 6020B - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.680		2.00	0.680	ug/L		11/15/22 04:52	11/28/22 08:36	1
Cobalt	<0.156		0.500	0.156	ug/L		11/15/22 04:52	11/28/22 08:36	1
Iron	433		50.0	20.0	ug/L		11/15/22 04:52	11/28/22 08:36	1
Manganese	14.3		2.00	0.950	ug/L		11/15/22 04:52	11/28/22 08:36	1
Molybdenum	0.149	J	0.500	0.130	ug/L		11/15/22 04:52	11/28/22 08:36	1

Client Sample ID: 10 g/L NaHCO3

Lab Sample ID: 410-105428-3

Date Collected: 11/11/22 10:50
Matrix: Water
Date Received: 11/11/22 14:32

Method: SW846 6010D - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.0		50.0	11.0	ug/L		11/21/22 14:07	11/23/22 15:31	1

Method: SW846 6020B - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.680		2.00	0.680	ug/L		11/21/22 14:07	12/11/22 08:22	1
Cobalt	0.259	J	0.500	0.156	ug/L		11/21/22 14:07	12/11/22 08:22	1
Iron	367	^2	50.0	20.0	ug/L		11/21/22 14:07	12/11/22 08:22	1
Manganese	9.48		2.00	0.950	ug/L		11/21/22 14:07	12/11/22 08:22	1
Molybdenum	0.584		0.500	0.130	ug/L		11/21/22 14:07	12/11/22 08:22	1

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-317506/1-A
Matrix: Water
Analysis Batch: 321615

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 317506

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.0		50.0	11.0	ug/L		11/15/22 04:52	11/29/22 03:00	1

Lab Sample ID: LCS 410-317506/2-A
Matrix: Water
Analysis Batch: 321615

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 317506

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	500	489.2		ug/L		98	80 - 120

Lab Sample ID: MB 410-319840/1-A
Matrix: Water
Analysis Batch: 320806

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 319840

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<11.0		50.0	11.0	ug/L		11/21/22 14:07	11/23/22 14:29	1

Lab Sample ID: LCS 410-319840/2-A
Matrix: Water
Analysis Batch: 320806

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 319840

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	500	494.2		ug/L		99	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-317506/1-A
Matrix: Water
Analysis Batch: 321226

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 317506

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.680		2.00	0.680	ug/L		11/15/22 04:52	11/28/22 08:11	1
Cobalt	<0.156		0.500	0.156	ug/L		11/15/22 04:52	11/28/22 08:11	1
Iron	<20.0		50.0	20.0	ug/L		11/15/22 04:52	11/28/22 08:11	1
Manganese	<0.950		2.00	0.950	ug/L		11/15/22 04:52	11/28/22 08:11	1
Molybdenum	<0.130		0.500	0.130	ug/L		11/15/22 04:52	11/28/22 08:11	1

Lab Sample ID: LCS 410-317506/2-A
Matrix: Water
Analysis Batch: 321226

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 317506

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	498.6		ug/L		100	85 - 120
Cobalt	500	514.4		ug/L		103	90 - 113
Iron	5000	5191		ug/L		104	88 - 119
Manganese	500	517.1		ug/L		103	89 - 120
Molybdenum	50.0	49.86		ug/L		100	85 - 115

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 410-319840/1-A
Matrix: Water
Analysis Batch: 325764

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 319840

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.680		2.00	0.680	ug/L		11/21/22 14:07	12/11/22 08:14	1
Cobalt	<0.156		0.500	0.156	ug/L		11/21/22 14:07	12/11/22 08:14	1
Iron	<20.0		50.0	20.0	ug/L		11/21/22 14:07	12/11/22 08:14	1
Manganese	<0.950		2.00	0.950	ug/L		11/21/22 14:07	12/11/22 08:14	1
Molybdenum	<0.130		0.500	0.130	ug/L		11/21/22 14:07	12/11/22 08:14	1

Lab Sample ID: LCS 410-319840/2-A
Matrix: Water
Analysis Batch: 325764

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 319840

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	475.5		ug/L		95	85 - 120
Cobalt	500	501.9		ug/L		100	90 - 113
Iron	5000	5087		ug/L		102	88 - 119
Manganese	500	495.1		ug/L		99	89 - 120
Molybdenum	50.0	48.37		ug/L		97	85 - 115

Metals

Prep Batch: 317506

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-2	0.5 g/L NaOH	Total Recoverable	Water	3005A	
MB 410-317506/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 410-317506/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Prep Batch: 319840

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-1	50 g/L FB	Total Recoverable	Water	3005A	
410-105428-3	10 g/L NaHCO3	Total Recoverable	Water	3005A	
MB 410-319840/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 410-319840/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Analysis Batch: 320806

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-3	10 g/L NaHCO3	Total Recoverable	Water	6010D	319840
MB 410-319840/1-A	Method Blank	Total Recoverable	Water	6010D	319840
LCS 410-319840/2-A	Lab Control Sample	Total Recoverable	Water	6010D	319840

Analysis Batch: 321226

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-2	0.5 g/L NaOH	Total Recoverable	Water	6020B	317506
MB 410-317506/1-A	Method Blank	Total Recoverable	Water	6020B	317506
LCS 410-317506/2-A	Lab Control Sample	Total Recoverable	Water	6020B	317506

Analysis Batch: 321615

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-1	50 g/L FB	Total Recoverable	Water	6010D	319840
410-105428-2	0.5 g/L NaOH	Total Recoverable	Water	6010D	317506
MB 410-317506/1-A	Method Blank	Total Recoverable	Water	6010D	317506
LCS 410-317506/2-A	Lab Control Sample	Total Recoverable	Water	6010D	317506

Analysis Batch: 325764

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-105428-1	50 g/L FB	Total Recoverable	Water	6020B	319840
410-105428-1	50 g/L FB	Total Recoverable	Water	6020B	319840
410-105428-1	50 g/L FB	Total Recoverable	Water	6020B	319840
410-105428-3	10 g/L NaHCO3	Total Recoverable	Water	6020B	319840
MB 410-319840/1-A	Method Blank	Total Recoverable	Water	6020B	319840
LCS 410-319840/2-A	Lab Control Sample	Total Recoverable	Water	6020B	319840

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Client Sample ID: 50 g/L FB

Lab Sample ID: 410-105428-1

Date Collected: 11/11/22 10:30

Matrix: Water

Date Received: 11/11/22 14:32

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6010D		10	321615	VYB8	ELLE	11/29/22 05:42
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6020B		1	325764	UCIG	ELLE	12/11/22 08:24
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6020B		10	325764	UCIG	ELLE	12/11/22 08:26
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6020B		50	325764	UCIG	ELLE	12/11/22 10:21

Client Sample ID: 0.5 g/L NaOH

Lab Sample ID: 410-105428-2

Date Collected: 11/11/22 10:40

Matrix: Water

Date Received: 11/11/22 14:32

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	3005A			317506	UAMX	ELLE	11/15/22 04:52
Total Recoverable	Analysis	6010D		1	321615	VYB8	ELLE	11/29/22 03:45
Total Recoverable	Prep	3005A			317506	UAMX	ELLE	11/15/22 04:52
Total Recoverable	Analysis	6020B		1	321226	F7JF	ELLE	11/28/22 08:36

Client Sample ID: 10 g/L NaHCO3

Lab Sample ID: 410-105428-3

Date Collected: 11/11/22 10:50

Matrix: Water

Date Received: 11/11/22 14:32

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6010D		1	320806	T8CQ	ELLE	11/23/22 15:31
Total Recoverable	Prep	3005A			319840	UAMX	ELLE	11/21/22 14:07
Total Recoverable	Analysis	6020B		1	325764	UCIG	ELLE	12/11/22 08:22

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
Alaska	State	PA00009	07-01-23
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-22 *
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-23
Georgia (DW)	State	C048	01-31-23
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-22 *
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-22
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Mississippi	State	022	01-31-23
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-22-43	08-31-23
USDA	US Federal Programs	P330-19-00197	08-09-23
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-22
West Virginia DEP	State	055	07-31-23

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Client: Terra Systems Inc
Job ID: 410-105428-1
Project/Site: Stantec CCR TS

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Method	Method Description	Protocol	Laboratory
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	ELLE

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS

Job ID: 410-105428-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-105428-1	50 g/L FB	Water	11/11/22 10:30	11/11/22 14:32
410-105428-2	0.5 g/L NaOH	Water	11/11/22 10:40	11/11/22 14:32
410-105428-3	10 g/L NaHCO3	Water	11/11/22 10:50	11/11/22 14:32

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Stantec CCR TS	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-11-11-22		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Analyses Requested: Total As, Co, Fe, Mn, & Mo	Total Li								
														Preservation Codes: N	P	-	-	N	N	-	-		
50 g/L FB	11/11/2022	10:30		X					X				2	X	X								
0.5 g/L NaOH	11/11/2022	10:40		X					X				2	X	X								
10 g/L NaHCO3	11/11/2022	10:50		X					X				2	X	X								

For Lab Use Only
SF #: _____
SCR #: _____

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Remarks

410-105428 Chain of Custody

Turnaround Time Requested (TAT) (please check): Standard ☐ Rush ☑
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 11/4/22/2022

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Michael Lee	11/11/22	11:15	BR LC	11/11/22	1145
BR LC	11/11/22	1432			

Relinquished by Commercial Carrier: UPS _____ FedEx _____ Other ✓

Received by: Date 11/11/22 Time 14:32

Temperature upon receipt 0.0 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 7045 0216

JM CB

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-105428-1

Login Number: 105428

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: McCaskey, Jonathan

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

June 22, 2023

Angus McGrath and James Witty
Stantec

TERRA SYSTEMS, INC. DRAFT REPORT TO STANTEC FOR COAL ASH RESIDUE COLUMN TREATABILITY STUDIES FOR PLANT ARKWRIGHT AP3

1.0 INTRODUCTION

Coal ash residue (CCR) landfill may generate conditions which allow metals such as cobalt, arsenic, iron, lithium, molybdenum, and selenium to be mobilized at levels above regulatory limits. This bench-scale treatability test evaluated neutralization/precipitation with five reagents chosen by Stantec to treat cobalt, arsenic, iron, lithium, molybdenum, and selenium. The Georgia groundwater protection standard (GWPS) for arsenic is 0.010 mg/L, cobalt is 0.006 mg/L, lithium is 0.04 mg/L, molybdenum is 0.1 mg/L, and selenium is 0.05 mg/L.

2.0 BENCH-SCALE STUDY SCOPE

The following phases were conducted for the treatability study:

Initial Characterization
The groundwater was analyzed for

- Field parameters pH, oxidation reduction potential (ORP), dissolved oxygen (DO), specific conductivity (SC), and ferrous iron, sulfide, alkalinity, and hardness using their respective Hach test kits,
- Anions (chloride, fluoride, and sulfate)
- Major dissolved cations (calcium, iron, manganese, magnesium, potassium, and sodium)
- Dissolved trace elements (arsenic, cobalt, molybdenum, and selenium)
- Dissolved lithium
- Dissolved organic carbon (DOC)
- Total dissolved solids (TDS)

The soil was analyzed for percent moisture, soil density, and field holding capacity by TSI.

Column Study

- Objectives:
  - Evaluate pore volume treatment and evolution under transient flow conditions similar to field conditions (increase flow rate by no more than 10x to obtain sample volume)
  - Evaluate influence of treatment reagents on permeability / flow through column
- Soil and groundwater from well GWC-17
- Field flow rate: 0.12 feet per day
- Three reagents and one soil/water control

- Analyze complete chemistry on aqueous sample (pH, ORP, SC, alkalinity, anions [SO4 Cl F], major ions [Fe, Mg, Mn, Na, K, Ca], trace elements [As, Co, Li, Mo, Se] weekly
- Record observations related to flow, leakage, precipitation, photograph periodically

2.1 Bench-scale Groundwater and Soil Collection

Groundwater samples were collected from monitoring well GWC-17 in eight 2.5-gallon cubicontainers (total of 89.9 kg including containers or 20 gallons) on September 6 and 7, 2023. The groundwater samples were received at Terra Systems, Inc. (TSI) on September 9, 2023. Saturated zone soil (20.8 kg) was collected from ARK-SO-GWC-17SB-A/E-20/30-09132022 on September 13, 2022, and received at TSI on September 14, 2022. Additional saturated zone soil was collected from ARK-SO-GWC-17SB-F (21.8 kg) and ARAMW-9 30-40 (38.6 kg) on October 2-3, 2022, and received at TSI on October 6, 2023. Fractured bedrock samples were collected from ARAMW-9 at 41-43' (2.8 kg), 95-96.5' (2.0 kg), 100.7-102' (2.3 kg) on October 4, 2022, and received at TSI on October 6, 2022. Copies of the chain-of-custody forms are attached in Appendix I.

2.2 Baseline Characterization

At the beginning of the bench-scale treatability test, baseline characterization was performed to verify contaminant concentrations in the samples. Homogenized groundwater samples were analyzed for dissolved cations calcium, magnesium, potassium, and sodium; dissolved organic carbon (DOC), total dissolved solids; and sulfate by the Eurofins Lancaster Laboratories. Each cubicontainer was analyzed for dissolved lithium, major cations (calcium, iron, magnesium, manganese, and potassium) and dissolved trace elements of concern: arsenic, cobalt, molybdenum, and selenium. The volume of samples for each analysis in the initial characterization are shown in Table 1. The analytical methods and detection limits provided by Eurofins Lancaster Laboratory are shown in Table 2. TSI measured pH in the soil and groundwater, ORP, dissolved oxygen (DO), total suspended solids, specific conductivity, total and bicarbonate alkalinity, total hardness, ferrous iron, and sulfide in the aqueous phase using calibrated meters and Hach procedures.

Table 1. Analyses and Volumes for Initial Characterization

Analyses	GW Volume
	L
Cations in GW Total Fe, Mg, Mn, Na, K, Ca	0.25
GW Dissolved As, Co, Mo, Se	0.25
GW Dissolved Li	0.25
DOC	0.05
Sulfate, Chloride, and Fluoride	0.05
Total Dissolved Solids	0.5
Field Parameters	0.05
Soil Total As, Co, Fe, Mo, Mn, Se, % Moisture	
Total	1.75

Table 2. Analytes, Methods, and Detection Limits

Analyte	Method	Detection Limit mg/L
Arsenic	6020B ICP/MS	0.00070
Calcium	6010D ICP	0.0989
Chloride	EPA 300.0 R2.1	3.0
Cobalt	6020B ICP/MS	0.000161
Fluoride	EPA 300.0 R2.1	0.45
Iron	6020B ICP/MS	0.0206
Lithium	6010D ICP	0.0113
Magnesium	6020B ICP/MS	0.0165
Manganese	6020B ICP/MS	0.000979
Molybdenum	6020B ICP/MS	0.000134
Potassium	6020B ICP/MS	0.0670
Selenium	6020B ICP/MS	0.000285
Sodium	6020B ICP/MS	0.0927
Sulfate	EPA 300.0 R2.1	0.50
TDS	2540C	13.3

2.3 Initial Characterization Results

As shown in Table 3, the composite groundwater was sampled for sulfate (162 mg/L), fluoride (<0.45 mg/L), chloride (3.1 mg/L), dissolved organic carbon (<0.5 mg/L), calcium (28.5 mg/L), magnesium (21.9 mg/L), potassium (1.79 mg/L), sodium (10.4 mg/L) and total dissolved solids (274 mg/L). Groundwater samples collected at 8:00, 8:40, 9:15, 9:50, 10:35, 14:00, 14:30, and 15:05 were analyzed for dissolved arsenic, cobalt, iron, manganese, molybdenum, and selenium plus dissolved lithium. Lithium and molybdenum were non-detect (<0.000134 mg/L) in all samples. There were low levels of dissolved arsenic (0.00125 to 0.0043 mg/L with an average of 0.00236 mg/L); all were below the GA GWPS of 0.010 mg/L. Dissolved cobalt exceeded the GA GWPS of 0.032 mg/L with concentrations between 0.0547 and 0.0596 mg/L and an average of 0.0576 mg/L. Dissolved selenium was below the GA GWPS of 0.005 mg/L with concentrations between 0.000423 and 0.00122 mg/L and an average of 0.000597 mg/L. Dissolved iron ranged from 0.0919 and 0.192 mg/L with an average of 0.148 mg/L. Dissolved manganese ranged from 1.7 and 1.79 mg/L with an average of 1.74 mg/L.

The pH in the eight samples ranged from 5.2 to 5.8 SU, ORP from 182 to 207 mV, dissolved oxygen from 7.4 to 9.1 mg/L, specific conductivity from 376 to 445 µS/cm, and total suspended solids from 0 to 6.9 mg/L. The composite groundwater had a bicarbonate alkalinity of 40 mg/L as CaCO3, hardness of 180 mg/L as CaCO3, with no detected ferrous iron or sulfide; Hach procedures were used for these analyses.

Table 4 has the results for the soil samples. The ARK-SO-GWC-17SB-A/E-20/30-09132022 soil had a density of 1.64 g/cm^3 (about 102 pounds/cubic feet), field holding capacity of 0.10 g/g soil, and soil dry weight of 70.7%. A composite soil sample had 0.54 mg/kg arsenic, 31.3 mg/kg cobalt, 6.783 mg/kg lithium, 0.279 mg/kg molybdenum, and <0.104 mg/kg selenium. Other metals including 2,930 mg/kg calcium, 46,600 mg/kg iron, 999 mg/kg manganese, 6,140 mg/kg potassium, and 302 mg/kg sodium were detected. The soil contained 30.3 moisture.

The composite ARK-SO-GWC-17SB-F and ARAMW-9 30-40’ soil had a density of 1.73 g/cm^3 (about 108 pounds/cubic feet), field holding capacity of 0.14 g/g soil, and soil dry weight of 82.3%. When saturated with water, the composite soil contained 31.2% moisture (total porosity).

Terra Systems
INCORPORATED

Table 3. Initial Groundwater Characterization Results

Well		GA GWPS	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17	GWC-17 Avg	GW Composite
Time Collected			8:00	8:40	9:15	9:50	10:35	14:00	14:30	15:05		
GW pH	SU		5.8	5.6	5.3	5.2	5.2	5.2	5.2	5.2		
GW ORP	mV		207	184	191	189	194	182	184	185		
GW DO	mg/L		7.5	9.1	7.8	7.6	7.4	8.0	8.2	7.9		
Specific Conductivity	µS/cm		445	409	385	380	376	381	389	386		
GW TSS	mg/L		6.9	0	2.0	1.0	1.2	0	0	0		
GW Hach Bicarbonate Alkalinity	mg/L											40
GW Hach Hardness as CaCO3	mg/L											180
GW Hach Ferrous Iron	mg/L											<0.01
GW Hach Sulfide	mg/L											<0.01
ELLE Results												
Sulfate	mg/L											162
Fluoride	mg/L											<0.45
Chloride	mg/L											3.1
Dissolved Organic Carbon	mg/L											<0.5
Dissolved Arsenic	mg/L	0.010	0.00377	0.00125	0.0043	0.00233	0.00209	0.00127	0.00218	0.00249	0.00246	
Dissolved Cobalt	mg/L	0.032	**0.0583**	**0.0575**	**0.0575**	**0.0592**	**0.0596**	**0.0547**	**0.0579**	**0.0557**	**0.0576**	
Dissolved Iron	mg/L		0.113	0.162	0.0919	0.141	0.133	0.18	0.192	0.175	0.148	
Dissolved Lithium	mg/L	0.040	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	<0.0113	
Dissolved Manganese	mg/L		1.72	1.79	1.75	1.74	1.70	1.74	1.79	1.70	1.74	
Dissolved Molybdenum	mg/L	0.10	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	<0.000134	
Dissolved Selenium	mg/L	0.050	0.000504	0.000446	0.000505	0.000724	0.000423	0.000469	0.000484	0.00122	0.000597	
Total Calcium	mg/L											28.5
Total Magnesium	mg/L											21.9
Total Potassium	mg/L											1.79
Total Sodium	mg/L											10.5
Total Dissolved Solids	mg/L											274
GA GWPS = Georgia Groundwater Protection Standard												
123	Compound above GWPS											
	J Value, compound detected above method detection limit by below method calibration											
	Compound detected in laboratory blank associated with these samples											

Table 4. Soil Characterization

ARK-SO-GWC-17SB-A/E-20/30-09132022 Soil		
Total Arsenic	mg/kg	0.54
Total Calcium	mg/kg	2930
Total Cobalt	mg/kg	31.3
Total Iron	mg/kg	46600
Total Lithium	mg/kg	6.73
Total Magnesium	mg/kg	7440
Total Manganese	mg/kg	999
Total Molybdenum	mg/kg	0.279
Total Potassium	mg/kg	6140
Total Selenium	mg/kg	<0.104
Total Sodium	mg/kg	302
Moisture	%	30.3
Soil Density	g/cm^3	1.64
Soil Field Holding Capacity	g/g	0.10
Soil Dry Weight	%	70.7
Composite ARK-SO-GWC-17SB-F and ARAMW-9 30-40		
Composite Soil Dry Weight	%	82.3
Saturated Composite Soil Density	g/cm^3	1.73
Saturated Composite Soil Dry Weight	%	68.8
Porosity	%	31.2

3.0 COLUMN TESTS

3.1 Column Reagent Selection

Based upon the batch tests described previously, the following reagents were chosen for the column tests:

- Control Column with only soil
- Sodium Bicarbonate: Sodium bicarbonate can increase the pH up to about 8.3 SU. A loading of 3% by weight of the soil was applied to the column.
- CERES 73MF2 – alkaline buffered magnesium oxide and ferrous sulfate at a loading of 3% by weight soil.
- CERES 73MF3 – alkaline buffered magnesium hydroxide, ferrous sulfate, and ferric sulfate at a loading of 3% by weight soil.

The groundwater flowrate (GWFR) for the site was estimated to be 0.12 ft/day. However, this flowrate would not yield sufficient groundwater for the analyses. Increasing the GWFR to 0.6 ft/day (5X the estimated in situ groundwater flowrate) with the 2" diameter column would yield 122 mL/day of flow or 854 mL/week which would be sufficient groundwater for the analyses.

Table 5. Quantities of Soil, Groundwater, and Flowrates for Column Study Based upon Column Diameter and 0.6 ft/day Groundwater Flow Rates

Column Width	**in**	**2**
Column Length	**in**	**36**
Groundwater Flowrate	**ft/day**	**0.60**
Column Volume	cm^3	1,964
Soil Quantity	g	2,991
Total Soil for 4 Columns x 1.25	pounds	26.4
Pore Volume (31.2%) Porosity	mL	612
Flow per minute	mL/minute	0.085
Flow per Day	mL	122
Groundwater per Column for 56 days	mL	6,832
Total Volume Groundwater x 1.25	gal	9.0

3.2 Column Preparation

Four 36-inch long 2-inch diameter clear PVC columns (volumes averaged 1,923 cm^3) were prepared with site soil and groundwater. With a 31.2% total porosity, the pore volume was calculated to be about 600 mL. The columns were prepared by installing a 3/8" plastic bushing to a small luer outlet onto both endcaps. The weight of the empty column and endcaps were recorded. The bottom endcap had a geotextile membrane layer at the bottom and was glued onto the column. The soil was weighed and then added to the column while maintaining the groundwater level (to prevent trapping air bubbles). The column was filled with soil and groundwater and periodically tapped. Once each column was filled, a geotextile covering was placed over the soil and the top endcap was glued onto the column. The weight of soil used in the column, the weight of groundwater, and the weight of the column and endcaps were used to estimate the pore volume of groundwater.

Table 6 shows the quantities of reagents added to each column. The columns were prepared and groundwater flow established overnight. Control column 1 received 3,350 k soil and 458 g groundwater. With a porosity of 31.2%, the pore volume was estimated to be 618 mL.

The sodium bicarbonate column 2 received 3,098 g soil and 503 g groundwater and the pore volume was estimated to be 612 mL. The sodium bicarbonate reagent (93 g) was prepared with 610 mL of groundwater (1 pore volume) and pumped onto column 2 with a moderate flowrate. The loading of sodium bicarbonate was 26.9 g/kg of soil and groundwater in the column.

The first CERES MF2 column 3 received 2,845 g soil and 636 g groundwater and the pore volume was estimated to be 586 mL. Only a portion of the 97 g of 73MF2 reagent suspended in 610 g groundwater slurry for column 3 could be pumped onto the column due to the high backpressure and inadequate capacity of the peristaltic pump. The top 1.5" of the column was cut off, the soil and groundwater removed (3,595 g) from the column, 72 g (additional 2% by weight) of the 73 MF2 reagent was added to the soil and groundwater, mixed with an electric drill and auger, and the soil, groundwater, and amendment placed back into the column, and a new cap added. Little flow was achieved through column 3 from Days 4 to 14. The 3,460 g soil was removed from Column 3 on Day 14 and packed into another longer column (3R) with 3 inches of sand (293 g sand on the bottom of the column and 200 g sand on top to help distribute flow) and an additional 289 g groundwater. The replacement column had a pore volume estimated to be 663 mL.

The first CERES MF3 column 4 received 2,807 g soil and 678 g groundwater and the pore volume was estimated to be 585 mL. The top 1.5 inches of column 4 was cut off, the soil and groundwater removed, 109 g 73MF3 added (3% by weight), mixed with an electric drill and auger, and the soil, groundwater, and amendment were placed back into the column, and a new cap added. The flow through column 4 was very slow. A new column was prepared on Day 7 with 2,990 g soil, three inches of sand on both ends of the column (454 g total), 734 g groundwater, and 109 g MF3 reagent. The replacement column 4R had a pore volume estimated to be 711 mL.

Table 6. Quantities of Soil, Sand, Groundwater, and Reagents added to Columns

Column	Treatment	Quantity Soil (g)	Quantity Sand (g)	Quantity GW (g)	Quantity Reagent (g)	Quantity GW Reagent Dissolved	Reagent g/kg Soil + GW	Pore Volume (mL)
1	Control	3,350		458	0	0	0	618
2	Sodium Bicarbonate	3,098		503	97	610	26.9	612
3	CERES 73MTS2	2,845		636	97	610	27.9	586
3R	CERES 73MTS2	3,460	493	289	72		19.2	663
4	CERES 73MTS3	2,807		678	109		31.3	585
4R	CERES 73MTS3	2,990	454	734	93		25.0	711

The GWC-17 groundwater was pumped from the bottom of the columns with an eight-channel peristaltic pump at a flow rate of about 0.6 ft/day or 122 mL/day or 0.085 mL/min or a residence time in the column of about 5 days. The volume of flow and the time for collection of the groundwater was recorded and the flowrates calculated.

The columns were run for 56 days (8 weeks). The influent was in the cubicontainers the groundwater was shipped in and was open to the atmosphere. The effluent samples were collected in Tedlar bags. Influent samples were analyzed for anions and metals every two weeks (see Table 7) for a total of 5 sampling events. Effluent samples from the columns were submitted to Eurofins Lancaster Laboratories to be analyzed for anions and metals on a weekly basis for 8 samples per column. The DO, pH, ORP, and SC were monitored two times per week using laboratory meters and probes and Hach methods. The alkalinity, total hardness, ferrous iron, and sulfide were monitored weekly. The flowrate, leakage, precipitation, and any comments were recorded. Photographs were made of the columns periodically (see Figures 1 and 2). Soil residue samples were collected and frozen for soils characterization (soil analyses are not included in the scope of work). The soils will be held for six months. Adjustments to the column studies may be made with the approval of the Stantec project manager.

Figure 1. Columns February 27, 2023

Figure 2. Columns March 3, 2023

Table 7. Column Sampling Schedule

Column		Frequency days	Number
GW Influent	Dissolved Metals As, Co, Fe, Mn, Mo, Se	7, 21, 35, 49, and 56	5
	Anions Cl, F, SO4	7, 21, 35, 49, and 56	5
	Dissolved Lithium and Calcium	7, 21, 35, 49, and 56	5
	Dissolved Cations Mg, Na, K	7, 21, 35, 49, and 56	5
GW Effluent	Dissolved Metals As, Co, Fe, Mn, Mo, Se	7, 14, 21, 28, 35, 42, 49, and 56	8
Per Column	Anions Cl, F, SO4	7, 14, 21, 28, 35, 42, 49, and 56	8
	Dissolved Lithium and Calcium	7, 14, 21, 28, 35, 42, 49, and 56	8
	Dissolved Cations Mg, Na, K	7, 14, 21, 28, 35, 42, 49, and 56	8

3.3 Column Operation

3.3.1 Column Flow

Table 8 presents the flowrates for the four columns. The flow rate for the Control column 1 ranged from 0.005 to 0.283 mL/min with an average of 0.137 mL/min and a total flow of 10.8 L or about 17.6 pore volumes. The flowrate was equivalent to 0.31 pore volumes/day or a groundwater flowrate of 0.67 ft/day.

The flow rate for the Sodium Bicarbonate column 2 ranged from 0.000 to 0.265 mL/min with an average of 0.139 mL/min and a total flow of 11.5 L or about 18.8 pore volumes. The flowrate was equivalent to 0.34 pore volumes/day or a groundwater flowrate of 0.56 ft/day.

The flow rate for the MF2 column 3 ranged from 0.000 to 0.282 mL/min with an average of 0.080 mL/min and a total flow of 6.8 L or about 11.6 pore volumes. The flow was low from Days 4 to Day 14 (0 to 0.030 mL/min). The column was repacked on Day 14 with sand on either end to reduce plugging. On Day 21, there was a leak and some of the flow bypassed the column. The flowrate was equivalent to 0.21 pore volumes/day or a groundwater flowrate of 0.31 ft/day.

The flow rate for the MF3 column 4 ranged from 0.001 to 0.254 mL/min with an average of 0.125 mL/min and a total flow of 10.8 L or about 15.3 pore volumes. The flow was low from Days 4 to Day 7 (0.001 to 0.006 mL/min). The column was repacked with sand on either end on Day 7. The flowrate was equivalent to 0.27 pore volumes/day or a groundwater flowrate of 0.38 ft/day.

3.3.2 Column Field Parameters

Influent. The pH in the influent ranged from 6.7 to 9.4 SU and increased over the incubation period for unknown reasons. One possible explanation was the groundwater was supersaturated with carbon dioxide and the pH increased as the carbon dioxide escaped. The ORP was slightly oxidizing ranging from 97 to 204 mV. Specific conductivity ranged from 358 to 499 µS/cm except for the first sampling point on Day -2 (882 µS/cm). The influent was aerobic with DO levels between 8.9 and 11.1 mg/L. There was only a moderate alkalinity (<20 to 40 mg/L as $CaCO_3$) or hardness (160 to 220 mg/L as $CaCO_3$). From Days 7 to 14, ferrous iron was elevated (0.32 to 2.1 mg/L) but was 0.13 mg/L or lower afterwards. Only trace levels of sulfide were detected.

Control Column 1. The pH in the effluent from Column 1 ranged from 3.1 (Day -2) to 8.8 SU and increased over the incubation period for unknown reasons. The ORP was slightly oxidizing ranging from 116 to 410 mV (Day -2). The effluent was aerobic with DO levels between 3.7 and 9.4 mg/L. Specific conductivity ranged from 373 to 701 µS/cm with a slight decrease over time. There was only a moderate alkalinity (40 to 60 mg/L as $CaCO_3$) or hardness (180 to 240 mg/L as $CaCO_3$). Ferrous iron was low (0.03 to 0.24 mg/L). Only trace levels of sulfide were detected.

Sodium Bicarbonate Column 2. The pH in the effluent from Column 2 ranged from 5.5 (Day -2) to 8.5 SU (Day -1). The ORP was slightly oxidizing ranging from 107 to 227 mV (Day -2). Specific conductivity ranged from 380 to 6950 µS/cm. The effluent was aerobic with DO levels between 5.9 and 9.5 mg/L. Specific conductivity was highest at Day -1 and fell to background levels by Day 35. There was elevated alkalinity from Days 7 to 28 (120 to 960 mg/L as $CaCO_3$). Hardness ranged from 60 to 240 mg/L as $CaCO_3$. Ferrous iron was moderate (0.01 to 0.44 mg/L). Only trace levels of sulfide were detected.

MF2 Column 3. Before the MF3 was introduced onto the column, the pH in the effluent from Column 3 ranged from 6.8 (Day -2) to 9.2 SU (Day -1). The pH ranged from 7.1 to 8.4 from Days 14 to 56 after repacking the column. The ORP weas slightly oxidizing ranging from 102 to 242 mV (Day -2). The effluent was aerobic with DO levels between 2.3 and 9.4 mg/L. Moderate

DO levels of 2.3 to 4.5 mg/L were observed from Days 32 to 56. Specific conductivity ranged from 411 to 9,280 µS/cm. Specific conductivity was highest at Day 0 and had fallen to background levels by Day 53. The specific conductivity dropped to 411 µS/cm on Day 21 during the flow interruption. There was low alkalinity ranging from 20 to 60 mg/L as $CaCO_3$. Hardness ranged from 240 to 8,400 mg/L (Day 7) as $CaCO_3$ with an anomalous reading at Day 21 during the flow interruption. Ferrous iron was low (<0.05 to 0.17 mg/L). Only trace levels of sulfide were detected.

Terra Systems INCORPORATED

Table 8. Groundwater Flow Rates and Cumulative Pore Volumes

1	Control					2	NaHCO3					3	MF2					4	MF3		
Day	Flow	Flowrate	Pore Volumes	Cum PV		Flow	Flowrate	Pore Volumes	Cum PV			Flow	Flowrate	Pore Volumes	Cum PV			Flow	Flowrate	Pore Volumes	Cum PV
	mL	mL/min	mL			mL	mL/min	mL				mL	mL/min	mL				mL	mL/min	mL	
-2	78.8		0.13	0.13		351.3		0.57	0.57			271.0		0.46	0.46			274.4		0.47	0.47
-1	250.4		0.41	0.53		596.7		0.98	1.55			83.2		0.14	0.60						
0	240.3		0.39	0.92		251.2		0.41	1.96			62.9		0.11	0.71			1		0.00	0.47
1	257.3	0.195	0.42	1.34		241.4	0.183	0.39	2.36			13.8	0.01	0.02	0.74			0			
2	312.5	0.203	0.51	1.84		363.6	0.236	0.59	2.95			183.8	0.12	0.31	1.05			9.4	0.006	0.02	0.49
3	183.3	0.217	0.30	2.14		180.8	0.214	0.30	3.25			183.8	0.22	0.31	1.36			3.8	0.004	0.01	0.49
4	7.9	0.005	0.01	2.15		0	0.000	0.00	3.25			0	0.00	0	1.36			7.0	0.005	0.01	0.51
7	243.5	0.057	0.39	2.55		231.8	0.054	0.38	3.63			129.3	0.030	0.22	1.58		4R	4.1	0.001	0.01	0.51
9	341.6	0.130	0.55	3.10		387	0.147	0.63	4.26			15.7	0.006	0.03	1.61			251.4	0.096	0.35	0.87
11	650.6	0.224	1.05	4.15		683.3	0.235	1.12	5.38			29.9	0.010	0.05	1.66			738.6	0.254	1.04	1.90
14	710.3	0.170	1.15	5.30		737.5	0.177	1.21	6.58		3R	3.6	0.001	0.01	1.67			799.3	0.192	1.12	3.03
17	546.0	0.132	0.88	6.19		573.9	0.138	0.94	7.52			526.6	0.127	0.90	2.57			617.8	0.149	0.87	3.90
18	139.0	0.107	0.23	6.41		144.8	0.111	0.24	7.76			95.2	0.073	0.16	2.73			155.6	0.120	0.22	4.12
21	409.2	0.097	0.66	7.08		427.4	0.101	0.70	8.46			1190.5	0.282	2.03	4.76			388.1	0.092	0.55	4.66
25	531.5	0.095	0.86	7.94		357.7	0.064	0.58	9.04			292.9	0.053	0.50	5.26			598.3	0.107	0.84	5.50
28	383.8	0.090	0.62	8.56		425.8	0.100	0.70	9.74			77.8	0.018	0.13	5.39			465.3	0.109	0.65	6.16
32	185.4	0.033	0.30	8.86		51.4	0.009	0.08	9.82			138.5	0.024	0.24	5.63			105	0.018	0.15	6.30
35	1194	0.283	1.93	10.79		1117.7	0.265	1.83	11.65			195.4	0.046	0.33	5.96			1551.2	0.368	2.18	8.48
39	918.4	0.164	1.49	12.28		991.6	0.177	1.62	13.27			588.6	0.105	1.00	6.97			1024.1	0.182	1.44	9.92
42	592.5	0.139	0.959	13.24		619.4	0.145	1.013	14.28			437.8	0.102	0.747	7.71			668.7	0.156	0.940	10.86
45	599.1	0.140	0.970	14.21		626.7	0.146	1.025	15.31			481.3	0.112	0.821	8.54			679	0.158	0.955	11.82
49	795.4	0.141	1.288	15.49		832	0.147	1.361	16.67			650.4	0.115	1.110	9.65			895	0.158	1.258	13.08
53	740.1	0.131	1.198	16.69		672.1	0.119	1.099	17.77			624.4	0.110	1.066	10.71			883.1	0.156	1.241	14.32
56	531.9	0.124	0.861	17.55		638.9	0.149	1.045	18.81			510.6	0.119	0.871	11.58			688.1	0.160	0.967	15.29
	Cum	Avg				Cum	Avg					Cum	Avg					Cum	Avg		
	10842.8	0.137				11504	0.139					6787	0.080					10808.3	0.125		

Table 9. Field Parameters

Influent										1	Control						
Day	pH	ORP	DO	SC	Alk	Hard	Fe2+	S		pH	ORP	DO	SC	Alk	Hard	Fe2+	S
	SU	mV	mg/L	mS/cm	mg/L CaCO3	mg/L CaCO3	mg/L	mg/L		SU	mV	mg/L	mS/cm	mg/L CaCO3	mg/L CaCO3	mg/L	mg/L
-2	6.7	169	9.7	882						3.1	410						
-1										6.8	169	9.4	568				
0	7.9	97	9.1	403						7.1	195	5.2	701				
1	8.6	193	9.1	481						6.6	180	4.4	497				
4	7.3	191	9.7	448						7.3	150	6.5	462				
7	7.5	197	9.4	360	40	200	0.32	0.04		6.8	156	6.6	465	60	240	0.03	0.04
9	7.2	158	9.5	358						6.9	208	8.1	446				
11	8.2	184	9.4	494						7.4	156	4.0	460				
14	7.2	192	10.6	421	40	180	2.1	0.01		6.9	161	3.7	414	40	240	0.08	0.02
17	8.4	196	9.7	499						7.6	173	5.8	459				
21	7.7	204	11.1	397	40	160	0.08	0.01		7.3	172	6.2	435	40	240	0.03	0.01
25	7.7	187	9.9	386						7.3	180	7.0	428				
28	7.4	199	9.7	375	40	180	0.13	0		6.9	193	5.0	400	40	240	0.06	0
32	8.0	136	9.4	364						7.7	123	7.6	386				
35	8.2	138	9.6	367	40	160	0.07	0		7.5	118	7.8	373	40	240	0.24	0.04
39	8.3	145	9.9	360						8.0	121	8.1	386				
42	8.7	172	9.6	390	40	160	0.02	0		7.9	135	7.9	379	40	180	0.09	0.02
45	8.1	176	11.1	422						7.7	146	7.7	391				
49	8.6	181	9.9	392	40	220	0.09	0.01		7.90	139	7.8	385	40	240	0.19	<0.01
53	8.9	134	8.9	392						8.3	116	8.2	386				
56	9.4	143	8.9	385	<20	200	0.12	<0.01		8.8	119	7.5	380	40	200	0.09	<0.01

Table 9. Field Parameters

2	NaHCO3										3	MF2		3R	MF2			
Day	pH	ORP	DO	SC	Alk	Hard	Fe2+	S			pH	ORP	DO	SC	Alk	Hard	Fe2+	S
	SU	mV	mg/L	mS/cm	mg/L CaCO3	mg/L CaCO3	mg/L	mg/L			SU	mV	mg/L	mS/cm	mg/L CaCO3	mg/L CaCO3	mg/L	mg/L
-2	5.5	227	8.5	1042							6.8	242	6.7	809				
-1	8.5	167	9.5	6950							9.2	125	7.8	9050				
0	8.0	151	6.7	2580							8.6	110	6.8	9280				
1	7.2	196	5.9	4850							7.7	169	6.4	5230				
4	7.2	150	7.3	2470							8.0	164	3.5	5280				
7	7.2	140	7.2	1539	960	240	0.9	0.04			6.9	130	4.0	5700	60	8400	<0.03	0.03
9	7.4	158	7.9	1145							7.2	161	5.9	6260				
11	7.4	142	6.8	994							7.1	155	4.9	6340				
14	7.4	128	6.7	813	480	120	0.38	0.03		3R	7.1	140	7.3	1769				
17	7.7	158	7.0	690							8.1	163	6.5	1138				
21	7.6	159	6.9	631	240	120	0.06	0.01			7.3	145	9.4	411	40	480	0.09	0.03
25	7.6	154	7.3	551							7.3	173	6.4	3290				
28	7.4	170	7.3	489	120	80	0.15	0.01			7.2	187	6.8	3030	40	1920	0.11	0
32	7.8	115	7.3	472							7.4	120	2.5	2580				
35	7.7	111	8.9	399	80	60	0.44	0.01			7.5	102	2.3	1315	40	840	<0.05	<0.01
39	7.9	112	8.4	380							7.7	114	4.2	967				
42	7.7	128	7.7	400	40	160	0.01	<0.01			7.6	124	2.7	751	40	360	0.1	<0.01
45	7.6	137	6.9	403							7.5	136	4.5	622				
49	7.7	130	8.3	394	40	160	0.10	0.01			7.7	123	4.4	526	20	360	0.04	<0.01
53	8.0	107	7.4	389							8.1	104	4.2	458				
56	8.3	113	7.3	389	40	200	0.04	<0.01			8.4	104	4.3	429	20	240	0.17	<0.01

Table 9. Field Parameters

		4	MF3						
Day		pH	ORP	DO	SC	Alk	Hard	Fe2+	S
		SU	mV	mg/L	mS/cm	mg/L CaCO3	mg/L CaCO3	mg/L	mg/L
-2		9.7	149	9.6	1416				
-1									
0									
1									
4		7.7	153	7.6	>10000				
7	4R	4.1	277	5.9		60	3600		
9		7.2	154	8.2	8070				
11		7.1	153	2.5	6320				
14		7.1	134	2.9	4210	20	6000	0.2	0.02
17		7.8	163	5.0	1740				
21		7.0	162	6.6	1136	20	1080	0.06	0.01
25		7.3	160	7.2	980				
28		7.3	191	10.2	3530	20	480	0.23	0.06
32		7.5	105	7.4	786				
35		7.5	92	7.2	571	20	360	<0.01	<0.01
39		7.7	109	7.9	529				
42		7.5	105	7.5	544	40	360	0.02	<0.01
45		7.5	132	7.0	525				
49		7.7	120	7.4	475	20	320	0.06	0.02
53		8.0	102	6.4	455				
56		8.3	102	7.3	418	20	240	<0.01	<0.01

>10000 specific conductivity exceeded the maximum range

MF3 Column 4. The pH in the effluent from Column 4 ranged from 4.1 (Day 7) to 9.7 SU (Day -2). The pH ranged from 7.2 to 8.3 from Days 9 to 56. The ORP was slightly oxidizing ranging from 92 to 277 mV (Day 7). The effluent was aerobic with DO levels between 2.5 and 10.2 mg/L. Moderate DO levels of 2.5 to 5.0 mg/L were observed from Days 11 to 17. Specific conductivity ranged from 418 to >10,000 µS/cm (Day 4). Specific conductivity was highest on Day 4 and had fallen to background levels by Day 49. There was low alkalinity 20 to 60 mg/L as $CaCO_3$. Hardness ranged from 240 to 6,000 mg/L (Day 14) as $CaCO_3$. Ferrous iron was low (<0.01 to 0.23 mg/L). Only trace levels of sulfide were detected.

3.3.3 Column Metals and Anions

Table 10 presents the metals and anions data for each column.

Influent. Arsenic decreased from 0.00887 to <0.00070 mg/L in the influent likely due to the aerobic conditions in the storage vessels and/or precipitation with ferric oxides. Arsenic never exceeded the GA GWPS of 0.010 mg/L in the influent. Cobalt ranged from 0.0524 to 0.0614 mg/L in the influent and remained above the GA GWPS of 0.0060 mg/L. Dissolved iron ranged from <0.0206 to 0.0434 mg/L. Dissolved manganese ranged from 1.7 to 1.8 mg/L. Molybdenum, lithium, and fluoride were not detected in the influent. Only low levels of selenium (0.000422 to 0.000493 mg/L) were detected. Calcium, magnesium, sodium, and potassium showed little variability, with calcium ranging from 25.4 to 27.2 mg/L, magnesium from 23.1 to 24.8 mg/L, sodium from 10.5 to 10.9 mg/L, and potassium from 1.41 to 1.45 mg/L. Only trace levels of chloride were detected. Sulfate varied between 152 and 167 mg/L.

Control Column 1. Arsenic decreased from 0.00779 to <0.00070 mg/L in the Control Column effluent likely due to the aerobic conditions in the storage vessels and/or precipitation with ferric oxides. Arsenic never exceeded the GA GWPS. Cobalt ranged from 0.016 to 0.0432 mg/L in the effluent and remained above the GA GWPS of 0.0060 mg/L. Dissolved iron ranged from <0.0206 to 0.0417 mg/L. Dissolved manganese ranged from 1.78 to 4.78 mg/L. Molybdenum was present at low concentrations of 0.000282 to 0.00051 mg/L. Lithium was only detected once at 0.0177 mg/L on Day 28. Only low levels of selenium (0.000357 to 0.000562 mg/L) were detected. Calcium, magnesium, sodium, and potassium showed little variability, with calcium ranging from 33.0 to 46.9 mg/L, magnesium from 18.9 to 27.6 mg/L, sodium from 11.5 to 19.8 mg/L, and potassium from 1.61 to 2.12 mg/L. Only trace levels of chloride were detected. Sulfate varied between 157 and 228 mg/L.

Sodium Bicarbonate Column 2. Arsenic decreased from 0.0068 to <0.00070 mg/L in the Sodium Bicarbonate Column 2 effluent likely due to the aerobic conditions in the storage vessels and/or precipitation with ferric oxides. Arsenic never exceeded the GA GWPS. Cobalt ranged from 0.000562 to 0.00487 mg/L in the effluent and remained below the GA GWPS of 0.0060 mg/L. Dissolved iron ranged from <0.0206 to 0.0391 mg/L. Dissolved manganese ranged from 0.136 to 0.824 mg/L which was 52.6 to 92.0% lower than the influent. Molybdenum was present at low concentrations of 0.000133 to 0.000613 mg/L. Lithium was not detected. Only low levels of selenium (0.000396 to 0.000773 mg/L) were

detected. Calcium ranged from 10.3 to 48.5 (day 7) mg/L, magnesium from 5.06 to 33.6 mg/L, sodium from 19.7 to 714 mg/L, and potassium from 0.947 to 3.95 mg/L. The maximum sodium was detected on Day 7 and decreased to 19.7 mg/L on Day 56. Only low levels of chloride were detected. Sulfate varied between 157 and 280 mg/L.

MF2 Column 3. Arsenic decreased from 0.00664 to <0.00070 mg/L in the MF2 Column 3 effluent likely due to the aerobic conditions in the storage vessels and/or precipitation with ferric oxides. Arsenic never exceeded the GA GWPS. Cobalt ranged from 0.000315 to 0.0422 mg/L in the effluent and remained below the GA GWPS of 0.0060 mg/L except on Day 21 during the flow interruption. Dissolved iron ranged from <0.0206 to 0.0816 mg/L. Dissolved manganese ranged from 0.00718 to 1.48 mg/L which was 14.5 to 99.6% lower than the influent. Molybdenum was present at low concentrations of 0.000364 to 0.00235 mg/L. Lithium was not detected. Only low levels of selenium (0.000364 to 0.000645 mg/L) were detected. Calcium ranged from 24 to 455 (day 7) mg/L, magnesium from 34.1 to 1.070 mg/L, sodium from 18.7 to 164 mg/L, and potassium from 1.26 to 6.48 mg/L. The maximums for calcium, magnesium, and sodium were detected on Days 7 to 14 and decreased to near background levels by Day 56. The MF2 reagent contains calcium, magnesium, and sodium. While it also contains ferrous sulfate, little ferrous iron or dissolved iron was detected in the effluent possibly due to the aerobic conditions. Only moderate levels of chloride (3.15 to 34.6 mg/L) were detected. Sulfate decreased from 5,680 mg/L on Day 7 to 211 mg/L on Day 56.

MF3 Column 4. Not enough effluent was available to collect a sample on Day 7. Arsenic decreased from 0.00322 to <0.00070 mg/L in the MF3 Column 4 effluent likely due to the aerobic conditions in the storage vessels and/or precipitation with ferric oxides. Arsenic never exceeded the GA GWPS. Cobalt ranged from 0.000193 to 0.00915 mg/L in the effluent and remained below the GA GWPS. Dissolved iron ranged from <0.0206 to 0.0632 mg/L. Dissolved manganese ranged from 0.00573 to 0.153 mg/L which was 91.2 to 99.7% lower than the influent. Molybdenum was present at low concentrations of 0.000151 to 0.00108 mg/L. Lithium was detected at 0.0178 mg/L only on Day 14. Only low levels of selenium (0.000313 to 0.000731 mg/L) were detected. Calcium ranged from 30 to 401 (Day 14) mg/L, magnesium from 28.3 to 812 mg/L, sodium from 15.6 to 32.7 mg/L, and potassium from 1.45 to 3.25 mg/L. The maximum calcium, magnesium, and sodium were detected on Day 14 and decreased to near background levels by Day 56. The MF3 reagent contains calcium and magnesium. While it also contains ferrous sulfate and ferric sulfate, little ferrous iron or dissolved iron was detected in the effluent. Only moderate levels of chloride (3.15 to 18 mg/L) were detected. Sulfate decreased from 4,210 mg/L on Day 14 to 224 mg/L on Day 56 which is 34% higher than the influent.

Table 10. Metals and Anions in Columns

Day	Dis As	Dis Co	Dis Fe	Dis Mn	Dis Mo	Dis Se	Dis Li	Dis Ca	Dis Mg	Dis Na	Dis K	Chloride	Fluoride	Sulfate
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
GA GWPS	0.010	0.0060			0.10	0.050	0.040							
Influent														
7	0.00887	**0.0524**	<0.0206	1.74	<0.000134	0.000461	<0.0113	27	24.8	10.6	1.45	3.19	<0.45	158
21	0.00346	**0.0597**	<0.0206	1.73	<0.000134	0.000422	<0.0113	27	23.4	10.5	1.41	<3	<0.45	152
35	0.00247	**0.0594**	<0.0206	1.7	<0.000134	0.000493	<0.0113	27.2	23.1	10.5	1.43	3.01	<0.45	154
49	0.000732	**0.0614**	0.0434	1.8	<0.000134	0.000432	<0.0113	25.7	23.5	10.9	1.42	3.03	<0.45	158
56	<0.00070	**0.0585**	0.0275	1.7	<0.000134	0.000475	<0.0113	25.5	23.5	10.6	1.43	3.31	<0.45	167
Column	1	Control												
7	0.00779	**0.016**	<0.0206	1.78	0.000282	0.000562	<0.0113	46.9	27.6	19.8	2.12	5.62	<0.45	228
14	0.0045	**0.0427**	<0.0206	4.78	0.000362	0.000559	<0.0113	41.5	23.1	15.4	1.75	4.4	<0.45	207
21	0.00616	**0.0425**	<0.0206	4.23	0.000436	0.000357	<0.0113	39.6	20.3	13.8	1.66	3.34	<0.45	172
28	0.00458	**0.0432**	<0.0206	4.55	0.000431	0.000416	0.0177	36.1	20.3	13.1	1.67	3.48	<0.45	217
35	0.00348	**0.0351**	<0.0206	4.09	0.000508	0.000424	<0.0113	37.9	18.9	12.1	1.62	3.24	<0.45	157
42	0.00105	**0.0267**	0.0265	3.87	**0.00051**	0.000437	<0.0113	35.7	19.4	11.6	1.61	3.20	<0.45	169
49	<0.00070	**0.0221**	<0.0206	3.63	0.000336	0.000495	<0.0113	33.1	20.2	11.6	1.70	3.12	<0.45	159
56	<0.00070	**0.0178**	0.0417	3.18	0.000394	0.000473	<0.0113	33.0	18.9	11.5	1.73	3.16	<0.45	171
Column	2	NaHCO3												
7	0.00680	0.00487	<0.0206	0.824	0.00542	0.000773	<0.0113	48.5	33.6	714	3.95	7.29	<0.45	280
14	0.00377	0.00196	0.0391	0.373	0.00423	0.000511	<0.0113	23.2	12.7	195	1.82	4.3	<0.45	236
21	0.00309	0.00126	<0.0206	0.22	0.00458	0.000397	<0.0113	15.3	7.38	125	1.26	3.07	0.472	178
28	0.00265	0.000780	<0.0206	0.147	0.00613	0.000396	<0.0113	10.3	5.06	97.7	1.03	<3.0	0.50	167
35	0.00403	0.000739	<0.0206	0.136	0.00307	0.000535	<0.0113	13.7	6.99	68.6	1.00	<3	<0.45	159
42	<0.00070	0.000578	<0.0206	0.181	0.00256	0.000407	<0.0113	18.7	8.87	55.9	0.971	<3	<0.45	163
49	<0.00070	0.000755	<0.0206	0.245	0.00177	0.000461	<0.0113	27.2	14.4	31.0	0.997	3.01	<0.45	157
56	<0.00070	0.000562	<0.0206	0.263	0.00133	0.000448	<0.0113	33.0	17.3	19.7	0.947	3.48	<0.45	177
Column	3	MF2												
7	0.00255	0.00135	<0.0206	0.144	0.00235	0.000490	<0.0113	455	1030	148	5.15	34.6	<0.45	5680
14	0.00178	0.00435	0.0816	0.483	0.00170	0.000346			1070	164	6.48			
21	0.00664	**0.0422**	<0.0206	1.48	0.000561	0.000645	<0.0113	40	59.9	18.7	1.75	4.14	<0.45	333
28	0.00307	0.00131	0.0267	0.0839	0.00140	<0.000286	<0.0113	180	408	101	3.55	15.2	<0.45	2190
35	0.00517	0.00171	0.0303	0.149	0.000997	<0.000286	<0.0113	126	285	87.1	4.49	15.6	<0.45	1480
42	0.00134	0.000428	0.0435	0.0512	0.000535	<0.000286	<0.0113	52.2	97.2	38.8	1.7	3.62	<0.45	573
49	<0.00070	0.000315	<0.0206	0.0173	0.000391	<0.000286	<0.0113	28.7	46.1	22.7	1.26	<3.0	<0.45	280
56	<0.00070	<0.000161	0.0359	0.00718	0.000364	<0.000286	<0.0113	24.0	34.1	21.1	1.28	3.15	<0.45	211
Column	4	MF3												
7														
14	0.00322	0.000766	0.0632	0.153	0.00108	0.000731	0.0178	401	812	32.7	3.25	18	<0.45	4210
21	0.00205	0.000915	<0.0206	0.0353	0.000441	<0.000286	<0.0113	126	167	19.8	1.98	5.35	<0.45	1020
28	0.00349	0.000361	0.0236	0.0165	0.000181	<0.000286	<0.0113	59	85.9	20	1.77	3.47	<0.45	480
35	0.00225	0.000419	<0.0206	0.0165	0.000194	0.000313	<0.0113	41	45.9	15.7	1.45	3.21	<0.45	289
42	0.000822	0.000201	0.0212	0.00573	0.000285	<0.000286	<0.0113	38.4	41.6	16.5	1.59	<3.0	<0.45	267
49	0.000862	0.000193	<0.0206	0.00637	0.000151	<0.000286	<0.0113	32.8	34.5	17.1	1.61	<3.0	<0.45	242
56	<0.00070	<0.000161	0.0344	0.0106	<0.000134	<0.000286	<0.0113	30.0	28.3	15.6	1.6	3.21	<0.45	224

0.000732 J value, compound detected above method detection limit but below method calibration limit

0.0524 Compound exceeds GA GWPS

4.0 CONCLUSIONS

The following conclusions can be reached from the column study:

1. Arsenic levels were below the GA GWPS in the groundwater. Aerobic conditions and potentially adsorption to iron oxides appeared to completely remove arsenic in the influent and effluents of the four columns by Day 56.
2. Sodium bicarbonate, CERES MF2, and CERES MF3 were effective in reducing the cobalt to below the GA GWPS (except for the flow interruption in Column 3 on Day 21).
3. Lithium, molybdenum, and selenium were below the GA GWPS in the groundwater and the effluents from the four columns.
4. Sodium bicarbonate at a loading of 27 g/kg of soil and groundwater maintained conditions favorable for cobalt removal for over 19 pore volumes even after the sodium and alkalinity had fallen to background levels.
5. The 19 g/kg CERES MF2 and 25 g/kg MF3 reagents were both effective in treating cobalt for more than 12 to 15 pore volumes.

Please let me know if you have any questions about this draft report.

Sincerely,
TERRA SYSTEMS, INC.

Michael D. Lee, Ph.D.
Vice-President Research and Development

Terra Systems
INCORPORATED

ATTACHMENT 1
CHAIN-OF-CUSTODY FORMS

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

Terra Systems INCORPORATED

No. __ 1 of 1

TERRA SYSTEMS, INC.

130 Hickman Road, Suite 1, Claymont, DE 19703 phone 302-798-9553 fax 302-798-9554

Chain of Custody

Client: Stantec

Project Name: GPC - Plant Arkwright Treatability

Project Description: Treatability Study

Project Manager /Contact: Edgar Smith edgar.smithii@stantec.com Shannon Zahuranec shannon.zahuranec@stantec.com

Lot:

Location: Macon, Ga

Phone: 770-656-2676 / 859-619-6086

Sampler: Jackson Bankston

Parameters for Analysis

Date	Time	Sample Identification	Sample Technique	Matrix	Preser-vative	Container Type	Number of Containers	Treatability								Remarks
9/6/2022	14:00	GWC17-09062022-01	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1400-1425
9/6/2022	14:30	GWC17-09062022-02	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1430-1457
9/6/2022	15:05	GWC17-09062022-03	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1505-1532
9/7/2022	8:00	GWC17-09062022-04	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0800-0835
9/7/2022	8:40	GWC17-09062022-05	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0840-0910
9/7/2022	9:15	GWC17-09062022-06	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 0915-0945
9/7/2022	9:50	GWC17-09062022-07	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 950-1030
9/7/2022	10:35	GWC17-09062022-08	Low Flow	WG	Ice/None	2.5 G Cubitainer	1	X								Time: 1035-1100

Relinquished by (signature)	Date/time	Received by (signature)	Date/time
Jackson Bankston	9/8/2022 1500	R. L Michael R Lee	9/9/22 10:00

Shipped to: Dr. Mike Lee

Terra Systems Incorporated

130 Hickman Road, Suite 1, Claymont, Delaware 19703

Date/time: 09/08/2022 / 15:00

Carrier/Airbill number: FedEx

Cooler Temperature: °C pH: Comments:

Cooler 4 of 4

No. __ 1 of 1

TERRA SYSTEMS, INC.

Chain of Custody

130 Hickman Road, Suite 1, Claymont, DE 19703 phone 302-798-9553 fax 302-798-9554

Client:	Stantec	Project Name:	GPC - Plant Arkwright Treatability		
Project Description:	Treatability Study	Project Manager /Contact:	Edgar Smith edgar.smithii@stantec.com Shannon Zahuranec shannon.zahuranec@stantec.com	Lot:	
Location:	Macon, Ga	Phone:	770-656-2676 / 859-619-6086	Number of Containers	Treatability
Sampler:	Jackson Bankston				

Date	Time	Sample Identification	Sample Technique	Matrix	Preser-vative	Container Type	Number of Containers	Treatability	Parameters for Analysis								Remarks
10/2/2022	16:10	ARK-SO-GWC-17SB-F	Rotary Sonic	SO	Ice/None	2 G Bucket	2	X									

Relinquished by (signature)	Date/time	Received by (signature)	Date/time
		Michael D Lee	10/6/22 10:00

Shipped to: Dr. Mike Lee

Terra Systems Incorporated

130 Hickman Road, Suite 1, Claymont, Delaware 19703

Date/time: 10/5/2022 / 1930

Carrier/Airbill number: FedEx

Cooler Temperature: °C pH: Comments:

Cooler of

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

No. __ 1 of 1

TERRA SYSTEMS, INC.

130 Hickman Road, Suite 1, Claymont, DE 19703 phone 302-798-9553 fax 302-798-9554

Chain of Custody

Client:	Stantec	Project Name:	GPC - Plant Arkwright Treatability		
Project Description:	Treatability Study	Project Manager /Contact:	Edgar Smith edgar.smithii@stantec.com Shannon Zahuranec shannon.zahuranec@stantec.com	Lot:	
Location:	Macon, Ga	Phone:	770-656-2676 / 859-619-6086		
Sampler:	Jackson Bankston				

Date	Time	Sample Identification	Sample Technique	Matrix	Preser-vative	Container Type	Number of Containers	Parameters for Analysis: Treatability	Remarks
10/3/2022	12:00	ARAMW-9 30.0-40.0	Rotary Sonic	SO	Ice/None	2 Gal Bucket	4	X	
10/4/2022	13:24	ARAMW-9 41.0-43.0	Rotary Sonic	ROCK	Ice/None	2 Gal Ziploc	1	X	
10/4/2022	17:00	ARAMW-9 95.0-96.5	Rotary Sonic	ROCK	Ice/None	2 Gal Ziploc	1	X	
10/4/2022	17:39	ARAMW-9 100.7-102.0	Rotary Sonic	ROCK	Ice/None	2 Gal Ziploc	1	X	

Relinquished by (signature)	Date/time	Received by (signature)	Date/time
[signature]	10/5/222030	FedEx	
		Michael D Lee	10/6/22 1030

Shipped to: Dr. Mike Lee

Terra Systems Incorporated

130 Hickman Road, Suite 1, Claymont, Delaware 19703

Date/time: 10/5/2022 / 1930

Carrier/Airbill number: FedEx

Cooler Temperature: °C pH: Comments:

Cooler of

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

Terra Systems
INCORPORATED

ATTACHMENT 2
ANALYTICAL REPORTS

130 Hickman Road – Suite 1 – Claymont – Delaware – 19703
Phone: 302-798-9553 or Visit www.terrasystems.net

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 3/6/2023 4:53:04 AM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-116891-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
3/6/2023 4:53:04 AM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

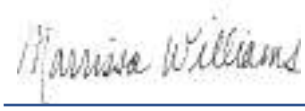


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-116891-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
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.
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-116891-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-116891-1

Receipt
The samples were received on 2/27/2023 3:44 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 time was 0.2°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Client Sample ID: Influent Day 7 — Lab Sample ID: 410-116891-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	158	F1	75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.19	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	27.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	8.87		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	52.4		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	24800		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1740		2.06	0.979	ug/L	1		6020B	Dissolved
Potassium	1450		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.461	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	10600		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 1 Day 7 — Lab Sample ID: 410-116891-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	228		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	5.62	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	46.9		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	7.79		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	16.0		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	27600		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1780		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.282	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	2120		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.562	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	19800		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 7 — Lab Sample ID: 410-116891-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	280		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	7.29	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	48.5		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	6.80		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	4.87		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	33600	^2	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	824		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	5.42		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	3950		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.773	J F1	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	714000		2060	927	ug/L	10		6020B	Dissolved

Client Sample ID: Column 3 Day 7 — Lab Sample ID: 410-116891-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	5680		1500	500	mg/L	1000		EPA 300.0 R2.1	Total/NA
Chloride	34.6		15.0	6.00	mg/L	10		EPA 300.0 R2.1	Total/NA
Calcium	455		5.15	0.989	mg/L	10		6010D	Dissolved
Arsenic	2.55		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	1.35		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	1030000		5150	1650	ug/L	100		6020B	Dissolved
Manganese	144		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	2.35		0.515	0.134	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 3 Day 7 (Continued)

Lab Sample ID: 410-116891-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Potassium	5150		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.490	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	148000		2060	927	ug/L	10		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Client Sample ID: Influent Day 7

Lab Sample ID: 410-116891-1

Date Collected: 02/27/23 07:15
Matrix: Water
Date Received: 02/27/23 15:44

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/01/23 21:58	5
Sulfate	**158**	**F1**	75.0	25.0	mg/L			03/02/23 22:23	50
Chloride	**3.19**	**J**	7.50	3.00	mg/L			03/01/23 21:58	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/01/23 09:39	03/02/23 02:58	1
Calcium	**27.0**		0.515	0.0989	mg/L		03/01/23 09:39	03/02/23 02:58	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**8.87**		2.06	0.700	ug/L		03/01/23 09:39	03/01/23 14:40	1
Cobalt	**52.4**		0.515	0.161	ug/L		03/02/23 13:08	03/02/23 19:59	1
Iron	<20.6		51.5	20.6	ug/L		03/01/23 09:39	03/01/23 14:40	1
Magnesium	**24800**		51.5	16.5	ug/L		03/02/23 13:08	03/02/23 19:59	1
Manganese	**1740**		2.06	0.979	ug/L		03/01/23 09:39	03/01/23 14:40	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/01/23 09:39	03/01/23 14:40	1
Potassium	**1450**		206	67.0	ug/L		03/02/23 13:08	03/02/23 19:59	1
Selenium	**0.461**	**J**	1.03	0.286	ug/L		03/01/23 09:39	03/01/23 14:40	1
Sodium	**10600**		206	92.7	ug/L		03/02/23 13:08	03/02/23 19:59	1

Client Sample ID: Column 1 Day 7

Lab Sample ID: 410-116891-2

Date Collected: 02/27/23 07:45
Matrix: Water
Date Received: 02/27/23 15:44

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/01/23 22:08	5
Sulfate	**228**		75.0	25.0	mg/L			03/02/23 18:49	50
Chloride	**5.62**	**J**	7.50	3.00	mg/L			03/01/23 22:08	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/01/23 09:39	03/02/23 03:01	1
Calcium	**46.9**		0.515	0.0989	mg/L		03/01/23 09:39	03/02/23 03:01	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**7.79**		2.06	0.700	ug/L		03/01/23 09:39	03/01/23 14:42	1
Cobalt	**16.0**		0.515	0.161	ug/L		03/02/23 13:08	03/02/23 19:46	1
Iron	<20.6		51.5	20.6	ug/L		03/01/23 09:39	03/01/23 14:42	1
Magnesium	**27600**		51.5	16.5	ug/L		03/02/23 13:08	03/02/23 19:46	1
Manganese	**1780**		2.06	0.979	ug/L		03/01/23 09:39	03/01/23 14:42	1
Molybdenum	**0.282**	**J**	0.515	0.134	ug/L		03/01/23 09:39	03/01/23 14:42	1
Potassium	**2120**		206	67.0	ug/L		03/02/23 13:08	03/02/23 19:46	1
Selenium	**0.562**	**J**	1.03	0.286	ug/L		03/01/23 09:39	03/01/23 14:42	1
Sodium	**19800**		206	92.7	ug/L		03/02/23 13:08	03/02/23 19:46	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Client Sample ID: Column 2 Day 7

Lab Sample ID: 410-116891-3

Date Collected: 02/27/23 08:15

Matrix: Water

Date Received: 02/27/23 15:44

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/01/23 22:41	5
Sulfate	**280**		75.0	25.0	mg/L			03/02/23 18:57	50
Chloride	**7.29**	**J**	7.50	3.00	mg/L			03/01/23 22:41	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/01/23 09:39	03/02/23 01:50	1
Calcium	**48.5**		0.515	0.0989	mg/L		03/01/23 09:39	03/02/23 01:50	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**6.80**		2.06	0.700	ug/L		03/01/23 09:39	03/01/23 14:06	1
Cobalt	**4.87**		0.515	0.161	ug/L		03/02/23 12:57	03/02/23 17:41	1
Iron	<20.6		51.5	20.6	ug/L		03/01/23 09:39	03/01/23 14:06	1
Magnesium	**33600**	**^2**	51.5	16.5	ug/L		03/02/23 12:57	03/02/23 17:41	1
Manganese	**824**		2.06	0.979	ug/L		03/01/23 09:39	03/01/23 14:06	1
Molybdenum	**5.42**		0.515	0.134	ug/L		03/01/23 09:39	03/01/23 14:06	1
Potassium	**3950**		206	67.0	ug/L		03/02/23 12:57	03/02/23 17:41	1
Selenium	**0.773**	**J F1**	1.03	0.286	ug/L		03/01/23 09:39	03/01/23 14:06	1
Sodium	**714000**		2060	927	ug/L		03/02/23 12:57	03/03/23 07:27	10

Client Sample ID: Column 3 Day 7

Lab Sample ID: 410-116891-4

Date Collected: 02/27/23 08:45

Matrix: Water

Date Received: 02/27/23 15:44

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/02/23 01:11	5
Sulfate	**5680**		1500	500	mg/L			03/02/23 21:58	1000
Chloride	**34.6**		15.0	6.00	mg/L			03/02/23 21:49	10

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/01/23 09:39	03/02/23 02:55	1
Calcium	**455**		5.15	0.989	mg/L		03/01/23 09:39	03/02/23 19:26	10

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**2.55**		2.06	0.700	ug/L		03/01/23 09:39	03/01/23 14:36	1
Cobalt	**1.35**		0.515	0.161	ug/L		03/02/23 12:57	03/02/23 17:23	1
Iron	<20.6		51.5	20.6	ug/L		03/01/23 09:39	03/01/23 14:36	1
Magnesium	**1030000**		5150	1650	ug/L		03/02/23 12:57	03/02/23 18:27	100
Manganese	**144**		2.06	0.979	ug/L		03/01/23 09:39	03/01/23 14:36	1
Molybdenum	**2.35**		0.515	0.134	ug/L		03/01/23 09:39	03/01/23 14:36	1
Potassium	**5150**		206	67.0	ug/L		03/02/23 12:57	03/02/23 17:23	1
Selenium	**0.490**	**J**	1.03	0.286	ug/L		03/01/23 09:39	03/01/23 14:36	1
Sodium	**148000**		2060	927	ug/L		03/02/23 12:57	03/02/23 18:25	10

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-349219/5
Matrix: Water
Analysis Batch: 349219

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/01/23 12:59	1
Sulfate	<0.500		1.50	0.500	mg/L			03/01/23 12:59	1
Chloride	<0.600		1.50	0.600	mg/L			03/01/23 12:59	1

Lab Sample ID: LCS 410-349219/3
Matrix: Water
Analysis Batch: 349219

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7290		mg/L		97	90 - 110
Sulfate	7.50	7.283		mg/L		97	90 - 110
Chloride	3.00	2.916		mg/L		97	90 - 110

Lab Sample ID: LCSD 410-349219/4
Matrix: Water
Analysis Batch: 349219

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7371		mg/L		98	90 - 110	1	20
Sulfate	7.50	7.282		mg/L		97	90 - 110	0	20
Chloride	3.00	2.919		mg/L		97	90 - 110	0	20

Lab Sample ID: MB 410-349329/5
Matrix: Water
Analysis Batch: 349329

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/02/23 00:39	1
Sulfate	<0.500		1.50	0.500	mg/L			03/02/23 00:39	1
Chloride	<0.600		1.50	0.600	mg/L			03/02/23 00:39	1

Lab Sample ID: LCS 410-349329/3
Matrix: Water
Analysis Batch: 349329

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7528		mg/L		100	90 - 110
Sulfate	7.50	7.338		mg/L		98	90 - 110
Chloride	3.00	2.963		mg/L		99	90 - 110

Lab Sample ID: LCSD 410-349329/4
Matrix: Water
Analysis Batch: 349329

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7531		mg/L		100	90 - 110	0	20
Sulfate	7.50	7.348		mg/L		98	90 - 110	0	20
Chloride	3.00	2.970		mg/L		99	90 - 110	0	20

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: 410-116891-4 MS
Matrix: Water
Analysis Batch: 349329

Client Sample ID: Column 3 Day 7
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Fluoride	<0.450		2.50	2.411		mg/L		96	90 - 110		

Lab Sample ID: 410-116891-4 DU
Matrix: Water
Analysis Batch: 349329

Client Sample ID: Column 3 Day 7
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Fluoride	<0.450			<0.450		mg/L				NC	15

Lab Sample ID: MB 410-349650/5
Matrix: Water
Analysis Batch: 349650

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/02/23 12:49	1
Sulfate	<0.500		1.50	0.500	mg/L			03/02/23 12:49	1
Chloride	<0.600		1.50	0.600	mg/L			03/02/23 12:49	1

Lab Sample ID: LCS 410-349650/3
Matrix: Water
Analysis Batch: 349650

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Sulfate			7.50	7.123		mg/L		95	90 - 110		
Chloride			3.00	2.911		mg/L		97	90 - 110		

Lab Sample ID: LCSD 410-349650/4
Matrix: Water
Analysis Batch: 349650

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate			7.50	7.245		mg/L		97	90 - 110	2	20
Chloride			3.00	2.905		mg/L		97	90 - 110	0	20

Lab Sample ID: MB 410-349691/5
Matrix: Water
Analysis Batch: 349691

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/02/23 21:23	1
Sulfate	<0.500		1.50	0.500	mg/L			03/02/23 21:23	1
Chloride	<0.600		1.50	0.600	mg/L			03/02/23 21:23	1

Lab Sample ID: LCS 410-349691/3
Matrix: Water
Analysis Batch: 349691

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Sulfate			7.50	7.268		mg/L		97	90 - 110		
Chloride			3.00	2.935		mg/L		98	90 - 110		

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: LCSD 410-349691/4
Matrix: Water
Analysis Batch: 349691

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate			7.50	7.277		mg/L		97	90 - 110	0	20
Chloride			3.00	2.941		mg/L		98	90 - 110	0	20

Lab Sample ID: 410-116891-1 MS
Matrix: Water
Analysis Batch: 349691

Client Sample ID: Influent Day 7
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Sulfate	158	F1	250	446.9	F1	mg/L		115	90 - 110		

Lab Sample ID: 410-116891-1 DU
Matrix: Water
Analysis Batch: 349691

Client Sample ID: Influent Day 7
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Sulfate	158	F1		158.7		mg/L				0.2	15

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-349057/1-A
Matrix: Water
Analysis Batch: 349430

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349057

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/01/23 09:39	03/02/23 01:44	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/01/23 09:39	03/02/23 01:44	1

Lab Sample ID: LCS 410-349057/2-A
Matrix: Water
Analysis Batch: 349430

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349057

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Lithium			0.500	0.5656		mg/L		113	80 - 120		
Calcium			5.00	5.304		mg/L		106	80 - 120		

Lab Sample ID: 410-116891-3 MS
Matrix: Water
Analysis Batch: 349430

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Lithium	<0.0113		0.500	0.5745		mg/L		115	75 - 125		
Calcium	48.5		5.00	55.17	4	mg/L		133	75 - 125		

Lab Sample ID: 410-116891-3 MSD
Matrix: Water
Analysis Batch: 349430

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lithium	<0.0113		0.500	0.5527		mg/L		111	75 - 125	4	20
Calcium	48.5		5.00	53.77	4	mg/L		105	75 - 125	3	20

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: 410-116891-3 DU
Matrix: Water
Analysis Batch: 349430

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Lithium	<0.0113		<0.0113		mg/L		NC	20
Calcium	48.5		48.60		mg/L		0.2	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-349057/1-A
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349057

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/01/23 09:39	03/01/23 13:56	1
Cobalt	<0.161		0.515	0.161	ug/L		03/01/23 09:39	03/01/23 13:56	1
Iron	<20.6		51.5	20.6	ug/L		03/01/23 09:39	03/01/23 13:56	1
Magnesium	<16.5		51.5	16.5	ug/L		03/01/23 09:39	03/01/23 13:56	1
Manganese	<0.979		2.06	0.979	ug/L		03/01/23 09:39	03/01/23 13:56	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/01/23 09:39	03/01/23 13:56	1
Potassium	<67.0		206	67.0	ug/L		03/01/23 09:39	03/01/23 13:56	1
Selenium	<0.286		1.03	0.286	ug/L		03/01/23 09:39	03/01/23 13:56	1
Sodium	<92.7		206	92.7	ug/L		03/01/23 09:39	03/01/23 13:56	1

Lab Sample ID: LCS 410-349057/2-A
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349057

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	577.7		ug/L		116	85 - 120
Iron	5000	5816		ug/L		116	88 - 119
Manganese	500	581.7		ug/L		116	89 - 120
Molybdenum	50.0	55.21		ug/L		110	85 - 115
Selenium	100	115.9		ug/L		116	80 - 120

Lab Sample ID: MB 410-349586/1-A
Matrix: Water
Analysis Batch: 349739

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349586

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/02/23 12:57	03/02/23 16:44	1
Cobalt	<0.161		0.515	0.161	ug/L		03/02/23 12:57	03/02/23 16:44	1
Iron	<20.6		51.5	20.6	ug/L		03/02/23 12:57	03/02/23 16:44	1
Magnesium	<16.5		51.5	16.5	ug/L		03/02/23 12:57	03/02/23 16:44	1
Manganese	<0.979		2.06	0.979	ug/L		03/02/23 12:57	03/02/23 16:44	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/02/23 12:57	03/02/23 16:44	1
Potassium	<67.0		206	67.0	ug/L		03/02/23 12:57	03/02/23 16:44	1
Selenium	<0.286		1.03	0.286	ug/L		03/02/23 12:57	03/02/23 16:44	1
Sodium	<92.7		206	92.7	ug/L		03/02/23 12:57	03/02/23 16:44	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-349586/2-A
Matrix: Water
Analysis Batch: 349739

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349586

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	491.8		ug/L		98	85 - 120
Cobalt	500	472.0		ug/L		94	90 - 113
Iron	5000	4945		ug/L		99	88 - 119
Magnesium	5000	5030		ug/L		101	90 - 112
Manganese	500	491.4		ug/L		98	89 - 120
Molybdenum	50.0	50.10		ug/L		100	85 - 115
Potassium	5000	4929		ug/L		99	90 - 112
Selenium	100	98.12		ug/L		98	80 - 120
Sodium	5000	5022		ug/L		100	89 - 112

Lab Sample ID: MB 410-349591/1-A
Matrix: Water
Analysis Batch: 349729

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349591

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/02/23 13:08	03/02/23 19:36	1
Cobalt	<0.161		0.515	0.161	ug/L		03/02/23 13:08	03/02/23 19:36	1
Iron	<20.6		51.5	20.6	ug/L		03/02/23 13:08	03/02/23 19:36	1
Magnesium	<16.5		51.5	16.5	ug/L		03/02/23 13:08	03/02/23 19:36	1
Manganese	<0.979		2.06	0.979	ug/L		03/02/23 13:08	03/02/23 19:36	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/02/23 13:08	03/02/23 19:36	1
Potassium	<67.0		206	67.0	ug/L		03/02/23 13:08	03/02/23 19:36	1
Selenium	<0.286		1.03	0.286	ug/L		03/02/23 13:08	03/02/23 19:36	1
Sodium	<92.7		206	92.7	ug/L		03/02/23 13:08	03/02/23 19:36	1

Lab Sample ID: LCS 410-349591/2-A
Matrix: Water
Analysis Batch: 349729

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349591

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	495.5		ug/L		99	85 - 120
Cobalt	500	485.4		ug/L		97	90 - 113
Iron	5000	5032		ug/L		101	88 - 119
Magnesium	5000	4939		ug/L		99	90 - 112
Manganese	500	502.1		ug/L		100	89 - 120
Molybdenum	50.0	50.05		ug/L		100	85 - 115
Potassium	5000	5015		ug/L		100	90 - 112
Selenium	100	100.1		ug/L		100	80 - 120
Sodium	5000	4785		ug/L		96	89 - 112

Lab Sample ID: 410-116891-3 MS
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	6.80		500	619.9		ug/L		123	75 - 125
Iron	<20.6		5000	5736		ug/L		115	75 - 125
Manganese	824		500	1398		ug/L		115	75 - 125
Molybdenum	5.42		50.0	59.62		ug/L		108	81 - 125

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 410-116891-3 MS
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Selenium	0.773	J F1	100	126.5	F1	ug/L		126	75 - 125

Lab Sample ID: 410-116891-3 MSD
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	6.80		500	606.2		ug/L		120	75 - 125	2	20
Iron	<20.6		5000	5596		ug/L		112	75 - 125	2	20
Manganese	824		500	1380		ug/L		111	75 - 125	1	20
Molybdenum	5.42		50.0	60.79		ug/L		111	81 - 125	2	20
Selenium	0.773	J F1	100	124.6		ug/L		124	75 - 125	2	20

Lab Sample ID: 410-116891-3 DU
Matrix: Water
Analysis Batch: 349306

Client Sample ID: Column 2 Day 7
Prep Type: Dissolved
Prep Batch: 349057

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	6.80		7.112		ug/L		5	20
Iron	<20.6		<20.6		ug/L		NC	20
Manganese	824		824.1		ug/L		0	20
Molybdenum	5.42		5.360		ug/L		1	20
Selenium	0.773	J F1	0.8683	J	ug/L		12	20

Lab Sample ID: 410-116891-2 MS
Matrix: Water
Analysis Batch: 349729

Client Sample ID: Column 1 Day 7
Prep Type: Dissolved
Prep Batch: 349591

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Cobalt	16.0		500	512.7		ug/L		99	80 - 125
Magnesium	27600		5000	32650	4	ug/L		100	75 - 125
Potassium	2120		5000	7353		ug/L		105	75 - 125
Sodium	19800		5000	24810		ug/L		100	75 - 125

Lab Sample ID: 410-116891-2 MSD
Matrix: Water
Analysis Batch: 349729

Client Sample ID: Column 1 Day 7
Prep Type: Dissolved
Prep Batch: 349591

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Cobalt	16.0		500	495.8		ug/L		96	80 - 125	3	20
Magnesium	27600		5000	31740	4	ug/L		82	75 - 125	3	20
Potassium	2120		5000	7073		ug/L		99	75 - 125	4	20
Sodium	19800		5000	23970		ug/L		83	75 - 125	3	20

Lab Sample ID: 410-116891-2 DU
Matrix: Water
Analysis Batch: 349729

Client Sample ID: Column 1 Day 7
Prep Type: Dissolved
Prep Batch: 349591

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Cobalt	16.0		16.41		ug/L		2	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 410-116891-2 DU
Client Sample ID: Column 1 Day 7
Matrix: Water
Prep Type: Dissolved
Analysis Batch: 349729
Prep Batch: 349591

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Magnesium	27600			27720		ug/L				0.3	20
Potassium	2120			2125		ug/L				0.1	20
Sodium	19800			20130		ug/L				2	20

HPLC/IC

Analysis Batch: 349219

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-2	Column 1 Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-3	Column 2 Day 7	Total/NA	Water	EPA 300.0 R2.1	
MB 410-349219/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-349219/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-349219/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 349329

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-4	Column 3 Day 7	Total/NA	Water	EPA 300.0 R2.1	
MB 410-349329/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-349329/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-349329/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	
410-116891-4 MS	Column 3 Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-4 DU	Column 3 Day 7	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 349650

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-2	Column 1 Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-3	Column 2 Day 7	Total/NA	Water	EPA 300.0 R2.1	
MB 410-349650/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-349650/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-349650/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 349691

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-4	Column 3 Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-4	Column 3 Day 7	Total/NA	Water	EPA 300.0 R2.1	
MB 410-349691/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-349691/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-349691/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	
410-116891-1 MS	Influent Day 7	Total/NA	Water	EPA 300.0 R2.1	
410-116891-1 DU	Influent Day 7	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 349057

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-2	Column 1 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-3	Column 2 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-4	Column 3 Day 7	Dissolved	Water	Non-Digest Prep	
MB 410-349057/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-349057/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	
410-116891-3 MS	Column 2 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-3 MSD	Column 2 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-3 DU	Column 2 Day 7	Dissolved	Water	Non-Digest Prep	

Metals

Analysis Batch: 349306

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Dissolved	Water	6020B	349057
410-116891-2	Column 1 Day 7	Dissolved	Water	6020B	349057
410-116891-3	Column 2 Day 7	Dissolved	Water	6020B	349057
410-116891-4	Column 3 Day 7	Dissolved	Water	6020B	349057
MB 410-349057/1-A	Method Blank	Total/NA	Water	6020B	349057
LCS 410-349057/2-A	Lab Control Sample	Total/NA	Water	6020B	349057
410-116891-3 MS	Column 2 Day 7	Dissolved	Water	6020B	349057
410-116891-3 MSD	Column 2 Day 7	Dissolved	Water	6020B	349057
410-116891-3 DU	Column 2 Day 7	Dissolved	Water	6020B	349057

Analysis Batch: 349430

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Dissolved	Water	6010D	349057
410-116891-2	Column 1 Day 7	Dissolved	Water	6010D	349057
410-116891-3	Column 2 Day 7	Dissolved	Water	6010D	349057
410-116891-4	Column 3 Day 7	Dissolved	Water	6010D	349057
MB 410-349057/1-A	Method Blank	Total/NA	Water	6010D	349057
LCS 410-349057/2-A	Lab Control Sample	Total/NA	Water	6010D	349057
410-116891-3 MS	Column 2 Day 7	Dissolved	Water	6010D	349057
410-116891-3 MSD	Column 2 Day 7	Dissolved	Water	6010D	349057
410-116891-3 DU	Column 2 Day 7	Dissolved	Water	6010D	349057

Prep Batch: 349586

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-3	Column 2 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-4	Column 3 Day 7	Dissolved	Water	Non-Digest Prep	
MB 410-349586/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-349586/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 349591

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-2	Column 1 Day 7	Dissolved	Water	Non-Digest Prep	
MB 410-349591/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-349591/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	
410-116891-2 MS	Column 1 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-2 MSD	Column 1 Day 7	Dissolved	Water	Non-Digest Prep	
410-116891-2 DU	Column 1 Day 7	Dissolved	Water	Non-Digest Prep	

Analysis Batch: 349729

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-1	Influent Day 7	Dissolved	Water	6020B	349591
410-116891-2	Column 1 Day 7	Dissolved	Water	6020B	349591
MB 410-349591/1-A	Method Blank	Total/NA	Water	6020B	349591
LCS 410-349591/2-A	Lab Control Sample	Total/NA	Water	6020B	349591
410-116891-2 MS	Column 1 Day 7	Dissolved	Water	6020B	349591
410-116891-2 MSD	Column 1 Day 7	Dissolved	Water	6020B	349591
410-116891-2 DU	Column 1 Day 7	Dissolved	Water	6020B	349591

QC Association Summary

Client: Terra Systems Inc
Job ID: 410-116891-1
Project/Site: Stantec CCR TS AP3

Metals

Analysis Batch: 349739

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-3	Column 2 Day 7	Dissolved	Water	6020B	349586
410-116891-4	Column 3 Day 7	Dissolved	Water	6020B	349586
410-116891-4	Column 3 Day 7	Dissolved	Water	6020B	349586
410-116891-4	Column 3 Day 7	Dissolved	Water	6020B	349586
MB 410-349586/1-A	Method Blank	Total/NA	Water	6020B	349586
LCS 410-349586/2-A	Lab Control Sample	Total/NA	Water	6020B	349586

Analysis Batch: 349743

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-4	Column 3 Day 7	Dissolved	Water	6010D	349057

Analysis Batch: 349937

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-116891-3	Column 2 Day 7	Dissolved	Water	6020B	349586

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Client Sample ID: Influent Day 7

Lab Sample ID: 410-116891-1

Date Collected: 02/27/23 07:15
Matrix: Water
Date Received: 02/27/23 15:44

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	349691	L4QM	ELLE	03/02/23 22:23
Total/NA	Analysis	EPA 300.0 R2.1		5	349219	L4QM	ELLE	03/01/23 21:58
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6010D		1	349430	S4PD	ELLE	03/02/23 02:58
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6020B		1	349306	UCIG	ELLE	03/01/23 14:40
Dissolved	Prep	Non-Digest Prep			349591	UAMX	ELLE	03/02/23 13:08
Dissolved	Analysis	6020B		1	349729	UCIG	ELLE	03/02/23 19:59

Client Sample ID: Column 1 Day 7

Lab Sample ID: 410-116891-2

Date Collected: 02/27/23 07:45
Matrix: Water
Date Received: 02/27/23 15:44

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	349650	L4QM	ELLE	03/02/23 18:49
Total/NA	Analysis	EPA 300.0 R2.1		5	349219	L4QM	ELLE	03/01/23 22:08
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6010D		1	349430	S4PD	ELLE	03/02/23 03:01
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6020B		1	349306	UCIG	ELLE	03/01/23 14:42
Dissolved	Prep	Non-Digest Prep			349591	UAMX	ELLE	03/02/23 13:08
Dissolved	Analysis	6020B		1	349729	UCIG	ELLE	03/02/23 19:46

Client Sample ID: Column 2 Day 7

Lab Sample ID: 410-116891-3

Date Collected: 02/27/23 08:15
Matrix: Water
Date Received: 02/27/23 15:44

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	349650	L4QM	ELLE	03/02/23 18:57
Total/NA	Analysis	EPA 300.0 R2.1		5	349219	L4QM	ELLE	03/01/23 22:41
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6010D		1	349430	S4PD	ELLE	03/02/23 01:50
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6020B		1	349306	UCIG	ELLE	03/01/23 14:06
Dissolved	Prep	Non-Digest Prep			349586	UAMX	ELLE	03/02/23 12:57
Dissolved	Analysis	6020B		1	349739	UCIG	ELLE	03/02/23 17:41
Dissolved	Prep	Non-Digest Prep			349586	UAMX	ELLE	03/02/23 12:57
Dissolved	Analysis	6020B		10	349937	F7JF	ELLE	03/03/23 07:27

Client Sample ID: Column 3 Day 7

Lab Sample ID: 410-116891-4

Date Collected: 02/27/23 08:45
Matrix: Water
Date Received: 02/27/23 15:44

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		10	349691	L4QM	ELLE	03/02/23 21:49

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-116891-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 3 Day 7
Lab Sample ID: 410-116891-4

Date Collected: 02/27/23 08:45
Matrix: Water

Date Received: 02/27/23 15:44

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		1000	349691	L4QM	ELLE	03/02/23 21:58
Total/NA	Analysis	EPA 300.0 R2.1		5	349329	L4QM	ELLE	03/02/23 01:11
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6010D		1	349430	S4PD	ELLE	03/02/23 02:55
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6010D		10	349743	T8CQ	ELLE	03/02/23 19:26
Dissolved	Prep	Non-Digest Prep			349057	HUH3	ELLE	03/01/23 09:39
Dissolved	Analysis	6020B		1	349306	UCIG	ELLE	03/01/23 14:36
Dissolved	Prep	Non-Digest Prep			349586	UAMX	ELLE	03/02/23 12:57
Dissolved	Analysis	6020B		1	349739	UCIG	ELLE	03/02/23 17:23
Dissolved	Prep	Non-Digest Prep			349586	UAMX	ELLE	03/02/23 12:57
Dissolved	Analysis	6020B		10	349739	UCIG	ELLE	03/02/23 18:25
Dissolved	Prep	Non-Digest Prep			349586	UAMX	ELLE	03/02/23 12:57
Dissolved	Analysis	6020B		100	349739	UCIG	ELLE	03/02/23 18:27

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-11-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-23 *
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-23 *
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Client: Terra Systems Inc
Job ID: 410-116891-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-116891-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-116891-1	Influent Day 7	Water	02/27/23 07:15	02/27/23 15:44
410-116891-2	Column 1 Day 7	Water	02/27/23 07:45	02/27/23 15:44
410-116891-3	Column 2 Day 7	Water	02/27/23 08:15	02/27/23 15:44
410-116891-4	Column 3 Day 7	Water	02/27/23 08:45	02/27/23 15:44

410-116891 Chain of Custody

Environmental Analysis Request/Chain of Custody

Acct. # ____________ Group # ________________ Sample # ____________________

Client: **Terra Systems, Inc.**

Project Name/#:	Stantec CCR TS AP3	Site ID #:	Macon, GA
Project Manager:	Michael D. Lee	P.O. #:	222538-2-27-23
Sampler:	Michael D. Lee	PWSID #:	
Phone #:	302-798-9553	Quote #:	41011818
State where samples were collected:	GA	For Compliance:	Yes ☐ No ☑

Matrix: Soil ☐ Sediment ☐ Tissue ☐; Water: Ground ☑ Surface ☐ Potable ☐ NPDES ☐; Other:

Analyses Requested / Preservation Codes

Sample Identification	Collection Date	Collection Time	Grab	Composite	Soil/Sediment/Tissue	Water	Other	Total # of Containers	Dis (ff) As, Co, Fe, K, Mg, Mn. (N)	Mo, Na, Se (P)	Cl, F, SO4 by EPA 300 (-)	Dis (ff) Ca, Li (-)	(N)	(N)	(-)	(-)			Remarks
Influent Day 7	2/27/2023	7:15		X		X		3	X		X	X							ff= field filtered
Column 1 Day 7	2/27/2023	7:45		X		X		3	X		X	X							
Column 2 Day 7	2/27/2023	8:15		X		X		3	X		X	X							
Column 3 Day 7	2/27/2023	8:45		X		X		3	X		X	X							

For Lab Use Only

SF #: ____________

SCR #: ____________

Preservation Codes

H = HCl T = Thiosulfate

N = HNO_3 B = NaOH

S = H_2SO_4 P = H_3PO_4

O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 3/13/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: ____________

Relinquished by:	Date	Time	Received by:	Date	Time
Michael Lee	2/27/22	11:20	[signature]	2/27/23	1120
[signature]	2/27/23	1544			
			[signature]	2/27/23	15:44

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other X

Temperature upon receipt 0.2 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0216

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-116891-1

Login Number: 116891

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: Jeremiah, Cory T

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 3/22/2023 2:12:34 PM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-117722-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
3/22/2023 2:12:34 PM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

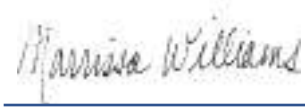


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-117722-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-117722-1

Receipt
The samples were received on 3/6/2023 4:25 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 time was -0.1°C

Receipt Exceptions
The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): Column 1 Day 14 (410-117722-1). The container labels list Column 1 Day 7 08:45, while the COC lists Column 1 Day 14 08:15.

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): Column 2 Day 14 (410-117722-2). The container labels list 09:15, while the COC lists 08:45.

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): Column 3 Day 14 (410-117722-3). The container labels list 09:45, while the COC lists 09:15.

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): Column 4 Day 14 (410-117722-4). The container labels list 10:15, while the COC lists 09:45.

Limited volume received. When received, container is only filled about 1/3 of the way.

Column 3 Day 14 (410-117722-3)

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Client Sample ID: Column 1 Day 14 — Lab Sample ID: 410-117722-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	207		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	4.40	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	41.5		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	4.50		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	42.7		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	23100	^2	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	4780		10.3	4.89	ug/L	5		6020B	Dissolved
Molybdenum	0.362	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1750		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.559	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	15400		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 14 — Lab Sample ID: 410-117722-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	236		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	4.30	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	23.2		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.77		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	1.96		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	39.1	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	12700	^2	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	373		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	4.23		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1820		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.511	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	195000		1030	464	ug/L	5		6020B	Dissolved

Client Sample ID: Column 3 Day 14 — Lab Sample ID: 410-117722-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	1.78	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	4.35		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	81.6		51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	1070000	^2	5150	1650	ug/L	100		6020B	Dissolved
Manganese	483		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	1.70		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	6480		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.346	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	164000		1030	464	ug/L	5		6020B	Dissolved

Client Sample ID: Column 4 Day 14 — Lab Sample ID: 410-117722-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	4210	F1	750	250	mg/L	500		EPA 300.0 R2.1	Total/NA
Chloride	18.0		7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Lithium	0.0178	J	0.0515	0.0113	mg/L	1		6010D	Dissolved
Calcium	401		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.22		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.766		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	63.2		51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	812000	^2	515	165	ug/L	10		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 4 Day 14 (Continued)

Lab Sample ID: 410-117722-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Manganese	153		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	1.08		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	3250		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.731	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	32700	^2	206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 1 Day 14

Lab Sample ID: 410-117722-1

Date Collected: 03/06/23 08:15

Matrix: Water

Date Received: 03/06/23 16:25

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/08/23 10:20	5
Sulfate	**207**		75.0	25.0	mg/L			03/09/23 19:58	50
Chloride	**4.40**	**J**	7.50	3.00	mg/L			03/08/23 10:20	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/08/23 10:26	03/09/23 04:16	1
Calcium	**41.5**		0.515	0.0989	mg/L		03/08/23 10:26	03/09/23 04:16	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.50**		2.06	0.700	ug/L		03/08/23 10:26	03/08/23 19:16	1
Cobalt	**42.7**		0.515	0.161	ug/L		03/08/23 10:26	03/08/23 19:16	1
Iron	<20.6		51.5	20.6	ug/L		03/08/23 10:26	03/08/23 19:16	1
Magnesium	**23100**	**^2**	51.5	16.5	ug/L		03/08/23 10:26	03/08/23 19:16	1
Manganese	**4780**		10.3	4.89	ug/L		03/08/23 10:26	03/08/23 19:28	5
Molybdenum	**0.362**	**J**	0.515	0.134	ug/L		03/08/23 10:26	03/08/23 19:16	1
Potassium	**1750**		206	67.0	ug/L		03/08/23 10:26	03/08/23 19:16	1
Selenium	**0.559**	**J**	1.03	0.286	ug/L		03/08/23 10:26	03/08/23 19:16	1
Sodium	**15400**		206	92.7	ug/L		03/08/23 10:26	03/08/23 19:16	1

Client Sample ID: Column 2 Day 14

Lab Sample ID: 410-117722-2

Date Collected: 03/06/23 08:45

Matrix: Water

Date Received: 03/06/23 16:25

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/08/23 11:35	5
Sulfate	**236**		75.0	25.0	mg/L			03/10/23 08:17	50
Chloride	**4.30**	**J**	7.50	3.00	mg/L			03/08/23 11:35	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/08/23 10:26	03/09/23 04:19	1
Calcium	**23.2**		0.515	0.0989	mg/L		03/08/23 10:26	03/09/23 04:19	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.77**		2.06	0.700	ug/L		03/08/23 10:26	03/08/23 19:20	1
Cobalt	**1.96**		0.515	0.161	ug/L		03/08/23 10:26	03/08/23 19:20	1
Iron	**39.1**	**J**	51.5	20.6	ug/L		03/08/23 10:26	03/08/23 19:20	1
Magnesium	**12700**	**^2**	51.5	16.5	ug/L		03/08/23 10:26	03/08/23 19:20	1
Manganese	**373**		2.06	0.979	ug/L		03/08/23 10:26	03/08/23 19:20	1
Molybdenum	**4.23**		0.515	0.134	ug/L		03/08/23 10:26	03/08/23 19:20	1
Potassium	**1820**		206	67.0	ug/L		03/08/23 10:26	03/08/23 19:20	1
Selenium	**0.511**	**J**	1.03	0.286	ug/L		03/08/23 10:26	03/08/23 19:20	1
Sodium	**195000**		1030	464	ug/L		03/08/23 10:26	03/08/23 19:30	5

Client Sample ID: Column 3 Day 14

Lab Sample ID: 410-117722-3

Date Collected: 03/06/23 09:15

Matrix: Water

Date Received: 03/06/23 16:25

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	1.78	J	2.06	0.700	ug/L		03/08/23 10:26	03/08/23 19:23	1
Cobalt	4.35		0.515	0.161	ug/L		03/08/23 10:26	03/08/23 19:23	1
Iron	81.6		51.5	20.6	ug/L		03/08/23 10:26	03/08/23 19:23	1
Magnesium	1070000	^2	5150	1650	ug/L		03/08/23 10:26	03/08/23 19:34	100
Manganese	483		2.06	0.979	ug/L		03/08/23 10:26	03/08/23 19:23	1
Molybdenum	1.70		0.515	0.134	ug/L		03/08/23 10:26	03/08/23 19:23	1
Potassium	6480		206	67.0	ug/L		03/08/23 10:26	03/08/23 19:23	1
Selenium	0.346	J	1.03	0.286	ug/L		03/08/23 10:26	03/08/23 19:23	1
Sodium	164000		1030	464	ug/L		03/08/23 10:26	03/08/23 19:32	5

Client Sample ID: Column 4 Day 14

Lab Sample ID: 410-117722-4

Date Collected: 03/06/23 09:45

Matrix: Water

Date Received: 03/06/23 16:25

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/08/23 10:41	5
Sulfate	4210	F1	750	250	mg/L			03/09/23 20:37	500
Chloride	18.0		7.50	3.00	mg/L			03/08/23 10:41	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	0.0178	J	0.0515	0.0113	mg/L		03/08/23 10:26	03/09/23 04:12	1
Calcium	401		0.515	0.0989	mg/L		03/08/23 10:26	03/09/23 04:12	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3.22		2.06	0.700	ug/L		03/08/23 10:26	03/08/23 18:34	1
Cobalt	0.766		0.515	0.161	ug/L		03/08/23 10:26	03/08/23 18:34	1
Iron	63.2		51.5	20.6	ug/L		03/08/23 10:26	03/08/23 18:34	1
Magnesium	812000	^2	515	165	ug/L		03/08/23 10:26	03/08/23 19:25	10
Manganese	153		2.06	0.979	ug/L		03/08/23 10:26	03/08/23 18:34	1
Molybdenum	1.08		0.515	0.134	ug/L		03/08/23 10:26	03/08/23 18:34	1
Potassium	3250		206	67.0	ug/L		03/08/23 10:26	03/08/23 18:34	1
Selenium	0.731	J	1.03	0.286	ug/L		03/08/23 10:26	03/08/23 18:34	1
Sodium	32700	^2	206	92.7	ug/L		03/08/23 10:26	03/08/23 18:34	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-351427/5
Matrix: Water
Analysis Batch: 351427

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/08/23 09:48	1
Sulfate	<0.500		1.50	0.500	mg/L			03/08/23 09:48	1
Chloride	<0.600		1.50	0.600	mg/L			03/08/23 09:48	1

Lab Sample ID: LCS 410-351427/3
Matrix: Water
Analysis Batch: 351427

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.6994		mg/L		93	90 - 110
Sulfate	7.50	7.644		mg/L		102	90 - 110
Chloride	3.00	2.986		mg/L		100	90 - 110

Lab Sample ID: LCSD 410-351427/4
Matrix: Water
Analysis Batch: 351427

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7030		mg/L		94	90 - 110	1	20
Sulfate	7.50	7.322		mg/L		98	90 - 110	4	20
Chloride	3.00	2.935		mg/L		98	90 - 110	2	20

Lab Sample ID: MB 410-352079/5
Matrix: Water
Analysis Batch: 352079

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	<0.500		1.50	0.500	mg/L			03/10/23 02:16	1

Lab Sample ID: LCS 410-352079/3
Matrix: Water
Analysis Batch: 352079

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	7.50	7.559		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-352079/4
Matrix: Water
Analysis Batch: 352079

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate	7.50	7.552		mg/L		101	90 - 110	0	20

Lab Sample ID: MB 410-352100/5
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/09/23 17:59	1
Sulfate	<0.500		1.50	0.500	mg/L			03/09/23 17:59	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 410-352100/5
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.600		1.50	0.600	mg/L			03/09/23 17:59	1

Lab Sample ID: LCS 410-352100/3
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7200		mg/L		96	90 - 110
Sulfate	7.50	7.526		mg/L		100	90 - 110
Chloride	3.00	3.002		mg/L		100	90 - 110

Lab Sample ID: LCSD 410-352100/4
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7199		mg/L		96	90 - 110	0	20
Sulfate	7.50	7.523		mg/L		100	90 - 110	0	20
Chloride	3.00	3.003		mg/L		100	90 - 110	0	20

Lab Sample ID: 410-117722-4 MS
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Column 4 Day 14
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	<45.0		250	271.0		mg/L		108	90 - 110
Sulfate	4210	F1	2500	7402	F1	mg/L		128	90 - 110
Chloride	<300	F1	1000	1139	F1	mg/L		114	90 - 110

Lab Sample ID: 410-117722-4 DU
Matrix: Water
Analysis Batch: 352100

Client Sample ID: Column 4 Day 14
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Fluoride	<45.0		<45.0		mg/L		NC	15
Sulfate	4210	F1	4223		mg/L		0.2	15
Chloride	<300	F1	<300		mg/L		NC	15

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-351392/1-A
Matrix: Water
Analysis Batch: 351701

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 351392

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/08/23 10:26	03/09/23 03:53	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/08/23 10:26	03/09/23 03:53	1

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-351392/2-A
Matrix: Water
Analysis Batch: 351701

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 351392

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.4962		mg/L		99	80 - 120
Calcium	5.00	4.970		mg/L		99	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-351392/1-A
Matrix: Water
Analysis Batch: 351635

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 351392

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/08/23 10:26	03/08/23 17:49	1
Cobalt	<0.161		0.515	0.161	ug/L		03/08/23 10:26	03/08/23 17:49	1
Iron	<20.6		51.5	20.6	ug/L		03/08/23 10:26	03/08/23 17:49	1
Magnesium	<16.5		51.5	16.5	ug/L		03/08/23 10:26	03/08/23 17:49	1
Manganese	<0.979		2.06	0.979	ug/L		03/08/23 10:26	03/08/23 17:49	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/08/23 10:26	03/08/23 17:49	1
Potassium	<67.0		206	67.0	ug/L		03/08/23 10:26	03/08/23 17:49	1
Selenium	<0.286		1.03	0.286	ug/L		03/08/23 10:26	03/08/23 17:49	1
Sodium	<92.7		206	92.7	ug/L		03/08/23 10:26	03/08/23 17:49	1

Lab Sample ID: LCS 410-351392/2-A
Matrix: Water
Analysis Batch: 351635

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 351392

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	493.7		ug/L		99	85 - 120
Cobalt	500	475.6		ug/L		95	90 - 113
Iron	5000	4922		ug/L		98	88 - 119
Magnesium	5000	4879		ug/L		98	90 - 112
Manganese	500	493.6		ug/L		99	89 - 120
Molybdenum	50.0	49.07		ug/L		98	85 - 115
Potassium	5000	4948		ug/L		99	90 - 112
Selenium	100	100.8		ug/L		101	80 - 120
Sodium	5000	4587		ug/L		92	89 - 112

QC Association Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

HPLC/IC

Analysis Batch: 351427

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-1	Column 1 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-117722-2	Column 2 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-117722-4	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	
MB 410-351427/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-351427/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-351427/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 352079

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-2	Column 2 Day 14	Total/NA	Water	EPA 300.0 R2.1	
MB 410-352079/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-352079/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-352079/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 352100

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-1	Column 1 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-117722-4	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	
MB 410-352100/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-352100/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-352100/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	
410-117722-4 MS	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-117722-4 DU	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 351392

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-1	Column 1 Day 14	Dissolved	Water	Non-Digest Prep	
410-117722-2	Column 2 Day 14	Dissolved	Water	Non-Digest Prep	
410-117722-3	Column 3 Day 14	Dissolved	Water	Non-Digest Prep	
410-117722-4	Column 4 Day 14	Dissolved	Water	Non-Digest Prep	
MB 410-351392/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-351392/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 351635

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-1	Column 1 Day 14	Dissolved	Water	6020B	351392
410-117722-1	Column 1 Day 14	Dissolved	Water	6020B	351392
410-117722-2	Column 2 Day 14	Dissolved	Water	6020B	351392
410-117722-2	Column 2 Day 14	Dissolved	Water	6020B	351392
410-117722-3	Column 3 Day 14	Dissolved	Water	6020B	351392
410-117722-3	Column 3 Day 14	Dissolved	Water	6020B	351392
410-117722-3	Column 3 Day 14	Dissolved	Water	6020B	351392
410-117722-4	Column 4 Day 14	Dissolved	Water	6020B	351392
410-117722-4	Column 4 Day 14	Dissolved	Water	6020B	351392
MB 410-351392/1-A	Method Blank	Total/NA	Water	6020B	351392
LCS 410-351392/2-A	Lab Control Sample	Total/NA	Water	6020B	351392

QC Association Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Metals

Analysis Batch: 351701

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-117722-1	Column 1 Day 14	Dissolved	Water	6010D	351392
410-117722-2	Column 2 Day 14	Dissolved	Water	6010D	351392
410-117722-4	Column 4 Day 14	Dissolved	Water	6010D	351392
MB 410-351392/1-A	Method Blank	Total/NA	Water	6010D	351392
LCS 410-351392/2-A	Lab Control Sample	Total/NA	Water	6010D	351392

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Client Sample ID: Column 1 Day 14
Date Collected: 03/06/23 08:15
Date Received: 03/06/23 16:25

Lab Sample ID: 410-117722-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	352100	L4QM	ELLE	03/09/23 19:58
Total/NA	Analysis	EPA 300.0 R2.1		5	351427	L4QM	ELLE	03/08/23 10:20
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6010D		1	351701	S4PD	ELLE	03/09/23 04:16
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		1	351635	UCIG	ELLE	03/08/23 19:16
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		5	351635	UCIG	ELLE	03/08/23 19:28

Client Sample ID: Column 2 Day 14
Date Collected: 03/06/23 08:45
Date Received: 03/06/23 16:25

Lab Sample ID: 410-117722-2
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	352079	L4QM	ELLE	03/10/23 08:17
Total/NA	Analysis	EPA 300.0 R2.1		5	351427	L4QM	ELLE	03/08/23 11:35
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6010D		1	351701	S4PD	ELLE	03/09/23 04:19
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		1	351635	UCIG	ELLE	03/08/23 19:20
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		5	351635	UCIG	ELLE	03/08/23 19:30

Client Sample ID: Column 3 Day 14
Date Collected: 03/06/23 09:15
Date Received: 03/06/23 16:25

Lab Sample ID: 410-117722-3
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		1	351635	UCIG	ELLE	03/08/23 19:23
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		5	351635	UCIG	ELLE	03/08/23 19:32
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		100	351635	UCIG	ELLE	03/08/23 19:34

Client Sample ID: Column 4 Day 14
Date Collected: 03/06/23 09:45
Date Received: 03/06/23 16:25

Lab Sample ID: 410-117722-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		500	352100	L4QM	ELLE	03/09/23 20:37
Total/NA	Analysis	EPA 300.0 R2.1		5	351427	L4QM	ELLE	03/08/23 10:41
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6010D		1	351701	S4PD	ELLE	03/09/23 04:12

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Client Sample ID: Column 4 Day 14

Date Collected: 03/06/23 09:45
Date Received: 03/06/23 16:25

Lab Sample ID: 410-117722-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		1	351635	UCIG	ELLE	03/08/23 18:34
Dissolved	Prep	Non-Digest Prep			351392	HUH3	ELLE	03/08/23 10:26
Dissolved	Analysis	6020B		10	351635	UCIG	ELLE	03/08/23 19:25

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-11-23
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-12-23
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-117722-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-117722-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-117722-1	Column 1 Day 14	Water	03/06/23 08:15	03/06/23 16:25
410-117722-2	Column 2 Day 14	Water	03/06/23 08:45	03/06/23 16:25
410-117722-3	Column 3 Day 14	Water	03/06/23 09:15	03/06/23 16:25
410-117722-4	Column 4 Day 14	Water	03/06/23 09:45	03/06/23 16:25

410-117722 Chain of Custody

Environmental Analysis Request/Chain of Custody

Acct. # ____ Group # ____ Sample # ____

Client: **Terra Systems, Inc.**

Project Name/#:	Stantec CCR TS AP3	Site ID #:	Macon, GA
Project Manager:	Michael D. Lee	P.O. #:	222538-3-6-23
Sampler:	Michael D. Lee	PWSID #:	
Phone #:	302-798-9553	Quote #:	41011818
State where samples were collected:	GA	For Compliance:	Yes ☐ No ☑

Matrix: Soil ☐ Tissue ☐ Sediment ☐ | Water: Ground ☑ Surface ☐ Potable ☐ NPDES ☐ | Other:

Analyses Requested / Preservation Codes

Sample Identification	Date	Time	Grab	Composite	Soil/Sediment	Water	Other	Total # of Containers	Dis (ff) As, Co, Fe, K, Mg, Mn, (N)	Mo, Na, Se (N)	Cl, F, SO4 by EPA 300 (-)	Dis (ff) Ca, Li (N)	Remarks
Column 1 Day 14	3/6/2023	8:15		X		X		3	X		X	X	ff= field filtered
Column 2 Day 14	3/6/2023	8:45		X		X		3	X		X	X	
Column 3 Day 14	3/6/2023	9:15		X		X		1	X				
Column 4 Day 14	3/6/2023	9:45		X		X		3	X		X	X	

For Lab Use Only
SF #: ____
SCR #: ____

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 3/20/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	3/6/23	12:00	[signature]	3/6/23	1206
[signature]	3/6/23	1625			
			[signature]	3/6/23	1625

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other X

Temperature upon receipt -0.1 °C

Data Package Options (please check if required)
Type I (Validation/non-CLP) ☐ MA MCP ☐
Type III (Reduced non-CLP) ☐ CT RCP ☐
Type VI (Raw Data Only) ☐ TX TRRP-13 ☐
NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: ____

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 7045 0216

CJ

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-117722-1

Login Number: 117722
List Number: 1
Creator: Jeremiah, Cory T

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	False	Refer to Job Narrative for details.
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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 3/22/2023 7:07:54 AM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-118682-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
3/22/2023 7:07:54 AM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

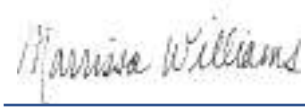


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-118682-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-118682-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-118682-1

Receipt
The samples were received on 3/13/2023 4:15 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 time was 1.8°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Client Sample ID: Influent Day 14 — Lab Sample ID: 410-118682-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	152		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Calcium	27.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.46		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	59.7		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	23400		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1730		2.06	0.979	ug/L	1		6020B	Dissolved
Potassium	1410		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.422	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	10500		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 1 Day 14 — Lab Sample ID: 410-118682-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	172		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.34	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	39.6		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	6.16		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	42.5		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	20300		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	4230		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.436	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1660		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.357	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	13800		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 14 — Lab Sample ID: 410-118682-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Fluoride	0.472	J	1.00	0.450	mg/L	5		EPA 300.0 R2.1	Total/NA
Sulfate	178		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.07	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	15.3		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.09		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	1.26		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	7380		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	220		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	4.58		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1260		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.397	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	125000		1030	464	ug/L	5		6020B	Dissolved

Client Sample ID: Column 3 Day 14 — Lab Sample ID: 410-118682-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	333		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	4.14	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	40.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	6.64		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	42.2		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	59900		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1480		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.561		0.515	0.134	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 3 Day 14 (Continued)
Lab Sample ID: 410-118682-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Potassium	1750		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.645	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	18700		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 4 Day 14
Lab Sample ID: 410-118682-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	1020		300	100	mg/L	200		EPA 300.0 R2.1	Total/NA
Chloride	5.35	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	126		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	2.05	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.915		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	167000		258	82.4	ug/L	5		6020B	Dissolved
Manganese	35.3		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.441	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1980		206	67.0	ug/L	1		6020B	Dissolved
Sodium	19800		206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Client Sample ID: Influent Day 14

Lab Sample ID: 410-118682-1

Date Collected: 03/13/23 08:15
Matrix: Water
Date Received: 03/13/23 16:15

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/16/23 15:50	5
Sulfate	**152**		75.0	25.0	mg/L			03/16/23 16:15	50
Chloride	<3.00		7.50	3.00	mg/L			03/16/23 15:50	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 19:12	1
Calcium	**27.0**		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 19:12	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.46**		2.06	0.700	ug/L		03/21/23 05:16	03/21/23 14:53	1
Cobalt	**59.7**		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 14:53	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 14:53	1
Magnesium	**23400**		51.5	16.5	ug/L		03/21/23 05:16	03/21/23 14:53	1
Manganese	**1730**		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 14:53	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/21/23 05:16	03/21/23 14:53	1
Potassium	**1410**		206	67.0	ug/L		03/21/23 05:16	03/21/23 14:53	1
Selenium	**0.422**	**J**	1.03	0.286	ug/L		03/21/23 05:16	03/21/23 14:53	1
Sodium	**10500**		206	92.7	ug/L		03/21/23 05:16	03/21/23 14:53	1

Client Sample ID: Column 1 Day 14

Lab Sample ID: 410-118682-2

Date Collected: 03/13/23 08:45
Matrix: Water
Date Received: 03/13/23 16:15

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/16/23 16:27	5
Sulfate	**172**		75.0	25.0	mg/L			03/16/23 16:52	50
Chloride	**3.34**	**J**	7.50	3.00	mg/L			03/16/23 16:27	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 19:15	1
Calcium	**39.6**		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 19:15	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**6.16**		2.06	0.700	ug/L		03/21/23 05:16	03/21/23 14:55	1
Cobalt	**42.5**		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 14:55	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 14:55	1
Magnesium	**20300**		51.5	16.5	ug/L		03/21/23 05:16	03/21/23 14:55	1
Manganese	**4230**		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 14:55	1
Molybdenum	**0.436**	**J**	0.515	0.134	ug/L		03/21/23 05:16	03/21/23 14:55	1
Potassium	**1660**		206	67.0	ug/L		03/21/23 05:16	03/21/23 14:55	1
Selenium	**0.357**	**J**	1.03	0.286	ug/L		03/21/23 05:16	03/21/23 14:55	1
Sodium	**13800**		206	92.7	ug/L		03/21/23 05:16	03/21/23 14:55	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Client Sample ID: Column 2 Day 14

Lab Sample ID: 410-118682-3

Date Collected: 03/13/23 09:15

Matrix: Water

Date Received: 03/13/23 16:15

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.472**	**J**	1.00	0.450	mg/L			03/16/23 17:05	5
Sulfate	**178**		75.0	25.0	mg/L			03/16/23 17:30	50
Chloride	**3.07**	**J**	7.50	3.00	mg/L			03/16/23 17:05	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 19:18	1
Calcium	**15.3**		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 19:18	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.09**		2.06	0.700	ug/L		03/21/23 05:16	03/21/23 14:57	1
Cobalt	**1.26**		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 14:57	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 14:57	1
Magnesium	**7380**		51.5	16.5	ug/L		03/21/23 05:16	03/21/23 14:57	1
Manganese	**220**		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 14:57	1
Molybdenum	**4.58**		0.515	0.134	ug/L		03/21/23 05:16	03/21/23 14:57	1
Potassium	**1260**		206	67.0	ug/L		03/21/23 05:16	03/21/23 14:57	1
Selenium	**0.397**	**J**	1.03	0.286	ug/L		03/21/23 05:16	03/21/23 14:57	1
Sodium	**125000**		1030	464	ug/L		03/21/23 05:16	03/21/23 15:19	5

Client Sample ID: Column 3 Day 14

Lab Sample ID: 410-118682-4

Date Collected: 03/13/23 09:45

Matrix: Water

Date Received: 03/13/23 16:15

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/16/23 17:42	5
Sulfate	**333**		75.0	25.0	mg/L			03/16/23 18:32	50
Chloride	**4.14**	**J**	7.50	3.00	mg/L			03/16/23 17:42	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 18:57	1
Calcium	**40.0**		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 18:57	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**6.64**		2.06	0.700	ug/L		03/21/23 05:16	03/21/23 14:42	1
Cobalt	**42.2**		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 14:42	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 14:42	1
Magnesium	**59900**		51.5	16.5	ug/L		03/21/23 05:16	03/21/23 14:42	1
Manganese	**1480**		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 14:42	1
Molybdenum	**0.561**		0.515	0.134	ug/L		03/21/23 05:16	03/21/23 14:42	1
Potassium	**1750**		206	67.0	ug/L		03/21/23 05:16	03/21/23 14:42	1
Selenium	**0.645**	**J**	1.03	0.286	ug/L		03/21/23 05:16	03/21/23 14:42	1
Sodium	**18700**		206	92.7	ug/L		03/21/23 05:16	03/21/23 14:42	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Client Sample ID: Column 4 Day 14

Date Collected: 03/13/23 10:15
Date Received: 03/13/23 16:15

Lab Sample ID: 410-118682-5

Matrix: Water

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/16/23 18:45	5
Sulfate	**1020**		300	100	mg/L			03/17/23 20:58	200
Chloride	**5.35**	**J**	7.50	3.00	mg/L			03/16/23 18:45	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 19:00	1
Calcium	**126**		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 19:00	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**2.05**	**J**	2.06	0.700	ug/L		03/21/23 05:16	03/21/23 14:51	1
Cobalt	**0.915**		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 14:51	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 14:51	1
Magnesium	**167000**		258	82.4	ug/L		03/21/23 05:16	03/21/23 15:16	5
Manganese	**35.3**		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 14:51	1
Molybdenum	**0.441**	**J**	0.515	0.134	ug/L		03/21/23 05:16	03/21/23 14:51	1
Potassium	**1980**		206	67.0	ug/L		03/21/23 05:16	03/21/23 14:51	1
Selenium	<0.286		1.03	0.286	ug/L		03/21/23 05:16	03/21/23 14:51	1
Sodium	**19800**		206	92.7	ug/L		03/21/23 05:16	03/21/23 14:51	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-354437/5
Matrix: Water
Analysis Batch: 354437

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/16/23 13:54	1
Sulfate	<0.500		1.50	0.500	mg/L			03/16/23 13:54	1
Chloride	<0.600		1.50	0.600	mg/L			03/16/23 13:54	1

Lab Sample ID: LCS 410-354437/3
Matrix: Water
Analysis Batch: 354437

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.6828		mg/L		91	90 - 110
Sulfate	7.50	7.392		mg/L		99	90 - 110
Chloride	3.00	3.041		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-354437/4
Matrix: Water
Analysis Batch: 354437

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.6843		mg/L		91	90 - 110	0	20
Sulfate	7.50	7.433		mg/L		99	90 - 110	1	20
Chloride	3.00	3.046		mg/L		102	90 - 110	0	20

Lab Sample ID: MB 410-354459/5
Matrix: Water
Analysis Batch: 354459

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/17/23 14:43	1
Sulfate	<0.500		1.50	0.500	mg/L			03/17/23 14:43	1
Chloride	<0.600		1.50	0.600	mg/L			03/17/23 14:43	1

Lab Sample ID: LCS 410-354459/3
Matrix: Water
Analysis Batch: 354459

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7002		mg/L		93	90 - 110
Sulfate	7.50	7.555		mg/L		101	90 - 110
Chloride	3.00	3.107		mg/L		104	90 - 110

Lab Sample ID: LCSD 410-354459/4
Matrix: Water
Analysis Batch: 354459

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.6993		mg/L		93	90 - 110	0	20
Sulfate	7.50	7.479		mg/L		100	90 - 110	1	20
Chloride	3.00	3.086		mg/L		103	90 - 110	1	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-355548/1-A
Matrix: Water
Analysis Batch: 355960

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 355548

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/21/23 05:16	03/21/23 18:04	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/21/23 05:16	03/21/23 18:04	1

Lab Sample ID: LCS 410-355548/2-A
Matrix: Water
Analysis Batch: 355960

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355548

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5692		mg/L		114	80 - 120
Calcium	5.00	5.600		mg/L		112	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-355548/1-A
Matrix: Water
Analysis Batch: 355908

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 355548

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/21/23 05:16	03/21/23 13:58	1
Cobalt	<0.161		0.515	0.161	ug/L		03/21/23 05:16	03/21/23 13:58	1
Iron	<20.6		51.5	20.6	ug/L		03/21/23 05:16	03/21/23 13:58	1
Magnesium	<16.5		51.5	16.5	ug/L		03/21/23 05:16	03/21/23 13:58	1
Manganese	<0.979		2.06	0.979	ug/L		03/21/23 05:16	03/21/23 13:58	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/21/23 05:16	03/21/23 13:58	1
Potassium	<67.0		206	67.0	ug/L		03/21/23 05:16	03/21/23 13:58	1
Selenium	<0.286		1.03	0.286	ug/L		03/21/23 05:16	03/21/23 13:58	1
Sodium	<92.7		206	92.7	ug/L		03/21/23 05:16	03/21/23 13:58	1

Lab Sample ID: LCS 410-355548/2-A
Matrix: Water
Analysis Batch: 355908

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355548

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	553.0		ug/L		111	85 - 120
Cobalt	500	532.2		ug/L		106	90 - 113
Iron	5000	5322		ug/L		106	88 - 119
Magnesium	5000	5272		ug/L		105	90 - 112
Manganese	500	529.8		ug/L		106	89 - 120
Molybdenum	50.0	54.00		ug/L		108	85 - 115
Potassium	5000	5226		ug/L		105	90 - 112
Selenium	100	109.3		ug/L		109	80 - 120
Sodium	5000	5294		ug/L		106	89 - 112

HPLC/IC

Analysis Batch: 354437

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-118682-1	Influent Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-1	Influent Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-2	Column 1 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-2	Column 1 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-3	Column 2 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-3	Column 2 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-4	Column 3 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-4	Column 3 Day 14	Total/NA	Water	EPA 300.0 R2.1	
410-118682-5	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	
MB 410-354437/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-354437/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-354437/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 354459

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-118682-5	Column 4 Day 14	Total/NA	Water	EPA 300.0 R2.1	
MB 410-354459/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-354459/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-354459/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 355548

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-118682-1	Influent Day 14	Dissolved	Water	Non-Digest Prep	
410-118682-2	Column 1 Day 14	Dissolved	Water	Non-Digest Prep	
410-118682-3	Column 2 Day 14	Dissolved	Water	Non-Digest Prep	
410-118682-4	Column 3 Day 14	Dissolved	Water	Non-Digest Prep	
410-118682-5	Column 4 Day 14	Dissolved	Water	Non-Digest Prep	
MB 410-355548/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-355548/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 355908

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-118682-1	Influent Day 14	Dissolved	Water	6020B	355548
410-118682-2	Column 1 Day 14	Dissolved	Water	6020B	355548
410-118682-3	Column 2 Day 14	Dissolved	Water	6020B	355548
410-118682-3	Column 2 Day 14	Dissolved	Water	6020B	355548
410-118682-4	Column 3 Day 14	Dissolved	Water	6020B	355548
410-118682-5	Column 4 Day 14	Dissolved	Water	6020B	355548
410-118682-5	Column 4 Day 14	Dissolved	Water	6020B	355548
MB 410-355548/1-A	Method Blank	Total/NA	Water	6020B	355548
LCS 410-355548/2-A	Lab Control Sample	Total/NA	Water	6020B	355548

Analysis Batch: 355960

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-118682-1	Influent Day 14	Dissolved	Water	6010D	355548
410-118682-2	Column 1 Day 14	Dissolved	Water	6010D	355548
410-118682-3	Column 2 Day 14	Dissolved	Water	6010D	355548
410-118682-4	Column 3 Day 14	Dissolved	Water	6010D	355548
410-118682-5	Column 4 Day 14	Dissolved	Water	6010D	355548

Metals (Continued)

Analysis Batch: 355960 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 410-355548/1-A	Method Blank	Total/NA	Water	6010D	355548
LCS 410-355548/2-A	Lab Control Sample	Total/NA	Water	6010D	355548

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Client Sample ID: Influent Day 14

Lab Sample ID: 410-118682-1

Date Collected: 03/13/23 08:15
Matrix: Water
Date Received: 03/13/23 16:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	354437	L4QM	ELLE	03/16/23 15:50
Total/NA	Analysis	EPA 300.0 R2.1		50	354437	L4QM	ELLE	03/16/23 16:15
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6010D		1	355960	T8CQ	ELLE	03/21/23 19:12
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		1	355908	UCIG	ELLE	03/21/23 14:53

Client Sample ID: Column 1 Day 14

Lab Sample ID: 410-118682-2

Date Collected: 03/13/23 08:45
Matrix: Water
Date Received: 03/13/23 16:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	354437	L4QM	ELLE	03/16/23 16:27
Total/NA	Analysis	EPA 300.0 R2.1		50	354437	L4QM	ELLE	03/16/23 16:52
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6010D		1	355960	T8CQ	ELLE	03/21/23 19:15
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		1	355908	UCIG	ELLE	03/21/23 14:55

Client Sample ID: Column 2 Day 14

Lab Sample ID: 410-118682-3

Date Collected: 03/13/23 09:15
Matrix: Water
Date Received: 03/13/23 16:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	354437	L4QM	ELLE	03/16/23 17:05
Total/NA	Analysis	EPA 300.0 R2.1		50	354437	L4QM	ELLE	03/16/23 17:30
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6010D		1	355960	T8CQ	ELLE	03/21/23 19:18
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		1	355908	UCIG	ELLE	03/21/23 14:57
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		5	355908	UCIG	ELLE	03/21/23 15:19

Client Sample ID: Column 3 Day 14

Lab Sample ID: 410-118682-4

Date Collected: 03/13/23 09:45
Matrix: Water
Date Received: 03/13/23 16:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	354437	L4QM	ELLE	03/16/23 17:42
Total/NA	Analysis	EPA 300.0 R2.1		50	354437	L4QM	ELLE	03/16/23 18:32
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6010D		1	355960	T8CQ	ELLE	03/21/23 18:57
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		1	355908	UCIG	ELLE	03/21/23 14:42

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-118682-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 4 Day 14
Lab Sample ID: 410-118682-5

Date Collected: 03/13/23 10:15
Matrix: Water

Date Received: 03/13/23 16:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	354437	L4QM	ELLE	03/16/23 18:45
Total/NA	Analysis	EPA 300.0 R2.1		200	354459	L4QM	ELLE	03/17/23 20:58
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6010D		1	355960	T8CQ	ELLE	03/21/23 19:00
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		1	355908	UCIG	ELLE	03/21/23 14:51
Dissolved	Prep	Non-Digest Prep			355548	UAMX	ELLE	03/21/23 05:16
Dissolved	Analysis	6020B		5	355908	UCIG	ELLE	03/21/23 15:16

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-118682-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Job ID: 410-118682-1
Project/Site: Stantec CCR TS AP3

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-118682-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-118682-1	Influent Day 14	Water	03/13/23 08:15	03/13/23 16:15
410-118682-2	Column 1 Day 14	Water	03/13/23 08:45	03/13/23 16:15
410-118682-3	Column 2 Day 14	Water	03/13/23 09:15	03/13/23 16:15
410-118682-4	Column 3 Day 14	Water	03/13/23 09:45	03/13/23 16:15
410-118682-5	Column 4 Day 14	Water	03/13/23 10:15	03/13/23 16:15

Environmen... est/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # ______

410-118682 Chain of Custody

Client: Terra Systems, Inc.					
Project Name/#: Stantec CCR TS AP3			Site ID #: Macon, GA		
Project Manager: Michael D. Lee			P.O. #: 222538-3-13-23		
Sampler: Michael D. Lee			PWSID #:		
Phone #: 302-798-9553			Quote #: 41011818		
State where samples were collected: GA			For Compliance: Yes ☐ No ☑		

Matrix: Tissue ☐, Sediment ☐, Soil ☐; Water: Ground ☑, Surface ☐, Potable ☐, NPDES ☐; Other:

Analyses Requested / Preservation Codes

Sample Identification	Collection Date	Collection Time	Grab	Composite	Soil	Water	Other	Total # of Containers	Dis (ff) As, Co, Fe, K, Mg, Mn (N)	Mo, Na, Se	Cl, F, SO4 by EPA 300 (-)	Dis (ff) Ca, Li (N)	Remarks
Influent Day 14	3/13/2023	8:15		X		X		3	X		X	X	ff= field filtered
Column 1 Day 14	3/13/2023	8:45		X		X		3	X		X	X	
Column 2 Day 14	3/13/2023	9:15		X		X		3	X		X	X	
Column 3 Day 14	3/13/2023	9:45		X		X		3	X		X	X	
Column 4 Day 14	3/13/2023	10:15		X		X		3	X		X	X	

For Lab Use Only

SF #: ______

SCR #: ______

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 3/27/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: ______

Relinquished by:	Date	Time	Received by:	Date	Time
Michael Lee	3/13/23	11:35	[signature]	3/13/23	1135
[signature]	3/13/23	1615			
			KCM	3/13/23	1615

Relinquished by Commercial Carrier: UPS ______ FedEx ______ Other ______

Temperature upon receipt [T8] (6) 5.1 °C Q06-19

Temp: 1.8°C 3/13/23

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0216

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-118682-1

Login Number: 118682

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: Wrye, Shaun

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	Not present
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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	Not present.
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 4/3/2023 12:25:17 PM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-119466-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
4/3/2023 12:25:17 PM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

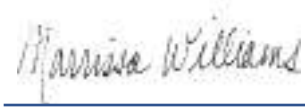


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-119466-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-119466-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-119466-1

Receipt
The samples were received on 3/20/2023 4:38 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 time was 0.5°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-119466-1

Client Sample ID: Column 1 Day 28 — Lab Sample ID: 410-119466-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	217		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.48	J F1	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Lithium	0.0177	J	0.0515	0.0113	mg/L	1		6010D	Dissolved
Calcium	36.1		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	4.58		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	43.2		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	20300		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	4550		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.431	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1670		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.416	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	13100	^2	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 28 — Lab Sample ID: 410-119466-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Fluoride	0.500	J	1.00	0.450	mg/L	5		EPA 300.0 R2.1	Total/NA
Sulfate	167		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Calcium	10.3		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	2.65		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.780		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	5060		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	147		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	6.13		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1030		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.396	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	97700		2060	927	ug/L	10		6020B	Dissolved

Client Sample ID: Column 3 Day 28 — Lab Sample ID: 410-119466-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	2190		750	250	mg/L	500		EPA 300.0 R2.1	Total/NA
Chloride	15.2		7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	180		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.07		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	1.31		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	26.7	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	408000		515	165	ug/L	10		6020B	Dissolved
Manganese	83.9		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	1.40		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	3550		206	67.0	ug/L	1		6020B	Dissolved
Sodium	101000		2060	927	ug/L	10		6020B	Dissolved

Client Sample ID: Column 4 Day 28 — Lab Sample ID: 410-119466-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	480		150	50.0	mg/L	100		EPA 300.0 R2.1	Total/NA
Chloride	3.47	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	59.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	3.49		2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.361	J	0.515	0.161	ug/L	1		6020B	Dissolved
Iron	23.6	J	51.5	20.6	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 4 Day 28 (Continued)

Lab Sample ID: 410-119466-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Magnesium	85900		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	16.5		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.181	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1770		206	67.0	ug/L	1		6020B	Dissolved
Sodium	20000	^2	206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-119466-1

Client Sample ID: Column 1 Day 28

Lab Sample ID: 410-119466-1

Date Collected: 03/20/23 08:45

Matrix: Water

Date Received: 03/20/23 16:38

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450	F1	1.00	0.450	mg/L			03/23/23 15:07	5
Sulfate	**217**		75.0	25.0	mg/L			03/24/23 22:50	50
Chloride	**3.48**	**J F1**	7.50	3.00	mg/L			03/23/23 15:07	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	**0.0177**	**J**	0.0515	0.0113	mg/L		03/25/23 06:44	03/29/23 01:52	1
Calcium	**36.1**		0.515	0.0989	mg/L		03/25/23 06:44	03/29/23 01:52	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.58**		2.06	0.700	ug/L		03/25/23 06:44	03/27/23 10:24	1
Cobalt	**43.2**		0.515	0.161	ug/L		03/25/23 06:44	03/27/23 10:24	1
Iron	<20.6		51.5	20.6	ug/L		03/25/23 06:44	03/27/23 10:24	1
Magnesium	**20300**		51.5	16.5	ug/L		03/25/23 06:44	03/27/23 10:24	1
Manganese	**4550**		2.06	0.979	ug/L		03/25/23 06:44	03/27/23 10:24	1
Molybdenum	**0.431**	**J**	0.515	0.134	ug/L		03/25/23 06:44	03/27/23 10:24	1
Potassium	**1670**		206	67.0	ug/L		03/25/23 06:44	03/27/23 10:24	1
Selenium	**0.416**	**J**	1.03	0.286	ug/L		03/25/23 06:44	03/27/23 10:24	1
Sodium	**13100**	**^2**	206	92.7	ug/L		03/25/23 06:44	03/27/23 10:24	1

Client Sample ID: Column 2 Day 28

Lab Sample ID: 410-119466-2

Date Collected: 03/20/23 09:15

Matrix: Water

Date Received: 03/20/23 16:38

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.500**	**J**	1.00	0.450	mg/L			03/23/23 13:52	5
Sulfate	**167**		30.0	10.0	mg/L			03/24/23 22:00	20
Chloride	<3.00		7.50	3.00	mg/L			03/23/23 13:52	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/25/23 06:08	03/28/23 05:17	1
Calcium	**10.3**		0.515	0.0989	mg/L		03/25/23 06:08	03/28/23 05:17	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**2.65**		2.06	0.700	ug/L		03/25/23 06:08	03/27/23 08:06	1
Cobalt	**0.780**		0.515	0.161	ug/L		03/25/23 06:08	03/27/23 08:06	1
Iron	<20.6		51.5	20.6	ug/L		03/25/23 06:08	03/27/23 08:06	1
Magnesium	**5060**		51.5	16.5	ug/L		03/25/23 06:08	03/27/23 08:06	1
Manganese	**147**		2.06	0.979	ug/L		03/25/23 06:08	03/27/23 08:06	1
Molybdenum	**6.13**		0.515	0.134	ug/L		03/25/23 06:08	03/27/23 08:06	1
Potassium	**1030**		206	67.0	ug/L		03/25/23 06:08	03/27/23 08:06	1
Selenium	**0.396**	**J**	1.03	0.286	ug/L		03/25/23 06:08	03/27/23 08:06	1
Sodium	**97700**		2060	927	ug/L		03/25/23 06:08	03/28/23 11:48	10

Client Sample ID: Column 3 Day 28

Lab Sample ID: 410-119466-3

Date Collected: 03/20/23 09:45

Matrix: Water

Date Received: 03/20/23 16:38

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/23/23 13:27	5
Sulfate	**2190**		750	250	mg/L			03/24/23 19:29	500
Chloride	**15.2**		7.50	3.00	mg/L			03/23/23 13:27	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/25/23 06:08	03/28/23 05:05	1
Calcium	**180**		0.515	0.0989	mg/L		03/25/23 06:08	03/28/23 05:05	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.07**		2.06	0.700	ug/L		03/25/23 06:08	03/27/23 08:04	1
Cobalt	**1.31**		0.515	0.161	ug/L		03/25/23 06:08	03/27/23 08:04	1
Iron	**26.7**	**J**	51.5	20.6	ug/L		03/25/23 06:08	03/27/23 08:04	1
Magnesium	**408000**		515	165	ug/L		03/25/23 06:08	03/28/23 11:46	10
Manganese	**83.9**		2.06	0.979	ug/L		03/25/23 06:08	03/27/23 08:04	1
Molybdenum	**1.40**		0.515	0.134	ug/L		03/25/23 06:08	03/27/23 08:04	1
Potassium	**3550**		206	67.0	ug/L		03/25/23 06:08	03/27/23 08:04	1
Selenium	<0.286		1.03	0.286	ug/L		03/25/23 06:08	03/27/23 08:04	1
Sodium	**101000**		2060	927	ug/L		03/25/23 06:08	03/28/23 11:46	10

Client Sample ID: Column 4 Day 28

Lab Sample ID: 410-119466-4

Date Collected: 03/20/23 10:15

Matrix: Water

Date Received: 03/20/23 16:38

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			03/23/23 15:44	5
Sulfate	**480**		150	50.0	mg/L			03/24/23 23:27	100
Chloride	**3.47**	**J**	7.50	3.00	mg/L			03/23/23 15:44	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/25/23 06:44	03/29/23 01:56	1
Calcium	**59.0**		0.515	0.0989	mg/L		03/25/23 06:44	03/29/23 01:56	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.49**		2.06	0.700	ug/L		03/25/23 06:44	03/27/23 10:26	1
Cobalt	**0.361**	**J**	0.515	0.161	ug/L		03/25/23 06:44	03/27/23 10:26	1
Iron	**23.6**	**J**	51.5	20.6	ug/L		03/25/23 06:44	03/27/23 10:26	1
Magnesium	**85900**		51.5	16.5	ug/L		03/25/23 06:44	03/27/23 10:26	1
Manganese	**16.5**		2.06	0.979	ug/L		03/25/23 06:44	03/27/23 10:26	1
Molybdenum	**0.181**	**J**	0.515	0.134	ug/L		03/25/23 06:44	03/27/23 10:26	1
Potassium	**1770**		206	67.0	ug/L		03/25/23 06:44	03/27/23 10:26	1
Selenium	<0.286		1.03	0.286	ug/L		03/25/23 06:44	03/27/23 10:26	1
Sodium	**20000**	**^2**	206	92.7	ug/L		03/25/23 06:44	03/27/23 10:26	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-356839/5
Matrix: Water
Analysis Batch: 356839

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/23/23 11:59	1
Sulfate	<0.500		1.50	0.500	mg/L			03/23/23 11:59	1
Chloride	<0.600		1.50	0.600	mg/L			03/23/23 11:59	1

Lab Sample ID: LCS 410-356839/3
Matrix: Water
Analysis Batch: 356839

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.6795		mg/L		91	90 - 110
Sulfate	7.50	7.261		mg/L		97	90 - 110
Chloride	3.00	3.000		mg/L		100	90 - 110

Lab Sample ID: LCSD 410-356839/4
Matrix: Water
Analysis Batch: 356839

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.6832		mg/L		91	90 - 110	1	20
Sulfate	7.50	7.269		mg/L		97	90 - 110	0	20
Chloride	3.00	3.006		mg/L		100	90 - 110	0	20

Lab Sample ID: 410-119466-1 MS
Matrix: Water
Analysis Batch: 356839

Client Sample ID: Column 1 Day 28
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	<0.450	F1	2.50	3.199	F1	mg/L		128	90 - 110
Chloride	3.48	J F1	10.0	16.13	F1	mg/L		127	90 - 110

Lab Sample ID: 410-119466-1 DU
Matrix: Water
Analysis Batch: 356839

Client Sample ID: Column 1 Day 28
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Fluoride	<0.450	F1	<0.450		mg/L		NC	15
Chloride	3.48	J F1	3.265	J	mg/L		6	15

Lab Sample ID: MB 410-357306/5
Matrix: Water
Analysis Batch: 357306

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/24/23 13:14	1
Sulfate	<0.500		1.50	0.500	mg/L			03/24/23 13:14	1
Chloride	<0.600		1.50	0.600	mg/L			03/24/23 13:14	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: LCS 410-357306/3
Matrix: Water
Analysis Batch: 357306

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.8111		mg/L		108	90 - 110
Sulfate	7.50	7.169		mg/L		96	90 - 110
Chloride	3.00	3.031		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-357306/4
Matrix: Water
Analysis Batch: 357306

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.8145		mg/L		109	90 - 110	0	20
Sulfate	7.50	7.149		mg/L		95	90 - 110	0	20
Chloride	3.00	3.031		mg/L		101	90 - 110	0	20

Lab Sample ID: MB 410-357321/5
Matrix: Water
Analysis Batch: 357321

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			03/24/23 21:22	1
Sulfate	<0.500		1.50	0.500	mg/L			03/24/23 21:22	1
Chloride	<0.600		1.50	0.600	mg/L			03/24/23 21:22	1

Lab Sample ID: LCS 410-357321/3
Matrix: Water
Analysis Batch: 357321

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	7.50	7.241		mg/L		97	90 - 110
Chloride	3.00	2.998		mg/L		100	90 - 110

Lab Sample ID: LCSD 410-357321/4
Matrix: Water
Analysis Batch: 357321

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate	7.50	7.213		mg/L		96	90 - 110	0	20
Chloride	3.00	3.025		mg/L		101	90 - 110	1	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-357386/1-A
Matrix: Water
Analysis Batch: 358062

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 357386

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/25/23 06:08	03/28/23 03:56	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/25/23 06:08	03/28/23 03:56	1

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-357386/2-A
Matrix: Water
Analysis Batch: 358062

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 357386

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.4946		mg/L		99	80 - 120
Calcium	5.00	4.867		mg/L		97	80 - 120

Lab Sample ID: MB 410-357389/1-A
Matrix: Water
Analysis Batch: 358500

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 357389

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/25/23 06:44	03/29/23 01:15	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/25/23 06:44	03/29/23 01:15	1

Lab Sample ID: LCS 410-357389/2-A
Matrix: Water
Analysis Batch: 358500

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 357389

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.4907		mg/L		98	80 - 120
Calcium	5.00	4.818		mg/L		96	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-357386/1-A
Matrix: Water
Analysis Batch: 357763

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 357386

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/25/23 06:08	03/27/23 07:24	1
Cobalt	<0.161		0.515	0.161	ug/L		03/25/23 06:08	03/27/23 07:24	1
Iron	<20.6		51.5	20.6	ug/L		03/25/23 06:08	03/27/23 07:24	1
Magnesium	<16.5		51.5	16.5	ug/L		03/25/23 06:08	03/27/23 07:24	1
Manganese	<0.979		2.06	0.979	ug/L		03/25/23 06:08	03/27/23 07:24	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/25/23 06:08	03/27/23 07:24	1
Potassium	<67.0		206	67.0	ug/L		03/25/23 06:08	03/27/23 07:24	1
Selenium	<0.286		1.03	0.286	ug/L		03/25/23 06:08	03/27/23 07:24	1
Sodium	<92.7		206	92.7	ug/L		03/25/23 06:08	03/27/23 07:24	1

Lab Sample ID: LCS 410-357386/2-A
Matrix: Water
Analysis Batch: 357763

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 357386

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	500.0		ug/L		100	85 - 120
Cobalt	500	491.7		ug/L		98	90 - 113
Iron	5000	4938		ug/L		99	88 - 119
Magnesium	5000	4992		ug/L		100	90 - 112
Manganese	500	494.6		ug/L		99	89 - 120
Molybdenum	50.0	49.76		ug/L		100	85 - 115
Potassium	5000	4821		ug/L		96	90 - 112
Selenium	100	100.9		ug/L		101	80 - 120
Sodium	5000	4864		ug/L		97	89 - 112

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-119466-1

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-357389/1-A
Matrix: Water
Analysis Batch: 357763

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 357389

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		03/25/23 06:44	03/27/23 10:02	1
Cobalt	<0.161		0.515	0.161	ug/L		03/25/23 06:44	03/27/23 10:02	1
Iron	<20.6		51.5	20.6	ug/L		03/25/23 06:44	03/27/23 10:02	1
Magnesium	<16.5		51.5	16.5	ug/L		03/25/23 06:44	03/27/23 10:02	1
Manganese	<0.979		2.06	0.979	ug/L		03/25/23 06:44	03/27/23 10:02	1
Molybdenum	<0.134		0.515	0.134	ug/L		03/25/23 06:44	03/27/23 10:02	1
Potassium	<67.0		206	67.0	ug/L		03/25/23 06:44	03/27/23 10:02	1
Selenium	<0.286		1.03	0.286	ug/L		03/25/23 06:44	03/27/23 10:02	1
Sodium	<92.7		206	92.7	ug/L		03/25/23 06:44	03/27/23 10:02	1

Lab Sample ID: LCS 410-357389/2-A
Matrix: Water
Analysis Batch: 357763

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 357389

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	506.3		ug/L		101	85 - 120
Cobalt	500	504.1		ug/L		101	90 - 113
Iron	5000	5051		ug/L		101	88 - 119
Magnesium	5000	5124		ug/L		102	90 - 112
Manganese	500	503.0		ug/L		101	89 - 120
Molybdenum	50.0	50.90		ug/L		102	85 - 115
Potassium	5000	4974		ug/L		99	90 - 112
Selenium	100	101.3		ug/L		101	80 - 120
Sodium	5000	4972		ug/L		99	89 - 112

HPLC/IC

Analysis Batch: 356839

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-1	Column 1 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-2	Column 2 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-3	Column 3 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-4	Column 4 Day 28	Total/NA	Water	EPA 300.0 R2.1	
MB 410-356839/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-356839/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-356839/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	
410-119466-1 MS	Column 1 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-1 DU	Column 1 Day 28	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 357306

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-3	Column 3 Day 28	Total/NA	Water	EPA 300.0 R2.1	
MB 410-357306/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-357306/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-357306/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 357321

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-1	Column 1 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-2	Column 2 Day 28	Total/NA	Water	EPA 300.0 R2.1	
410-119466-4	Column 4 Day 28	Total/NA	Water	EPA 300.0 R2.1	
MB 410-357321/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-357321/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-357321/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 357386

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-2	Column 2 Day 28	Dissolved	Water	Non-Digest Prep	
410-119466-3	Column 3 Day 28	Dissolved	Water	Non-Digest Prep	
MB 410-357386/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-357386/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 357389

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-1	Column 1 Day 28	Dissolved	Water	Non-Digest Prep	
410-119466-4	Column 4 Day 28	Dissolved	Water	Non-Digest Prep	
MB 410-357389/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-357389/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 357763

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-1	Column 1 Day 28	Dissolved	Water	6020B	357389
410-119466-2	Column 2 Day 28	Dissolved	Water	6020B	357386
410-119466-3	Column 3 Day 28	Dissolved	Water	6020B	357386
410-119466-4	Column 4 Day 28	Dissolved	Water	6020B	357389
MB 410-357386/1-A	Method Blank	Total/NA	Water	6020B	357386
MB 410-357389/1-A	Method Blank	Total/NA	Water	6020B	357389
LCS 410-357386/2-A	Lab Control Sample	Total/NA	Water	6020B	357386

Metals (Continued)

Analysis Batch: 357763 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 410-357389/2-A	Lab Control Sample	Total/NA	Water	6020B	357389

Analysis Batch: 358062

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-2	Column 2 Day 28	Dissolved	Water	6010D	357386
410-119466-3	Column 3 Day 28	Dissolved	Water	6010D	357386
MB 410-357386/1-A	Method Blank	Total/NA	Water	6010D	357386
LCS 410-357386/2-A	Lab Control Sample	Total/NA	Water	6010D	357386

Analysis Batch: 358214

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-2	Column 2 Day 28	Dissolved	Water	6020B	357386
410-119466-3	Column 3 Day 28	Dissolved	Water	6020B	357386

Analysis Batch: 358500

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-119466-1	Column 1 Day 28	Dissolved	Water	6010D	357389
410-119466-4	Column 4 Day 28	Dissolved	Water	6010D	357389
MB 410-357389/1-A	Method Blank	Total/NA	Water	6010D	357389
LCS 410-357389/2-A	Lab Control Sample	Total/NA	Water	6010D	357389

Client Sample ID: Column 1 Day 28
Lab Sample ID: 410-119466-1

Date Collected: 03/20/23 08:45
Matrix: Water
Date Received: 03/20/23 16:38

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	356839	L4QM	ELLE	03/23/23 15:07
Total/NA	Analysis	EPA 300.0 R2.1		50	357321	L4QM	ELLE	03/24/23 22:50
Dissolved	Prep	Non-Digest Prep			357389	UAMX	ELLE	03/25/23 06:44
Dissolved	Analysis	6010D		1	358500	MT26	ELLE	03/29/23 01:52
Dissolved	Prep	Non-Digest Prep			357389	UAMX	ELLE	03/25/23 06:44
Dissolved	Analysis	6020B		1	357763	F7JF	ELLE	03/27/23 10:24

Client Sample ID: Column 2 Day 28
Lab Sample ID: 410-119466-2

Date Collected: 03/20/23 09:15
Matrix: Water
Date Received: 03/20/23 16:38

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	356839	L4QM	ELLE	03/23/23 13:52
Total/NA	Analysis	EPA 300.0 R2.1		20	357321	L4QM	ELLE	03/24/23 22:00
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6010D		1	358062	MT26	ELLE	03/28/23 05:17
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6020B		1	357763	F7JF	ELLE	03/27/23 08:06
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6020B		10	358214	F7JF	ELLE	03/28/23 11:48

Client Sample ID: Column 3 Day 28
Lab Sample ID: 410-119466-3

Date Collected: 03/20/23 09:45
Matrix: Water
Date Received: 03/20/23 16:38

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	356839	L4QM	ELLE	03/23/23 13:27
Total/NA	Analysis	EPA 300.0 R2.1		500	357306	W3XT	ELLE	03/24/23 19:29
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6010D		1	358062	MT26	ELLE	03/28/23 05:05
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6020B		1	357763	F7JF	ELLE	03/27/23 08:04
Dissolved	Prep	Non-Digest Prep			357386	UAMX	ELLE	03/25/23 06:08
Dissolved	Analysis	6020B		10	358214	F7JF	ELLE	03/28/23 11:46

Client Sample ID: Column 4 Day 28
Lab Sample ID: 410-119466-4

Date Collected: 03/20/23 10:15
Matrix: Water
Date Received: 03/20/23 16:38

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	356839	L4QM	ELLE	03/23/23 15:44
Total/NA	Analysis	EPA 300.0 R2.1		100	357321	L4QM	ELLE	03/24/23 23:27
Dissolved	Prep	Non-Digest Prep			357389	UAMX	ELLE	03/25/23 06:44
Dissolved	Analysis	6010D		1	358500	MT26	ELLE	03/29/23 01:56

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-119466-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 4 Day 28
Lab Sample ID: 410-119466-4

Date Collected: 03/20/23 10:15
Matrix: Water

Date Received: 03/20/23 16:38

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			357389	UAMX	ELLE	03/25/23 06:44
Dissolved	Analysis	6020B		1	357763	F7JF	ELLE	03/27/23 10:26

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-119466-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-119466-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Job ID: 410-119466-1
Project/Site: Stantec CCR TS AP3

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-119466-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-119466-1	Column 1 Day 28	Water	03/20/23 08:45	03/20/23 16:38
410-119466-2	Column 2 Day 28	Water	03/20/23 09:15	03/20/23 16:38
410-119466-3	Column 3 Day 28	Water	03/20/23 09:45	03/20/23 16:38
410-119466-4	Column 4 Day 28	Water	03/20/23 10:15	03/20/23 16:38

410-119466 Chain of Custody

Environmental Analysis Request/Chain of Custody

Acct. # _____ Group # _____ Sample # _____

Client: **Terra Systems, Inc.**			
Project Name/#: Stantec CCR TS AP3	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-3-20-23		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Analyses Requested: Dis (ff) As, Co, Fe, K, Mg, Mn. (N)	Mo, Na, Se (N)	Cl, F, SO4 by EPA 300 (-)	Dis (ff) Ca, Li (N)
Column 1 Day 28	3/20/2023	8:45		X				X					3	X		X	X
Column 2 Day 28	3/20/2023	9:15		X				X					3	X		X	X
Column 3 Day 28	3/20/2023	9:45		X				X					3	X		X	X
Column 4 Day 28	3/20/2023	10:15		X				X					3	X		X	X

For Lab Use Only

SF #: _____

SCR #: _____

Preservation Codes

H = HCl T = Thiosulfate

N = HNO_3 B = NaOH

S = H_2SO_4 P = H_3PO_4

O = Other

Remarks

ff= field filtered

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 4/3/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP) ☐ MA MCP ☐

Type III (Reduced non-CLP) ☐ CT RCP ☐

Type VI (Raw Data Only) ☐ TX TRRP-13 ☐

NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

	Relinquished by:	Date	Time	Received by:	Date	Time
1	Michael D. Lee	3/20/23	11:15	[illegible]	3/20/23	1115
2	[illegible]	3/20/23	1630			
3						
4						
5				[illegible]	3/20/23	1638

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other X

Temperature upon receipt 0.5 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0216

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-119466-1

Login Number: 119466
List Number: 1
Creator: Wrye, Shaun

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 4/6/2023 5:22:55 AM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-120297-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

myEOL

Job Notes

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization

Generated
4/6/2023 5:22:55 AM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

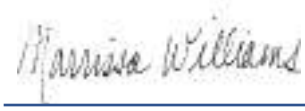


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-120297-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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.
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-120297-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-120297-1

Receipt
The samples were received on 3/27/2023 3:10 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 time was -0.8°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Client Sample ID: Influent Day 35 — Lab Sample ID: 410-120297-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	154		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.01	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	27.2		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.00247		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0594		0.000515	0.000161	mg/L	1		6020B	Dissolved
Magnesium	23.1		0.0515	0.0165	mg/L	1		6020B	Dissolved
Manganese	1.70		0.00206	0.000979	mg/L	1		6020B	Dissolved
Potassium	1.43		0.206	0.0670	mg/L	1		6020B	Dissolved
Selenium	0.000493	J	0.00103	0.000286	mg/L	1		6020B	Dissolved
Sodium	10.5		0.206	0.0927	mg/L	1		6020B	Dissolved

Client Sample ID: Column 1 Day 35 — Lab Sample ID: 410-120297-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	157		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Chloride	3.24	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	37.9		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.00348		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.0351		0.000515	0.000161	mg/L	1		6020B	Dissolved
Magnesium	18.9		0.0515	0.0165	mg/L	1		6020B	Dissolved
Manganese	4.09		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.000508	J	0.000515	0.000134	mg/L	1		6020B	Dissolved
Potassium	1.62		0.206	0.0670	mg/L	1		6020B	Dissolved
Selenium	0.000424	J	0.00103	0.000286	mg/L	1		6020B	Dissolved
Sodium	12.1		0.206	0.0927	mg/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 35 — Lab Sample ID: 410-120297-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	159		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Calcium	13.7		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.00403		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.000739		0.000515	0.000161	mg/L	1		6020B	Dissolved
Magnesium	6.99		0.0515	0.0165	mg/L	1		6020B	Dissolved
Manganese	0.136		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.00307		0.000515	0.000134	mg/L	1		6020B	Dissolved
Potassium	1.00		0.206	0.0670	mg/L	1		6020B	Dissolved
Selenium	0.000535	J	0.00103	0.000286	mg/L	1		6020B	Dissolved
Sodium	68.6		0.206	0.0927	mg/L	1		6020B	Dissolved

Client Sample ID: Column 3 Day 35 — Lab Sample ID: 410-120297-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	1480		300	100	mg/L	200		EPA 300.0 R2.1	Total/NA
Chloride	15.6		7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	126		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.00517		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.00171		0.000515	0.000161	mg/L	1		6020B	Dissolved
Iron	0.0303	J	0.0515	0.0206	mg/L	1		6020B	Dissolved
Magnesium	285		5.15	1.65	mg/L	100		6020B	Dissolved
Manganese	0.149		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.000997		0.000515	0.000134	mg/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 3 Day 35 (Continued) — Lab Sample ID: 410-120297-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Potassium	4.49		0.206	0.0670	mg/L	1		6020B	Dissolved
Sodium	87.1		0.206	0.0927	mg/L	1		6020B	Dissolved

Client Sample ID: Column 4 Day 35 — Lab Sample ID: 410-120297-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	289		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.21	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	41.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.00225		0.00206	0.000700	mg/L	1		6020B	Dissolved
Cobalt	0.000419	J	0.000515	0.000161	mg/L	1		6020B	Dissolved
Magnesium	45.9		0.0515	0.0165	mg/L	1		6020B	Dissolved
Manganese	0.0165		0.00206	0.000979	mg/L	1		6020B	Dissolved
Molybdenum	0.000194	J	0.000515	0.000134	mg/L	1		6020B	Dissolved
Potassium	1.45		0.206	0.0670	mg/L	1		6020B	Dissolved
Selenium	0.000313	J	0.00103	0.000286	mg/L	1		6020B	Dissolved
Sodium	15.7		0.206	0.0927	mg/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Client Sample ID: Influent Day 35

Lab Sample ID: 410-120297-1

Date Collected: 03/27/23 08:15
Matrix: Water
Date Received: 03/27/23 15:10

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/03/23 21:37	5
Sulfate	**154**		75.0	25.0	mg/L			04/04/23 17:10	50
Chloride	**3.01**	**J**	7.50	3.00	mg/L			04/03/23 21:37	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 17:29	1
Calcium	**27.2**		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 17:29	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00247**		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 10:27	1
Cobalt	**0.0594**		0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 10:27	1
Iron	<0.0206		0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 10:27	1
Magnesium	**23.1**		0.0515	0.0165	mg/L		03/30/23 05:47	03/31/23 10:27	1
Manganese	**1.70**		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 10:27	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 10:27	1
Potassium	**1.43**		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 10:27	1
Selenium	**0.000493**	**J**	0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 10:27	1
Sodium	**10.5**		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 10:27	1

Client Sample ID: Column 1 Day 35

Lab Sample ID: 410-120297-2

Date Collected: 03/27/23 08:45
Matrix: Water
Date Received: 03/27/23 15:10

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/03/23 20:08	5
Sulfate	**157**		30.0	10.0	mg/L			04/04/23 16:52	20
Chloride	**3.24**	**J**	7.50	3.00	mg/L			04/03/23 20:08	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 17:26	1
Calcium	**37.9**		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 17:26	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00348**		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 10:25	1
Cobalt	**0.0351**		0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 10:25	1
Iron	<0.0206		0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 10:25	1
Magnesium	**18.9**		0.0515	0.0165	mg/L		03/30/23 05:47	03/31/23 10:25	1
Manganese	**4.09**		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 10:25	1
Molybdenum	**0.000508**	**J**	0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 10:25	1
Potassium	**1.62**		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 10:25	1
Selenium	**0.000424**	**J**	0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 10:25	1
Sodium	**12.1**		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 10:25	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Client Sample ID: Column 2 Day 35

Lab Sample ID: 410-120297-3

Date Collected: 03/27/23 09:15

Matrix: Water

Date Received: 03/27/23 15:10

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/03/23 21:50	5
Sulfate	**159**		75.0	25.0	mg/L			04/04/23 17:27	50
Chloride	<3.00		7.50	3.00	mg/L			04/03/23 21:50	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 17:23	1
Calcium	**13.7**		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 17:23	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00403**		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 10:23	1
Cobalt	**0.000739**		0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 10:23	1
Iron	<0.0206		0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 10:23	1
Magnesium	**6.99**		0.0515	0.0165	mg/L		03/30/23 05:47	03/31/23 10:23	1
Manganese	**0.136**		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 10:23	1
Molybdenum	**0.00307**		0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 10:23	1
Potassium	**1.00**		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 10:23	1
Selenium	**0.000535**	**J**	0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 10:23	1
Sodium	**68.6**		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 10:23	1

Client Sample ID: Column 3 Day 35

Lab Sample ID: 410-120297-4

Date Collected: 03/27/23 09:45

Matrix: Water

Date Received: 03/27/23 15:10

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/03/23 20:34	5
Sulfate	**1480**		300	100	mg/L			04/04/23 17:35	200
Chloride	**15.6**		7.50	3.00	mg/L			04/03/23 20:34	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 17:20	1
Calcium	**126**		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 17:20	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00517**		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 10:21	1
Cobalt	**0.00171**		0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 10:21	1
Iron	**0.0303**	**J**	0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 10:21	1
Magnesium	**285**		5.15	1.65	mg/L		03/30/23 05:47	04/03/23 09:54	100
Manganese	**0.149**		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 10:21	1
Molybdenum	**0.000997**		0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 10:21	1
Potassium	**4.49**		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 10:21	1
Selenium	<0.000286		0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 10:21	1
Sodium	**87.1**		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 10:21	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Client Sample ID: Column 4 Day 35

Date Collected: 03/27/23 10:15
Date Received: 03/27/23 15:10

Lab Sample ID: 410-120297-5

Matrix: Water

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/03/23 22:03	5
Sulfate	**289**		75.0	25.0	mg/L			04/04/23 17:18	50
Chloride	**3.21**	**J**	7.50	3.00	mg/L			04/03/23 22:03	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 16:46	1
Calcium	**41.0**		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 16:46	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00225**		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 09:58	1
Cobalt	**0.000419**	**J**	0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 09:58	1
Iron	<0.0206		0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 09:58	1
Magnesium	**45.9**		0.0515	0.0165	mg/L		03/30/23 05:47	03/31/23 09:58	1
Manganese	**0.0165**		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 09:58	1
Molybdenum	**0.000194**	**J**	0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 09:58	1
Potassium	**1.45**		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 09:58	1
Selenium	**0.000313**	**J**	0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 09:58	1
Sodium	**15.7**		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 09:58	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-360356/5
Matrix: Water
Analysis Batch: 360356

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			04/03/23 15:01	1
Sulfate	<0.500		1.50	0.500	mg/L			04/03/23 15:01	1
Chloride	<0.600		1.50	0.600	mg/L			04/03/23 15:01	1

Lab Sample ID: LCS 410-360356/3
Matrix: Water
Analysis Batch: 360356

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7162		mg/L		95	90 - 110
Sulfate	7.50	7.494		mg/L		100	90 - 110
Chloride	3.00	3.013		mg/L		100	90 - 110

Lab Sample ID: LCSD 410-360356/4
Matrix: Water
Analysis Batch: 360356

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7204		mg/L		96	90 - 110	1	20
Sulfate	7.50	7.511		mg/L		100	90 - 110	0	20
Chloride	3.00	3.026		mg/L		101	90 - 110	0	20

Lab Sample ID: MB 410-360860/5
Matrix: Water
Analysis Batch: 360860

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	<0.500		1.50	0.500	mg/L			04/04/23 12:54	1

Lab Sample ID: LCS 410-360860/3
Matrix: Water
Analysis Batch: 360860

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	7.50	6.935		mg/L		92	90 - 110

Lab Sample ID: LCSD 410-360860/4
Matrix: Water
Analysis Batch: 360860

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate	7.50	6.931		mg/L		92	90 - 110	0	20

Lab Sample ID: 410-120297-4 MS
Matrix: Water
Analysis Batch: 360860

Client Sample ID: Column 3 Day 35
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	1480		1000	2577		mg/L		110	90 - 110

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: 410-120297-4 DU
Matrix: Water
Analysis Batch: 360860

Client Sample ID: Column 3 Day 35
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Sulfate	1480			1424		mg/L				4	15

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-358966/1-A
Matrix: Water
Analysis Batch: 359436

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 358966

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		03/30/23 05:47	03/30/23 16:34	1
Calcium	<0.0989		0.515	0.0989	mg/L		03/30/23 05:47	03/30/23 16:34	1

Lab Sample ID: LCS 410-358966/2-A
Matrix: Water
Analysis Batch: 359436

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 358966

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Lithium			0.500	0.5231		mg/L		105	80 - 120		
Calcium			5.00	5.286		mg/L		106	80 - 120		

Lab Sample ID: 410-120297-5 MS
Matrix: Water
Analysis Batch: 359436

Client Sample ID: Column 4 Day 35
Prep Type: Dissolved
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Lithium	<0.0113		0.500	0.5309		mg/L		106	75 - 125		
Calcium	41.0		5.00	46.20	4	mg/L		103	75 - 125		

Lab Sample ID: 410-120297-5 MSD
Matrix: Water
Analysis Batch: 359436

Client Sample ID: Column 4 Day 35
Prep Type: Dissolved
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lithium	<0.0113		0.500	0.5313		mg/L		106	75 - 125	0	20
Calcium	41.0		5.00	46.43	4	mg/L		108	75 - 125	0	20

Lab Sample ID: 410-120297-5 DU
Matrix: Water
Analysis Batch: 359436

Client Sample ID: Column 4 Day 35
Prep Type: Dissolved
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Lithium	<0.0113			<0.0113		mg/L				NC	20
Calcium	41.0			40.96		mg/L				0.2	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-358966/1-A
Matrix: Water
Analysis Batch: 359675

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 358966

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000700		0.00206	0.000700	mg/L		03/30/23 05:47	03/31/23 09:54	1
Cobalt	<0.000161		0.000515	0.000161	mg/L		03/30/23 05:47	03/31/23 09:54	1
Iron	<0.0206		0.0515	0.0206	mg/L		03/30/23 05:47	03/31/23 09:54	1
Magnesium	<0.0165		0.0515	0.0165	mg/L		03/30/23 05:47	03/31/23 09:54	1
Manganese	<0.000979		0.00206	0.000979	mg/L		03/30/23 05:47	03/31/23 09:54	1
Molybdenum	<0.000134		0.000515	0.000134	mg/L		03/30/23 05:47	03/31/23 09:54	1
Potassium	<0.0670		0.206	0.0670	mg/L		03/30/23 05:47	03/31/23 09:54	1
Selenium	<0.000286		0.00103	0.000286	mg/L		03/30/23 05:47	03/31/23 09:54	1
Sodium	<0.0927		0.206	0.0927	mg/L		03/30/23 05:47	03/31/23 09:54	1

Lab Sample ID: LCS 410-358966/2-A
Matrix: Water
Analysis Batch: 359675

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 358966

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.500	0.5174		mg/L		103	85 - 120
Cobalt	0.500	0.5101		mg/L		102	90 - 113
Iron	5.00	5.163		mg/L		103	88 - 119
Magnesium	5.00	5.055		mg/L		101	90 - 112
Manganese	0.500	0.5053		mg/L		101	89 - 120
Molybdenum	0.0500	0.05024		mg/L		100	85 - 115
Potassium	5.00	5.051		mg/L		101	90 - 112
Selenium	0.100	0.1030		mg/L		103	80 - 120
Sodium	5.00	5.036		mg/L		101	89 - 112

Lab Sample ID: 410-120297-5 MS
Matrix: Water
Analysis Batch: 359675

Client Sample ID: Column 4 Day 35
Prep Type: Dissolved
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.00225		0.500	0.5219		mg/L		104	75 - 125
Cobalt	0.000419	J	0.500	0.4919		mg/L		98	80 - 125
Iron	<0.0206		5.00	4.959		mg/L		99	75 - 125
Magnesium	45.9		5.00	50.09	4	mg/L		83	75 - 125
Manganese	0.0165		0.500	0.5121		mg/L		99	75 - 125
Molybdenum	0.000194	J	0.0500	0.05106		mg/L		102	81 - 125
Potassium	1.45		5.00	6.424		mg/L		100	75 - 125
Selenium	0.000313	J	0.100	0.1037		mg/L		103	75 - 125
Sodium	15.7		5.00	20.29		mg/L		92	75 - 125

Lab Sample ID: 410-120297-5 MSD
Matrix: Water
Analysis Batch: 359675

Client Sample ID: Column 4 Day 35
Prep Type: Dissolved
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	0.00225		0.500	0.5269		mg/L		105	75 - 125	1	20
Cobalt	0.000419	J	0.500	0.4937		mg/L		99	80 - 125	0	20
Iron	<0.0206		5.00	5.090		mg/L		102	75 - 125	3	20
Magnesium	45.9		5.00	50.55	4	mg/L		93	75 - 125	1	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 410-120297-5 MSD
Client Sample ID: Column 4 Day 35
Matrix: Water
Prep Type: Dissolved
Analysis Batch: 359675
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Manganese	0.0165		0.500	0.5155		mg/L		100	75 - 125	1	20
Molybdenum	0.000194	J	0.0500	0.05081		mg/L		101	81 - 125	0	20
Potassium	1.45		5.00	6.465		mg/L		100	75 - 125	1	20
Selenium	0.000313	J	0.100	0.1054		mg/L		105	75 - 125	2	20
Sodium	15.7		5.00	20.63		mg/L		99	75 - 125	2	20

Lab Sample ID: 410-120297-5 DU
Client Sample ID: Column 4 Day 35
Matrix: Water
Prep Type: Dissolved
Analysis Batch: 359675
Prep Batch: 358966

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	0.00225		0.002019	J	mg/L		11	20
Cobalt	0.000419	J	0.0003657	J	mg/L		14	20
Iron	<0.0206		<0.0206		mg/L		NC	20
Magnesium	45.9		46.57		mg/L		1	20
Manganese	0.0165		0.01661		mg/L		0.9	20
Molybdenum	0.000194	J	0.0001566	J F5	mg/L		21	20
Potassium	1.45		1.465		mg/L		1	20
Selenium	0.000313	J	<0.000286		mg/L		NC	20
Sodium	15.7		15.95		mg/L		2	20

HPLC/IC

Analysis Batch: 360356

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-1	Influent Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-2	Column 1 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-3	Column 2 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-4	Column 3 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-5	Column 4 Day 35	Total/NA	Water	EPA 300.0 R2.1	
MB 410-360356/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-360356/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-360356/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 360860

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-1	Influent Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-2	Column 1 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-3	Column 2 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-4	Column 3 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-5	Column 4 Day 35	Total/NA	Water	EPA 300.0 R2.1	
MB 410-360860/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-360860/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-360860/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	
410-120297-4 MS	Column 3 Day 35	Total/NA	Water	EPA 300.0 R2.1	
410-120297-4 DU	Column 3 Day 35	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 358966

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-1	Influent Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-2	Column 1 Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-3	Column 2 Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-4	Column 3 Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-5	Column 4 Day 35	Dissolved	Water	Non-Digest Prep	
MB 410-358966/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-358966/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	
410-120297-5 MS	Column 4 Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-5 MSD	Column 4 Day 35	Dissolved	Water	Non-Digest Prep	
410-120297-5 DU	Column 4 Day 35	Dissolved	Water	Non-Digest Prep	

Analysis Batch: 359436

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-1	Influent Day 35	Dissolved	Water	6010D	358966
410-120297-2	Column 1 Day 35	Dissolved	Water	6010D	358966
410-120297-3	Column 2 Day 35	Dissolved	Water	6010D	358966
410-120297-4	Column 3 Day 35	Dissolved	Water	6010D	358966
410-120297-5	Column 4 Day 35	Dissolved	Water	6010D	358966
MB 410-358966/1-A	Method Blank	Total/NA	Water	6010D	358966
LCS 410-358966/2-A	Lab Control Sample	Total/NA	Water	6010D	358966
410-120297-5 MS	Column 4 Day 35	Dissolved	Water	6010D	358966
410-120297-5 MSD	Column 4 Day 35	Dissolved	Water	6010D	358966
410-120297-5 DU	Column 4 Day 35	Dissolved	Water	6010D	358966

QC Association Summary

Client: Terra Systems Inc
Job ID: 410-120297-1
Project/Site: Stantec CCR TS AP3

Metals

Analysis Batch: 359675

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-1	Influent Day 35	Dissolved	Water	6020B	358966
410-120297-2	Column 1 Day 35	Dissolved	Water	6020B	358966
410-120297-3	Column 2 Day 35	Dissolved	Water	6020B	358966
410-120297-4	Column 3 Day 35	Dissolved	Water	6020B	358966
410-120297-5	Column 4 Day 35	Dissolved	Water	6020B	358966
MB 410-358966/1-A	Method Blank	Total/NA	Water	6020B	358966
LCS 410-358966/2-A	Lab Control Sample	Total/NA	Water	6020B	358966
410-120297-5 MS	Column 4 Day 35	Dissolved	Water	6020B	358966
410-120297-5 MSD	Column 4 Day 35	Dissolved	Water	6020B	358966
410-120297-5 DU	Column 4 Day 35	Dissolved	Water	6020B	358966

Analysis Batch: 360223

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-120297-4	Column 3 Day 35	Dissolved	Water	6020B	358966

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-120297-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Influent Day 35
Lab Sample ID: 410-120297-1
Date Collected: 03/27/23 08:15
Matrix: Water
Date Received: 03/27/23 15:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	360860	L4QM	ELLE	04/04/23 17:10
Total/NA	Analysis	EPA 300.0 R2.1		5	360356	L4QM	ELLE	04/03/23 21:37
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6010D		1	359436	T8CQ	ELLE	03/30/23 17:29
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		1	359675	F7JF	ELLE	03/31/23 10:27

Client Sample ID: Column 1 Day 35
Lab Sample ID: 410-120297-2
Date Collected: 03/27/23 08:45
Matrix: Water
Date Received: 03/27/23 15:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		20	360860	L4QM	ELLE	04/04/23 16:52
Total/NA	Analysis	EPA 300.0 R2.1		5	360356	L4QM	ELLE	04/03/23 20:08
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6010D		1	359436	T8CQ	ELLE	03/30/23 17:26
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		1	359675	F7JF	ELLE	03/31/23 10:25

Client Sample ID: Column 2 Day 35
Lab Sample ID: 410-120297-3
Date Collected: 03/27/23 09:15
Matrix: Water
Date Received: 03/27/23 15:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	360860	L4QM	ELLE	04/04/23 17:27
Total/NA	Analysis	EPA 300.0 R2.1		5	360356	L4QM	ELLE	04/03/23 21:50
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6010D		1	359436	T8CQ	ELLE	03/30/23 17:23
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		1	359675	F7JF	ELLE	03/31/23 10:23

Client Sample ID: Column 3 Day 35
Lab Sample ID: 410-120297-4
Date Collected: 03/27/23 09:45
Matrix: Water
Date Received: 03/27/23 15:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		200	360860	L4QM	ELLE	04/04/23 17:35
Total/NA	Analysis	EPA 300.0 R2.1		5	360356	L4QM	ELLE	04/03/23 20:34
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6010D		1	359436	T8CQ	ELLE	03/30/23 17:20
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		1	359675	F7JF	ELLE	03/31/23 10:21
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		100	360223	F7JF	ELLE	04/03/23 09:54

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-120297-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 4 Day 35
Lab Sample ID: 410-120297-5

Date Collected: 03/27/23 10:15
Matrix: Water

Date Received: 03/27/23 15:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		50	360860	L4QM	ELLE	04/04/23 17:18
Total/NA	Analysis	EPA 300.0 R2.1		5	360356	L4QM	ELLE	04/03/23 22:03
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6010D		1	359436	T8CQ	ELLE	03/30/23 16:46
Dissolved	Prep	Non-Digest Prep			358966	UAMX	ELLE	03/30/23 05:47
Dissolved	Analysis	6020B		1	359675	F7JF	ELLE	03/31/23 09:58

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-23 *
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
Washington	State	C457	04-11-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-120297-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-120297-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-120297-1	Influent Day 35	Water	03/27/23 08:15	03/27/23 15:10
410-120297-2	Column 1 Day 35	Water	03/27/23 08:45	03/27/23 15:10
410-120297-3	Column 2 Day 35	Water	03/27/23 09:15	03/27/23 15:10
410-120297-4	Column 3 Day 35	Water	03/27/23 09:45	03/27/23 15:10
410-120297-5	Column 4 Day 35	Water	03/27/23 10:15	03/27/23 15:10

Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

410-120297 Chain of Custody

Acct. # ___ Sample # ___

Client: Terra Systems, Inc.		Matrix	Analyses Requested	For Lab Use Only
Project Name/#: Stantec CCR TS AP3	Site ID #: Macon, GA		Preservation Codes	SF #:
Project Manager: Michael D. Lee	P.O. #: 222538-3-27-23		N, N, -, N	SCR #:
Sampler: Michael D. Lee	PWSID #:			
Phone #: 302-798-9553	Quote #: 41011818			
State where samples were collected: GA	For Compliance: Yes ☐ No ☑			

Matrix: Tissue ☐ Sediment ☐ Soil ☐ Water: Ground ☑ Surface ☐ Potable ☐ NPDES ☐ Other:

Preservation Codes: H = HCl, T = Thiosulfate, N = HNO_3, B = NaOH, S = H_2SO_4, P = H_3PO_4, O = Other

Sample Identification	Date	Time	Grab	Composite	Soil	Water	Other	Total # of Containers	Dis (ff) As, Co, Fe, K, Mg, Mn,	Mo, Na, Se	Cl, F, SO4 by EPA 300	Dis (ff) Ca, Li	Remarks
									N	N	-	N	
Influent Day 35	3/27/2023	8:15		X		X		3	X		X	X	ff= field filtered
Column 1 Day 35	3/27/2023	8:45		X		X		3	X		X	X	
Column 2 Day 35	3/27/2023	9:15		X		X		3	X		X	X	
Column 3 Day 35	3/27/2023	9:45		X		X		3	X		X	X	
Column 4 Day 35	3/27/2023	10:15		X		X		3	X		X	X	

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 4/10/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category ☐ A or ☐ B	

EDD Required? Yes ☐ No ☑ If yes, format: ___

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	3/27/23	11:15	[signature]	3/27/23	1115
[signature]	3/27/23	1510			
			[signature]	3/27/23	15:10

Relinquished by Commercial Carrier: UPS ___ FedEx ___ Other ___

Temperature upon receipt -0.8 °C

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-120297-1

Login Number: 120297
List Number: 1
Creator: Wrye, Shaun

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 4/17/2023 2:30:23 PM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-121193-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

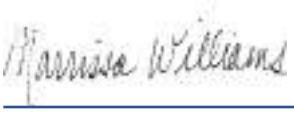
myEOL

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization



Generated
4/17/2023 2:30:23 PM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

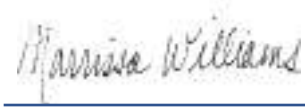


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-121193-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-121193-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-121193-1

Receipt
The samples were received on 4/3/2023 3:58 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 time was 1.8°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Client Sample ID: Column 1 Day 42 — Lab Sample ID: 410-121193-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	169		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Chloride	3.20	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	35.7		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	1.05	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	26.7		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	26.5	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	19400		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	3870		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.510	J B	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1610		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.437	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	11600		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 42 — Lab Sample ID: 410-121193-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	163		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Calcium	18.7		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	0.578		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	8870	^2	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	181		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	2.56		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	971		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.407	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	55900		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 3 Day 42 — Lab Sample ID: 410-121193-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	573		150	50.0	mg/L	100		EPA 300.0 R2.1	Total/NA
Chloride	3.62	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	52.2		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	1.34	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.428	J	0.515	0.161	ug/L	1		6020B	Dissolved
Iron	43.5	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	97200		258	82.4	ug/L	5		6020B	Dissolved
Manganese	51.2		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.535	B	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1700		206	67.0	ug/L	1		6020B	Dissolved
Sodium	38800		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 4 Day 42 — Lab Sample ID: 410-121193-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	267		150	50.0	mg/L	100		EPA 300.0 R2.1	Total/NA
Calcium	38.4		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.822	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.201	J	0.515	0.161	ug/L	1		6020B	Dissolved
Iron	21.2	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	41600		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	5.73		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.285	J B	0.515	0.134	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client Sample ID: Column 4 Day 42 (Continued)

Lab Sample ID: 410-121193-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Potassium	1590		206	67.0	ug/L	1		6020B	Dissolved
Sodium	16500		206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Client Sample ID: Column 1 Day 42

Lab Sample ID: 410-121193-1

Date Collected: 04/03/23 08:45

Matrix: Water

Date Received: 04/03/23 15:58

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/12/23 14:46	5
Sulfate	**169**		30.0	10.0	mg/L			04/14/23 18:59	20
Chloride	**3.20**	**J**	7.50	3.00	mg/L			04/12/23 14:46	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:48	04/07/23 17:01	1
Calcium	**35.7**		0.515	0.0989	mg/L		04/07/23 07:48	04/07/23 17:01	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.05**	**J**	2.06	0.700	ug/L		04/07/23 07:48	04/11/23 15:18	1
Cobalt	**26.7**		0.515	0.161	ug/L		04/07/23 07:48	04/11/23 15:18	1
Iron	**26.5**	**J**	51.5	20.6	ug/L		04/07/23 07:48	04/11/23 15:18	1
Magnesium	**19400**		51.5	16.5	ug/L		04/07/23 07:48	04/11/23 15:18	1
Manganese	**3870**		2.06	0.979	ug/L		04/07/23 07:48	04/11/23 15:18	1
Molybdenum	**0.510**	**J B**	0.515	0.134	ug/L		04/07/23 07:48	04/11/23 15:18	1
Potassium	**1610**		206	67.0	ug/L		04/07/23 07:48	04/11/23 15:18	1
Selenium	**0.437**	**J**	1.03	0.286	ug/L		04/07/23 07:48	04/11/23 15:18	1
Sodium	**11600**		206	92.7	ug/L		04/07/23 07:48	04/11/23 15:18	1

Client Sample ID: Column 2 Day 42

Lab Sample ID: 410-121193-2

Date Collected: 04/03/23 09:15

Matrix: Water

Date Received: 04/03/23 15:58

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/12/23 15:11	5
Sulfate	**163**		30.0	10.0	mg/L			04/14/23 12:00	20
Chloride	<3.00		7.50	3.00	mg/L			04/12/23 15:11	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:40	04/07/23 13:24	1
Calcium	**18.7**		0.515	0.0989	mg/L		04/07/23 07:40	04/07/23 13:24	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/07/23 07:40	04/10/23 17:00	1
Cobalt	**0.578**		0.515	0.161	ug/L		04/07/23 07:40	04/10/23 17:00	1
Iron	<20.6		51.5	20.6	ug/L		04/07/23 07:40	04/10/23 17:00	1
Magnesium	**8870**	**^2**	51.5	16.5	ug/L		04/07/23 07:40	04/10/23 17:00	1
Manganese	**181**		2.06	0.979	ug/L		04/07/23 07:40	04/10/23 17:00	1
Molybdenum	**2.56**		0.515	0.134	ug/L		04/07/23 07:40	04/10/23 17:00	1
Potassium	**971**		206	67.0	ug/L		04/07/23 07:40	04/10/23 17:00	1
Selenium	**0.407**	**J**	1.03	0.286	ug/L		04/07/23 07:40	04/10/23 17:00	1
Sodium	**55900**		206	92.7	ug/L		04/07/23 07:40	04/11/23 01:53	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Client Sample ID: Column 3 Day 42

Lab Sample ID: 410-121193-3

Date Collected: 04/03/23 09:45

Matrix: Water

Date Received: 04/03/23 15:58

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/12/23 15:37	5
Sulfate	**573**		150	50.0	mg/L			04/14/23 12:13	100
Chloride	**3.62**	**J**	7.50	3.00	mg/L			04/12/23 15:37	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:48	04/07/23 16:58	1
Calcium	**52.2**		0.515	0.0989	mg/L		04/07/23 07:48	04/07/23 16:58	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.34**	**J**	2.06	0.700	ug/L		04/07/23 07:48	04/11/23 15:16	1
Cobalt	**0.428**	**J**	0.515	0.161	ug/L		04/07/23 07:48	04/11/23 15:16	1
Iron	**43.5**	**J**	51.5	20.6	ug/L		04/07/23 07:48	04/11/23 15:16	1
Magnesium	**97200**		258	82.4	ug/L		04/07/23 07:48	04/11/23 15:28	5
Manganese	**51.2**		2.06	0.979	ug/L		04/07/23 07:48	04/11/23 15:16	1
Molybdenum	**0.535**	**B**	0.515	0.134	ug/L		04/07/23 07:48	04/11/23 15:16	1
Potassium	**1700**		206	67.0	ug/L		04/07/23 07:48	04/11/23 15:16	1
Selenium	<0.286		1.03	0.286	ug/L		04/07/23 07:48	04/11/23 15:16	1
Sodium	**38800**		206	92.7	ug/L		04/07/23 07:48	04/11/23 15:16	1

Client Sample ID: Column 4 Day 42

Lab Sample ID: 410-121193-4

Date Collected: 04/03/23 10:15

Matrix: Water

Date Received: 04/03/23 15:58

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/12/23 16:28	5
Sulfate	**267**		150	50.0	mg/L			04/14/23 12:26	100
Chloride	<3.00		7.50	3.00	mg/L			04/12/23 16:28	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:48	04/07/23 17:04	1
Calcium	**38.4**		0.515	0.0989	mg/L		04/07/23 07:48	04/07/23 17:04	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.822**	**J**	2.06	0.700	ug/L		04/07/23 07:48	04/11/23 15:20	1
Cobalt	**0.201**	**J**	0.515	0.161	ug/L		04/07/23 07:48	04/11/23 15:20	1
Iron	**21.2**	**J**	51.5	20.6	ug/L		04/07/23 07:48	04/11/23 15:20	1
Magnesium	**41600**		51.5	16.5	ug/L		04/07/23 07:48	04/11/23 15:20	1
Manganese	**5.73**		2.06	0.979	ug/L		04/07/23 07:48	04/11/23 15:20	1
Molybdenum	**0.285**	**J B**	0.515	0.134	ug/L		04/07/23 07:48	04/11/23 15:20	1
Potassium	**1590**		206	67.0	ug/L		04/07/23 07:48	04/11/23 15:20	1
Selenium	<0.286		1.03	0.286	ug/L		04/07/23 07:48	04/11/23 15:20	1
Sodium	**16500**		206	92.7	ug/L		04/07/23 07:48	04/11/23 15:20	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-363905/5
Matrix: Water
Analysis Batch: 363905

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			04/12/23 13:04	1
Sulfate	<0.500		1.50	0.500	mg/L			04/12/23 13:04	1
Chloride	<0.600		1.50	0.600	mg/L			04/12/23 13:04	1

Lab Sample ID: LCS 410-363905/3
Matrix: Water
Analysis Batch: 363905

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7074		mg/L		94	90 - 110
Sulfate	7.50	7.480		mg/L		100	90 - 110
Chloride	3.00	3.024		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-363905/4
Matrix: Water
Analysis Batch: 363905

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7108		mg/L		95	90 - 110	0	20
Sulfate	7.50	7.510		mg/L		100	90 - 110	0	20
Chloride	3.00	3.031		mg/L		101	90 - 110	0	20

Lab Sample ID: MB 410-364155/5
Matrix: Water
Analysis Batch: 364155

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			04/13/23 18:59	1
Sulfate	<0.500		1.50	0.500	mg/L			04/13/23 18:59	1
Chloride	<0.600		1.50	0.600	mg/L			04/13/23 18:59	1

Lab Sample ID: LCS 410-364155/3
Matrix: Water
Analysis Batch: 364155

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7809		mg/L		104	90 - 110
Sulfate	7.50	7.718		mg/L		103	90 - 110
Chloride	3.00	3.131		mg/L		104	90 - 110

Lab Sample ID: LCSD 410-364155/4
Matrix: Water
Analysis Batch: 364155

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7885		mg/L		105	90 - 110	1	20
Sulfate	7.50	7.722		mg/L		103	90 - 110	0	20
Chloride	3.00	3.173		mg/L		106	90 - 110	1	20

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 410-365057/5
Matrix: Water
Analysis Batch: 365057

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			04/14/23 16:12	1
Sulfate	<0.500		1.50	0.500	mg/L			04/14/23 16:12	1
Chloride	<0.600		1.50	0.600	mg/L			04/14/23 16:12	1

Lab Sample ID: LCS 410-365057/3
Matrix: Water
Analysis Batch: 365057

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7258		mg/L		97	90 - 110
Sulfate	7.50	7.459		mg/L		99	90 - 110
Chloride	3.00	3.028		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-365057/4
Matrix: Water
Analysis Batch: 365057

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7289		mg/L		97	90 - 110	0	20
Sulfate	7.50	7.475		mg/L		100	90 - 110	0	20
Chloride	3.00	3.020		mg/L		101	90 - 110	0	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-361921/1-A
Matrix: Water
Analysis Batch: 362413

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 361921

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:40	04/07/23 12:40	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/07/23 07:40	04/07/23 12:40	1

Lab Sample ID: LCS 410-361921/2-A
Matrix: Water
Analysis Batch: 362413

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 361921

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5826		mg/L		117	80 - 120
Calcium	5.00	5.673		mg/L		113	80 - 120

Lab Sample ID: MB 410-361927/1-A
Matrix: Water
Analysis Batch: 362412

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 361927

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/07/23 07:48	04/07/23 15:56	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/07/23 07:48	04/07/23 15:56	1

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-361927/2-A
Matrix: Water
Analysis Batch: 362412

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 361927

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5344		mg/L		107	80 - 120
Calcium	5.00	5.492		mg/L		110	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-361921/1-A
Matrix: Water
Analysis Batch: 362821

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 361921

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/07/23 07:40	04/10/23 15:44	1
Cobalt	<0.161		0.515	0.161	ug/L		04/07/23 07:40	04/10/23 15:44	1
Iron	<20.6		51.5	20.6	ug/L		04/07/23 07:40	04/10/23 15:44	1
Magnesium	<16.5		51.5	16.5	ug/L		04/07/23 07:40	04/10/23 15:44	1
Manganese	<0.979		2.06	0.979	ug/L		04/07/23 07:40	04/10/23 15:44	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/07/23 07:40	04/10/23 15:44	1
Potassium	<67.0		206	67.0	ug/L		04/07/23 07:40	04/10/23 15:44	1
Selenium	<0.286		1.03	0.286	ug/L		04/07/23 07:40	04/10/23 15:44	1
Sodium	<92.7		206	92.7	ug/L		04/07/23 07:40	04/10/23 15:44	1

Lab Sample ID: LCS 410-361921/2-A
Matrix: Water
Analysis Batch: 362821

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 361921

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	534.3		ug/L		107	85 - 120
Cobalt	500	546.0		ug/L		109	90 - 113
Iron	5000	5360		ug/L		107	88 - 119
Magnesium	5000	5407		ug/L		108	90 - 112
Manganese	500	540.4		ug/L		108	89 - 120
Molybdenum	50.0	55.51		ug/L		111	85 - 115
Potassium	5000	5386		ug/L		108	90 - 112
Selenium	100	106.4		ug/L		106	80 - 120
Sodium	5000	5373		ug/L		107	89 - 112

Lab Sample ID: MB 410-361927/1-A
Matrix: Water
Analysis Batch: 363346

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 361927

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/07/23 07:48	04/11/23 14:33	1
Cobalt	<0.161		0.515	0.161	ug/L		04/07/23 07:48	04/11/23 14:33	1
Iron	<20.6		51.5	20.6	ug/L		04/07/23 07:48	04/11/23 14:33	1
Magnesium	<16.5		51.5	16.5	ug/L		04/07/23 07:48	04/11/23 14:33	1
Manganese	<0.979		2.06	0.979	ug/L		04/07/23 07:48	04/11/23 14:33	1
Molybdenum	0.1391	J	0.515	0.134	ug/L		04/07/23 07:48	04/11/23 14:33	1
Potassium	<67.0		206	67.0	ug/L		04/07/23 07:48	04/11/23 14:33	1
Selenium	<0.286		1.03	0.286	ug/L		04/07/23 07:48	04/11/23 14:33	1
Sodium	<92.7		206	92.7	ug/L		04/07/23 07:48	04/11/23 14:33	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-361927/2-A
Matrix: Water
Analysis Batch: 363346

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 361927

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	529.0		ug/L		106	85 - 120
Cobalt	500	523.1		ug/L		105	90 - 113
Iron	5000	5285		ug/L		106	88 - 119
Magnesium	5000	5152		ug/L		103	90 - 112
Manganese	500	525.2		ug/L		105	89 - 120
Molybdenum	50.0	53.55		ug/L		107	85 - 115
Potassium	5000	5312		ug/L		106	90 - 112
Selenium	100	106.4		ug/L		106	80 - 120
Sodium	5000	5351		ug/L		107	89 - 112

HPLC/IC

Analysis Batch: 363905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-1	Column 1 Day 42	Total/NA	Water	EPA 300.0 R2.1	
410-121193-2	Column 2 Day 42	Total/NA	Water	EPA 300.0 R2.1	
410-121193-3	Column 3 Day 42	Total/NA	Water	EPA 300.0 R2.1	
410-121193-4	Column 4 Day 42	Total/NA	Water	EPA 300.0 R2.1	
MB 410-363905/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-363905/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-363905/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 364155

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-2	Column 2 Day 42	Total/NA	Water	EPA 300.0 R2.1	
410-121193-3	Column 3 Day 42	Total/NA	Water	EPA 300.0 R2.1	
410-121193-4	Column 4 Day 42	Total/NA	Water	EPA 300.0 R2.1	
MB 410-364155/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-364155/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-364155/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 365057

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-1	Column 1 Day 42	Total/NA	Water	EPA 300.0 R2.1	
MB 410-365057/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-365057/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-365057/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 361921

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-2	Column 2 Day 42	Dissolved	Water	Non-Digest Prep	
MB 410-361921/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-361921/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 361927

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-1	Column 1 Day 42	Dissolved	Water	Non-Digest Prep	
410-121193-3	Column 3 Day 42	Dissolved	Water	Non-Digest Prep	
410-121193-4	Column 4 Day 42	Dissolved	Water	Non-Digest Prep	
MB 410-361927/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-361927/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 362412

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-1	Column 1 Day 42	Dissolved	Water	6010D	361927
410-121193-3	Column 3 Day 42	Dissolved	Water	6010D	361927
410-121193-4	Column 4 Day 42	Dissolved	Water	6010D	361927
MB 410-361927/1-A	Method Blank	Total/NA	Water	6010D	361927
LCS 410-361927/2-A	Lab Control Sample	Total/NA	Water	6010D	361927

Analysis Batch: 362413

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-2	Column 2 Day 42	Dissolved	Water	6010D	361921

Metals (Continued)

Analysis Batch: 362413 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 410-361921/1-A	Method Blank	Total/NA	Water	6010D	361921
LCS 410-361921/2-A	Lab Control Sample	Total/NA	Water	6010D	361921

Analysis Batch: 362821

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-2	Column 2 Day 42	Dissolved	Water	6020B	361921
MB 410-361921/1-A	Method Blank	Total/NA	Water	6020B	361921
LCS 410-361921/2-A	Lab Control Sample	Total/NA	Water	6020B	361921

Analysis Batch: 362870

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-2	Column 2 Day 42	Dissolved	Water	6020B	361921

Analysis Batch: 363346

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-121193-1	Column 1 Day 42	Dissolved	Water	6020B	361927
410-121193-3	Column 3 Day 42	Dissolved	Water	6020B	361927
410-121193-3	Column 3 Day 42	Dissolved	Water	6020B	361927
410-121193-4	Column 4 Day 42	Dissolved	Water	6020B	361927
MB 410-361927/1-A	Method Blank	Total/NA	Water	6020B	361927
LCS 410-361927/2-A	Lab Control Sample	Total/NA	Water	6020B	361927

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Client Sample ID: Column 1 Day 42

Lab Sample ID: 410-121193-1

Date Collected: 04/03/23 08:45

Matrix: Water

Date Received: 04/03/23 15:58

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	363905	L4QM	ELLE	04/12/23 14:46
Total/NA	Analysis	EPA 300.0 R2.1		20	365057	L4QM	ELLE	04/14/23 18:59
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6010D		1	362412	MT26	ELLE	04/07/23 17:01
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6020B		1	363346	UCIG	ELLE	04/11/23 15:18

Client Sample ID: Column 2 Day 42

Lab Sample ID: 410-121193-2

Date Collected: 04/03/23 09:15

Matrix: Water

Date Received: 04/03/23 15:58

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	363905	L4QM	ELLE	04/12/23 15:11
Total/NA	Analysis	EPA 300.0 R2.1		20	364155	L4QM	ELLE	04/14/23 12:00
Dissolved	Prep	Non-Digest Prep			361921	HUH3	ELLE	04/07/23 07:40
Dissolved	Analysis	6010D		1	362413	MT26	ELLE	04/07/23 13:24
Dissolved	Prep	Non-Digest Prep			361921	HUH3	ELLE	04/07/23 07:40
Dissolved	Analysis	6020B		1	362870	F7JF	ELLE	04/11/23 01:53
Dissolved	Prep	Non-Digest Prep			361921	HUH3	ELLE	04/07/23 07:40
Dissolved	Analysis	6020B		1	362821	UCIG	ELLE	04/10/23 17:00

Client Sample ID: Column 3 Day 42

Lab Sample ID: 410-121193-3

Date Collected: 04/03/23 09:45

Matrix: Water

Date Received: 04/03/23 15:58

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	363905	L4QM	ELLE	04/12/23 15:37
Total/NA	Analysis	EPA 300.0 R2.1		100	364155	L4QM	ELLE	04/14/23 12:13
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6010D		1	362412	MT26	ELLE	04/07/23 16:58
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6020B		1	363346	UCIG	ELLE	04/11/23 15:16
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6020B		5	363346	UCIG	ELLE	04/11/23 15:28

Client Sample ID: Column 4 Day 42

Lab Sample ID: 410-121193-4

Date Collected: 04/03/23 10:15

Matrix: Water

Date Received: 04/03/23 15:58

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	363905	L4QM	ELLE	04/12/23 16:28
Total/NA	Analysis	EPA 300.0 R2.1		100	364155	L4QM	ELLE	04/14/23 12:26
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6010D		1	362412	MT26	ELLE	04/07/23 17:04

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-121193-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 4 Day 42
Lab Sample ID: 410-121193-4

Date Collected: 04/03/23 10:15
Matrix: Water

Date Received: 04/03/23 15:58

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			361927	HUH3	ELLE	04/07/23 07:48
Dissolved	Analysis	6020B		1	363346	UCIG	ELLE	04/11/23 15:20

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	04-17-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	04-17-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	04-17-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	04-17-23
Iowa	State	361	04-17-23
Kansas	NELAP	E-10151	04-17-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	04-17-23
Louisiana (All)	NELAP	02055	04-17-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	04-17-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	04-17-23
New Jersey	NELAP	PA011	04-17-23
New York	NELAP	10670	04-17-23
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	04-17-23
North Dakota	State	R-205	04-17-23
Oklahoma	NELAP	R-205	04-17-23
Oregon	NELAP	PA200001	04-17-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	04-17-23
Rhode Island	State	LAO00338	04-17-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	04-17-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	04-17-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-121193-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-121193-1	Column 1 Day 42	Water	04/03/23 08:45	04/03/23 15:58
410-121193-2	Column 2 Day 42	Water	04/03/23 09:15	04/03/23 15:58
410-121193-3	Column 3 Day 42	Water	04/03/23 09:45	04/03/23 15:58
410-121193-4	Column 4 Day 42	Water	04/03/23 10:15	04/03/23 15:58

Environmental Analysis Request/Chain of Custody

410-121193 Chain of Custody es

Acct. # _____ Group # _____ Sample # _____

Client: Terra Systems, Inc.			
Project Name/#: Stantec CCR TS AP3	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-4-3-23		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil ☐ Sediment ☐ Tissue ☐	Water: Potable ☐ Ground ☑ NPDES ☐ Surface ☐	Other:	Total # of Containers	Analyses Requested: Preservation Codes: Dis (ff) As, Co, Fe, K, Mg, Mn. (N)	Mo, Na, Se (N)	Cl, F, SO4 by EPA 300 (-)	Dis (ff) Ca, Li (N)	Remarks
Column 1 Day 42	4/3/2023	8:45		X		X		3	X	X	X	X	ff= field filtered
Column 2 Day 42	4/3/2023	9:15		X		X		3	X	X	X	X	
Column 3 Day 42	4/3/2023	9:45		X		X		3	X	X	X	X	
Column 4 Day 42	4/3/2023	10:15		X		X		3	X	X	X	X	

For Lab Use Only
SF #: _____
SCR #: _____

Preservation Codes
H = HCl T = Thiosulfate
N = HNO_3 B = NaOH
S = H_2SO_4 P = H_3PO_4
O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐
(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 4/17/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

	Relinquished by:	Date	Time	Received by:	Date	Time
1	Michael D Lee	4/3/23	11:35	Bob LaCo	4/3/23	1135
2	Bob LaCo	4/3/23	1558			
3						
4						
5				Ken	4/3/23	1558

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other _____

Temperature upon receipt 1.8 °C

Eurofins Lancaster Laboratories Environmental, LLC • 2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300

7045 0216

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-121193-1

Login Number: 121193

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

List Number: 1

Creator: Jeremiah, Cory T

Question	Answer	Comment
The cooler's custody seal is 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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 4/25/2023 3:18:15 PM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-122107-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

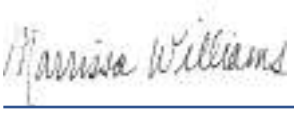
myEOL

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization



Generated
4/25/2023 3:18:15 PM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

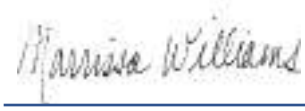


Table of Contents

Definitions/Glossary

Client: Terra Systems Inc
Job ID: 410-122107-1
Project/Site: Stantec CCR TS AP3

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Job ID: 410-122107-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-122107-1

Receipt
The samples were received on 4/10/2023 3:35 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 time was -0.3°C

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Client Sample ID: Influent Day 49 — Lab Sample ID: 410-122107-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	158		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.03	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	25.7		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.732	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	61.4		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	43.4	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	23500		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1800		2.06	0.979	ug/L	1		6020B	Dissolved
Potassium	1420		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.432	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	10900	^2	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 1 Day 49 — Lab Sample ID: 410-122107-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	159		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.12	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	33.1		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	22.1		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	20200	B	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	3630		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.336	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1700		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.495	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	11600	B ^2	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 49 — Lab Sample ID: 410-122107-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	157		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.01	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	27.2		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	0.755		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	14400		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	245		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	1.77		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	997		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.461	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	31000	^2	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 3 Day 49 — Lab Sample ID: 410-122107-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	280		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Calcium	28.7		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	0.315	J	0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	46100	B	51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	17.3		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.391	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1260		206	67.0	ug/L	1		6020B	Dissolved
Sodium	22700	B ^2	206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Client Sample ID: Column 4 Day 49

Lab Sample ID: 410-122107-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	242		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Calcium	32.8		0.515	0.0989	mg/L	1		6010D	Dissolved
Arsenic	0.862	J	2.06	0.700	ug/L	1		6020B	Dissolved
Cobalt	0.193	J	0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	34500		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	6.37		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.151	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1610		206	67.0	ug/L	1		6020B	Dissolved
Sodium	17100	^2	206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Client Sample ID: Influent Day 49

Lab Sample ID: 410-122107-1

Date Collected: 04/10/23 08:15
Date Received: 04/10/23 15:35

Matrix: Water

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/24/23 17:32	5
Sulfate	**158**		75.0	25.0	mg/L			04/24/23 17:44	50
Chloride	**3.03**	**J**	7.50	3.00	mg/L			04/24/23 17:32	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 10:39	04/18/23 03:35	1
Calcium	**25.7**		0.515	0.0989	mg/L		04/17/23 10:39	04/18/23 03:35	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.732**	**J**	2.06	0.700	ug/L		04/17/23 10:39	04/20/23 09:21	1
Cobalt	**61.4**		0.515	0.161	ug/L		04/17/23 10:39	04/20/23 09:21	1
Iron	**43.4**	**J**	51.5	20.6	ug/L		04/17/23 10:39	04/20/23 09:21	1
Magnesium	**23500**		51.5	16.5	ug/L		04/17/23 10:39	04/20/23 09:21	1
Manganese	**1800**		2.06	0.979	ug/L		04/17/23 10:39	04/20/23 09:21	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/17/23 10:39	04/20/23 09:21	1
Potassium	**1420**		206	67.0	ug/L		04/17/23 10:39	04/20/23 09:21	1
Selenium	**0.432**	**J**	1.03	0.286	ug/L		04/17/23 10:39	04/20/23 09:21	1
Sodium	**10900**	**^2**	206	92.7	ug/L		04/17/23 10:39	04/20/23 09:21	1

Client Sample ID: Column 1 Day 49

Lab Sample ID: 410-122107-2

Date Collected: 04/10/23 08:45
Date Received: 04/10/23 15:35

Matrix: Water

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/24/23 14:58	5
Sulfate	**159**		75.0	25.0	mg/L			04/24/23 15:11	50
Chloride	**3.12**	**J**	7.50	3.00	mg/L			04/24/23 14:58	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 11:00	04/18/23 01:48	1
Calcium	**33.1**		0.515	0.0989	mg/L		04/17/23 11:00	04/18/23 01:48	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/17/23 11:00	04/18/23 19:26	1
Cobalt	**22.1**		0.515	0.161	ug/L		04/17/23 11:00	04/18/23 19:26	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 11:00	04/18/23 19:26	1
Magnesium	**20200**	**B**	51.5	16.5	ug/L		04/17/23 11:00	04/18/23 19:26	1
Manganese	**3630**		2.06	0.979	ug/L		04/17/23 11:00	04/18/23 19:26	1
Molybdenum	**0.336**	**J**	0.515	0.134	ug/L		04/17/23 11:00	04/18/23 19:26	1
Potassium	**1700**		206	67.0	ug/L		04/17/23 11:00	04/18/23 19:26	1
Selenium	**0.495**	**J**	1.03	0.286	ug/L		04/17/23 11:00	04/18/23 19:26	1
Sodium	**11600**	**B ^2**	206	92.7	ug/L		04/17/23 11:00	04/18/23 19:26	1

Client Sample ID: Column 2 Day 49

Lab Sample ID: 410-122107-3

Date Collected: 04/10/23 09:15

Matrix: Water

Date Received: 04/10/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/24/23 18:23	5
Sulfate	**157**		75.0	25.0	mg/L			04/24/23 18:36	50
Chloride	**3.01**	**J**	7.50	3.00	mg/L			04/24/23 18:23	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 10:39	04/18/23 03:38	1
Calcium	**27.2**		0.515	0.0989	mg/L		04/17/23 10:39	04/18/23 03:38	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/17/23 10:39	04/20/23 09:33	1
Cobalt	**0.755**		0.515	0.161	ug/L		04/17/23 10:39	04/20/23 09:33	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 10:39	04/20/23 09:33	1
Magnesium	**14400**		51.5	16.5	ug/L		04/17/23 10:39	04/20/23 09:33	1
Manganese	**245**		2.06	0.979	ug/L		04/17/23 10:39	04/20/23 09:33	1
Molybdenum	**1.77**		0.515	0.134	ug/L		04/17/23 10:39	04/20/23 09:33	1
Potassium	**997**		206	67.0	ug/L		04/17/23 10:39	04/20/23 09:33	1
Selenium	**0.461**	**J**	1.03	0.286	ug/L		04/17/23 10:39	04/20/23 09:33	1
Sodium	**31000**	**^2**	206	92.7	ug/L		04/17/23 10:39	04/20/23 09:33	1

Client Sample ID: Column 3 Day 49

Lab Sample ID: 410-122107-4

Date Collected: 04/10/23 09:45

Matrix: Water

Date Received: 04/10/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/24/23 15:49	5
Sulfate	**280**		75.0	25.0	mg/L			04/24/23 16:02	50
Chloride	<3.00		7.50	3.00	mg/L			04/24/23 15:49	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 11:00	04/18/23 01:45	1
Calcium	**28.7**		0.515	0.0989	mg/L		04/17/23 11:00	04/18/23 01:45	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/17/23 11:00	04/18/23 19:20	1
Cobalt	**0.315**	**J**	0.515	0.161	ug/L		04/17/23 11:00	04/18/23 19:20	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 11:00	04/18/23 19:20	1
Magnesium	**46100**	**B**	51.5	16.5	ug/L		04/17/23 11:00	04/18/23 19:20	1
Manganese	**17.3**		2.06	0.979	ug/L		04/17/23 11:00	04/18/23 19:20	1
Molybdenum	**0.391**	**J**	0.515	0.134	ug/L		04/17/23 11:00	04/18/23 19:20	1
Potassium	**1260**		206	67.0	ug/L		04/17/23 11:00	04/18/23 19:20	1
Selenium	<0.286		1.03	0.286	ug/L		04/17/23 11:00	04/18/23 19:20	1
Sodium	**22700**	**B ^2**	206	92.7	ug/L		04/17/23 11:00	04/18/23 19:20	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Client Sample ID: Column 4 Day 49

Date Collected: 04/10/23 10:15
Date Received: 04/10/23 15:35

Lab Sample ID: 410-122107-5

Matrix: Water

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			04/24/23 16:15	5
Sulfate	**242**		75.0	25.0	mg/L			04/24/23 16:28	50
Chloride	<3.00		7.50	3.00	mg/L			04/24/23 16:15	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 10:39	04/18/23 03:32	1
Calcium	**32.8**		0.515	0.0989	mg/L		04/17/23 10:39	04/18/23 03:32	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.862**	**J**	2.06	0.700	ug/L		04/17/23 10:39	04/20/23 09:19	1
Cobalt	**0.193**	**J**	0.515	0.161	ug/L		04/17/23 10:39	04/20/23 09:19	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 10:39	04/20/23 09:19	1
Magnesium	**34500**		51.5	16.5	ug/L		04/17/23 10:39	04/20/23 09:19	1
Manganese	**6.37**		2.06	0.979	ug/L		04/17/23 10:39	04/20/23 09:19	1
Molybdenum	**0.151**	**J**	0.515	0.134	ug/L		04/17/23 10:39	04/20/23 09:19	1
Potassium	**1610**		206	67.0	ug/L		04/17/23 10:39	04/20/23 09:19	1
Selenium	<0.286		1.03	0.286	ug/L		04/17/23 10:39	04/20/23 09:19	1
Sodium	**17100**	**^2**	206	92.7	ug/L		04/17/23 10:39	04/20/23 09:19	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-367913/5
Matrix: Water
Analysis Batch: 367913

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			04/24/23 12:37	1
Sulfate	<0.500		1.50	0.500	mg/L			04/24/23 12:37	1
Chloride	<0.600		1.50	0.600	mg/L			04/24/23 12:37	1

Lab Sample ID: LCS 410-367913/3
Matrix: Water
Analysis Batch: 367913

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.6957		mg/L		93	90 - 110
Sulfate	7.50	7.167		mg/L		96	90 - 110
Chloride	3.00	2.921		mg/L		97	90 - 110

Lab Sample ID: LCSD 410-367913/4
Matrix: Water
Analysis Batch: 367913

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7048		mg/L		94	90 - 110	1	20
Sulfate	7.50	7.268		mg/L		97	90 - 110	1	20
Chloride	3.00	2.976		mg/L		99	90 - 110	2	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-364998/1-A
Matrix: Water
Analysis Batch: 365336

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 364998

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 10:39	04/18/23 02:57	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/17/23 10:39	04/18/23 02:57	1

Lab Sample ID: LCS 410-364998/2-A
Matrix: Water
Analysis Batch: 365336

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 364998

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5064		mg/L		101	80 - 120
Calcium	5.00	5.242		mg/L		105	80 - 120

Lab Sample ID: MB 410-365008/1-A
Matrix: Water
Analysis Batch: 365336

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 365008

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/17/23 11:00	04/18/23 01:09	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/17/23 11:00	04/18/23 01:09	1

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 410-365008/2-A
Matrix: Water
Analysis Batch: 365336

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 365008

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5064		mg/L		101	80 - 120
Calcium	5.00	5.163		mg/L		103	80 - 120

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-364998/1-A
Matrix: Water
Analysis Batch: 366578

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 364998

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/17/23 10:39	04/20/23 08:20	1
Cobalt	<0.161		0.515	0.161	ug/L		04/17/23 10:39	04/20/23 08:20	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 10:39	04/20/23 08:20	1
Magnesium	<16.5		51.5	16.5	ug/L		04/17/23 10:39	04/20/23 08:20	1
Manganese	<0.979		2.06	0.979	ug/L		04/17/23 10:39	04/20/23 08:20	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/17/23 10:39	04/20/23 08:20	1
Potassium	<67.0		206	67.0	ug/L		04/17/23 10:39	04/20/23 08:20	1
Selenium	<0.286		1.03	0.286	ug/L		04/17/23 10:39	04/20/23 08:20	1
Sodium	<92.7		206	92.7	ug/L		04/17/23 10:39	04/20/23 08:20	1

Lab Sample ID: LCS 410-364998/2-A
Matrix: Water
Analysis Batch: 366578

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 364998

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	537.6		ug/L		108	85 - 120
Cobalt	500	534.4		ug/L		107	90 - 113
Iron	5000	5247		ug/L		105	88 - 119
Magnesium	5000	5110		ug/L		102	90 - 112
Manganese	500	531.5		ug/L		106	89 - 120
Molybdenum	50.0	53.58		ug/L		107	85 - 115
Potassium	5000	5243		ug/L		105	90 - 112
Selenium	100	104.4		ug/L		104	80 - 120
Sodium	5000	5366		ug/L		107	89 - 112

Lab Sample ID: MB 410-365008/1-A
Matrix: Water
Analysis Batch: 365815

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 365008

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/17/23 11:00	04/18/23 18:55	1
Cobalt	<0.161		0.515	0.161	ug/L		04/17/23 11:00	04/18/23 18:55	1
Iron	<20.6		51.5	20.6	ug/L		04/17/23 11:00	04/18/23 18:55	1
Magnesium	17.13	J	51.5	16.5	ug/L		04/17/23 11:00	04/18/23 18:55	1
Manganese	<0.979		2.06	0.979	ug/L		04/17/23 11:00	04/18/23 18:55	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/17/23 11:00	04/18/23 18:55	1
Potassium	<67.0		206	67.0	ug/L		04/17/23 11:00	04/18/23 18:55	1
Selenium	<0.286		1.03	0.286	ug/L		04/17/23 11:00	04/18/23 18:55	1
Sodium	175.9	J	206	92.7	ug/L		04/17/23 11:00	04/18/23 18:55	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-365008/2-A
Matrix: Water
Analysis Batch: 365815

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 365008

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	528.0		ug/L		106	85 - 120
Cobalt	500	526.2		ug/L		105	90 - 113
Iron	5000	5209		ug/L		104	88 - 119
Magnesium	5000	5282		ug/L		106	90 - 112
Manganese	500	528.5		ug/L		106	89 - 120
Molybdenum	50.0	52.81		ug/L		106	85 - 115
Potassium	5000	5291		ug/L		106	90 - 112
Selenium	100	104.1		ug/L		104	80 - 120
Sodium	5000	5505		ug/L		110	89 - 112

HPLC/IC

Analysis Batch: 367913

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-1	Influent Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-1	Influent Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-2	Column 1 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-2	Column 1 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-3	Column 2 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-3	Column 2 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-4	Column 3 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-4	Column 3 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-5	Column 4 Day 49	Total/NA	Water	EPA 300.0 R2.1	
410-122107-5	Column 4 Day 49	Total/NA	Water	EPA 300.0 R2.1	
MB 410-367913/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-367913/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-367913/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 364998

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-1	Influent Day 49	Dissolved	Water	Non-Digest Prep	
410-122107-3	Column 2 Day 49	Dissolved	Water	Non-Digest Prep	
410-122107-5	Column 4 Day 49	Dissolved	Water	Non-Digest Prep	
MB 410-364998/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-364998/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 365008

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-2	Column 1 Day 49	Dissolved	Water	Non-Digest Prep	
410-122107-4	Column 3 Day 49	Dissolved	Water	Non-Digest Prep	
MB 410-365008/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-365008/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 365336

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-1	Influent Day 49	Dissolved	Water	6010D	364998
410-122107-2	Column 1 Day 49	Dissolved	Water	6010D	365008
410-122107-3	Column 2 Day 49	Dissolved	Water	6010D	364998
410-122107-4	Column 3 Day 49	Dissolved	Water	6010D	365008
410-122107-5	Column 4 Day 49	Dissolved	Water	6010D	364998
MB 410-364998/1-A	Method Blank	Total/NA	Water	6010D	364998
MB 410-365008/1-A	Method Blank	Total/NA	Water	6010D	365008
LCS 410-364998/2-A	Lab Control Sample	Total/NA	Water	6010D	364998
LCS 410-365008/2-A	Lab Control Sample	Total/NA	Water	6010D	365008

Analysis Batch: 365815

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-2	Column 1 Day 49	Dissolved	Water	6020B	365008
410-122107-4	Column 3 Day 49	Dissolved	Water	6020B	365008
MB 410-365008/1-A	Method Blank	Total/NA	Water	6020B	365008
LCS 410-365008/2-A	Lab Control Sample	Total/NA	Water	6020B	365008

QC Association Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Metals

Analysis Batch: 366578

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-122107-1	Influent Day 49	Dissolved	Water	6020B	364998
410-122107-3	Column 2 Day 49	Dissolved	Water	6020B	364998
410-122107-5	Column 4 Day 49	Dissolved	Water	6020B	364998
MB 410-364998/1-A	Method Blank	Total/NA	Water	6020B	364998
LCS 410-364998/2-A	Lab Control Sample	Total/NA	Water	6020B	364998

Lab Chronicle

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Client Sample ID: Influent Day 49

Lab Sample ID: 410-122107-1

Date Collected: 04/10/23 08:15
Matrix: Water
Date Received: 04/10/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	367913	L4QM	ELLE	04/24/23 17:32
Total/NA	Analysis	EPA 300.0 R2.1		50	367913	L4QM	ELLE	04/24/23 17:44
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6010D		1	365336	MT26	ELLE	04/18/23 03:35
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6020B		1	366578	F7JF	ELLE	04/20/23 09:21

Client Sample ID: Column 1 Day 49

Lab Sample ID: 410-122107-2

Date Collected: 04/10/23 08:45
Matrix: Water
Date Received: 04/10/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	367913	L4QM	ELLE	04/24/23 14:58
Total/NA	Analysis	EPA 300.0 R2.1		50	367913	L4QM	ELLE	04/24/23 15:11
Dissolved	Prep	Non-Digest Prep			365008	HUH3	ELLE	04/17/23 11:00
Dissolved	Analysis	6010D		1	365336	MT26	ELLE	04/18/23 01:48
Dissolved	Prep	Non-Digest Prep			365008	HUH3	ELLE	04/17/23 11:00
Dissolved	Analysis	6020B		1	365815	UCIG	ELLE	04/18/23 19:26

Client Sample ID: Column 2 Day 49

Lab Sample ID: 410-122107-3

Date Collected: 04/10/23 09:15
Matrix: Water
Date Received: 04/10/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	367913	L4QM	ELLE	04/24/23 18:23
Total/NA	Analysis	EPA 300.0 R2.1		50	367913	L4QM	ELLE	04/24/23 18:36
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6010D		1	365336	MT26	ELLE	04/18/23 03:38
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6020B		1	366578	F7JF	ELLE	04/20/23 09:33

Client Sample ID: Column 3 Day 49

Lab Sample ID: 410-122107-4

Date Collected: 04/10/23 09:45
Matrix: Water
Date Received: 04/10/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	367913	L4QM	ELLE	04/24/23 15:49
Total/NA	Analysis	EPA 300.0 R2.1		50	367913	L4QM	ELLE	04/24/23 16:02
Dissolved	Prep	Non-Digest Prep			365008	HUH3	ELLE	04/17/23 11:00
Dissolved	Analysis	6010D		1	365336	MT26	ELLE	04/18/23 01:45
Dissolved	Prep	Non-Digest Prep			365008	HUH3	ELLE	04/17/23 11:00
Dissolved	Analysis	6020B		1	365815	UCIG	ELLE	04/18/23 19:20

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-122107-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 4 Day 49
Lab Sample ID: 410-122107-5

Date Collected: 04/10/23 10:15
Matrix: Water

Date Received: 04/10/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	367913	L4QM	ELLE	04/24/23 16:15
Total/NA	Analysis	EPA 300.0 R2.1		50	367913	L4QM	ELLE	04/24/23 16:28
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6010D		1	365336	MT26	ELLE	04/18/23 03:32
Dissolved	Prep	Non-Digest Prep			364998	HUH3	ELLE	04/17/23 10:39
Dissolved	Analysis	6020B		1	366578	F7JF	ELLE	04/20/23 09:19

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-122107-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-24
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Job ID: 410-122107-1
Project/Site: Stantec CCR TS AP3

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Job ID: 410-122107-1
Project/Site: Stantec CCR TS AP3

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-122107-1	Influent Day 49	Water	04/10/23 08:15	04/10/23 15:35
410-122107-2	Column 1 Day 49	Water	04/10/23 08:45	04/10/23 15:35
410-122107-3	Column 2 Day 49	Water	04/10/23 09:15	04/10/23 15:35
410-122107-4	Column 3 Day 49	Water	04/10/23 09:45	04/10/23 15:35
410-122107-5	Column 4 Day 49	Water	04/10/23 10:15	04/10/23 15:35

Enviro Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

410-122107 Chain of Custody

Sample # _____

Client: **Terra Systems, Inc.**			
Project Name/#: Stantec CCR TS AP3	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-4-10-23		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Analyses Requested: Preservation Codes: N	N	-	N	Dis (ff) As, Co, Fe, K, Mg, Mn.	Mo, Na, Se	Cl, F, SO4 by EPA 300	Dis (ff) Ca, Li	Remarks
Influent Day 49	4/10/2023	8:15		X				X					3	X		X	X					ff= field filtered
Column 1 Day 49	4/10/2023	8:45		X				X					3	X		X	X					
Column 2 Day 49	4/10/2023	9:15		X				X					3	X		X	X					
Column 3 Day 49	4/10/2023	9:45		X				X					3	X		X	X					
Column 4 Day 49	4/10/2023	10:15		X				X					3	X		X	X					

Preservation Codes: H = HCl; T = Thiosulfate; N = HNO_3; B = NaOH; S = H_2SO_4; P = H_3PO_4; O = Other

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 4/24/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP) ☐ MA MCP ☐

Type III (Reduced non-CLP) ☐ CT RCP ☐

Type VI (Raw Data Only) ☐ TX TRRP-13 ☐

NJ DKQP ☐ NYSDEC Category ☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	4/10/23	11:25	Bob K	4/10/23	1125
Bob K	4/10/23	1535			
			Holly Charles	4-10-23	1535

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt -0.3 °C

Not Frozen

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-122107-1

Login Number: 122107
List Number: 1
Creator: Wrye, Shaun

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	Not present
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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	Not present.
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Michael D Lee
Terra Systems Inc
130 Hickman Road
Suite 1
Claymont, Delaware 19703

Generated 5/10/2023 11:59:49 AM

JOB DESCRIPTION

Stantec CCR TS AP3

JOB NUMBER

410-123117-1

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster PA 17601

See page two for job notes and contact information.

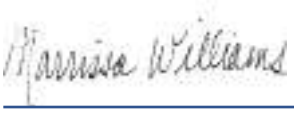
myEOL

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization



Generated
5/10/2023 11:59:49 AM

Authorized for release by
Marrissa Williams, Project Manager
Marrissa.Williams@et.eurofinsus.com
(717)556-7246

Compliance Statement

Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.
· QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
· Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
· Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied, except as otherwise agreed. We disclaim any other warranties, expressed or implied, including a warranty of fitness for particular purpose and warranty of merchantability. In no event shall Eurofins Lancaster Laboratories Environmental, LLC be liable for indirect, special, consequential, or incidental damages including, but not limited to, damages for loss of profit or goodwill regardless of (A) the negligence (either sole or concurrent) of Eurofins Lancaster Laboratories Environmental and (B) whether Eurofins Lancaster Laboratories Environmental has been informed of the possibility of such damages. We accept no legal responsibility for the purposes for which the client uses the test results. Except as otherwise agreed, no purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

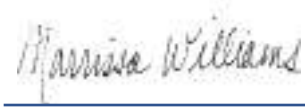


Table of Contents

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
^3+	Reporting Limit Check Standard is outside acceptance limits, high biased
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.
B	Compound was found in the blank and sample.
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

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

Case Narrative

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Job ID: 410-123117-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative
410-123117-1

Receipt
The samples were received on 4/17/2023 3:35 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 time was -0.4°C

Receipt Exceptions
The container label for the following samples did not match the information listed on the Chain-of-Custody (COC): Influent Day 56 (410-123117-1), Column 1 Day 56 (410-123117-2), Column 2 Day 56 (410-123117-3), Column 3 Day 56 (410-123117-4) and Column 4 Day 56 (410-123117-5). The container labels list IDs with Day 56, while the COC lists Day 49. Entered per COC.

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): Column 2 Day 56 (410-123117-3). The container labels list the collection date as 4/17/23, while the COC lists 4/10/23.

HPLC/IC
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Client Sample ID: Influent Day 56 — Lab Sample ID: 410-123117-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	167		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.31	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	25.5		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	58.5		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	27.5	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	23500		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	1700		2.06	0.979	ug/L	1		6020B	Dissolved
Potassium	1430		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.475	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	10600	B	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 1 Day 56 — Lab Sample ID: 410-123117-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	171		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Chloride	3.16	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	33.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	17.8		0.515	0.161	ug/L	1		6020B	Dissolved
Iron	41.7	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	18900		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	3180		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.394	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1730		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.473	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	11500		206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 2 Day 56 — Lab Sample ID: 410-123117-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	177		30.0	10.0	mg/L	20		EPA 300.0 R2.1	Total/NA
Chloride	3.48	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	33.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Cobalt	0.562		0.515	0.161	ug/L	1		6020B	Dissolved
Magnesium	17300		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	263		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	1.33		0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	947		206	67.0	ug/L	1		6020B	Dissolved
Selenium	0.448	J	1.03	0.286	ug/L	1		6020B	Dissolved
Sodium	19700	B	206	92.7	ug/L	1		6020B	Dissolved

Client Sample ID: Column 3 Day 56 — Lab Sample ID: 410-123117-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	211		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.15	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	24.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Iron	35.9	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	34100		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	7.18		2.06	0.979	ug/L	1		6020B	Dissolved
Molybdenum	0.364	J	0.515	0.134	ug/L	1		6020B	Dissolved
Potassium	1280		206	67.0	ug/L	1		6020B	Dissolved
Sodium	21100	B	206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Client Sample ID: Column 4 Day 56

Lab Sample ID: 410-123117-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	224		75.0	25.0	mg/L	50		EPA 300.0 R2.1	Total/NA
Chloride	3.21	J	7.50	3.00	mg/L	5		EPA 300.0 R2.1	Total/NA
Calcium	30.0		0.515	0.0989	mg/L	1		6010D	Dissolved
Iron	34.4	J	51.5	20.6	ug/L	1		6020B	Dissolved
Magnesium	28300		51.5	16.5	ug/L	1		6020B	Dissolved
Manganese	10.6		2.06	0.979	ug/L	1		6020B	Dissolved
Potassium	1600		206	67.0	ug/L	1		6020B	Dissolved
Sodium	15600		206	92.7	ug/L	1		6020B	Dissolved

This Detection Summary does not include radiochemical test results.

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Client Sample ID: Influent Day 56

Lab Sample ID: 410-123117-1

Date Collected: 04/17/23 08:15

Matrix: Water

Date Received: 04/17/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			05/09/23 05:19	5
Sulfate	**167**		75.0	25.0	mg/L			05/09/23 16:51	50
Chloride	**3.31**	**J**	7.50	3.00	mg/L			05/09/23 05:19	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:43	04/24/23 12:55	1
Calcium	**25.5**		0.515	0.0989	mg/L		04/24/23 03:43	04/24/23 12:55	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:43	04/28/23 00:11	1
Cobalt	**58.5**		0.515	0.161	ug/L		04/24/23 03:43	04/28/23 00:11	1
Iron	**27.5**	**J**	51.5	20.6	ug/L		04/24/23 03:43	04/28/23 16:07	1
Magnesium	**23500**		51.5	16.5	ug/L		04/24/23 03:43	04/28/23 00:11	1
Manganese	**1700**		2.06	0.979	ug/L		04/24/23 03:43	04/28/23 00:11	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/24/23 03:43	04/28/23 00:11	1
Potassium	**1430**		206	67.0	ug/L		04/24/23 03:43	04/28/23 00:11	1
Selenium	**0.475**	**J**	1.03	0.286	ug/L		04/24/23 03:43	04/28/23 00:11	1
Sodium	**10600**	**B**	206	92.7	ug/L		04/24/23 03:43	04/28/23 00:11	1

Client Sample ID: Column 1 Day 56

Lab Sample ID: 410-123117-2

Date Collected: 04/17/23 08:45

Matrix: Water

Date Received: 04/17/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			05/09/23 00:35	5
Sulfate	**171**		30.0	10.0	mg/L			05/09/23 16:00	20
Chloride	**3.16**	**J**	7.50	3.00	mg/L			05/09/23 00:35	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 05:29	04/24/23 12:36	1
Calcium	**33.0**		0.515	0.0989	mg/L		04/24/23 05:29	04/24/23 12:36	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 05:29	04/25/23 22:37	1
Cobalt	**17.8**		0.515	0.161	ug/L		04/24/23 05:29	04/25/23 22:37	1
Iron	**41.7**	**J**	51.5	20.6	ug/L		04/24/23 05:29	04/25/23 22:37	1
Magnesium	**18900**		51.5	16.5	ug/L		04/24/23 05:29	04/25/23 22:37	1
Manganese	**3180**		2.06	0.979	ug/L		04/24/23 05:29	04/25/23 22:37	1
Molybdenum	**0.394**	**J**	0.515	0.134	ug/L		04/24/23 05:29	04/25/23 22:37	1
Potassium	**1730**		206	67.0	ug/L		04/24/23 05:29	04/25/23 22:37	1
Selenium	**0.473**	**J**	1.03	0.286	ug/L		04/24/23 05:29	04/25/23 22:37	1
Sodium	**11500**		206	92.7	ug/L		04/24/23 05:29	04/25/23 22:37	1

Client Sample ID: Column 2 Day 56

Lab Sample ID: 410-123117-3

Date Collected: 04/10/23 09:15

Matrix: Water

Date Received: 04/17/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			05/06/23 19:21	5
Sulfate	**177**		30.0	10.0	mg/L			05/08/23 18:36	20
Chloride	**3.48**	**J**	7.50	3.00	mg/L			05/06/23 19:21	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:43	04/24/23 13:16	1
Calcium	**33.0**		0.515	0.0989	mg/L		04/24/23 03:43	04/24/23 13:16	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:43	04/28/23 00:13	1
Cobalt	**0.562**		0.515	0.161	ug/L		04/24/23 03:43	04/28/23 00:13	1
Iron	<20.6		51.5	20.6	ug/L		04/24/23 03:43	04/28/23 16:09	1
Magnesium	**17300**		51.5	16.5	ug/L		04/24/23 03:43	04/28/23 00:13	1
Manganese	**263**		2.06	0.979	ug/L		04/24/23 03:43	04/28/23 00:13	1
Molybdenum	**1.33**		0.515	0.134	ug/L		04/24/23 03:43	04/28/23 00:13	1
Potassium	**947**		206	67.0	ug/L		04/24/23 03:43	04/28/23 00:13	1
Selenium	**0.448**	**J**	1.03	0.286	ug/L		04/24/23 03:43	04/28/23 00:13	1
Sodium	**19700**	**B**	206	92.7	ug/L		04/24/23 03:43	04/28/23 00:13	1

Client Sample ID: Column 3 Day 56

Lab Sample ID: 410-123117-4

Date Collected: 04/17/23 09:45

Matrix: Water

Date Received: 04/17/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			05/09/23 05:32	5
Sulfate	**211**		75.0	25.0	mg/L			05/09/23 16:26	50
Chloride	**3.15**	**J**	7.50	3.00	mg/L			05/09/23 05:32	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:43	04/24/23 12:58	1
Calcium	**24.0**		0.515	0.0989	mg/L		04/24/23 03:43	04/24/23 12:58	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:43	04/28/23 00:15	1
Cobalt	<0.161		0.515	0.161	ug/L		04/24/23 03:43	04/28/23 00:15	1
Iron	**35.9**	**J**	51.5	20.6	ug/L		04/24/23 03:43	04/28/23 16:11	1
Magnesium	**34100**		51.5	16.5	ug/L		04/24/23 03:43	04/28/23 00:15	1
Manganese	**7.18**		2.06	0.979	ug/L		04/24/23 03:43	04/28/23 00:15	1
Molybdenum	**0.364**	**J**	0.515	0.134	ug/L		04/24/23 03:43	04/28/23 00:15	1
Potassium	**1280**		206	67.0	ug/L		04/24/23 03:43	04/28/23 00:15	1
Selenium	<0.286		1.03	0.286	ug/L		04/24/23 03:43	04/28/23 00:15	1
Sodium	**21100**	**B**	206	92.7	ug/L		04/24/23 03:43	04/28/23 00:15	1

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Client Sample ID: Column 4 Day 56

Lab Sample ID: 410-123117-5

Date Collected: 04/17/23 10:15

Matrix: Water

Date Received: 04/17/23 15:35

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.450		1.00	0.450	mg/L			05/09/23 01:00	5
Sulfate	**224**		75.0	25.0	mg/L			05/09/23 16:38	50
Chloride	**3.21**	**J**	7.50	3.00	mg/L			05/09/23 01:00	5

Method: SW846 6010D - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:49	04/24/23 14:57	1
Calcium	**30.0**		0.515	0.0989	mg/L		04/24/23 03:49	04/24/23 14:57	1

Method: SW846 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:49	04/25/23 19:31	1
Cobalt	<0.161		0.515	0.161	ug/L		04/24/23 03:49	04/25/23 19:31	1
Iron	**34.4**	**J**	51.5	20.6	ug/L		04/24/23 03:49	04/25/23 19:31	1
Magnesium	**28300**		51.5	16.5	ug/L		04/24/23 03:49	04/25/23 19:31	1
Manganese	**10.6**		2.06	0.979	ug/L		04/24/23 03:49	04/25/23 19:31	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/24/23 03:49	04/25/23 19:31	1
Potassium	**1600**		206	67.0	ug/L		04/24/23 03:49	04/25/23 19:31	1
Selenium	<0.286		1.03	0.286	ug/L		04/24/23 03:49	04/25/23 19:31	1
Sodium	**15600**		206	92.7	ug/L		04/24/23 03:49	04/25/23 19:31	1

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography

Lab Sample ID: MB 410-372942/5
Matrix: Water
Analysis Batch: 372942

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			05/06/23 12:06	1
Sulfate	<0.500		1.50	0.500	mg/L			05/06/23 12:06	1
Chloride	<0.600		1.50	0.600	mg/L			05/06/23 12:06	1

Lab Sample ID: LCS 410-372942/3
Matrix: Water
Analysis Batch: 372942

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7428		mg/L		99	90 - 110
Sulfate	7.50	7.488		mg/L		100	90 - 110
Chloride	3.00	3.051		mg/L		102	90 - 110

Lab Sample ID: LCSD 410-372942/4
Matrix: Water
Analysis Batch: 372942

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7406		mg/L		99	90 - 110	0	20
Sulfate	7.50	7.484		mg/L		100	90 - 110	0	20
Chloride	3.00	3.022		mg/L		101	90 - 110	1	20

Lab Sample ID: MB 410-373389/5
Matrix: Water
Analysis Batch: 373389

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			05/08/23 15:08	1
Sulfate	<0.500		1.50	0.500	mg/L			05/08/23 15:08	1
Chloride	<0.600		1.50	0.600	mg/L			05/08/23 15:08	1

Lab Sample ID: LCS 410-373389/3
Matrix: Water
Analysis Batch: 373389

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	7.50	7.054		mg/L		94	90 - 110
Chloride	3.00	2.827		mg/L		94	90 - 110

Lab Sample ID: LCSD 410-373389/4
Matrix: Water
Analysis Batch: 373389

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfate	7.50	7.070		mg/L		94	90 - 110	0	20
Chloride	3.00	2.837		mg/L		95	90 - 110	0	20

Method: EPA 300.0 R2.1 - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 410-373707/5
Matrix: Water
Analysis Batch: 373707

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			05/08/23 23:05	1
Sulfate	<0.500		1.50	0.500	mg/L			05/08/23 23:05	1
Chloride	<0.600		1.50	0.600	mg/L			05/08/23 23:05	1

Lab Sample ID: LCS 410-373707/3
Matrix: Water
Analysis Batch: 373707

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.750	0.7497		mg/L		100	90 - 110
Sulfate	7.50	7.576		mg/L		101	90 - 110
Chloride	3.00	3.095		mg/L		103	90 - 110

Lab Sample ID: LCSD 410-373707/4
Matrix: Water
Analysis Batch: 373707

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.7469		mg/L		100	90 - 110	0	20
Sulfate	7.50	7.564		mg/L		101	90 - 110	0	20
Chloride	3.00	3.070		mg/L		102	90 - 110	1	20

Lab Sample ID: MB 410-374193/5
Matrix: Water
Analysis Batch: 374193

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.0900		0.200	0.0900	mg/L			05/09/23 10:51	1
Sulfate	<0.500		1.50	0.500	mg/L			05/09/23 10:51	1
Chloride	<0.600		1.50	0.600	mg/L			05/09/23 10:51	1

Lab Sample ID: LCS 410-374193/3
Matrix: Water
Analysis Batch: 374193

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Sulfate	7.50	7.476		mg/L		100	90 - 110
Chloride	3.00	3.021		mg/L		101	90 - 110

Lab Sample ID: LCSD 410-374193/4
Matrix: Water
Analysis Batch: 374193

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Fluoride	0.750	0.8251		mg/L		110	90 - 110	1	20
Sulfate	7.50	7.451		mg/L		99	90 - 110	0	20
Chloride	3.00	3.012		mg/L		100	90 - 110	0	20

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 410-367535/1-A
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367535

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:43	04/24/23 12:32	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/24/23 03:43	04/24/23 12:32	1

Lab Sample ID: LCS 410-367535/2-A
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367535

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.4969		mg/L		99	80 - 120
Calcium	5.00	4.854		mg/L		97	80 - 120

Lab Sample ID: MB 410-367536/1-A
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367536

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 03:49	04/24/23 13:25	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/24/23 03:49	04/24/23 13:25	1

Lab Sample ID: LCS 410-367536/2-A
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367536

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5100		mg/L		102	80 - 120
Calcium	5.00	4.947		mg/L		99	80 - 120

Lab Sample ID: MB 410-367544/1-A
Matrix: Water
Analysis Batch: 367934

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367544

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0113		0.0515	0.0113	mg/L		04/24/23 05:29	04/24/23 11:39	1
Calcium	<0.0989		0.515	0.0989	mg/L		04/24/23 05:29	04/24/23 11:39	1

Lab Sample ID: LCS 410-367544/2-A
Matrix: Water
Analysis Batch: 367934

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367544

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.500	0.5009		mg/L		100	80 - 120
Calcium	5.00	5.040		mg/L		101	80 - 120

Lab Sample ID: 410-123117-5 MS
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	<0.0113		0.500	0.5069		mg/L		101	75 - 125
Calcium	30.0		5.00	34.70	4	mg/L		95	75 - 125

Method: 6010D - Metals (ICP)

Lab Sample ID: 410-123117-5 MSD
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lithium	<0.0113		0.500	0.5048		mg/L		101	75 - 125	0	20
Calcium	30.0		5.00	34.91	4	mg/L		99	75 - 125	1	20

Lab Sample ID: 410-123117-5 DU
Matrix: Water
Analysis Batch: 368040

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Lithium	<0.0113		<0.0113		mg/L		NC	20
Calcium	30.0		29.80		mg/L		0.6	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 410-367535/1-A
Matrix: Water
Analysis Batch: 369650

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367535

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:43	04/27/23 23:05	1
Cobalt	<0.161		0.515	0.161	ug/L		04/24/23 03:43	04/27/23 23:05	1
Iron	<20.6	^3+	51.5	20.6	ug/L		04/24/23 03:43	04/27/23 23:05	1
Magnesium	<16.5		51.5	16.5	ug/L		04/24/23 03:43	04/27/23 23:05	1
Manganese	<0.979		2.06	0.979	ug/L		04/24/23 03:43	04/27/23 23:05	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/24/23 03:43	04/27/23 23:05	1
Potassium	<67.0		206	67.0	ug/L		04/24/23 03:43	04/27/23 23:05	1
Selenium	<0.286		1.03	0.286	ug/L		04/24/23 03:43	04/27/23 23:05	1
Sodium	102.9	J	206	92.7	ug/L		04/24/23 03:43	04/27/23 23:05	1

Lab Sample ID: LCS 410-367535/2-A
Matrix: Water
Analysis Batch: 369650

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367535

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	489.6		ug/L		98	85 - 120
Cobalt	500	479.9		ug/L		96	90 - 113
Magnesium	5000	4952		ug/L		99	90 - 112
Manganese	500	483.6		ug/L		97	89 - 120
Molybdenum	50.0	49.11		ug/L		98	85 - 115
Potassium	5000	4882		ug/L		98	90 - 112
Selenium	100	99.15		ug/L		99	80 - 120
Sodium	5000	5032		ug/L		101	89 - 112

Lab Sample ID: LCS 410-367535/2-A
Matrix: Water
Analysis Batch: 370011

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367535

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	498.3		ug/L		100	85 - 120
Cobalt	500	505.2		ug/L		101	90 - 113
Iron	5000	5155		ug/L		103	88 - 119

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 410-367535/2-A
Matrix: Water
Analysis Batch: 370011

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367535

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Magnesium	5000	4931		ug/L		99	90 - 112
Manganese	500	509.9		ug/L		102	89 - 120
Molybdenum	50.0	50.62		ug/L		101	85 - 115
Potassium	5000	5001		ug/L		100	90 - 112
Selenium	100	97.11		ug/L		97	80 - 120
Sodium	5000	4937		ug/L		99	89 - 112

Lab Sample ID: MB 410-367536/1-A
Matrix: Water
Analysis Batch: 368498

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367536

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 03:49	04/25/23 18:43	1
Cobalt	<0.161		0.515	0.161	ug/L		04/24/23 03:49	04/25/23 18:43	1
Iron	<20.6		51.5	20.6	ug/L		04/24/23 03:49	04/25/23 18:43	1
Magnesium	<16.5		51.5	16.5	ug/L		04/24/23 03:49	04/25/23 18:43	1
Manganese	<0.979		2.06	0.979	ug/L		04/24/23 03:49	04/25/23 18:43	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/24/23 03:49	04/25/23 18:43	1
Potassium	<67.0		206	67.0	ug/L		04/24/23 03:49	04/25/23 18:43	1
Selenium	<0.286		1.03	0.286	ug/L		04/24/23 03:49	04/25/23 18:43	1
Sodium	<92.7		206	92.7	ug/L		04/24/23 03:49	04/25/23 18:43	1

Lab Sample ID: LCS 410-367536/2-A
Matrix: Water
Analysis Batch: 368498

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367536

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	500	502.8		ug/L		101	85 - 120
Cobalt	500	495.3		ug/L		99	90 - 113
Iron	5000	4870		ug/L		97	88 - 119
Magnesium	5000	4905		ug/L		98	90 - 112
Manganese	500	488.4		ug/L		98	89 - 120
Molybdenum	50.0	49.33		ug/L		99	85 - 115
Potassium	5000	4947		ug/L		99	90 - 112
Selenium	100	100.4		ug/L		100	80 - 120
Sodium	5000	4992		ug/L		100	89 - 112

Lab Sample ID: MB 410-367544/1-A
Matrix: Water
Analysis Batch: 368588

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367544

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.700		2.06	0.700	ug/L		04/24/23 05:29	04/25/23 22:10	1
Cobalt	<0.161		0.515	0.161	ug/L		04/24/23 05:29	04/25/23 22:10	1
Iron	<20.6		51.5	20.6	ug/L		04/24/23 05:29	04/25/23 22:10	1
Magnesium	<16.5		51.5	16.5	ug/L		04/24/23 05:29	04/25/23 22:10	1
Manganese	<0.979		2.06	0.979	ug/L		04/24/23 05:29	04/25/23 22:10	1
Molybdenum	<0.134		0.515	0.134	ug/L		04/24/23 05:29	04/25/23 22:10	1
Potassium	<67.0		206	67.0	ug/L		04/24/23 05:29	04/25/23 22:10	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 410-367544/1-A
Matrix: Water
Analysis Batch: 368588

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 367544

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	<0.286		1.03	0.286	ug/L		04/24/23 05:29	04/25/23 22:10	1
Sodium	<92.7		206	92.7	ug/L		04/24/23 05:29	04/25/23 22:10	1

Lab Sample ID: LCS 410-367544/2-A
Matrix: Water
Analysis Batch: 368588

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 367544

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Arsenic			500	522.2		ug/L		104	85 - 120		
Cobalt			500	503.3		ug/L		101	90 - 113		
Iron			5000	4958		ug/L		99	88 - 119		
Magnesium			5000	4981		ug/L		100	90 - 112		
Manganese			500	501.9		ug/L		100	89 - 120		
Molybdenum			50.0	50.49		ug/L		101	85 - 115		
Potassium			5000	5017		ug/L		100	90 - 112		
Selenium			100	103.2		ug/L		103	80 - 120		
Sodium			5000	5029		ug/L		101	89 - 112		

Lab Sample ID: 410-123117-5 MS
Matrix: Water
Analysis Batch: 368498

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Arsenic	<0.700		500	521.3		ug/L		104	75 - 125		
Cobalt	<0.161		500	488.1		ug/L		98	80 - 125		
Iron	34.4	J	5000	4843		ug/L		96	75 - 125		
Magnesium	28300		5000	31940	4	ug/L		73	75 - 125		
Manganese	10.6		500	498.3		ug/L		98	75 - 125		
Molybdenum	<0.134		50.0	49.74		ug/L		99	81 - 125		
Potassium	1600		5000	6446		ug/L		97	75 - 125		
Selenium	<0.286		100	102.0		ug/L		102	75 - 125		
Sodium	15600		5000	19750		ug/L		83	75 - 125		

Lab Sample ID: 410-123117-5 MSD
Matrix: Water
Analysis Batch: 368498

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	<0.700		500	519.4		ug/L		104	75 - 125	0	20
Cobalt	<0.161		500	503.6		ug/L		101	80 - 125	3	20
Iron	34.4	J	5000	4988		ug/L		99	75 - 125	3	20
Magnesium	28300		5000	33050	4	ug/L		95	75 - 125	3	20
Manganese	10.6		500	510.2		ug/L		100	75 - 125	2	20
Molybdenum	<0.134		50.0	50.39		ug/L		101	81 - 125	1	20
Potassium	1600		5000	6636		ug/L		101	75 - 125	3	20
Selenium	<0.286		100	102.5		ug/L		102	75 - 125	0	20
Sodium	15600		5000	20560		ug/L		99	75 - 125	4	20

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 410-123117-5 DU
Matrix: Water
Analysis Batch: 368498

Client Sample ID: Column 4 Day 56
Prep Type: Dissolved
Prep Batch: 367536

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	<0.700		<0.700		ug/L		NC	20
Cobalt	<0.161		<0.161		ug/L		NC	20
Iron	34.4	J	27.28	J F5	ug/L		23	20
Magnesium	28300		28070		ug/L		0.8	20
Manganese	10.6		11.08		ug/L		4	20
Molybdenum	<0.134		<0.134		ug/L		NC	20
Potassium	1600		1594		ug/L		0.5	20
Selenium	<0.286		<0.286		ug/L		NC	20
Sodium	15600		15460		ug/L		1	20

HPLC/IC

Analysis Batch: 372942

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-3	Column 2 Day 56	Total/NA	Water	EPA 300.0 R2.1	
MB 410-372942/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-372942/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-372942/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 373389

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-3	Column 2 Day 56	Total/NA	Water	EPA 300.0 R2.1	
MB 410-373389/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-373389/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-373389/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 373707

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-2	Column 1 Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-4	Column 3 Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-5	Column 4 Day 56	Total/NA	Water	EPA 300.0 R2.1	
MB 410-373707/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-373707/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-373707/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Analysis Batch: 374193

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-2	Column 1 Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-4	Column 3 Day 56	Total/NA	Water	EPA 300.0 R2.1	
410-123117-5	Column 4 Day 56	Total/NA	Water	EPA 300.0 R2.1	
MB 410-374193/5	Method Blank	Total/NA	Water	EPA 300.0 R2.1	
LCS 410-374193/3	Lab Control Sample	Total/NA	Water	EPA 300.0 R2.1	
LCSD 410-374193/4	Lab Control Sample Dup	Total/NA	Water	EPA 300.0 R2.1	

Metals

Prep Batch: 367535

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Dissolved	Water	Non-Digest Prep	
410-123117-3	Column 2 Day 56	Dissolved	Water	Non-Digest Prep	
410-123117-4	Column 3 Day 56	Dissolved	Water	Non-Digest Prep	
MB 410-367535/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-367535/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Prep Batch: 367536

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-5	Column 4 Day 56	Dissolved	Water	Non-Digest Prep	
MB 410-367536/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-367536/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	
410-123117-5 MS	Column 4 Day 56	Dissolved	Water	Non-Digest Prep	
410-123117-5 MSD	Column 4 Day 56	Dissolved	Water	Non-Digest Prep	
410-123117-5 DU	Column 4 Day 56	Dissolved	Water	Non-Digest Prep	

Metals

Prep Batch: 367544

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-2	Column 1 Day 56	Dissolved	Water	Non-Digest Prep	
MB 410-367544/1-A	Method Blank	Total/NA	Water	Non-Digest Prep	
LCS 410-367544/2-A	Lab Control Sample	Total/NA	Water	Non-Digest Prep	

Analysis Batch: 367934

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-2	Column 1 Day 56	Dissolved	Water	6010D	367544
MB 410-367544/1-A	Method Blank	Total/NA	Water	6010D	367544
LCS 410-367544/2-A	Lab Control Sample	Total/NA	Water	6010D	367544

Analysis Batch: 368040

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Dissolved	Water	6010D	367535
410-123117-3	Column 2 Day 56	Dissolved	Water	6010D	367535
410-123117-4	Column 3 Day 56	Dissolved	Water	6010D	367535
410-123117-5	Column 4 Day 56	Dissolved	Water	6010D	367536
MB 410-367535/1-A	Method Blank	Total/NA	Water	6010D	367535
MB 410-367536/1-A	Method Blank	Total/NA	Water	6010D	367536
LCS 410-367535/2-A	Lab Control Sample	Total/NA	Water	6010D	367535
LCS 410-367536/2-A	Lab Control Sample	Total/NA	Water	6010D	367536
410-123117-5 MS	Column 4 Day 56	Dissolved	Water	6010D	367536
410-123117-5 MSD	Column 4 Day 56	Dissolved	Water	6010D	367536
410-123117-5 DU	Column 4 Day 56	Dissolved	Water	6010D	367536

Analysis Batch: 368498

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-5	Column 4 Day 56	Dissolved	Water	6020B	367536
MB 410-367536/1-A	Method Blank	Total/NA	Water	6020B	367536
LCS 410-367536/2-A	Lab Control Sample	Total/NA	Water	6020B	367536
410-123117-5 MS	Column 4 Day 56	Dissolved	Water	6020B	367536
410-123117-5 MSD	Column 4 Day 56	Dissolved	Water	6020B	367536
410-123117-5 DU	Column 4 Day 56	Dissolved	Water	6020B	367536

Analysis Batch: 368588

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-2	Column 1 Day 56	Dissolved	Water	6020B	367544
MB 410-367544/1-A	Method Blank	Total/NA	Water	6020B	367544
LCS 410-367544/2-A	Lab Control Sample	Total/NA	Water	6020B	367544

Analysis Batch: 369650

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Dissolved	Water	6020B	367535
410-123117-3	Column 2 Day 56	Dissolved	Water	6020B	367535
410-123117-4	Column 3 Day 56	Dissolved	Water	6020B	367535
MB 410-367535/1-A	Method Blank	Total/NA	Water	6020B	367535
LCS 410-367535/2-A	Lab Control Sample	Total/NA	Water	6020B	367535

Analysis Batch: 370011

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-1	Influent Day 56	Dissolved	Water	6020B	367535
410-123117-3	Column 2 Day 56	Dissolved	Water	6020B	367535

Metals (Continued)

Analysis Batch: 370011 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-123117-4	Column 3 Day 56	Dissolved	Water	6020B	367535
LCS 410-367535/2-A	Lab Control Sample	Total/NA	Water	6020B	367535

Client Sample ID: Influent Day 56

Lab Sample ID: 410-123117-1

Date Collected: 04/17/23 08:15

Matrix: Water

Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	373707	L4QM	ELLE	05/09/23 05:19
Total/NA	Analysis	EPA 300.0 R2.1		50	374193	L4QM	ELLE	05/09/23 16:51
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6010D		1	368040	T8CQ	ELLE	04/24/23 12:55
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	369650	F7JF	ELLE	04/28/23 00:11
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	370011	S4PD	ELLE	04/28/23 16:07

Client Sample ID: Column 1 Day 56

Lab Sample ID: 410-123117-2

Date Collected: 04/17/23 08:45

Matrix: Water

Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	373707	L4QM	ELLE	05/09/23 00:35
Total/NA	Analysis	EPA 300.0 R2.1		20	374193	L4QM	ELLE	05/09/23 16:00
Dissolved	Prep	Non-Digest Prep			367544	UAMX	ELLE	04/24/23 05:29
Dissolved	Analysis	6010D		1	367934	T8CQ	ELLE	04/24/23 12:36
Dissolved	Prep	Non-Digest Prep			367544	UAMX	ELLE	04/24/23 05:29
Dissolved	Analysis	6020B		1	368588	F7JF	ELLE	04/25/23 22:37

Client Sample ID: Column 2 Day 56

Lab Sample ID: 410-123117-3

Date Collected: 04/10/23 09:15

Matrix: Water

Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		20	373389	L4QM	ELLE	05/08/23 18:36
Total/NA	Analysis	EPA 300.0 R2.1		5	372942	L4QM	ELLE	05/06/23 19:21
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6010D		1	368040	T8CQ	ELLE	04/24/23 13:16
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	369650	F7JF	ELLE	04/28/23 00:13
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	370011	S4PD	ELLE	04/28/23 16:09

Client Sample ID: Column 3 Day 56

Lab Sample ID: 410-123117-4

Date Collected: 04/17/23 09:45

Matrix: Water

Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	373707	L4QM	ELLE	05/09/23 05:32
Total/NA	Analysis	EPA 300.0 R2.1		50	374193	L4QM	ELLE	05/09/23 16:26
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6010D		1	368040	T8CQ	ELLE	04/24/23 12:58

Lab Chronicle

Client: Terra Systems Inc
Job ID: 410-123117-1
Project/Site: Stantec CCR TS AP3

Client Sample ID: Column 3 Day 56
Lab Sample ID: 410-123117-4

Date Collected: 04/17/23 09:45
Matrix: Water
Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	369650	F7JF	ELLE	04/28/23 00:15
Dissolved	Prep	Non-Digest Prep			367535	UAMX	ELLE	04/24/23 03:43
Dissolved	Analysis	6020B		1	370011	S4PD	ELLE	04/28/23 16:11

Client Sample ID: Column 4 Day 56
Lab Sample ID: 410-123117-5

Date Collected: 04/17/23 10:15
Matrix: Water
Date Received: 04/17/23 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	EPA 300.0 R2.1		5	373707	L4QM	ELLE	05/09/23 01:00
Total/NA	Analysis	EPA 300.0 R2.1		50	374193	L4QM	ELLE	05/09/23 16:38
Dissolved	Prep	Non-Digest Prep			367536	UAMX	ELLE	04/24/23 03:49
Dissolved	Analysis	6010D		1	368040	T8CQ	ELLE	04/24/23 14:57
Dissolved	Prep	Non-Digest Prep			367536	UAMX	ELLE	04/24/23 03:49
Dissolved	Analysis	6020B		1	368498	UCIG	ELLE	04/25/23 19:31

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Alaska (UST)	State	17-027	02-28-24
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-24
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24

Accreditation/Certification Summary

Client: Terra Systems Inc
Job ID: 410-123117-1
Project/Site: Stantec CCR TS AP3

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wyoming (UST)	A2LA	0001.01	11-30-24

Method Summary

Client: Terra Systems Inc
Job ID: 410-123117-1
Project/Site: Stantec CCR TS AP3

Method	Method Description	Protocol	Laboratory
EPA 300.0 R2.1	Anions, Ion Chromatography	EPA	ELLE
6010D	Metals (ICP)	SW846	ELLE
6020B	Metals (ICP/MS)	SW846	ELLE
Non-Digest Prep	Preparation, Non-Digested Aqueous Metals	EPA	ELLE

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Terra Systems Inc
Project/Site: Stantec CCR TS AP3

Job ID: 410-123117-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-123117-1	Influent Day 56	Water	04/17/23 08:15	04/17/23 15:35
410-123117-2	Column 1 Day 56	Water	04/17/23 08:45	04/17/23 15:35
410-123117-3	Column 2 Day 56	Water	04/10/23 09:15	04/17/23 15:35
410-123117-4	Column 3 Day 56	Water	04/17/23 09:45	04/17/23 15:35
410-123117-5	Column 4 Day 56	Water	04/17/23 10:15	04/17/23 15:35

Environmental Analysis Request

410-123117 Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

Client: **Terra Systems, Inc.**			
Project Name/#: Stantec CCR TS AP3	Site ID #: Macon, GA		
Project Manager: Michael D. Lee	P.O. #: 222538-4-17-23		
Sampler: Michael D. Lee	PWSID #:		
Phone #: 302-798-9553	Quote #: 41011818		
State where samples were collected: ___ GA	For Compliance: Yes ☐ No ☑		

Sample Identification	Collection Date	Collection Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	Dis (ff) As, Co, Fe, K, Mg, Mn.	Mo, Na, Se	Cl, F, SO4 by EPA 300	Dis (ff) Ca, Li	Remarks
														Preservation Codes: N	N	-	N	
Influent Day 49	4/17/2023	8:15		X				X					3	X		X	X	ff= field filtered
Column 1 Day 49	4/17/2023	8:45		X				X					3	X		X	X	
Column 2 Day 49	4/10/2023	9:15		X				X					3	X		X	X	
Column 3 Day 49	4/17/2023	9:45		X				X					3	X		X	X	
Column 4 Day 49	4/17/2023	10:15		X				X					3	X		X	X	

Preservation Codes: H = HCl; T = Thiosulfate; N = HNO_3; B = NaOH; S = H_2SO_4; P = H_3PO_4; O = Other

For Lab Use Only: SF #: _____ SCR #: _____

Turnaround Time Requested (TAT) (please check): Standard ☑ Rush ☐

(Rush TAT is subject to laboratory approval and surcharges.)

Date results are needed: 5/1/23

Rush results requested by (please check): E-Mail ☑ Phone ☐

E-mail Address: mlee@terrasystems.net

Phone: 302-798-9553

Data Package Options (please check if required)

Type I (Validation/non-CLP)	☐	MA MCP	☐
Type III (Reduced non-CLP)	☐	CT RCP	☐
Type VI (Raw Data Only)	☐	TX TRRP-13	☐
NJ DKQP	☐	NYSDEC Category	☐ A or ☐ B

EDD Required? Yes ☐ No ☑ If yes, format: _____

Relinquished by:	Date	Time	Received by:	Date	Time
Michael D Lee	4/10/23	11:15	Bec K Q	4/17/23	1115
Bec K Q	4/17/23	1535			

Relinquished by Commercial Carrier:

UPS _____ FedEx _____ Other _____

Temperature upon receipt 0.4 °C

Login Sample Receipt Checklist

Client: Terra Systems Inc

Job Number: 410-123117-1

Login Number: 123117
List Number: 1
Creator: Wrye, Shaun

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	Not present
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 (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	False	Refer to Job Narrative for details.
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	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	Not present.
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

APPENDIX B
RISK EVALUATION REPORT

RISK EVALUATION REPORT

FORMER PLANT ARKWRIGHT
ASH POND 3 LANDFILL AND MONOFILL
BIBB COUNTY, GEORGIA

Prepared for

Georgia Power
241 Ralph McGill Boulevard
Atlanta, Georgia 30308

Prepared by

WSP USA Environment & Infrastructure Inc.
1075 Big Shanty Road NW, #100
Kennesaw, Georgia 30144

February 2024

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Atlantic Coast Consulting, Inc.
AP	Ash Pond
CCR	Coal Combustion Residual
CEM	Conceptual Exposure Model
CFR	Code of Federal Regulations
COI	Constituent of Interest
COPI	Constituent of Potential Interest
EPC	Exposure Point Concentration
EPD	[Georgia] Environmental Protection Division
GCL	Geosynthetic Clay Liner
GWPS	Groundwater Protection Standard
HSRA	Hazardous Site Response Act
mg/L	Milligrams per liter
OCGA	Official Code of Georgia Annotated
ProUCL	ProUCL software version 5.2
PWR	Partially Weathered Rock
RME	Reasonable Maximum Exposure
RRS	Risk Reduction Standards
RSL	Regional Screening Level
SSL	Statistically Significant Level
UCL	95 Percent Upper Confidence Limit of the Arithmetic Mean
USEPA	United States Environmental Protection Agency
VRP	Voluntary Remediation Program

EXECUTIVE SUMMARY

Georgia Power's Plant Arkwright (site) is a former four-unit coal-fired, electric-generating facility approximately 6 miles northwest of the city of Macon, Georgia in Bibb County, Georgia. In compliance with applicable regulations, coal combustion residual (CCR) material resulting from power generation has historically been transferred and stored at the Ash Pond 3 Landfill and Monofill (AP-3), which were commissioned and operated separately but were then combined into one CCR unit in 2008 prior to closure. The Monofill disposal area is located just east of the AP-3 Landfill and was approved by EPD in January 1994 under Solid Waste Handling Permit 011-025D(LI) as a private industrial landfill to accept only waste from Georgia Power. This report focuses on the AP-3 Landfill and Monofill and is hereafter referred to as AP-3.

Georgia Power is currently updating the CCR permit application for AP-3, which was closed in accordance with solid waste landfill regulations specified in the Georgia Rules for Solid Waste Management, Chapter 391-3-4, in effect at the time of its closure in 2010. Closure construction of the AP-3 Landfill and Monofill was completed in 2009 utilizing a geosynthetic clay liner overlain by 18 inches of cover soil. The Closure Certificate issued by Georgia Environmental Protection Division (EPD) in August 19, 2010 for AP-3 initiated the post-closure care period for the CCR unit. AP-3 is exempt from the requirements in the Federal CCR Rule[1], in accordance with §257.50 (d) and (e), which states that the subpart does not apply to CCR landfills that have ceased receiving CCR prior to October 19, 2015. AP-3 is, however, subject to the requirements of relevant portions of the State CCR Rule (Georgia EPD Rule 391-3-4-.10; EPD, 2022a), which includes semi-annual groundwater monitoring and reporting. Georgia Power has elected to remove CCR material from AP-3 and place it in a new, lined landfill.

This report presents the results of a human health and ecological risk evaluation for the CCR constituent that exhibits statistically significant levels (SSLs) in groundwater at the site (cobalt) and the supporting human health and ecological risk evaluations for the downgradient surface water bodies (i.e., Beaverdam Creek Tributary, Beaverdam Creek, and the Ocmulgee River. A conservative, health-protective approach was used that is consistent with United States Environmental Protection Agency (USEPA) risk

[1] The full citation for the Federal CCR Rule is: 40 C.F.R. § 257, *Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*. The rule was finalized with an effective date of October 14, 2015 and last amended August 28, 2020 with an effective date of September 28, 2020 (USEPA, 2020a).

assessment guidance, Georgia EPD regulations and guidance, and standard practice for risk assessment in the State of Georgia. Cobalt was identified as an SSL-related constituent (Stantec, 2023a). The risk evaluation relies on groundwater data collected by Georgia Power between September 2016 to August 2023 in compliance with the State CCR Rule.

Consistent with USEPA guidance, this risk evaluation used a tiered approach to evaluate potential risks, which included the following steps:

1. Development of a conceptual exposure model (CEM) for AP-3.
2. Initial groundwater risk screening: Comparison of groundwater concentrations for the SSL-related constituent (cobalt) to conservative, health-protective criteria to assess whether constituents pose a risk to human health.
3. Refined groundwater risk evaluation: Performance of a more refined analysis for Constituents of Potential Interest (COPIs) that were retained in the initial risk screening in order to evaluate the potential risks to human health due to groundwater exposure.
4. Surface water screening: Comparison of surface water concentrations for the SSL-related constituent to conservative, health-protective criteria to assess whether that constituent poses a risk to human health and/or the environment as an additional line of evidence and a conservative measure.
5. Development of risk conclusions and identification of associated uncertainties.

Using this approach that includes multiple conservative assumptions, the only SSL-related constituent (cobalt) is not expected to pose a risk to human health or the environment. Therefore, no further risk evaluation for groundwater or surface water is warranted. Compliance groundwater monitoring for AP-3 under the State CCR Rule will continue. Georgia Power will proactively evaluate the data and update this evaluation, if necessary.

1 INTRODUCTION

This report summarizes a risk evaluation of AP-3 located at the former Georgia Power Plant Arkwright (the site) in Bibb County, Georgia (**Figure 1**). Georgia Power is currently updating the permit application for AP-3 in accordance with the State CCR Rule (EPD, 2022a). AP-3 is exempt from the requirements in the Federal CCR Rule, in accordance with §257.50 (d) and (e), which states that the subpart does not apply to CCR landfills that have ceased receiving CCR prior to October 19, 2015 (USEPA, 2020). Closure construction of the AP-3 Landfill and Monofill was completed in 2009 utilizing a geosynthetic clay liner overlain by 18 inches of cover soil. A Closure Certificate was issued by EPD in August 19, 2010 for AP-3. Georgia Power has elected to remove CCR material from AP-3 and place it in a new, lined landfill. The closure of AP-3 Landfill and Monofill by the removal of CCR material provides significant source control that reduces the potential for migration of CCR constituents to groundwater.

This risk evaluation provides additional technical review of the human health and environmental protectiveness associated with the closure of AP-3 with respect to cobalt concentrations in groundwater and in downgradient surface water bodies. Cobalt was identified as an SSL-related constituent (Stantec, 2023a). The evaluation relies on a conservative, health-protective approach that is consistent with the risk approaches outlined in Voluntary Remediation Program (VRP) (Georgia Voluntary Remediation Act, OCGA §12-8-100) and USEPA Regional Screening Levels (RSLs) User's Guide (USEPA, 2023). This evaluation also incorporated principles and assumptions consistent with the Federal and State CCR Rules.

The risk evaluation includes the development of a site-specific CEM and a stepwise risk screening process for the identified SSL-related constituent for AP-3. Cobalt was identified as an SSL-related constituent in monitoring well ARGWC-17 (Stantec, 2023a). Based on the results of the risk evaluation for this SSL-related constituent, a site-specific recommended path forward is provided.

The remainder of the report is organized as follows:

- ***Section 2, Basis and Background for the Development of the Conceptual Exposure Model*** – Presents site-specific information related to the site history, monitoring network, topography and surface hydrology, geology and hydrogeology, potential transport pathways, and receptors that could potentially be exposed to the SSL-related constituent.

- ***Section 3, Risk Evaluation Screening*** – Describes the process for the initial risk-based screening of the SSL-related constituent in groundwater to identify if it is a COPI.
- ***Section 4, Refined Risk Evaluation*** – Describes the risk screening process for the groundwater COPI, including calculation of exposure point concentrations (EPCs) and analysis of concentration trends over time, as well as the surface water risk screening process for the groundwater COPI in the downgradient surface water bodies.
- ***Section 5, Uncertainty Assessment*** – Describes the uncertainties associated with the risk screening process.
- ***Section 6, Conclusions*** – Presents the conclusions of the risk evaluation.
- ***Section 7, References*** – Provides reference information for the sources cited in this document.

2 BASIS AND BACKGROUND FOR DEVELOPMENT OF THE CONCEPTUAL EXPOSURE MODEL

This section provides a brief overview of the site location and operational history, site regulatory status, and geology/hydrogeology.

A CEM representing the site-specific processes and conditions that are relevant to the potential migration of groundwater and potential exposure to the SSL-related constituent has been developed based on a review and compilation of information previously presented in former Plant Arkwright AP-3 documents, including the *CCR Unit Permit Application Part A, Former Plant Arkwright – AP3 Landfill and Monofill* (Jacobs, 2018a), *CCR Unit Permit Application Part B, Former Plant Arkwright – AP3 Landfill and Monofill* (Jacobs, 2018b), and the *Plant Arkwright AP-3 2023 Annual Groundwater Monitoring and Corrective Action Report* (Stantec, 2023a). The CEM includes a conservative evaluation of potential transport pathways, potential exposure pathways, and potential human and ecological receptors.

2.1 Site Description

The former Plant Arkwright is located in Bibb County, Georgia, approximately 6 miles northwest of the city of Macon. Plant Arkwright is bordered by the Ocmulgee River on the east (**Figure 1**). The former Plant Arkwright was a four-unit coal-fired power generating facility that was retired in 2002 and decommissioned in 2003. CCR landfill units at the former Plant Arkwright include AP-1, AP-2 (Dry Ash Stockpile Landfill) and AP-3.

AP-3 was initially constructed as a surface impoundment prior to 1958 but did not receive CCR material until the 1970s. The CCR unit was closed in 2010 in accordance with the solid waste landfill regulations specified by Georgia EPD Rule 391-3-4, in effect at the time of its closure. Closure construction of AP-3 was completed in 2009 utilizing a geosynthetic clay liner overlain by 18 inches of cover soil. The closed footprint of the AP-3 Landfill encompasses 31.54 acres, and the closed footprint of the Monofill encompasses 4.08 acres. A closure certificate was issued by Georgia EPD for AP-3 on August 19, 2010, which initiated the post-closure care period for the CCR unit. Georgia Power has elected to remove CCR material from AP-3 and place it in a new, lined landfill. Semi-annual groundwater monitoring and reporting for AP-3 is performed in accordance with the monitoring program requirements of the State CCR Rule. A groundwater monitoring network was installed to monitor groundwater quality both upgradient and downgradient of AP-3. The AP-3 certified monitoring well network consists of six upgradient monitoring wells and eight downgradient monitoring wells. Three

piezometers (ARAMW-3, ARAMW-4, and ARAMW-6) were also installed at AP-3 in November 2019. The certified compliance well network is provided in **Figure 2**.

2.1.1 Topography and Surface Hydrology

The site is located along the southern edge of the Washington Slope Physiographic District. The Washington Slope is characterized by a gently undulating surface which generally slopes to the south and southeast towards the Coastal Plain Physiographic District located approximately 3.8 miles to the southeast of the site. Topography of the Washington Slope ranges from approximately 700 feet above sea level in the areas of southern Atlanta and Athens to approximately 300 feet above sea level at its southern limit along the Georgia Fall Line. Streams follow the structure of underlying crystalline rocks eastward toward the Ocmulgee River. Relief throughout the district is between 50 and 100 feet with the greatest relief being along the Ocmulgee River with steep walled valleys with elevation changes between 150 and 200 feet.

Wetland areas delineated on the former Plant Arkwright property are located south of the AP-3 Landfill earthen dike and not within the AP-3 permit boundary (**Figure 2**). A small, man-made pond is located adjacent to AP-3 to the north. Circa 2005, the configuration of the man-made pond was adjusted to allow for drainage into a man-made, jurisdictional surface water channel constructed between the AP-3 Landfill and Monofill, which generally runs from north to south. This man-made surface water channel discharges surface water through a weir structure located at the southeastern corner of AP-3 and into the wetlands area located further south, which then flows into Beaverdam Creek. Beaverdam Creek is a tributary of the Ocmulgee River and is located approximately 1,200 feet south of the southernmost extent of AP-3. Beaverdam Creek runs roughly from northwest to southeast, eventually discharging to the Ocmulgee River at a location over ¾-mile from AP-3. At its closest point, AP-3 is located approximately 1,400 feet west of the Ocmulgee River. The Ocmulgee River is part of the Lower Ocmulgee River Basin, flowing from north to south in the vicinity of former Plant Arkwright. All surface water and groundwater in the former Plant Arkwright area eventually flows in a southerly direction.

2.1.2 Geology and Hydrogeology

The geologic and hydrogeologic characteristics of the site have been extensively evaluated and compiled in previous reports. The following presents a brief summary of this information from the *Plant Arkwright AP-3 2023 Annual Groundwater Monitoring & Corrective Action Report* (Stantec, 2023a):

The general geology beneath Plant Arkwright consists of clays, silty and sandy clays, silty sands, sandy silts, and minor gravel at depth, underlain by a silty sand saprolite and bedrock. Historical borings advanced at the Site indicate bedrock occurs at depths ranging from approximately 14 feet to 63 feet below ground surface, and consists of weathered quartzofeldspathic gneiss, hornblende gneiss, and schist. Boring logs also indicate a relatively thin zone of partially weathered rock (PWR) above a more competent bedrock which ranges in thickness from 1 to 4 feet in the southern and eastern portions of the Site, and up to 14 feet in the northeastern portion of the Site.

Pertinent hydrogeologic information from the *Plant Arkwright AP-3 2023 Annual Groundwater Monitoring and Corrective Action Report* (Stantec, 2023a) is presented below:

The uppermost aquifer at the Site consists of two hydrostratigraphic units: the water table (overburden) hydrostratigraphic unit and the underlying shallow fractured bedrock hydrostratigraphic unit. The water table (overburden) unit is composed of unconsolidated silty sands and sandy silts with clays and variable thicknesses of PWR mantling the bedrock surface, whereas the bedrock unit is a zone comprised of weathered and fractured bedrock.

The water table unit is hydraulically connected to the underlying bedrock through fractures in the partially weathered and fractured bedrock (Southern Company Services, 2005) and is considered to be under unconfined conditions. The monitoring well network for AP-3 Landfill and Monofill (Figure 2) monitors the uppermost aquifer at the Site.

Slug testing data from the Site reflects a range of hydraulic conductivities from 10^{-6} to 10^{-3} centimeters per second in the water table hydrostratigraphic unit (Southern Company Services, 2005). Groundwater level gauging data from the Site indicates consistent water level elevations and the potentiometric surface map depicts groundwater generally flowing to the south and southeast across AP-3 Landfill and Monofill.

The potentiometric surface elevation contours for January 2023 are presented in **Figure 3**.

2.2 Potential Transport Pathways

A variety of geologic, hydrogeologic, and geochemical mechanisms can occur in the subsurface and serve to attenuate constituent concentrations in groundwater such as soil or rock characteristics, the local geology and hydrogeology, and the distance the groundwater must travel before reaching a potential receptor. Potential transport pathways to groundwater and surface water are discussed below**.**

2.2.1 Groundwater

Pertinent information regarding groundwater transport from Appendix D of the *Arkwright AP-3 2023 Annual Groundwater Monitoring and Corrective Action Report* (Stantec, 2023a) is presented below and is largely consistent with historical observations from 2016 through 2023:

> *Groundwater level monitoring data collected in 2020 through June 2023 from monitoring wells and piezometers show consistent groundwater flow directions. The potentiometric surface contour maps reflect groundwater generally flowing across AP-3 Landfill and Monofill toward the south in the direction of Beaverdam Creek, which is consistent with previous observations. New stream flow elevation data from the area near AP-3 Landfill and Monofill suggests that groundwater flows from AP-3 Landfill and Monofill towards the surface water feature separating AP-3 Landfill and Monofill but may be in near-equilibrium with reference to hydraulic heads on either side of the stream at some reaches.*

Groundwater flow direction in the uppermost aquifer is to the southeast in the northern portion of AP-3, and to the south in the southern portion of AP-3.

2.2.2 Surface Water

A man-made, jurisdictional surface water channel was constructed between the AP-3 Landfill and Monofill when the historical stream path of Beaverdam Creek Tributary was redirected during construction of AP-3. This man-made surface water channel flows north to south and discharges into the wetlands area south of AP-3, which then flows into Beaverdam Creek from the west side of the wetlands area (**Figure 2**). Beaverdam Creek runs roughly from northwest to southeast, eventually discharging to the Ocmulgee River at a location over ¾-mile from AP-3. All surface water and groundwater in the former Plant Arkwright area eventually flows in a southerly direction.

A conservative assumption for this assessment was made that all the groundwater from the site flows to the downgradient surface water bodies (Beaverdam Creek and Ocmulgee River). Beaverdam Creek represents a localized discharge boundary for groundwater flow in the upper aquifer from AP-3. In addition, for the purpose of this risk evaluation, it was assumed that the Ocmulgee River represents a regional hydraulic discharge boundary for groundwater flow in the upper aquifer from the area.

2.3 Potential Exposure Pathways and Receptors

The exposure pathways for groundwater and surface water were assumed to be complete as a conservative measure for the purposes of this risk evaluation and were used to identify potential receptors and estimate potential risk. The CEM (**Figure 4)** depicts the assumed potential exposure pathways and receptors included in the risk evaluation.

The following potential exposure pathways and receptors were considered:

- On-site industrial worker: The groundwater exposure pathway for the on-site industrial worker was considered incomplete because there are no wells on-site that are classified for use as potable wells.

- On-site construction worker: While there is a potential for limited exposure to groundwater by a future construction worker through dermal contact with on-site shallow groundwater during subsurface activities, future construction workers would be expected to have little to no direct contact with on-site groundwater due to safety procedures outlined in their site-specific health and safety plans.

- On-site resident: The groundwater exposure pathway for the on-site resident was considered incomplete because there is no residential use on-site under current site conditions and future residential use of the site is considered unlikely. Land use surrounding the site is zoned agricultural to the north, planned industrial to the west, agricultural to the southwest, and multi-family residential to the south (Bibb County, 2023). Beyond the Ocmulgee River to the east, land use is predominantly zoned agricultural/forestry (Jones County, 2007).

- Off-site industrial/construction worker: The potential for off-site worker exposure through direct contact with shallow groundwater was addressed through the evaluation of hypothetical off-site residential receptors. Health-protective screening levels for residential receptors would be more conservative than industrial and construction worker screening levels.

- Off-site resident: The groundwater exposure pathway for hypothetical off-site residential receptors was assumed potentially complete for the purpose of this evaluation. Numerous surveys of potential water supply wells and surface water intakes were conducted at the site. These surveys consisted of reviewing Federal, State, and County records and online sources, in addition to conducting windshield surveys of the area.

    - Kemron Environmental Services conducted a survey in 2003.

    - Jacobs conducted a water survey in 2018 encompassing a 0.5-mile search radius for private water supply wells and 2-mile search radius for public water supply wells and surface water intakes.

    - NewFields conducted a survey in 2020 which covered a 3-mile radius for water supply wells (**Appendix A**).

    - Jacobs conducted the surveys in 2021 encompassing a 0.5-mile search radius for private water supply wells and 2-mile search radius for public water supply wells and surface water intakes (Jacobs, 2022).

    - Stantec conducted an updated survey in 2022 within a 2-mile radius (Stantec, 2023b).

  The results of all the surveys up to a 3-mile radius have been combined and are presented in **Figure 5**.

  Combining well information from all sources with parcel data within the three-mile radius, 639 total parcels likely to be associated with an active or inactive private well were identified. Municipal water from the Macon Water Authority is widely available throughout the Bibb County portion of the area. The majority of the water lines around the plant were built in the 1970s, when the nearby homes were constructed. Municipal water is not available in the Monroe County part of the area. The residential area east of the Ocmulgee River is served by public water. No active public wells were located within the 3-mile radius. The closest private wells to AP-3 are south of the site and Beaverdam Creek, which was assumed to represent a localized hydraulic discharge boundary for groundwater flow in the upper aquifer from the area. The findings from the 2022 survey (Stantec, 2023b) were consistent with the 2020 and 2021 surveys.

According to the 2021 survey (Jacobs, 2022), the Macon Water Authority public water supply is sourced solely from a surface water intake approximately 3.7 miles downstream of the former Plant Arkwright on the Ocmulgee River. However, according to the numerous surveys, no surface water intakes were identified for public water supplies within three miles downstream of the site. Impacts to surface water are delineated within the site boundary. Surface water concentrations of cobalt in Beaverdam Creek and the Ocmulgee River were well below respective health-protective screening criteria for human receptors. As there are no surface water intakes near the site and cobalt concentrations in groundwater and surface water have been delineated on-site, surface water as a drinking water source is considered an incomplete exposure pathway.

As a conservative measure, potential off-site residential exposure to the SSL-related constituent was evaluated using on-site groundwater wells around the perimeter and downgradient of AP-3. This comparison makes the conservative assumption that on-site groundwater may potentially migrate to off-site drinking water wells, through advective transport in groundwater without any attenuation within the aquifer media through factors such as dilution, dispersion, or adsorption. The risk evaluation screening conservatively assumed that hypothetical off-site residential receptors could be exposed to the concentrations of the SSL-related constituent in groundwater through its use as a potable water supply by ingestion and dermal contact with groundwater.

- Recreational surface water receptors: The surface water exposure pathway for recreational receptors was assumed potentially complete for the purpose of this evaluation. Although cobalt concentrations were delineated below health-protective screening criteria in on-site groundwater, on-site and off-site surface water samples were evaluated as a conservative measure. Routes of exposure include ingestion of aquatic organisms (mainly fish) and potential incidental ingestion and dermal contact with surface water by adult and child recreational receptors.

- Ecological surface water receptors: The surface water exposure pathway for ecological receptors was assumed potentially complete for the purpose of this evaluation. Although cobalt concentrations were delineated below health-protective screening criteria in on-site groundwater, on-site and off-site surface water samples were evaluated as a conservative measure. Potential routes of exposure include direct contact to surface water by aquatic receptors as well as ingestion.

3 RISK EVALUATION SCREENING

The CEM developed in Section 2 was used to identify the potentially complete exposure pathways to human and ecological receptors that are considered in the risk evaluation. The initial step in the risk evaluation is the comparison of the SSL-related constituent in groundwater collected between September 2016 to August 2023 to health-protective levels for potentially complete exposure pathways. The approach used is consistent with the Georgia EPD regulations and guidance, USEPA guidance, and standard practice for risk assessment in the State of Georgia. The Georgia EPD allows for the site-specific evaluation of risk in programs such as the Voluntary Remediation Program (EPD, 2009).

The initial risk evaluation screening was performed for the potential groundwater exposure pathway by comparing the constituent concentrations of on-site groundwater wells determined to have an SSL-related constituent to appropriate health-protective screening criteria. These criteria included the risk reduction standards (RRS) established under the Hazardous Site Response Act (HSRA) for drinking water and site-specific background for the protection of human health. If the maximum concentration of an SSL-related constituent exceeded the screening criterion, the constituent was identified as a COPI for further evaluation in the refined risk evaluation. The methodology and screening criteria used were identified in accordance with regulatory guidance and standard risk assessment practices using an approach designed to conservatively overestimate possible exposures and risks, providing an additional level of confidence in the conclusions. The methodology is summarized in **Figure 6** and discussed in more detail below.

3.1 Data Used in Risk Evaluation Screening

This section provides information on the groundwater dataset used in the risk evaluation screening.

3.1.1 Groundwater Data

For the initial risk screening evaluation, groundwater data from samples collected between September 2016 to August 2023 from on-site monitoring well ARGWC-17 (cobalt data) were used in the risk screening evaluation for hypothetical off-site residential exposure. Cobalt in monitoring well ARGWC-17 was previously identified as an SSL-related constituent. Cobalt data for this well were screened against relevant health-protective screening criteria.

The well with the SSL-related constituent is depicted on **Figure 2** and the groundwater dataset used in the risk evaluation is presented in **Appendix B.** Method detection limits for the groundwater dataset used in the risk evaluation were reviewed and confirmed to be less than the screening levels.

3.1.2 Background Groundwater Quality

Statistical analysis of groundwater monitoring data is performed at the former Plant Arkwright pursuant to §257.93-95 following the established statistical method from the Unified Guidance (USEPA, 2009) for AP-3; background values are routinely updated under the program. Six monitoring wells in the certified monitoring well network are designated as upgradient or background locations, including ARGWA-3, ARGWA-5, ARGWA-12, ARGWA-13, ARGWA-14, and ARGWA-24. Statistical analyses were performed on groundwater data using Sanitas groundwater statistical software, as described in the *2023 Annual Groundwater Monitoring & Corrective Action Report Statistical Summary* (Stantec, 2023a) and text from that document is presented below.

> *Upper Tolerance Limits (UTLs) were calculated from pooled upgradient well data for Appendix IV constituents. Parametric UTLs were calculated when data followed a normal or transformed-normal distribution. When data contained greater than 50% non-detects or were not normal or transformed-normal distribution, non-parametric tolerance limits were used. When parametric methods were appropriate, a 95% UTL with 95% coverage was calculated. When non-parametric UTLs were appropriate, the level of confidence could not be pre-specified and was a function of the size of the data set. The level of confidence for the non-parametric UTLs is provided in the GSC, 2022 and 2023 reports (Appendix C). The background limits were evaluated when determining the GWPS under 40 CFR § 257.95(h).*

Naturally occurring or site-specific background concentrations can exceed health-protective screening criteria. Therefore, site-specific background values were used as the groundwater screening values if background concentrations were identified as greater than the groundwater screening values, as further described in Section 3.2.

3.2 Groundwater Screening Evaluation

The process of screening SSL-related constituents in groundwater against human health screening levels for groundwater is discussed below and presented in **Figure 6**. The HSRA RRS evaluated under the VRP approach presented herein included Type 1 and Type 2 standards for off-site residential receptors. The Hazardous Site Response Act,

Rule 391-3-19.07(1) notes that "*[a]ll risk reduction standards will, when implemented, provide adequate protection of human health and the environment.*" In addition, Rule 391-3-19.07(3) notes a corrective action, if needed, may be considered complete when "*a site meets any or a combination of the applicable risk reduction standards described in Rule 391-3-19-.07.*"

In accordance with risk standards and methodologies approved by the Georgia EPD, the screening level hierarchy for the SSL-related constituents is as follows:

- The higher of the Type 1 or Type 2 RRS for hypothetical off-site residential exposures, which are considered protective of human health for those constituents regulated under HSRA (i.e., cobalt).

  The Type 2 RRS was used for cobalt, which is the lower of the calculated carcinogenic and non-carcinogenic values derived using the default exposure factors for residential receptors and the methodology found in Appendix III of the HSRA rule (EPD, 2018). Toxicity values for cobalt used for the Type 2 RRS calculations were identified in the Provisional Peer Reviewed Toxicity Value for Cobalt (USEPA, 2008). The risk-based Type 2 RRS were calculated using USEPA's RSL calculator (USEPA, 2023) assuming a target cancer risk of 1×10^{-5} and a target hazard quotient of 1, consistent with the Georgia EPD guidance (EPD, 2018). The calculations of the Type 2 RRS values for the SSL-related constituent (cobalt) are presented in **Appendix C**.

- If site-specific background concentrations are greater than the criteria described above, then the site-specific background concentration is used as the screening level in accordance with the CCR methodology for development of groundwater protection standards (USEPA, 2020). However, for this evaluation, background was not used as the relevant screening level.

Groundwater data collected from the well identified to have an SSL-related constituent were compared to residential screening criteria as a conservative measure for protection of hypothetical off-site receptors. Concentrations of cobalt in ARGWC-17 were compared to the higher of the HSRA Type 1 RRS, Type 2 RRS, and background values for groundwater pursuant to standard practice for risk assessment within the State of Georgia.

Table 1 presents the maximum detected concentration for the only SSL-related constituent (0.069 mg/L for cobalt), which was used to represent potential offsite groundwater quality for comparison to the selected screening level for hypothetical off-

site residential receptors of 0.006 mg/L. As noted in **Table 1**, cobalt was detected at concentrations that exceeded the screening level, was identified as a COPI, and thereby was retained for further evaluation in the refined risk evaluation.

4 REFINED RISK EVALUATION

A refined risk evaluation was conducted for the groundwater COPI (i.e., cobalt) that was detected at concentrations that exceeded the health-protective screening criterion. The refined risk evaluation identified EPCs for cobalt in groundwater for the purpose of characterizing potential risk to human receptors. If the EPC is greater than the respective screening level, then the constituent is identified as a constituent of interest (COI) with the potential for risk that warrants additional evaluation (e.g., performing a surface water evaluation). Although cobalt was not identified as a groundwater COI in the refined risk evaluation, cobalt was further evaluated in the downgradient surface water bodies as a conservative measure.

4.1 Refined Groundwater Risk Evaluation

Potential risk associated with exposure to cobalt by hypothetical off-site residential receptors was refined using the methodology described in the HSRA and VRP guidance (EPD, 2018; EPD, 2009) and is presented in the following section and on **Figure 7**.

For the refined risk evaluation, groundwater data from samples collected between 2016 and August 2023 from the on-site well that was identified to have an SSL-related constituent (ARGWC-17) and nearby and downgradient wells/piezometers that represent groundwater flow in the same hydraulically downgradient direction were used to evaluate hypothetical off-site residential exposure. The nearby and downgradient groundwater monitoring wells/piezometers included in the refined risk evaluation are depicted with yellow well labels on **Figure 2**. The following list used to assess hypothetical off-site residential exposure includes the one SSL-related constituent well along with the wells/piezometers nearby and downgradient of the well exhibiting an SSL:

ARGWC-17 (SSL)

ARAMW-4

ARGWC-16

ARGWC-18

ARGWC-7

Groundwater data used in the refined risk evaluation were collected from the uppermost aquifer and are considered to be representative of groundwater conditions at the site. The groundwater dataset used in the refined risk evaluation is presented in **Appendix B.**

4.1.1 Groundwater Exposure Point Calculation

The refined risk evaluation for cobalt includes the development of an EPC. The EPC is a conservative estimate of potential exposure to a receptor. The EPC is based on the 95 percent upper confidence limit of the arithmetic mean (UCL) and accounts for uncertainty and variability in the dataset (USEPA, 2002). Consistent with USEPA guidance for developing groundwater EPCs (USEPA, 2014), UCLs were calculated using USEPA ProUCL 5.2 software (ProUCL) (USEPA, 2022a) and user's guide (USEPA, 2022b). For the refined risk evaluation, the UCLs for cobalt were calculated using the following specific datasets:

- UCL for the individual well with an SSL-related constituent;
- UCL based on combined data from the well with an SSL-related constituent and other wells/piezometers in the general vicinity to include downgradient monitoring wells/piezometers that represent groundwater flow in the same hydraulically downgradient direction; and
- UCL based on the combined data from the farthest downgradient well(s) that are hydraulically downgradient of the well with an SSL-related constituent.

Other assumptions made in the calculations of the UCLs include:

- Primary samples (no duplicates) were used to calculate EPCs as duplicate samples were analyzed for quality assurance purposes.
- If the calculated UCL exceeded the maximum detected concentration or if enough samples were not available to calculate an UCL, then the maximum detected concentration was used as the EPC.

ProUCL software calculates multiple UCLs and provides a recommended UCL that was selected as the EPC. If there were multiple UCLs recommended by ProUCL, the maximum UCL value was selected. **Appendix D-1** provides a summary of the UCLs calculated using the methods described above, and **Appendix D-2** presents a figure showing the wells used in the calculation of the EPCs for cobalt. **Appendix D-3** provides the input and output files associated with the ProUCL software.

Table 2 summarizes the groundwater EPC selected for cobalt. This table shows the number of samples, the maximum detected concentration, the UCL recommended by ProUCL software, and the selected EPC.

4.1.2 COPI Concentration Trend Analysis

Concentration trends over time were evaluated as one line of evidence in the refined risk evaluation for cobalt. The Mann-Kendall trend test with an alpha value equal to 0.05 and the Theil-Sen line test were conducted on the data from ARGWC-17 for cobalt to evaluate the trends in concentrations over time. The tests were conducted using the USEPA ProUCL 5.2 software (USEPA, 2022a).

The Mann-Kendall and Theil-Sen test results are presented on a time series graph in **Appendix D-4** and indicated a statistically significant increasing trend in cobalt concentrations over time at ARGWC-17.

A trend analysis for cobalt was also evaluated for the wells/piezometers nearby and downgradient of ARGWC-17 (i.e., ARAMW-4, ARGWC-16, ARGWC-18, and ARGWC-7). The Mann-Kendall and Theil-Sen test results presented in **Appendix D-4** indicated a statistically significant decreasing trend in cobalt concentrations over time at ARAMW-4 and ARGWC-18. Although there is insufficient statistical evidence of a significant trend in cobalt concentrations at ARGWC-16 and ARGWC-7, cobalt has been non-detect during the most recent sampling events from August 2020 through August 2023 for ARGWC-16 and from April 2020 through August 2023 for ARGWC-7.

4.1.3 Refined Groundwater Risk Evaluation Results

Cobalt was identified as a groundwater COPI in the initial risk screening. In the refined risk evaluation, comparison of the calculated EPC to the screening level was used to identify whether cobalt is a COI that may pose a potential risk to hypothetical off-site residential receptors exposed through the use of groundwater as potable water. If the EPC from the farthest downgradient well(s) is greater than the respective screening level, then the constituent is identified as having the potential for risk that warrants additional evaluation (i.e., performing a surface water evaluation).

Cobalt was detected in 20 out of 20 groundwater samples in well ARGWC-17 at concentrations that exceeded the off-site groundwater screening level for residential receptors. For the refined risk evaluation, the following EPCs were calculated for cobalt using the monitoring wells/piezometers shown in **Appendices D-1** and **D-2**:

- Data from ARGWC-17 were combined to represent groundwater exposure for the well with an SSL-related constituent (EPC Step 1 in **Appendix D-1**).
- Data from ARGWC-17, the nearby piezometer ARAMW-4, and downgradient wells ARGWC-16, ARGWC-18, and ARGWC-7 were combined to represent

groundwater exposure in the same hydraulically downgradient direction (EPC Step 2 in **Appendix D-1**).

- Data from ARGWC-18 and ARGWC-7 were combined to represent groundwater exposure using the wells that are the farthest hydraulically downgradient of well ARGWC-17 (EPC Step 3 in **Appendix D-1**).

The UCLs for EPC Step 1 of 0.033 mg/L and EPC Step 2 of 0.0093 mg/L exceeded the screening level of 0.006 mg/L. The UCL for EPC Step 3 of 0.00089 mg/L is below the screening level of 0.006 mg/L.

Table 3 presents the results of the refined screening comparing the farthest hydraulically downgradient EPC (Step 3) to the screening criterion. Cobalt was not identified as a groundwater COI for hypothetical off-site residential receptors and is not expected to pose a risk to human health through off-site potable water use.

4.2 Surface Water Risk Evaluation

Although cobalt was not identified as a groundwater COI in the refined groundwater risk evaluation, a surface water screening evaluation was conducted for the downgradient surface water bodies (i.e., Beaverdam Creek Tributary, Beaverdam Creek, and the Ocmulgee River) for the SSL-related constituent, cobalt, as a conservative measure.

Both human and ecological receptors have the potential to come into contact with surface water. Routes of exposure include ingestion of aquatic organisms (mainly fish) and potential incidental ingestion and dermal contact with surface water by adult and child recreational receptors. Potential routes of exposure for ecological receptors include direct contact to surface water and ingestion by aquatic receptors.

The surface water screening process for cobalt is discussed below and presented in **Figure 8**.

4.2.1 Surface Water Data

Surface water data for cobalt included up to nine sampling events conducted between November 2020 and October 2023 at the below locations:

- Beaverdam Creek Tributary: BT-1.6 (background, located upstream of AP-3), BT-1.3, BT-1.2, BT-1.1, BT-1.0, and BC-0.8b.

- Beaverdam Creek: BC-0.8a (background, located upstream of confluence with Beaverdam Creek Tributary), BC-0.5.7, BC-0.5.6, BC-0.5.5, BC-BR, BC-0.3, and BC-0.1.

- Ocmulgee River: OR-0.8 (background, located upstream of the Site), OR-0.3, OR-0.1, OR+0.25, and OR+1.0.

The surface water sampling locations are shown in **Figure 9**. The surface water dataset used in the risk evaluation is presented in **Appendix B-2**.

4.2.2 Human Health Screening

Surface water human health screening values for the groundwater COI was selected from the following order of hierarchy:

- Georgia In-Stream Water Quality Criteria (ISWQC) for human health (EPD, 2022b), when available.

- National ambient water quality criteria (USEPA, 2015) for human health, ingestion of water and organisms. When there is no numerical value for a constituent in surface water, USEPA (2015) states that USEPA has issued an maximum contaminant level (MCL) which may be more stringent than the National Ambient Water Quality Criteria for these constituents suggesting the use of the MCL for surface water screening. This is a conservative approach.

- In accordance with standard practice using methodologies approved by the Georgia EPD, the higher of the residential groundwater screening levels described in Section 3.2.2 for the remaining constituents due to lack of human health surface water screening levels for these constituents, which is a conservative approach.

- If site-specific surface water background concentrations are greater than the criteria described above, then the site-specific surface water background concentration is used as the screening level. Background concentrations were less than the screening levels described above.

For cobalt, the higher of the residential groundwater screening levels described in Section 3.2 (the Type 2 RRS) was used because of the lack of human health surface water screening levels within the Georgia ISWQC (EPD, 2022b) or national ambient water quality criteria (USEPA, 2015). The use of drinking water screening levels for surface water exposure is a conservative approach as Beaverdam Creek and Tributary are not

used as a source of potable drinking water, and therefore, is an incomplete exposure pathway.

The surface water human health screening level (0.006 mg/L) was compared to the maximum detected concentrations for cobalt in surface water from four exposure units, as shown in **Table 4**. The maximum detected concentration of cobalt (0.013 mg/L) in Beaverdam Creek Tributary (adjacent to/immediately downstream of AP-3) exceeded the screening level of 0.006 mg/L. However, detections of cobalt in surface water samples at the remaining downstream exposure units, the farthest downstream location in Beaverdam Creek Tributary prior to the confluence with Beaverdam Creek (BC-0.8b), Beaverdam Creek, and the Ocmulgee River, were all below the screening criterion. Exceedances of the screening criterion are limited to on-site locations in Beaverdam Creek Tributary at BT-1.3, BT-1.2, and BT-1.1 adjacent to AP-3. Therefore, cobalt was identified as a human health COPI in surface water for Beaverdam Creek Tributary adjacent to AP-3. However, farther downstream, in Beaverdam Creek Tributary, Beaverdam Creek, and the off-site Ocmulgee River, cobalt was not retained as a human health COPI for further evaluation and is not expected to pose a risk to human health because cobalt concentrations have been delineated in on-site surface water to concentrations not exceeding health-protective screening criteria.

4.2.3 Ecological Screening

Surface water screening values for aquatic ecological receptors were selected from the following order of hierarchy for the COPIs:

- Chronic freshwater Georgia ISWQC (EPD, 2022b), when available.
- USEPA Region 4 chronic freshwater screening levels (USEPA, 2018).
- If site-specific surface water background concentrations were greater than the criteria described above, then the site-specific surface water background concentration is used as the screening level. Background concentrations were less than the screening levels described above.

Because cobalt does not have a chronic freshwater Georgia ISWQC for ecological receptors (EPD, 2022b), the USEPA Region 4 chronic freshwater screening level for total concentrations (USEPA, 2018) was used in the surface water ecological screening for aquatic ecological receptors.

The ecological surface water screening level (0.019 mg/L) was compared to the maximum detected concentrations of cobalt in surface water from four exposure units, as shown in **Table 5**. Cobalt was detected in surface water at concentrations below the ecological screening criterion in Beaverdam Creek Tributary (adjacent to/immediately downstream of AP-3 and prior to the confluence with Beaverdam Creek), Beaverdam Creek, and the Ocmulgee River. Therefore, cobalt was not retained as an ecological COPI in surface water for further evaluation and is not expected to pose a risk to ecological receptors.

4.2.4 Refined Groundwater Risk Evaluation Summary and Conclusions

Detections of cobalt at ARGWC-17 were reported at concentrations above the groundwater screening value and shown to have a statistically significant increasing trend. However, the results of the refined risk evaluation for groundwater indicate the following:

- Cobalt is not expected to pose a risk to hypothetical off-site residential receptors.

- All of the individual data points used to calculate the cobalt EPC to represent potential groundwater exposure for hypothetical off-site residential receptors based on the farthest hydraulically downgradient monitoring wells (ARGWC-18 and ARGWC-7) were less than the health-protective screening level.

- Statistically significant decreasing trends in cobalt concentrations have been observed at the farthest downgradient well ARGWC-18, as well as piezometer ARAMW-4. Although there is insufficient statistical evidence of a significant trend in cobalt concentrations at the two other downgradient wells (ARGWC-16 and ARGWC-7), cobalt has been non-detect during the most recent sampling events from August 2020 through August 2023 for ARGWC-16 and from April 2020 through August 2023 for ARGWC-7.

- Although cobalt was not identified as a groundwater COI for hypothetical off-site residential receptors, cobalt was evaluated further in the downstream surface water bodies (i.e., Beaverdam Creek Tributary, Beaverdam Creek, and the Ocmulgee River) for potential exposure to human and ecological receptors as a conservative measure.

- On-site Beaverdam Creek Tributary surface water concentrations of cobalt adjacent to AP-3 exceeded the health-protective surface water screening criteria for human receptors; however, cobalt concentrations at the remaining downstream

surface water locations in Beaverdam Creek Tributary and Beaverdam Creek were below health-protective surface water screening criteria for human and ecological receptors. Cobalt concentrations in off-site surface water in the Ocmulgee River were also below health-protective surface water screening criteria for human and ecological receptors. Although cobalt was identified as a human health COPI in on-site surface water adjacent to AP-3, cobalt was not retained as a COPI in downstream and off-site surface water. Therefore, a refined surface water risk evaluation was not necessary as cobalt is not expected to pose a risk to human health or ecological receptors.

- Cobalt concentrations in groundwater and surface water have been delineated on-site to concentrations not exceeding health-protective screening criteria for human and ecological receptors.

Based on the multiple lines of evidence, further risk evaluation for groundwater and surface water is not warranted. Compliance groundwater monitoring under the State CCR Rule will continue.

5 UNCERTAINTY ASSESSMENT

USEPA guidance stresses the importance of providing an analysis of uncertainties so that risk managers are better informed when evaluating risk assessment conclusions (USEPA, 1989). The uncertainty assessment provides a better understanding of the key uncertainties that are most likely to affect the risk assessment results and conclusions.

The potential uncertainties associated with the risk evaluation are as follows:

Health-Protective Screening Criteria Uncertainties:

- In accordance with risk standards and methodologies approved by the Georgia EPD, the Type 2 standard was selected for the residential screening criterion for cobalt. Selection of the screening criteria per standard practice for risk assessment within the State of Georgia is considered appropriate for risk quantification for AP-3. The Hazardous Site Response Act, Rule 391-3-19.07(1) notes that "*[a]ll risk reduction standards will, when implemented, provide adequate protection of human health and the environment.*"

- Screening criteria based on RRSs, including cobalt, represent the reasonable maximum exposure (RME). The RME is defined as "the highest exposure that is reasonably expected to occur at a site but that is still within the range of possible exposures" (USEPA, 1989). USEPA (1989) states that the "intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures." Potential receptors will likely have lower exposures than those presented in this risk evaluation (i.e., a majority of the site concentrations will be less than the UCL), and therefore, potential exposures are likely overestimated.

Exposure Uncertainties:

- The maximum detected concentration of the SSL-related constituent was compared to the conservative screening criterion to identify the COPI. Use of the maximum detected concentration is consistent with standard practice; however, use of the maximum detected concentration for exposure likely overestimates potential risk.

- The constituent included in the risk evaluation occurs naturally in the site geologic setting. Although background concentrations were evaluated and used in the screening process, contributions to exposure and risk were assumed to

be entirely CCR-related and natural background sources were not quantified. Thus, SSL-related exposures were likely overestimated.

- Hypothetical off-site residential exposure was evaluated using on-site groundwater data from wells around the perimeter and downgradient of AP-3. This comparison makes the conservative assumption that on-site groundwater may potentially migrate to off-site drinking water wells through advective transport in groundwater, but without any attenuation within the aquifer media through factors such as dilution, dispersion, or adsorption, overestimating potential exposure and risk to hypothetical off-site receptors. Concentrations above the screening criterion are not migrating off-site as wells located downgradient (ARGWC-18 and ARGWC-7) of the screening level exceedances for cobalt have concentrations less than the health-protective criterion.

- EPCs for metals in groundwater were assumed to be 100 percent bioavailable by ingestion and dermal contact. This assumption may tend to overestimate risk.

- Multiple well surveys (NewFields, 2020; Jacobs, 2022; Stantec, 2023) have been conducted and consisted of reviewing federal, state, and county records and online sources, in addition to conducting windshield surveys of the area. WSP relied on the data collected by Jacobs, NewFields, and Stantec.

  The evaluation used on-site groundwater data to represent hypothetical off-site exposure, which is a conservative approach that likely results in overestimation of assumed exposure and assumed potential risk. The closest private wells to AP-3 are south of the site and Beaverdam Creek, which represents a localized discharge boundary for groundwater flow in the upper aquifer from the area. According to the 2021 supply well survey (Jacobs, 2022), no surface water intakes have been identified for public water supplies within three miles downgradient of the site. Although off-site potable wells identified in the well survey were not included in the risk evaluation, the presence of these wells do not appear to change the conclusions of the risk evaluation because concentrations of COPIs in groundwater and surface water have been delineated on-site to concentrations not exceeding health-protective screening criteria for human and ecological receptors.

Toxicity Uncertainties:

- Toxicity factors used to calculate health-protective criteria are established at conservative levels to account for uncertainties and often result in criteria that are many times lower than the levels observed to cause effects in human or animal studies. Therefore, a screening level exceedance does not necessarily equate to an adverse effect.

6 CONCLUSIONS

This human health and ecological risk evaluation for the SSL-related constituent in groundwater at the site, along with a surface water risk evaluation for the downgradient surface water bodies, was conducted using methods consistent with Georgia EPD and USEPA guidance and included multiple conservative assumptions. Based on this evaluation, cobalt is not expected to pose a risk to human health or the environment.

Accordingly, no further risk evaluation for groundwater or surface water is warranted. Compliance groundwater monitoring for AP-3 under the State CCR Rule will continue. Georgia Power will proactively evaluate the data and update this evaluation, if necessary.

7 REFERENCES

Bibb County, 2023. Bibb County Zoning Map and LDGS Total Points. Bibb County Community Development. Located at https://Bibbmaps.maps.arcgis.com/apps/webappviewer/index.html?id=a1aa357d5c50483a817bf14b54df65ba

EPD, 2009. Georgia Voluntary Remediation Act, OCGA 12-8-100, June 1, 2009.

EPD, 2018. Hazardous Site Response Act, Georgia Department of Natural Resources, Environmental Protection Division, Chapter 391-3-19-0.07. Revised September 25, 2018.

EPD, 2022a. Coal Combustion Residuals, 391-3-4-.10, amended March 22, 2022; effective April 11, 2022.

EPD, 2022b. Water Use Classification and Water Quality Standards, 391-3-6-.03, effective February 27, 2022. Georgia Instream Water Quality Criteria. Available at:https://epd.georgia.gov/watershed-protection-branch/georgia-water-quality-standards

Jacobs, 2018a. CCR Unit Permit Application Part A, Former Plant Arkwright – AP-3 Landfill and Monofill. November 2018.

Jacobs, 2018b. CCR Unit Permit Application Part B, Former Plant Arkwright – AP-3 Landfill and Monofill. November 2018.

Jacobs, 2022. New CCR Landfill Site Acceptability Report – Final Report, Former Plant Arkwright. March 31, 2022.

Jones County, 2007. Joint Comprehensive Plan for Jones County and City of Gray. June 2007. Available at https://www.dca.ga.gov/sites/default/files/jones_county_comp_plan_update_cag_2007_0.pdf

NewFields, 2020. Plant Arkwright Well Survey, Ash Pond No. 2 Dry Ash Stock Pile and AP-3 Landfill and Monofill. March 2020.

Stantec, 2023a. 2023 Annual Groundwater Monitoring and Corrective Action Report. Georgia Power Company – Plant Arkwright, Ash Pond 3 and Monofill. July 2023.

Stantec, 2023b. Appendix B Updated Area Well Survey in Semi-Annual Remedy Selection and Design Process Report. Plant Arkwright, Ash Pond 3 Landfill and Monofill. February 28, 2023.

USEPA, 1989. Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A). EPA/540/1-89/002.

USEPA, 2002. Supplemental Guidance to Risk Assessment for Superfund:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Publication Number 9285 .6-10. Office of Solid Waste and Emergency Response. December 2002.

USEPA, 2008. Provisional Peer Reviewed Toxicity Values for Cobalt. EPA/690/R-08/008F. August 25, 2008. Available at https://cfpub.epa.gov/ncea/pprtv/documents/Cobalt.pdf

USEPA, 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Resource Conservation and Recovery – Program Implementation and Information Division. March 2009.

USEPA, 2014. Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance. OSWER Directive 9283.1-42, February. Available at: https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917

USEPA, 2015. National Ambient Water Quality Criteria, June. Available at: https://www.epa.gov/wqc/2015-epa-updated-ambient-water-quality-criteria-protection-human-health

USEPA, 2018. Region 4 Ecological Risk Assessment Supplemental Guidance, March. Available at: https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance

USEPA, 2022a. Statistical Software ProUCL 5.2.00 for Environmental Applications for Data Sets with and without Nondetect Observations, last updated June 14, 2022.

USEPA, 2022b. ProUCL Version 5.2 User Guide. Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, Office of Research and Development, EPA/600/R-07/041, June 14, 2022.

USEPA, 2020. Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 40 CFR Part 257. Effective Date October 14, 2015. Last amended August 28, 2020 with a final Effective Date of September 28, 2020.

USEPA, 2023. USEPA Regional Screening Levels. Revised May 2023. Available at: www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

TABLES

Table 1
SSL-Related Constituent Groundwater Screening
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

CCR Rule Designation	Constituent	CAS No.	Detection Frequency[1]	Exceedance Frequency[2]	Maximum Concentration (mg/L)	Screening Level (mg/L)	Source	Site-Specific Background (mg/L)	COPI? (Y/N)	Rationale[3]
Appendix IV	Cobalt	7440-48-4	20 / 20	20 / 20	0.069	0.0060	Type 2 RRS[4]	0.0058	Y	ASL

Notes:
[1] September 2016 to August 2023 data for monitoring well ARGWC-17 (cobalt).
[2] Exceedance frequency is for the specific constituent that exceeds the first screening value in the hierarchy of screening values.
[3] Rationale for classification or exclusion of constituent as a COPI:
ASL = Above respective screening level
BSL = Below respective screening level
[4] The Type 2 RRSs and site-specific screening levels are calculated by the EPA RSL calculator with exposure factors inputs from HSRA Appendix III, Table 3.

Definitions:
CAS = Chemical Abstract Service
CCR = Coal Combustion Residuals
COPI = Constituent of Potential Interest
EPA = United States Environmental Protection Agency
RRS = Risk Reduction Standard

Prepared by/Date: LO 10/18/23
Checked by/Date: IMR 10/20/23

Table 2
Groundwater Exposure Point Concentration Summary
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Exposure Unit	CCR Rule Designation	Constituent	CAS No.	Detection Frequency	Maximum Concentration (mg/L)	95% UCL (mg/L)	Recommended UCL Method	Selected EPC[1] (mg/L)
AP-3	Appendix IV	Cobalt	7440-48-4	22 / 40	0.0021	0.00089	95% KM(t) UCL	0.00089

Notes:

[1] EPCs calculated in accordance with USEPA, 2014. Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance. OSWER Directive 9283.1-42, February 2014. Located at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917. For further detail on the selected EPC, refer to Appendix D.

Definitions:

CAS = Chemical Abstract Service
CCR = Coal Combustion Residuals
mg/L = milligrams per liter
95% UCL = 95 percent upper confidence limit
EPC = Exposure Point Concentration

Prepared by/Date: LO 10/20/23
Checked by/Date: IMR 10/20/23

Table 3
Downgradient Groundwater Refined Screening
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Exposure Unit	CCR Rule Designation	Constituent	CAS No.	Detection Frequency	Exceedance Frequency[1]	Selected EPC[2] (mg/L)	Screening Level (mg/L)	Source	Site-Specific Background (mg/L)	COI? (Y/N)	Rationale[3]
AP-3	Appendix IV	Cobalt	7440-48-4	22 / 40	0 / 40	0.00089	0.0060	Type 2 RRS[4]	0.0058	N	BSL

Notes:

[1] The exceedance frequency is based on the number of samples with detected concentrations that exceed the identified screening level.

[2] EPCs calculated in accordance with USEPA, 2014. Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance. OSWER Directive 9283.1-42, February 2014. Located at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917.
For further detail on the selected EPC, refer to Appendix D.

[3] Rationale for classification of constituent as a COI or exclusion as a COI:

ASL = Above respective screening level
BSL = Below respective screening level
ND = Not detected (maximum practical quantitation limit [PQL])

[4] The Type 2 RRSs are calculated by the EPA RSL calculator with exposure factors inputs from HSRA Appendix III, Table 3.

Definitions:

CAS = Chemical Abstract Service
CCR = Coal Combustion Residuals
COI = Constituent of Interest
mg/L = milligrams per liter
EPC = Exposure Point Concentration

Prepared by/Date: LO 10/20/23
Checked by/Date: IMR 10/20/23

Table 4
Human Health Surface Water Screening - Beaverdam Creek and Tributary and Ocmulgee River[1]
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

CCR Rule Designation	Constituents	CAS No.	Exposure Unit	Sample Locations	Detection Frequency	Exceedance Frequency[2]	Maximum Concentration (mg/L)	Screening Level (mg/L)	Source[3, 4]	Site-Specific Background (mg/L)[5]	COPI? (Y/N)	Rationale[6]
Appendix IV	Cobalt	7440-48-4	Beaverdam Creek Tributary Adjacent to/Immediately Downstream of AP-3	BT-1.3, BT-1.2, BT-1.1, BT-1.0	16 / 21	9 / 21	0.013	0.0060	Type 2 RRS	0.00040 J	Y	ASL
			Beaverdam Creek Tributary (Prior to confluence with Beaverdam Creek)	BC-0.8b	1 / 4	0 / 4	0.00044 J	0.0060	Type 2 RRS	0.00040 J	N	BSL
			Beaverdam Creek	BC-0.5.7, BC-0.5.6, BC-0.5.5, BC-BR, BC-0.3, and BC-0.1	19 / 37	0 / 37	0.0008 J	0.0060	Type 2 RRS	0.00057 J	N	BSL
			Ocmulgee River	OR-0.3, OR-0.1, OR+0.25, OR+1.0	4 / 13	0 / 13	0.00018 J	0.0060	Type 2 RRS	< 0.00039	N	BSL

Notes:
[1] Surface water evaluation includes data collected from November 2020 to October 2023 from the locations presented in Figure 9.
[2] Exceedance frequency is for the specific constituent that exceeds the first screening value in the hierarchy of screening values
- The hierarchy of screening values is GA ISWQC > NRWQC > Selected residential groundwater screening level if no surface water screening level available
- For sites with site-specific background concentrations greater than all applicable screening values, the site-specific background value was used as the screening value

[3] The Type 2 RRS was calculated by the EPA RSL calculator using residential exposure factor inputs from HSRA Appendix III, Table 3.
[4] This residential groundwater screening level was used because no human health surface water screening level was available. The use of drinking water screening levels for surface water exposure is a conservative approach as domestic use of Beaverdam Creek or Beaverdam Creek Tributary surface water for human receptors is an incomplete exposure pathway
[5] The following surface water sample locations represent the site-specific background (maximum or maximum detection limit) for the respective surface water bodies.
Beaverdam Creek Tributary: BT-1.6 (located upstream of AP-3)
Beaverdam Creek: BC-0.8a (located upstream of AP-2 and the confluence of Beaverdam Creek Tributary and Beaverdam Creek)
Ocmulgee River: OR-0.8 (located upstream of AP-1 and Plant Arkwright)
[6] Rationale for classification of constituent as a COPI or exclusion as a COPI
ASL = Above respective screening level
BSL = Below respective screening level

Definitions:
CAS = Chemical Abstract Service
CCR = Coal Combustion Residuals
COPI = Constituent of Potential Interest
EPA = United States Environmental Protection Agency
GA ISWQC = Georgia Instream Water Quality Criteria
NRWQC = National Recommended Water Quality Criteria
RRS = Risk Reduction Standard
mg/L = milligrams per Liter

Prepared by/Date: LO 11/20/23
Checked by/Date: IMR 11/20/23

Table 5
Ecological Fresh Surface Water Screening - Beaverdam Creek and Tributary and Ocmulgee River[1]
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

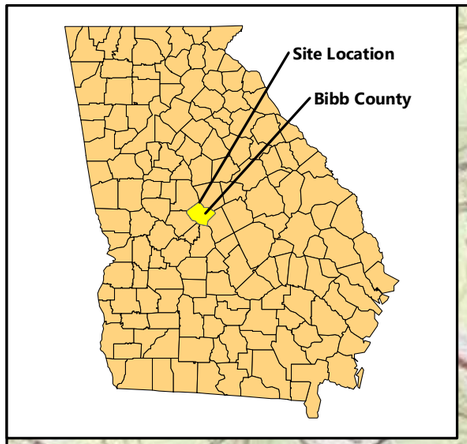
CCR Rule Designation	Constituents	CAS No.	Exposure Unit	Sample Locations	Detection Frequency	Exceedance Frequency[2]	Maximum Concentration (mg/L)	Screening Value (mg/L) (Total)	Hardness Dependent? (Y/N)	Source	Site-Specific Background (mg/L)[3]	COPI? (Y/N)	Rationale[4]
Appendix IV	Cobalt	7440-48-4	Beaverdam Creek Tributary Adjacent to/Immediately Downstream of AP-3	BT-1.3, BT-1.2, BT-1.1, BT-1.0	16 / 21	0 / 21	0.013	0.019	N	EPA Reg. 4	0.00040 J	N	BSL
			Beaverdam Creek Tributary (Prior to confluence with Beaverdam Creek)	BC-0.8b	1 / 4	0 / 4	0.00044 J	0.019	N	EPA Reg. 4	0.00040 J	N	BSL
			Beaverdam Creek	BC-0.5.7, BC-0.5.6, BC-0.5.5, BC-BR, BC-0.3, and BC-0.1	19 / 37	0 / 37	0.0008 J	0.019	N	EPA Reg. 4	0.00057 J	N	BSL
			Ocmulgee River	OR-0.3, OR-0.1, OR+0.25, OR+1.0	4 / 13	0 / 13	0.00018 J	0.019	N	EPA Reg. 4	< 0.00039	N	BSL

Notes:
[1] Surface water evaluation includes data collected from November 2020 to October 2023 from the locations presented in Figure 9.
[2] Exceedance frequency is for the specific constituent that exceeds the first screening value in the hierarchy of screening values
- The hierarchy of screening value sources is GA ISWQC > EPA Region 4
- For sites with site-specific background concentrations greater than all applicable screening values, the site-specific background value will be used as the screening valu
[3] The following surface water sample locations represent the site-specific background (maximum or non-detect) for the respective surface water bodies.
Beaverdam Creek Tributary: BT-1.6 (located upstream of AP-3)
Beaverdam Creek: BC-0.8a (located upstream of AP-2 and the confluence of Beaverdam Creek Tributary and Beaverdam Creek)
Ocmulgee River: OR-0.8 (located upstream of AP-1 and Plant Arkwright)
[4] Rationale for classification of constituent as a COPI or exclusion as a COPI
ASL = Above respective screening level;
BSL = Equal to or below respective screening level.

Definitions:
J = Estimated value less than the reporting limit but greater than the method detection limit
CAS = Chemical Abstract Service
CCR = Coal Combustion Residuals
COPI = Constituent of Potential Concern
EPA = United States Environmental Protection Agency
GA ISWQC = Georgia Instream Water Quality Criteria

Prepared by/Date: LO 11/20/23
Checked by/Date: IMR 11/20/23

FIGURES



N

0 1,000 2,000 Feet

Monofill

AP-3

Arkwright

Power Plant

INTERCHANGE 56

INTERCHANGE 55

Pumping Sta

WT

Substa

Sewage Disposal Pond

BR 369

SHERATON

ARKWRIGHT

DRIVE

BM 338

BM 321

Legend

- Approximate Limits of Waste
- Approximate Property Boundary

Former Plant Arkwright AP-3
Site Location

Prepared By-Date: JRM - 11/1/2023	
Checked By-Date: LO - 11/1/2023	
Project Number:	

wsp

Figure: 1

N

0 100 200 400 Feet

ARGWA-12
ARGWA-24
ARGWA-5
ARGWA-3
ARGWA-14
ARGWA-13
AP-3
Monofill
ARAMW-4
ARGWC-15
ARGWC-10
ARGWC-17
ARGWC-16
ARGWC-9
ARAMW-3
ARGWC-8
ARGWC-18
ARAMW-6
ARGWC-7

Legend

- Piezometer Installed November 2019
- Groundwater Monitoring Network Well
- Approximate Limits of Waste
- Approximate Property Boundary
- Surface Water Feature
- ARGWC-18 Downgradient Well Used in Risk Evaluation
- ARGWC-17 Well with SSL

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Former Plant Arkwright AP-3
Site Layout and Monitoring Well Network

Prepared By-Date: JRM - 11/2/2023	wsp	Figure: 2
Checked By-Date: LO - 11/2/2023		
Project Number:		

Note:
- Groundwater elevation and contour data source: Stantec, 2023. 2023 Annual Groundwater Monitoring and Corrective Action Report – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, July 31, 2023.

N

0 100 200 400 Feet

ARGWA-12 358.01
ARGWA-24 353.85
ARGWA-5 353.5
ARGWA-3 353.39
ARGWA-13 347.97
ARGWA-14 346.2
ARGWC-10 349.74
ARGWC-9 346.57
ARAMW-4 346.84
ARGWC-15 346.65
ARGWC-17 346.87
ARGWC-16 344.99
ARAMW-3 330.68
ARGWC-8 330.25
ARAMW-6 324.77
ARGWC-18 326.92
ARGWC-7 329.44

AP-3
Monofill

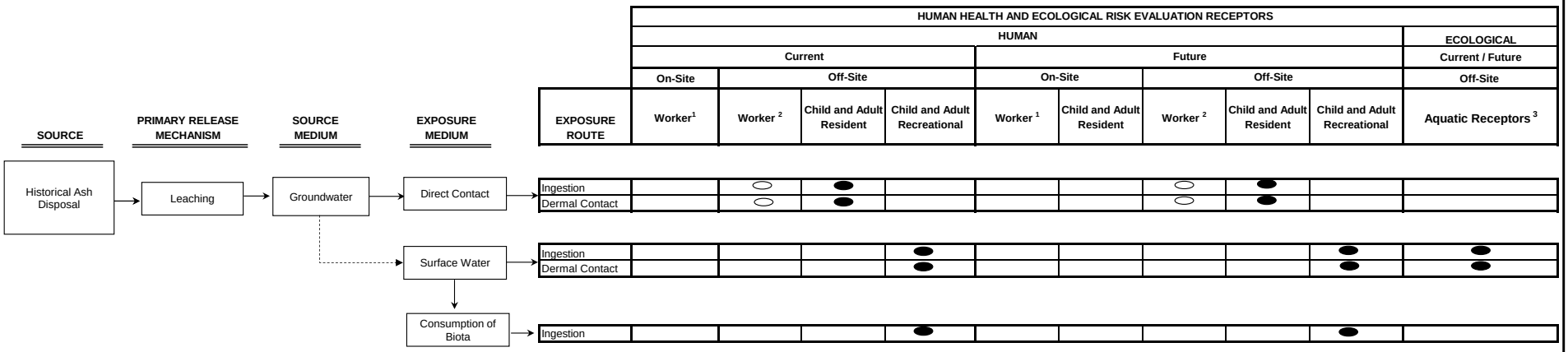
356 354 352 350 348 346 344 342 340 338 336 334 332 330 328 326

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

358.01 Groundwater Elevation (ft asml)
Piezometer Installed November 2019
Groundwater Monitoring Network Well
Approximate Limits of Waste
Approximate Property Boundary
Groundwater Elevation Contour (ft)
Approximate Groundwater Flow Direction
Surface Water Feature

Former Plant Arkwright AP-3
Potentiometric Surface Elevation Contours (January 2023)

Prepared By-Date: JRM - 11/2/2023	wsp	**Figure: 3**
Checked By-Date: LO - 11/2/2023		
Project Number:		



Legend

A conservative assumption for this assessment was made that groundwater from the site flows to the downgradien t surface water.

Indicates potentially complete pathway, which is evaluated quantitatively.

Indicates potentially complete pathway, which is evaluated qualitatively.

Footnotes

1. Industrial worker was considered incomplete because there are no wells on-site that are classified for use as potable wells. On-site construction workers would be expected to have little to no direct contact with on-site groundwater due to safety procedures outlined in their site-specific health and safety plans.
2. Off-site industrial/construction worker addressed through the evaluation of hypothetical off-site residential receptors as health-protective screening levels for residential receptors would be more conservative than industrial and construction worker screening levels.
3. Generalized receptor for ecological health risk evaluation.

Former Plant Arkwright AP-3
Conceptual Exposure Model

Figure 4

Project Number

Prepared by/Date: LO 11/21/23
Checked by/Date: XXXXXXXXX

- Inactive Industrial Well
- Inactive Private Drinking Well
- Industrial Well
- Monitoring Well
- Private Drinking Well
- Potential Private Drinking Well
- Approximate Limits of Waste
- Approximate Property Boundary
- Surface Water Feature

Source:
- NewFields, 2020. Plant Arkwright Well Survey, Ash Pond No. 2 Dry Ash Stock Pile and AP-3 Landfill and Monofill. March 2020.
- Jacobs, 2022. New CCR Landfill Site Acceptability Report – Final Report, Former Plant Arkwright. March 31, 2022.
- Stantec, 2023. Appendix B Updated Area Well Survey in Semi-Annual Remedy Selection and Design Process Report. Plant Arkwright, Ash Pond 3 Landfill and Monofill. February 28, 2023.

JONES
Monofill
Ash Pond 3
Beaverdam Creek
MONROE
BIBB
Ocmulgee River

N

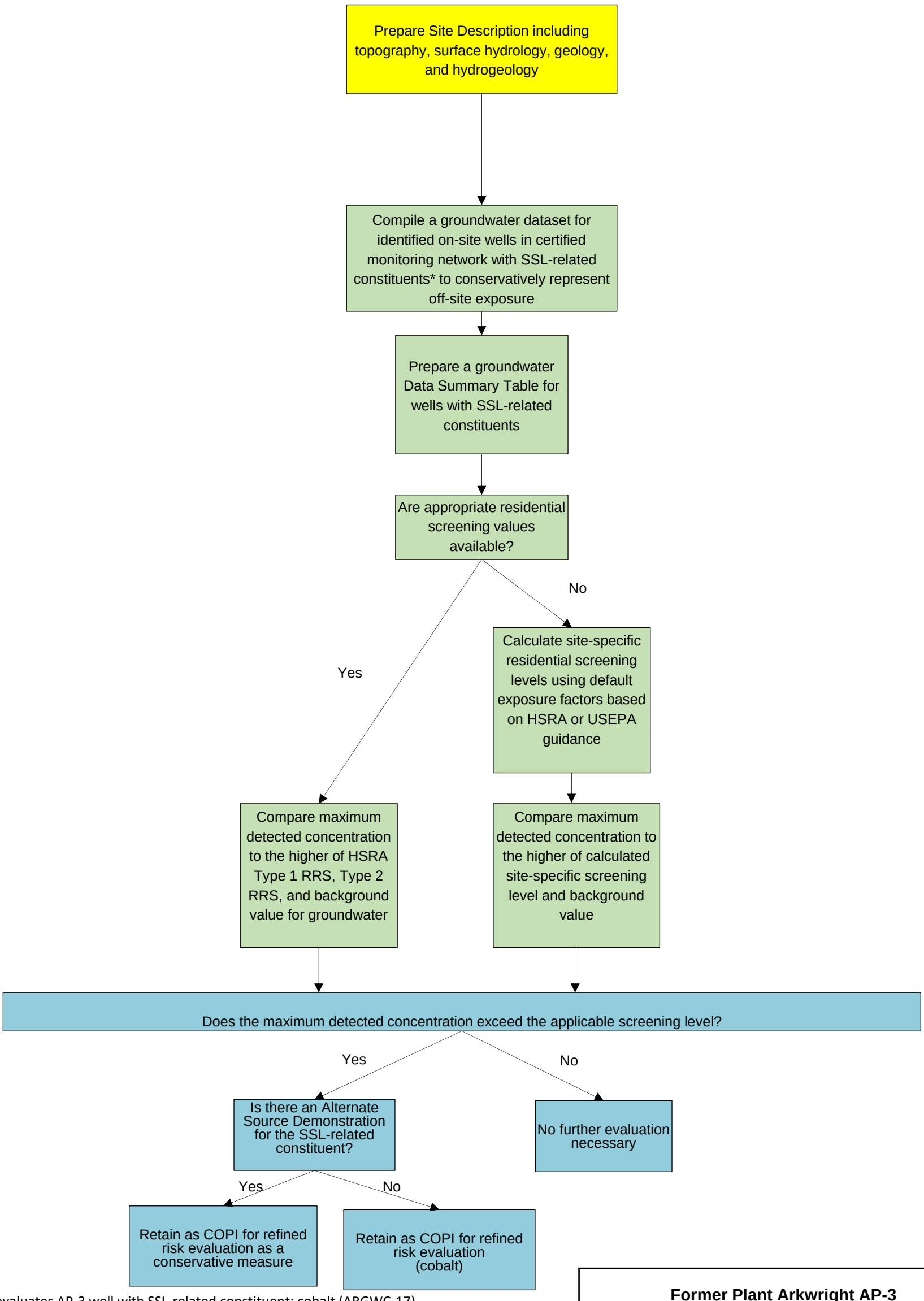
0 0.5 1 2 Miles

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Former Plant Arkwright AP-3
Well Survey Results

Prepared By-Date: JRM - 12/1/2023	wsp	Figure: 5
Checked By-Date: LO - 12/1/2023		
Project Number:		

Risk Screening Approach (Groundwater) for AP-3



Notes:
* Initial screen evaluates AP-3 well with SSL-related constituent: cobalt (ARGWC-17)
SSL = Statistically Significant Level
COPI = Constituent of Potential Interest
HSRA = Hazardous Site Response Act
RRS = Risk Reduction Standard
USEPA = United States Environmental Protection Agency

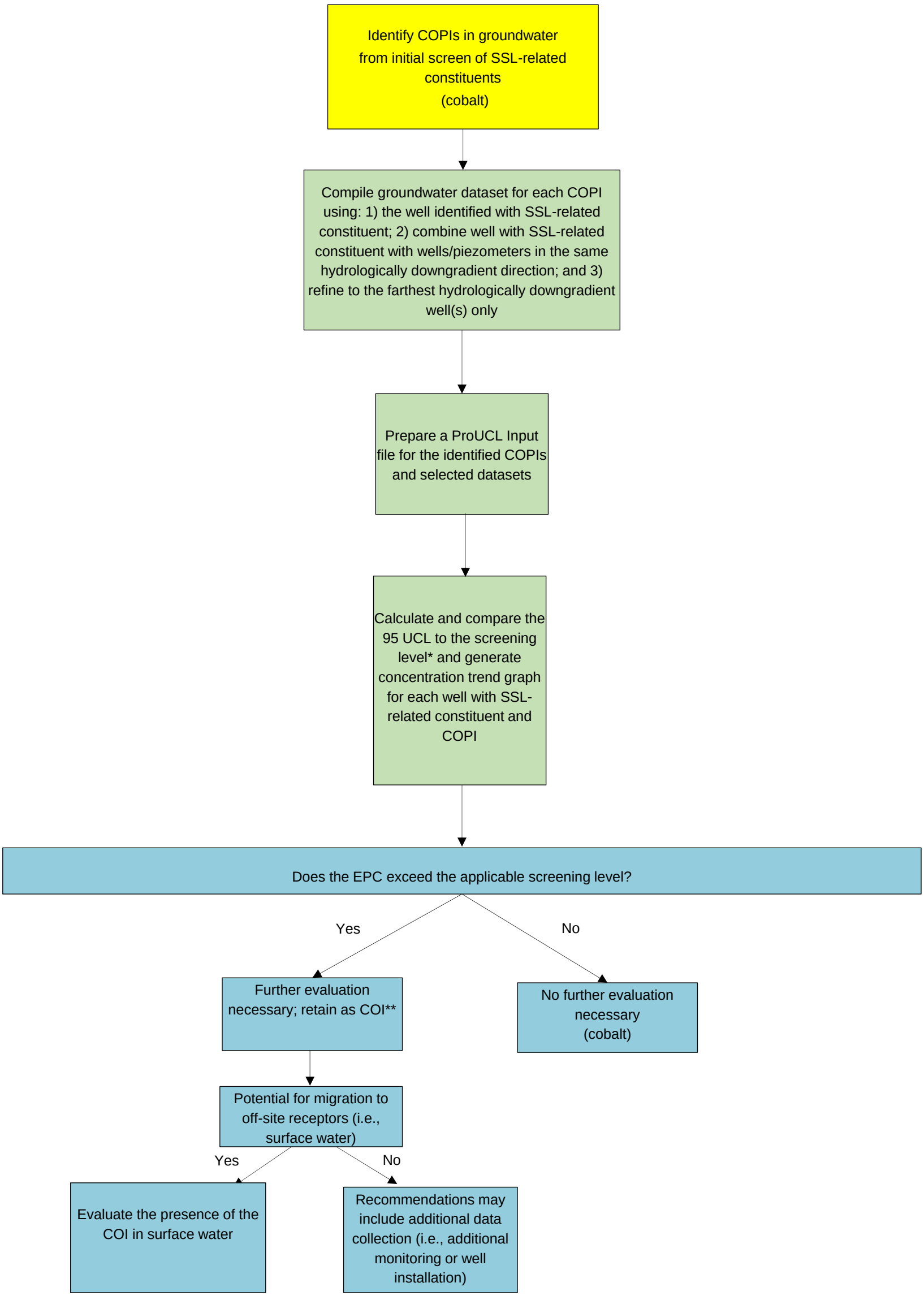
Former Plant Arkwright AP-3
Groundwater Risk Screening Approach

Figure 6

Project Number

Prepared by/Date: IMR 10/31/23
Checked by/Date: NSR 11/01/23

Approach for Refined Risk Evaluation (Groundwater) for AP-3



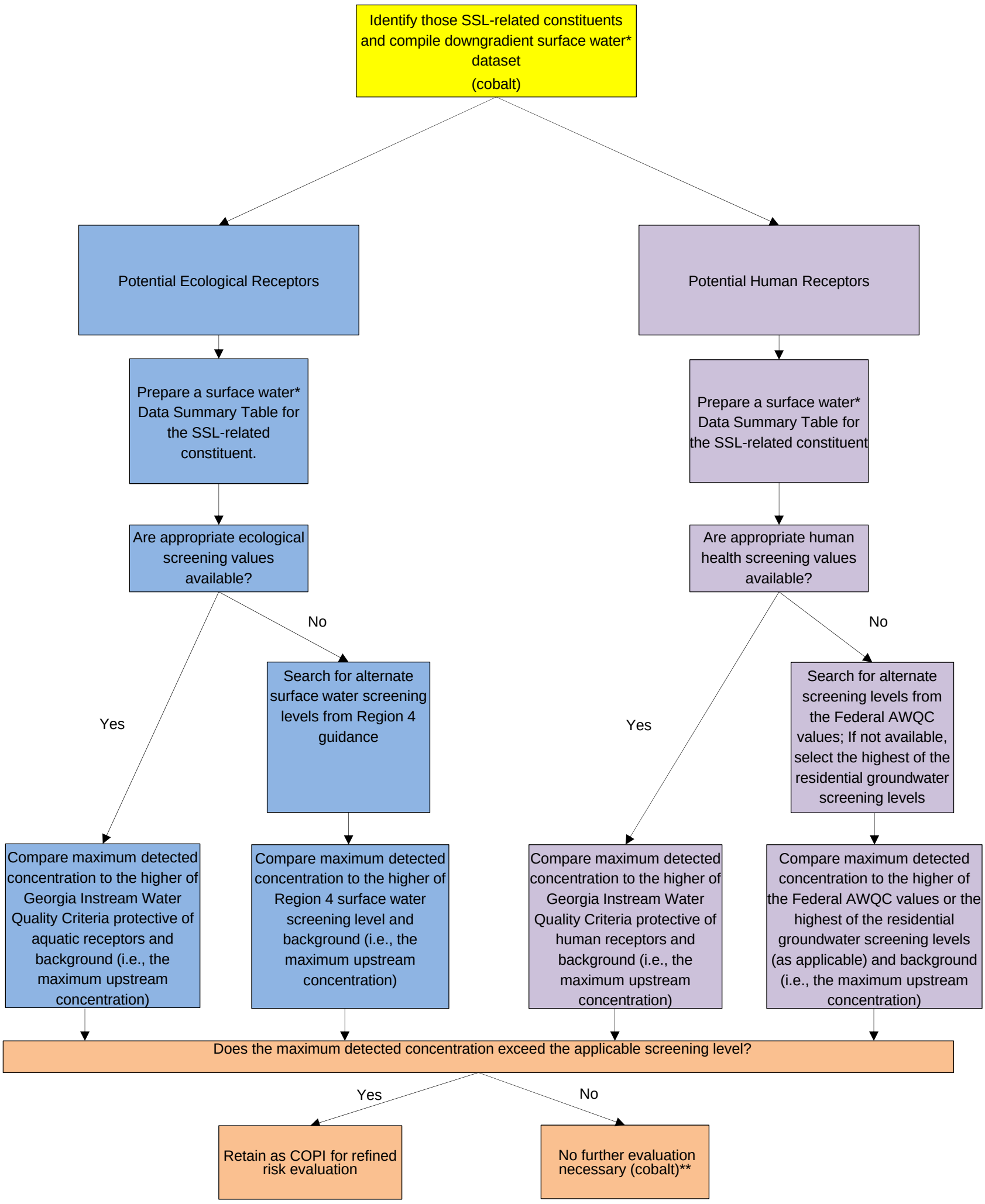
Notes:
*If the 95 UCL exceeds the maximum concentration, use the maximum as the EPC.
**This step is not necessary for Former Plant Arkwright AP-3.
SSL = Statistically Significant Level
COPI = Constituent of Potential Interest
EPC = Exposure Point Concentration
UCL = Upper Confidence Limit
COI = Constituent of Interest

Former Plant Arkwright AP-3
Approach for Refined Groundwater Risk Evaluation

Figure 7

Project Number	Prepared by/Date: IMR 10/31/23 Checked by/Date: NSR 11/01/23

Risk Screening Approach (Surface Water) for AP-3



* Surface water data evaluated as four exposure units: Beaverdam Creek Tributary (adjacent to/immediately downstream of AP-3), Beaverdam Creek Tributary (prior to confluence with Beaverdam Creek), Beaverdam Creek, and the Ocmulgee River (off-site).

** Although cobalt was identified as a human health COPI in on-site surface water in Beaverdam Creek Tributary adjacent to AP-3, cobalt was not retained as a COPI in downstream and off-site surface water. Therefore, a refined surface water risk evaluation was not necessary.

SSL = Statistically Significant Level
AWQC = Ambient Water Quality Criteria
COI = Constituent of Interest
COPI = Constituent of Potential Interest

Former Plant Arkwright AP-3
Surface Water Risk Screening Approach

Figure 8

Project Number

Prepared by/Date: LO 11/21/23
Checked by/Date: NSR 11/30/23

Surface water sampling locations provided by Southern Company Services.

N

0 500 1,000 2,000 Feet

BT-1.6
BT-1.3
Monofill
BT-1.2
BT-1.1
Ash Pond 3
BT-1.0
OR-0.8
Beaverdam Creek
BC-0.8a
BC-0.8b
Ash Pond 2
BC-0.5.7
BC-0.5.6
BC-0.5.5
BC-BR
OR-0.3
BC-0.3
OR-0.1
BC-0.1
OR+0.25
Ocmulgee River
OR+1.0

Legend

- Background Surface Water Sample Location
- Surface Water Sample Location
- Approximate Limits of Waste
- Approximate Property Boundary
- Streams

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Former Plant Arkwright AP-3
Surface Water Sample Locations

Prepared By-Date: JRM - 12/1/2023	wsp	Figure: 9
Checked By-Date: LO - 12/1/2023		
Project Number:		

APPENDIX A

Plant Arkwright Well Survey

Well Survey

Plant Arkwright

Ash Pond No. 2 Dry Ash Stock Pile and AP-3 Landfill and Monofill

Macon, GA

Prepared for

Georgia Power Company

241 Ralph McGill Blvd., Atlanta, GA 30308

Prepared by

NewFields

1349 W. Peachtree Street, Suite 2000

Atlanta, GA 30309

March 5, 2020

Introduction

Plant Arkwright is located along the Ocmulgee River approximately six miles northwest of Macon, Ga. Plant Arkwright ceased electricity generation in 2002.

Newfields conducted a well survey of potential drinking water wells within a three-mile radius of the two CCR Units at Plant Arkwright: Ash Pond No. 2 Dry Ash Stock Pile (AP-2DAS) and AP-3 Landfill and Monofill (AP-3 Landfill). Both units received a closure certificate in 2010. This radius is referred to in this report as the Investigated Area, and is shown on Figure 1.

As part of this survey, NewFields accessed and reviewed information from a number of Federal, State, and County records and online sources, as well as a windshield survey of the Investigated Area. Information from each identified well was then compiled into a geographic information system (GIS) database.

Information Collection

This section summarizes the sources utilized for identifying potential drinking water wells within the Investigated Area.

1. Federal Sources
    a. **United States Geological Survey (USGS).** USGS maintains an inventory database of wells sampled by a USGS-affiliated program for ground-water levels and/or water quality parameters at any time in the past.[1] Well information and coordinates were downloaded for the state of Georgia and compiled into the GIS database. The wells in the Investigated Area in the USGS database included several that are labelled 'monitoring wells' and one labelled 'private drinking'. Many of the monitoring wells appear to be co-located with drinking water wells and may in fact be private drinking water wells utilized for monitoring purposes by USGS. Some listings in this database are over 50 years old and may be inactive.

    b. **Safe Drinking Water Information System (SDWIS).** This EPA database has listings of public water systems but does not have well location information. SDWIS information was used to help identify the suppliers of public water in the vicinity of the facility. Public water in the Investigated Area is supplied primarily by the Macon Water Authority. Monroe and Jones counties have much smaller municipal water systems.

2. State Sources
    a. **Georgia Environmental Protection Division**
        i. **Drinking Water Branch.** EPD maintains records about municipal and industrial wells, whose presence or absence within a radius of a site can be ascertained by contacting the agency. An email was sent to Michael Gillis of EPD on October 21st, 2019 requesting information about wells in the Investigated Area. Mr. Gillis confirmed that there are no public wells in the Investigated Area.

[1] http://waterdata.usgs.gov/ga/nwis/inventory?introduction

ii. **Hazardous Site Inventory (HSI) files.** EPD maintains the Hazardous Site Inventory files for sites which are undergoing state-led corrective action. These files usually contain groundwater data and well surveys. There are no HSI sites within the Investigated Area.

iii. **Hazardous Site Response Act (HSRA) notifications.** EPD maintains non-HSI HSRA notification reports (i.e., notifications submitted after releases of reportable substances). NewFields reviewed reports associated with sites Bibb, Jones, and Monroe Counties and identified a previous well survey conducted in 2003. The survey identified a public well at what is now the Brickyard Golf Course (approximately 2.25 miles to the northwest of AP-2DAS and AP-3 Landfill) that was active in 2003. NewFields determined that well is now inactive based on the results of the EPD search. The 2003 well survey also identified both active and inactive private wells, active industrial wells on the other side of Arkwright Road to the north of AP-2DAS and AP-3 Landfill, and an inactive industrial well at the former Stewart McElreath Lumber property. These were added to the database as inactive public or industrial wells.

b. **Agricultural and Environmental Services Laboratory (AESL) records.** The University of Georgia's AESL Laboratory tests drinking water samples submitted by private individuals to their local county extension service. Maps of these sampling results can be viewed online.[2] Precise coordinates are not available, but NewFields was able to use online images to find approximate locations. For many of these points, the well appears to be located in the roadway and could not be placed on a real estate parcel.

c. **State Department of Public Health (DPH).** During July 2012 and January 2013, the Department of Public Health, DPH tested 64 wells in Monroe County as part of an assessment of uranium and radionuclides in the area. Street addresses of the wells sampled were obtained from the DPH with an Open Records Request.

3. County and Local Sources
   a. **Health Department Records.** The Macon-Bibb County Health Department County maintains records of known private wells within the County. NewFields provided the Health Department the coordinates of the plant and requested a search of a three-mile radius. The Health Department responded with a list of known private drinking water wells. NewFields also contacted the Monroe County Health Department to search septic permits, which typically indicate the water source for each property. Monroe County would not grant NewFields access to the septic permits.

[2] http://aesl.ces.uga.edu/water/map/

b. **Water Departments.** NewFields contacted the Macon Water Authority, which provided a shapefile of waterlines within Bibb County, including the dates of construction. Waterlines began to be constructed as far back as 1922, with most of the lines in the Investigated Area constructed in the 1970s. NewFields also contacted the Monroe County Water System, who indicated that their public water infrastructure does not extend into the Monroe County portion of the Investigated Area. Jones County Water stated that the River North area of the county, the neighborhood across the Ocmulgee River from Plant Arkwright, has public water.

c. **Tax Assessor Records.** NewFields contacted the Middle Georgia Regional Commission and obtained parcel shapefiles and parcel improvement data dated January 2019 for Monroe County. The parcel data for Monroe County includes information about the water source for each parcel, and the majority of parcels in the Monroe County portion of the Investigated Area are identified as having a private well.

   Parcel shapefiles and parcel improvement data from Bibb County, current as of July 2019, were available for download from the Internet. Parcel shapes for Jones County were downloaded from the county website. Due to the high cost and relatively small number of relevant parcels, the parcel improvement data for Jones County was not acquired.

4. Windshield Surveys

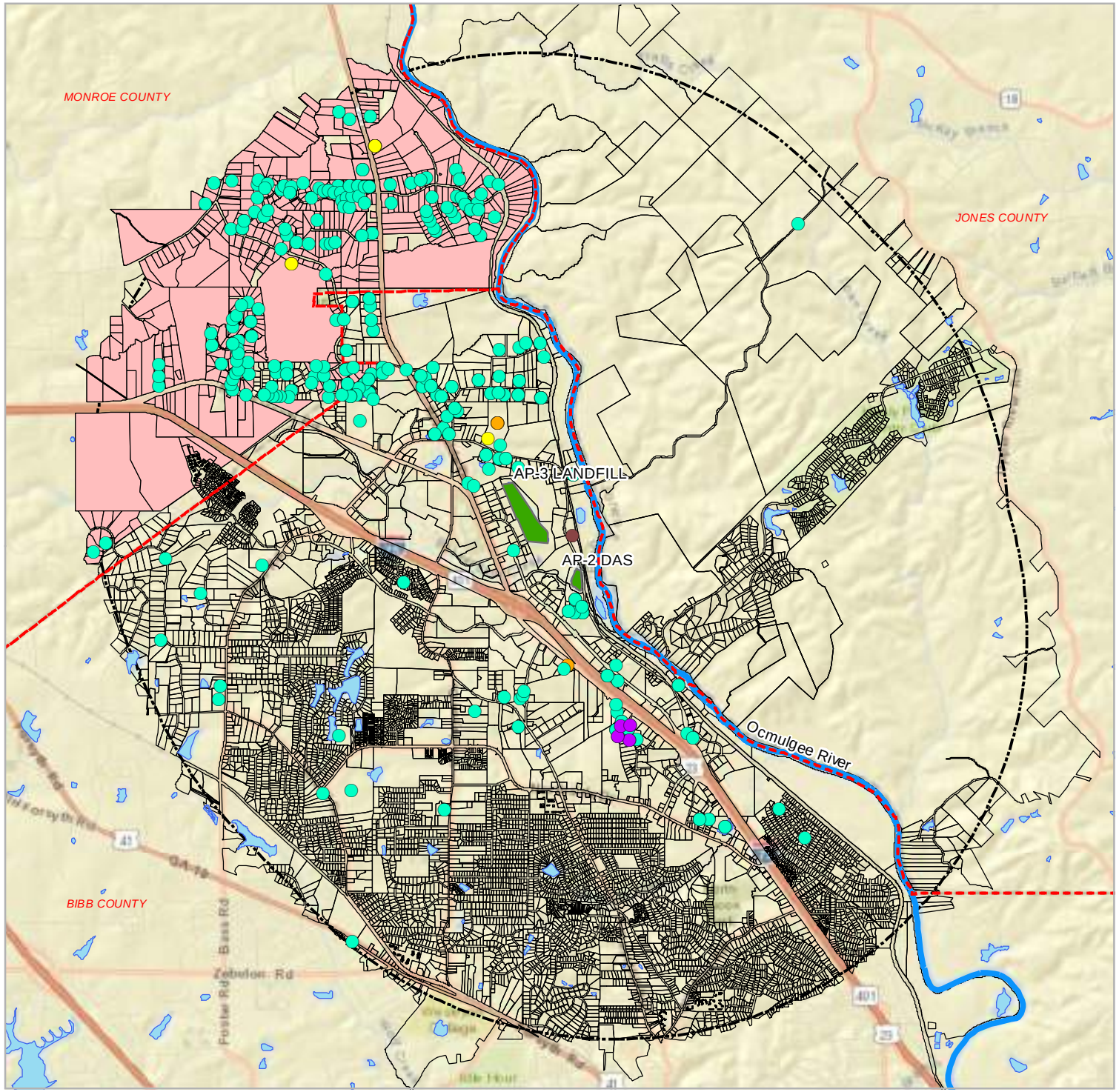
   A windshield survey of the area was conducted on November 15, 2019. During the survey wells were visually identified and compiled into the GIS database. The majority of these wells were located near residences. The windshield survey could not be conducted in the area across the Ocmulgee River in Jones County, as the entire area is part of a gated community.

Summary

Municipal water from the Macon Water Authority is widely available throughout the Bibb County portion of the Investigated Area. Some water lines dates as far back as 1922, with the majority of the water lines around the plant being built in the 1970s, when the nearby homes were constructed. Municipal water is not available in the Monroe County part of the Investigated Area. The River North community, which constitutes the residential parcels in the Jones County portion of the Investigated Area (east of the Ocmulgee River), are all served by public water. There are no active public wells in the Investigated Area.

Combining well data from all sources with parcel data, NewFields identified 639 total parcels likely to be associated with an active or inactive private well within the Investigated Area. Of these, 515 were identified using parcel data. During the windshield survey, 127 wells were visually identified. Fifty-nine (59) parcels were identified by the Macon-Bibb County Health Department, and 7 parcels by the state Department of Public Health. Fifty-nine (59) wells were shown on a 2003 well survey found in non-HSI files, 40 wells were identified by UGA's AESL sampling program, and 7 wells were in the USGS database (including 3 on one parcel). Most wells were identified by multiple sources.

Figure 1 shows points for identified wells and shades parcels that were identified from parcel data as likely to contain wells. When viewed as a PDF file, the figure is interactive.



N
W E
S

Inactive Private Drinking Well
Private Drinking Well
Monitoring Well
Industrial Well
Inactive Industrial Well
CCR Facilities
Parcels identified as likely containing a well
Parcels
3-Mile Radius
Rivers
Lakes & Ponds
County Border

0 2,550 5,100 10,200
Feet

Title	**Plant Arkwright CCR Facilities**
Project	**GPC Plants Georgia**
NewFields	Two Midtown Plaza 1349 W. Peachtree St, #2000 Atlanta, Georgia 30309 Tel: 404-347-9050
Date 02/14/2020	Rev. No. 00
MXD GPC_ARKWRIGHT_01	Figure No. 01

APPENDIX B
Groundwater Data

Appendix B-1
Groundwater Data for Evaluation of SSLs[1]
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Well	Date	CAS	Constituent	Units	Obs	Flags	MDL	PQL
ARGWC-17	09/01/16	7440-48-4	Cobalt	mg/L	0.037		0.00040	0.0025
ARGWC-17	10/25/16	7440-48-4	Cobalt	mg/L	0.014		0.00050	0.010
ARGWC-17	01/26/17	7440-48-4	Cobalt	mg/L	0.022		0.00040	0.0025
ARGWC-17	04/11/17	7440-48-4	Cobalt	mg/L	0.026		0.00040	0.00040
ARGWC-17	06/21/17	7440-48-4	Cobalt	mg/L	0.027		0.00040	0.0025
ARGWC-17	10/26/17	7440-48-4	Cobalt	mg/L	0.021		0.00040	0.0025
ARGWC-17	04/10/18	7440-48-4	Cobalt	mg/L	0.021		0.00040	0.0025
ARGWC-17	10/17/18	7440-48-4	Cobalt	mg/L	0.014		0.00040	0.0025
ARGWC-17	08/21/19	7440-48-4	Cobalt	mg/L	0.018		0.000075	0.00050
ARGWC-17	10/09/19	7440-48-4	Cobalt	mg/L	0.017		0.000075	0.00050
ARGWC-17	04/08/20	7440-48-4	Cobalt	mg/L	0.016		0.00013	0.0025
ARGWC-17	06/24/20	7440-48-4	Cobalt	mg/L	0.024		0.00013	0.0025
ARGWC-17	08/18/20	7440-48-4	Cobalt	mg/L	0.030		0.00013	0.0025
ARGWC-17	09/29/20	7440-48-4	Cobalt	mg/L	0.027		0.00013	0.0025
ARGWC-17	02/09/21	7440-48-4	Cobalt	mg/L	0.025		0.00013	0.0025
ARGWC-17	09/08/21	7440-48-4	Cobalt	mg/L	0.032		0.00013	0.0025
ARGWC-17	02/02/22	7440-48-4	Cobalt	mg/L	0.033		0.00026	0.0025
ARGWC-17	09/02/22	7440-48-4	Cobalt	mg/L	0.052		0.00030	0.0010
ARGWC-17	02/03/23	7440-48-4	Cobalt	mg/L	0.033		0.00030	0.0010
ARGWC-17	08/09/23	7440-48-4	Cobalt	mg/L	0.069		0.00030	0.0010
ARAMW-4	01/15/20	7440-48-4	Cobalt	mg/L	0.0064		0.00013	0.00050
ARAMW-4	02/11/20	7440-48-4	Cobalt	mg/L	0.0042		0.00013	0.00050
ARAMW-4	06/24/20	7440-48-4	Cobalt	mg/L	0.0049		0.00013	0.0025
ARAMW-4	08/20/20	7440-48-4	Cobalt	mg/L	0.0050		0.00013	0.0025
ARAMW-4	09/30/20	7440-48-4	Cobalt	mg/L	0.0046		0.00013	0.0025
ARAMW-4	02/10/21	7440-48-4	Cobalt	mg/L	0.0053		0.00013	0.0025
ARAMW-4	09/08/21	7440-48-4	Cobalt	mg/L	0.0048		0.00013	0.0025
ARAMW-4	02/02/22	7440-48-4	Cobalt	mg/L	0.0042		0.00026	0.0025
ARAMW-4	09/02/22	7440-48-4	Cobalt	mg/L	0.0041		0.00030	0.0010
ARAMW-4	02/07/23	7440-48-4	Cobalt	mg/L	0.0034		0.00030	0.0010
ARAMW-4	08/09/23	7440-48-4	Cobalt	mg/L	0.0034		0.00030	0.0010
ARGWC-16	09/01/16	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.0025
ARGWC-16	10/25/16	7440-48-4	Cobalt	mg/L	< 0.0005	U	0.00050	0.010
ARGWC-16	01/26/17	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.0025
ARGWC-16	04/11/17	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.00040
ARGWC-16	06/21/17	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-16	10/26/17	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-16	04/10/18	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-16	10/16/18	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-16	08/20/19	7440-48-4	Cobalt	mg/L	0.00016	J	0.000075	0.00050
ARGWC-16	10/09/19	7440-48-4	Cobalt	mg/L	0.00026	J	0.000075	0.00050
ARGWC-16	04/08/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-16	06/24/20	7440-48-4	Cobalt	mg/L	0.00013	J	0.00013	0.0025
ARGWC-16	08/19/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-16	09/29/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-16	02/09/21	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-16	09/08/21	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-16	02/03/22	7440-48-4	Cobalt	mg/L	< 0.00026	U	0.00026	0.0025
ARGWC-16	08/31/22	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010
ARGWC-16	02/02/23	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010
ARGWC-16	08/10/23	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010
ARGWC-18	09/01/16	7440-48-4	Cobalt	mg/L	0.0014	J	0.00040	0.0025

Appendix B-1
Groundwater Data for Evaluation of SSLs[1]
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Well	Date	CAS	Constituent	Units	Obs	Flags	MDL	PQL
ARGWC-18	10/26/16	7440-48-4	Cobalt	mg/L	0.0013	J	0.00050	0.010
ARGWC-18	01/27/17	7440-48-4	Cobalt	mg/L	0.0021	J	0.00040	0.0025
ARGWC-18	04/12/17	7440-48-4	Cobalt	mg/L	0.0015	J	0.00040	0.00040
ARGWC-18	06/21/17	7440-48-4	Cobalt	mg/L	0.0018	J	0.00040	0.0025
ARGWC-18	10/25/17	7440-48-4	Cobalt	mg/L	0.0013	J	0.00040	0.0025
ARGWC-18	04/11/18	7440-48-4	Cobalt	mg/L	0.0014	J	0.00040	0.0025
ARGWC-18	10/17/18	7440-48-4	Cobalt	mg/L	0.0012	J	0.00040	0.0025
ARGWC-18	08/21/19	7440-48-4	Cobalt	mg/L	0.0012		0.000075	0.00050
ARGWC-18	10/09/19	7440-48-4	Cobalt	mg/L	0.00099		0.000075	0.00050
ARGWC-18	04/09/20	7440-48-4	Cobalt	mg/L	0.00091	J	0.00013	0.0025
ARGWC-18	06/24/20	7440-48-4	Cobalt	mg/L	0.0012	J	0.00013	0.0025
ARGWC-18	08/20/20	7440-48-4	Cobalt	mg/L	0.0015	J	0.00013	0.0025
ARGWC-18	09/30/20	7440-48-4	Cobalt	mg/L	0.0013	J	0.00013	0.0025
ARGWC-18	02/10/21	7440-48-4	Cobalt	mg/L	0.0011	J	0.00013	0.0025
ARGWC-18	09/09/21	7440-48-4	Cobalt	mg/L	0.0016	J	0.00013	0.0025
ARGWC-18	02/03/22	7440-48-4	Cobalt	mg/L	0.0013	J	0.00026	0.0025
ARGWC-18	09/02/22	7440-48-4	Cobalt	mg/L	0.0011		0.00030	0.0010
ARGWC-18	02/02/23	7440-48-4	Cobalt	mg/L	0.0011		0.00030	0.0010
ARGWC-18	08/10/23	7440-48-4	Cobalt	mg/L	0.0011		0.00030	0.0010
ARGWC-7	08/31/16	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.0025
ARGWC-7	10/25/16	7440-48-4	Cobalt	mg/L	< 0.0005	U	0.00050	0.010
ARGWC-7	01/26/17	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.0025
ARGWC-7	04/12/17	7440-48-4	Cobalt	mg/L	< 0.0004	U	0.00040	0.00040
ARGWC-7	06/22/17	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-7	10/25/17	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-7	04/10/18	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-7	10/17/18	7440-48-4	Cobalt	mg/L	< 0.00040	U	0.00040	0.0025
ARGWC-7	08/21/19	7440-48-4	Cobalt	mg/L	0.000086	J	0.000075	0.00050
ARGWC-7	10/09/19	7440-48-4	Cobalt	mg/L	0.00034	J	0.000075	0.00050
ARGWC-7	04/08/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	06/25/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	08/18/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	09/29/20	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	02/10/21	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	09/10/21	7440-48-4	Cobalt	mg/L	< 0.00013	U	0.00013	0.0025
ARGWC-7	02/03/22	7440-48-4	Cobalt	mg/L	< 0.00026	U	0.00026	0.0025
ARGWC-7	08/31/22	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010
ARGWC-7	02/02/23	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010
ARGWC-7	08/10/23	7440-48-4	Cobalt	mg/L	< 0.000300	U	0.00030	0.0010

Notes:

1) Highlighted rows indicate constituent identified in the well at a statistically significant level (SSL).

J - indicates an estimated value; the substance was detected between the laboratory MDL and PQL.
MDL - method detection limit
mg/L - milligrams per liter
PQL - practical quantitation limit

Prepared by/Date: LO 10/19/23
Checked by/Date: IMR 10/20/23

Appendix B-2
Surface Water Data
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Location ID	Sample Location	Sample Designation	Date	CAS	Constituent	Units	Fraction	Result	Flags	MDL	RL
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00040	J	0.00013	0.0025
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00038	J	0.00026	0.0025
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.00028	J	0.00013	0.0025
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.6	Beaverdam Creek Tributary	Upstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.3	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.0020	J	0.00026	0.0025
BT-1.3	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.3	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	0.0085		0.00039	0.0050
BT-1.3	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	0.011		0.00039	0.0050
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.0094		0.00013	0.0025
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	11/02/21	7440-48-4	Cobalt	mg/L	T	0.0081		0.00013	0.0025
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.0056		0.00026	0.0025
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	0.012		0.00039	0.0050
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	0.013		0.00039	0.0050
BT-1.2	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	0.013		0.00039	0.0050
BT-1.1	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.0075		0.00026	0.0025
BT-1.1	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.1	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	0.0072		0.00039	0.0050
BT-1.1	Beaverdam Creek Tributary	Adjacent to AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.0013	J	0.00013	0.0025
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00039	J	0.00013	0.0025
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	11/02/21	7440-48-4	Cobalt	mg/L	T	0.00013	J	0.00013	0.0025
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00057	J	0.00026	0.0025
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	0.0058		0.00039	0.0050
BT-1.0	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.8b	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill; Prior to confluence with Beaverdam Creek	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00044	J	0.00013	0.0025
BC-0.8b	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill; Prior to confluence with Beaverdam Creek	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.8b	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill; Prior to confluence with Beaverdam Creek	02/08/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.8b	Beaverdam Creek Tributary	Downstream of AP-3 Landfill and Monofill; Prior to confluence with Beaverdam Creek	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.8a	Beaverdam Creek	Upstream of Beaverdam Creek Tributary Confluen	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00031	J	0.00013	0.00250
BC-0.8a	Beaverdam Creek	Upstream of Beaverdam Creek Tributary Confluen	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00057	J	0.00026	0.00250
BC-0.8a	Beaverdam Creek	Upstream of Beaverdam Creek Tributary Confluen	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.8a	Beaverdam Creek	Upstream of Beaverdam Creek Tributary Confluen	02/08/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.8a	Beaverdam Creek	Upstream of Beaverdam Creek Tributary Confluen	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00071	J	0.00026	0.00250
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.00056	J	0.00013	0.00250
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00045	J	0.00013	0.00250
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/09/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.7	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.0008	J	0.00026	0.00250
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.00057	J	0.00013	0.00250
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00033	J	0.00013	0.00250
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/09/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.6	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00056	J	0.00013	0.00250
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00052	J	0.00026	0.00250
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.0005	J	0.00013	0.00250
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	11/03/20	7440-48-4	Cobalt	mg/L	T	0.00047	J	0.00013	0.00250
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/09/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.5.5	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/02/22	7440-48-4	Cobalt	mg/L	T	0.00061	J	0.00026	0.00250
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/10/21	7440-48-4	Cobalt	mg/L	T	0.00052	J	0.00013	0.00250
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	11/03/20	7440-48-4	Cobalt	mg/L	T	0.00048	J	0.00013	0.00250
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	09/30/21	7440-48-4	Cobalt	mg/L	T	0.00042	J	0.00013	0.00250
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/16/22	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	02/08/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-BR	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	08/10/23	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.00500
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	2/10/2021	7440-48-4	Cobalt	mg/L	T	0.00050	J	0.00013	0.0025
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00029	J	0.00013	0.0025
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	2/2/2022	7440-48-4	Cobalt	mg/L	T	0.00058	J	0.00026	0.0025
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	2/8/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.3	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.1	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	2/10/2021	7440-48-4	Cobalt	mg/L	T	0.00057	J	0.00013	0.0025
BC-0.1	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00071	J	0.00013	0.0025
BC-0.1	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
BC-0.1	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	2/8/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050

Appendix B-2
Surface Water Data
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Location ID	Sample Location	Sample Designation	Date	CAS	Constituent	Units	Fraction	Result	Flags	MDL	RL
BC-0.1	Beaverdam Creek	Downstream of AP-3 Landfill and Monofill	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.8	Ocmulgee River	Upstream of AP-1 and Site	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.8	Ocmulgee River	Upstream of AP-1 and Site	2/9/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.8	Ocmulgee River	Upstream of AP-1 and Site	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.3	Ocmulgee River	Adjacent to AP-1	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00018	J	0.00013	0.0025
OR-0.3	Ocmulgee River	Adjacent to AP-1	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.3	Ocmulgee River	Adjacent to AP-1	2/9/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.3	Ocmulgee River	Adjacent to AP-1	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.1	Ocmulgee River	Downstream of AP-1	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00016	J	0.00013	0.0025
OR-0.1	Ocmulgee River	Downstream of AP-1	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.1	Ocmulgee River	Downstream of AP-1	2/9/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR-0.1	Ocmulgee River	Downstream of AP-1	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR+0.25	Ocmulgee River	Downstream of Site	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00013	J	0.00013	0.0025
OR+0.25	Ocmulgee River	Downstream of Site	8/16/2022	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR+0.25	Ocmulgee River	Downstream of Site	2/9/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR+0.25	Ocmulgee River	Downstream of Site	10/3/2023	7440-48-4	Cobalt	mg/L	T	< 0.00039	U	0.00039	0.0050
OR+1.0	Ocmulgee River	Downstream of Site	9/30/2021	7440-48-4	Cobalt	mg/L	T	0.00015	J	0.00013	0.0025

Notes:

J - indicates an estimated value; the substance was detected between the laboratory MDL and RL
MDL - method detection limit
mg/L - milligrams per liter
U - not detected above the laboratory MDL
RL - Reporting Limit
T - Total

Prepared by/Date: LO 11/17/23
Checked by/Date: IMR 11/20/23

APPENDIX C

USEPA RSL Calculator Generated Residential Screening Levels

Appendix C-1
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Variable	Value
THQ (target hazard quotient) unitless	1
TR (target risk) unitless	0.00001
LT (lifetime) years	70
K (volatilization factor of Andelman) L/m^3	0.5
l_{sc} (apparent thickness of stratum corneum) cm	0.001
ED_{res} (exposure duration - resident) years	26
$ED_{res\text{-}c}$ (exposure duration - child) years	6
$ED_{res\text{-}a}$ (exposure duration - adult) years	20
$ED_{0\text{-}2}$ (mutagenic exposure duration first phase) years	2
$ED_{2\text{-}6}$ (mutagenic exposure duration second phase) years	4
$ED_{6\text{-}16}$ (mutagenic exposure duration third phase) years	10
$ED_{16\text{-}26}$ (mutagenic exposure duration fourth phase) years	10
EF_{res} (exposure frequency) days/year	350
$EF_{res\text{-}c}$ (exposure frequency - child) days/year	350
$EF_{res\text{-}a}$ (exposure frequency - adult) days/year	350
$EF_{0\text{-}2}$ (mutagenic exposure frequency first phase) days/year	350
$EF_{2\text{-}6}$ (mutagenic exposure frequency second phase) days/year	350
$EF_{6\text{-}16}$ (mutagenic exposure frequency third phase) days/year	350
$EF_{16\text{-}26}$ (mutagenic exposure frequency fourth phase) days/year	350
$ET_{event\text{-}res\text{-}adj}$ (age-adjusted exposure time) hours/event	0.67077
$ET_{event\text{-}res\text{-}madj}$ (mutagenic age-adjusted exposure time) hours/event	0.67077
ET_{res} (exposure time) hours/day	24
$ET_{res\text{-}c}$ (dermal exposure time - child) hours/event	0.54
$ET_{res\text{-}a}$ (dermal exposure time - adult) hours/event	0.71
$ET_{res\text{-}c}$ (inhalation exposure time - child) hours/day	24
$ET_{res\text{-}a}$ (inhalation exposure time - adult) hours/day	24
Appendix D-3	24
$ET_{16\text{-}26}$ (mutagenic inhalation exposure time fourth phase) hours/day	24
$ET_{0\text{-}2}$ (mutagenic dermal exposure time first phase) hours/event	0.54
$ET_{2\text{-}6}$ (mutagenic dermal exposure time second phase) hours/event	0.54
$ET_{6\text{-}16}$ (mutagenic dermal exposure time third phase) hours/event	0.71
$ET_{16\text{-}26}$ (mutagenic dermal exposure time fourth phase) hours/event	0.71
$BW_{res\text{-}a}$ (body weight - adult) kg	80

Appendix C-1
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Variable	Value
BW_{res-c} (body weight - child) kg	15
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-26} (mutagenic body weight) kg	80
$IFW_{res-adj}$ (adjusted intake factor) L/kg	327.95
$IFW_{res-adj}$ (adjusted intake factor) L/kg	327.95
$IFWM_{res-adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
$IFWM_{res-adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
IRW_{res-c} (water intake rate - child) L/day	0.78
IRW_{res-a} (water intake rate - adult) L/day	2.5
IRW_{0-2} (mutagenic water intake rate) L/day	0.78
IRW_{2-6} (mutagenic water intake rate) L/day	0.78
IRW_{6-16} (mutagenic water intake rate) L/day	2.5
IRW_{16-26} (mutagenic water intake rate) L/day	2.5
EV_{res-a} (events - adult) per day	1
EV_{res-c} (events - child) per day	1
EV_{0-2} (mutagenic events) per day	1
EV_{2-6} (mutagenic events) per day	1
EV_{6-16} (mutagenic events) per day	1
EV_{16-26} (mutagenic events) per day	1
$DFW_{res-adj}$ (age-adjusted dermal factor) cm^2-event/kg	2610650
$DFWM_{res-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	8191633
SA_{res-c} (skin surface area - child) cm^2	6365
SA_{res-a} (skin surface area - adult) cm^2	19652
SA_{0-2} (mutagenic skin surface area) cm^2	6365
SA_{2-6} (mutagenic skin surface area) cm^2	6365
SA_{6-16} (mutagenic skin surface area) cm^2	19652
SA_{16-26} (mutagenic skin surface area) cm^2	19652

Appendix C-2
Default
Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	K_p (cm/hr)	MW
Cobalt	7440-48-4	No	No	Inorganics	-		9.00E-03	P	3.00E-04	P	6.00E-06	P	1.00E+00	4.00E-04	5.89E+01
Molybdenum	7439-98-7	No	No	Inorganics	-		-		5.00E-03	I	-		1.00E+00	1.00E-03	9.59E+01

Appendix C-2
Default
Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	B (unitless)	t^* (hr)	T_{event} (hr/event)	FA (unitless)	In EPD?	$DA_{event\ (ca)}$	$DA_{event\ (nc\ child)}$	$DA_{event\ (nc\ adult)}$	MCL (ug/L)
Cobalt	7440-48-4	No	No	Inorganics	1.18E-03	5.40E-01	2.25E-01	1.00E+00	Yes	-	7.37E-04	1.27E-03	-
Molybdenum	7439-98-7	No	No	Inorganics	3.77E-03	8.70E-01	3.62E-01	1.00E+00	Yes	-	1.23E-02	2.12E-02	-

Appendix C-2
Default
Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	Ingestion SL TR=1E-05 (ug/L)	Dermal SL TR=1E-05 (ug/L)	Inhalation SL TR=1E-05 (ug/L)	Carcinogenic SL TR=1E-05 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)
Cobalt	7440-48-4	No	No	Inorganics	-	-	-	-	6.02E+00	3.41E+03
Molybdenum	7439-98-7	No	No	Inorganics	-	-	-	-	1.00E+02	2.28E+04

Appendix C-2
Default
Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	Ingestion SL Adult THQ=1 (ug/L)	Dermal SL Adult THQ=1 (ug/L)	Inhalation SL Adult THQ=1 (ug/L)
Cobalt	7440-48-4	No	No	Inorganics	-	6.01E+00	1.00E+01	4.48E+03	-
Molybdenum	7439-98-7	No	No	Inorganics	-	9.98E+01	1.67E+02	2.99E+04	-

Appendix C-2
Default
Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	Noncarcinogenic SL Adult THI=1 (ug/L)	Screening Level (ug/L)
Cobalt	7440-48-4	No	No	Inorganics	9.99E+00	6.01E+00 nc
Molybdenum	7439-98-7	No	No	Inorganics	1.66E+02	9.98E+01 nc

APPENDIX D

Support for Refined Risk Evaluation

Appendix D-1

Exposure Point Concentration Calculation Results

Appendix D-1
Exposure Point Calculation Details[1]
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

CCR Rule Designation	Constituent	Well IDs Included	Maximum Concentration (mg/L)	Detection Frequency	Exceedance Frequency	EPC Step 1 Individual Target Well(s) 2016-2023 (mg/L)	EPC Step 2 Target Well(s) & Downgradient Well(s) 2016-2023 (mg/L)	EPC Step 3 Farthest Downgradient Well(s) 2016-2023 (mg/L)
Appendix IV	Cobalt	ARGWC-17	0.069	20 / 20	20 / 20	0.033		
		ARAMW-4 ARGWC-17 ARGWC-16 ARGWC-18 ARGWC-7	0.069	56 / 91	21 / 91		0.0093	
		ARGWC-18 ARGWC-7	0.0021	22 / 40	0 / 40			0.00089

Notes:

Highlighted value is the EPC selected for the refined screening.

1 - EPCs calculated in accordance with USEPA, 2014. Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance. OSWER Directive 9283.1-42, February 2014. Located at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917

Definitions:

EPC = Exposure Point Concentration

mg/L = milligrams per liter

Prepared by/Date: LO 10/20/23

Checked by/Date: IMR 10/20/23

Appendix D-2

Exposure Point Concentration Figure

Note:
- Groundwater elevation and contour data source: Stantec, 2023. 2023 Annual Groundwater Monitoring and Corrective Action Report – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, July 31, 2023.

N

0 100 200 400 Feet

ARGWA-12
358.01

ARGWA-3
353.39

ARGWA-24
353.85

ARGWA-5
353.5

ARGWA-13
347.97

ARGWA-14
346.2

AP-3

Monofill

ARAMW-4
346.84

ARGWC-15
346.65

ARGWC-10
349.74

ARGWC-17
346.87

ARGWC-16
344.99

ARGWC-9
346.57

ARAMW-3
330.68

ARGWC-8
330.25

ARGWC-18
326.92

ARAMW-6
324.77

ARGWC-7
329.44

356 354 352 350 348 346 344 342 340 338 336 334 332 330 328 326

358.01 Groundwater Elevation (ft asml)
Piezometer Installed November 2019
Groundwater Monitoring Network Well
Individual Target Wells (Step 1)
Target Wells and Downgradient Wells (Step 2)
Farthest Downgradient Wells (Step 3)
Groundwater Elevation Contour (ft)
Approximate Groundwater Flow Direction
Approximate Limits of Waste
Approximate Property Boundary
Surface Water Feature

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Former Plant Arkwright AP-3
Exposure Point Concentration for Cobalt

Prepared By-Date: JRM - 12/20/2023	wsp	Figure: D-2
Checked By-Date: LO - 12/20/2023		
Project Number:		

Appendix D-3

Groundwater ProUCL Input/Output Files

Appendix D-3a
Groundwater ProUCL Input - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Step 1

Well(1)	Date(1)	Cobalt1	D_Cobalt1
ARGWC-17	09/01/16	0.037	1
ARGWC-17	10/25/16	0.014	1
ARGWC-17	01/26/17	0.022	1
ARGWC-17	04/11/17	0.026	1
ARGWC-17	06/21/17	0.027	1
ARGWC-17	10/26/17	0.021	1
ARGWC-17	04/10/18	0.021	1
ARGWC-17	10/17/18	0.014	1
ARGWC-17	08/21/19	0.018	1
ARGWC-17	10/09/19	0.017	1
ARGWC-17	04/08/20	0.016	1
ARGWC-17	06/24/20	0.024	1
ARGWC-17	08/18/20	0.030	1
ARGWC-17	09/29/20	0.027	1
ARGWC-17	02/09/21	0.025	1
ARGWC-17	09/08/21	0.032	1
ARGWC-17	02/02/22	0.033	1
ARGWC-17	09/02/22	0.052	1
ARGWC-17	02/03/23	0.033	1
ARGWC-17	08/09/23	0.069	1

Step 2

Well(2)	Date(2)	Cobalt2	D_Cobalt2
ARGWC-17	09/01/16	0.037	1
ARGWC-17	10/25/16	0.014	1
ARGWC-17	01/26/17	0.022	1
ARGWC-17	04/11/17	0.026	1
ARGWC-17	06/21/17	0.027	1
ARGWC-17	10/26/17	0.021	1
ARGWC-17	04/10/18	0.021	1
ARGWC-17	10/17/18	0.014	1
ARGWC-17	08/21/19	0.018	1
ARGWC-17	10/09/19	0.017	1
ARGWC-17	04/08/20	0.016	1
ARGWC-17	06/24/20	0.024	1
ARGWC-17	08/18/20	0.030	1
ARGWC-17	09/29/20	0.027	1
ARGWC-17	02/09/21	0.025	1
ARGWC-17	09/08/21	0.032	1
ARGWC-17	02/02/22	0.033	1
ARGWC-17	09/02/22	0.052	1
ARGWC-17	02/03/23	0.033	1
ARGWC-17	08/09/23	0.069	1
ARAMW-4	01/15/20	0.0064	1
ARAMW-4	02/11/20	0.0042	1
ARAMW-4	06/24/20	0.0049	1
ARAMW-4	08/20/20	0.0050	1
ARAMW-4	09/30/20	0.0046	1
ARAMW-4	02/10/21	0.0053	1
ARAMW-4	09/08/21	0.0048	1
ARAMW-4	02/02/22	0.0042	1
ARAMW-4	09/02/22	0.0041	1
ARAMW-4	02/07/23	0.0034	1
ARAMW-4	08/09/23	0.0034	1
ARGWC-16	09/01/16	0.00040	0
ARGWC-16	10/25/16	0.00050	0
ARGWC-16	01/26/17	0.00040	0
ARGWC-16	04/11/17	0.00040	0
ARGWC-16	06/21/17	0.00040	0
ARGWC-16	10/26/17	0.00040	0
ARGWC-16	04/10/18	0.00040	0
ARGWC-16	10/16/18	0.00040	0
ARGWC-16	08/20/19	0.00016	1
ARGWC-16	10/09/19	0.00026	1
ARGWC-16	04/08/20	0.00013	0
ARGWC-16	06/24/20	0.00013	1
ARGWC-16	08/19/20	0.00013	0
ARGWC-16	09/29/20	0.00013	0
ARGWC-16	02/09/21	0.00013	0
ARGWC-16	09/08/21	0.00013	0
ARGWC-16	02/03/22	0.00026	0
ARGWC-16	08/31/22	0.00030	0
ARGWC-16	02/02/23	0.00030	0
ARGWC-16	08/10/23	0.00030	0
ARGWC-18	09/01/16	0.0014	1
ARGWC-18	10/26/16	0.0013	1
ARGWC-18	01/27/17	0.0021	1
ARGWC-18	04/12/17	0.0015	1
ARGWC-18	06/21/17	0.0018	1
ARGWC-18	10/25/17	0.0013	1
ARGWC-18	04/11/18	0.0014	1

Step 3

Well(3)	Date(3)	Cobalt3	D_Cobalt3
ARGWC-18	09/01/16	0.0014	1
ARGWC-18	10/26/16	0.0013	1
ARGWC-18	01/27/17	0.0021	1
ARGWC-18	04/12/17	0.0015	1
ARGWC-18	06/21/17	0.0018	1
ARGWC-18	10/25/17	0.0013	1
ARGWC-18	04/11/18	0.0014	1
ARGWC-18	10/17/18	0.0012	1
ARGWC-18	08/21/19	0.0012	1
ARGWC-18	10/09/19	0.00099	1
ARGWC-18	04/09/20	0.00091	1
ARGWC-18	06/24/20	0.0012	1
ARGWC-18	08/20/20	0.0015	1
ARGWC-18	09/30/20	0.0013	1
ARGWC-18	02/10/21	0.0011	1
ARGWC-18	09/09/21	0.0016	1
ARGWC-18	02/03/22	0.0013	1
ARGWC-18	09/02/22	0.0011	1
ARGWC-18	02/02/23	0.0011	1
ARGWC-18	08/10/23	0.0011	1
ARGWC-7	08/31/16	0.00040	0
ARGWC-7	10/25/16	0.00050	0
ARGWC-7	01/26/17	0.00040	0
ARGWC-7	04/12/17	0.00040	0
ARGWC-7	06/22/17	0.00040	0
ARGWC-7	10/25/17	0.00040	0
ARGWC-7	04/10/18	0.00040	0
ARGWC-7	10/17/18	0.00040	0
ARGWC-7	08/21/19	0.000086	1
ARGWC-7	10/09/19	0.00034	1
ARGWC-7	04/08/20	0.00013	0
ARGWC-7	06/25/20	0.00013	0
ARGWC-7	08/18/20	0.00013	0
ARGWC-7	09/29/20	0.00013	0
ARGWC-7	02/10/21	0.00013	0
ARGWC-7	09/10/21	0.00013	0
ARGWC-7	02/03/22	0.00026	0
ARGWC-7	08/31/22	0.00030	0
ARGWC-7	02/02/23	0.00030	0
ARGWC-7	08/10/23	0.00030	0

Appendix D-3a
Groundwater ProUCL Input - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Step 1

Well(1)	Date(1)	Cobalt1	D_Cobalt1

Step 2

Well(2)	Date(2)	Cobalt2	D_Cobalt2
ARGWC-18	10/17/18	0.0012	1
ARGWC-18	08/21/19	0.0012	1
ARGWC-18	10/09/19	0.00099	1
ARGWC-18	04/09/20	0.00091	1
ARGWC-18	06/24/20	0.0012	1
ARGWC-18	08/20/20	0.0015	1
ARGWC-18	09/30/20	0.0013	1
ARGWC-18	02/10/21	0.0011	1
ARGWC-18	09/09/21	0.0016	1
ARGWC-18	02/03/22	0.0013	1
ARGWC-18	09/02/22	0.0011	1
ARGWC-18	02/02/23	0.0011	1
ARGWC-18	08/10/23	0.0011	1
ARGWC-7	08/31/16	0.00040	0
ARGWC-7	10/25/16	0.00050	0
ARGWC-7	01/26/17	0.00040	0
ARGWC-7	04/12/17	0.00040	0
ARGWC-7	06/22/17	0.00040	0
ARGWC-7	10/25/17	0.00040	0
ARGWC-7	04/10/18	0.00040	0
ARGWC-7	10/17/18	0.00040	0
ARGWC-7	08/21/19	0.000086	1
ARGWC-7	10/09/19	0.00034	1
ARGWC-7	04/08/20	0.00013	0
ARGWC-7	06/25/20	0.00013	0
ARGWC-7	08/18/20	0.00013	0
ARGWC-7	09/29/20	0.00013	0
ARGWC-7	02/10/21	0.00013	0
ARGWC-7	09/10/21	0.00013	0
ARGWC-7	02/03/22	0.00026	0
ARGWC-7	08/31/22	0.00030	0
ARGWC-7	02/02/23	0.00030	0
ARGWC-7	08/10/23	0.00030	0

Step 3

Well(3)	Date(3)	Cobalt3	D_Cobalt3

Notes:
1) Concentrations in units of mg/L.

Prepared by/Date: LO 10/20/23
Checked by/Date: IMR 10/20/23

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/20/2023 11:22:02 AM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (step 1)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	0.014	Mean	0.0279
Maximum	0.0689	Median	0.0255
SD	0.0132	Std. Error of Mean	0.00294
Coefficient of Variation	0.472	Skewness	1.877

Normal GOF Test

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.868	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.223	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.033	95% Adjusted-CLT UCL (Chen-1995)	0.0341
		95% Modified-t UCL (Johnson-1978)	0.0332

Gamma GOF Test

A-D Test Statistic	0.429	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.133	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.194	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.066	k star (bias corrected MLE)	5.189
Theta hat (MLE)	0.0046	Theta star (bias corrected MLE)	0.00538
nu hat (MLE)	242.6	nu star (bias corrected)	207.6
MLE Mean (bias corrected)	0.0279	MLE Sd (bias corrected)	0.0122
		Approximate Chi Square Value (0.05)	175.2
Adjusted Level of Significance	0.038	Adjusted Chi Square Value	172.9

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.0331	95% Adjusted Gamma UCL	0.0335

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.92	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.112	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.176	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.269	Mean of logged Data	-3.664
Maximum of Logged Data	-2.675	SD of logged Data	0.406

Assuming Lognormal Distribution

95% H-UCL	0.0333	90% Chebyshev (MVUE) UCL	0.0355
95% Chebyshev (MVUE) UCL	0.039	97.5% Chebyshev (MVUE) UCL	0.0438
99% Chebyshev (MVUE) UCL	0.0534		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0327	95% BCA Bootstrap UCL	0.0342
95% Standard Bootstrap UCL	0.0326	95% Bootstrap-t UCL	0.0358
95% Hall's Bootstrap UCL	0.058	95% Percentile Bootstrap UCL	0.033
90% Chebyshev(Mean, Sd) UCL	0.0367	95% Chebyshev(Mean, Sd) UCL	0.0407
97.5% Chebyshev(Mean, Sd) UCL	0.0463	99% Chebyshev(Mean, Sd) UCL	0.0572

Suggested UCL to Use

95% Student's-t UCL	0.033

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Cobalt (step 2)

General Statistics

Total Number of Observations	91	Number of Distinct Observations	48
Number of Detects	56	Number of Non-Detects	35
Number of Distinct Detects	45	Number of Distinct Non-Detects	5
Minimum Detect	8.6000E-5	Minimum Non-Detect	1.3000E-4
Maximum Detect	0.0689	Maximum Non-Detect	5.0000E-4
Variance Detects	2.1679E-4	Percent Non-Detects	38.46%
Mean Detects	0.0114	SD Detects	0.0147
Median Detects	0.00416	CV Detects	1.297
Skewness Detects	1.753	Kurtosis Detects	3.448
Mean of Logged Detects	-5.518	SD of Logged Detects	1.648

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	3.899E-12	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.136	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00703	KM Standard Error of Mean	0.00134
90KM SD	0.0127	95% KM (BCA) UCL	0.0095
95% KM (t) UCL	0.00926	95% KM (Percentile Bootstrap) UCL	0.00942
95% KM (z) UCL	0.00923	95% KM Bootstrap t UCL	0.00969
90% KM Chebyshev UCL	0.0111	95% KM Chebyshev UCL	0.0129
97.5% KM Chebyshev UCL	0.0154	99% KM Chebyshev UCL	0.0204

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.851	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.807	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.163	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.125	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.595	k star (bias corrected MLE)	0.575
Theta hat (MLE)	0.0191	Theta star (bias corrected MLE)	0.0197
nu hat (MLE)	66.65	nu star (bias corrected)	64.41
Mean (detects)	0.0114		

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.6000E-5	Mean	0.0108
Maximum	0.0689	Median	0.01
SD	0.0115	CV	1.064
k hat (MLE)	0.91	k star (bias corrected MLE)	0.887
Theta hat (MLE)	0.0119	Theta star (bias corrected MLE)	0.0122
nu hat (MLE)	165.6	nu star (bias corrected)	161.5
Adjusted Level of Significance (β)	0.0474		
Approximate Chi Square Value (161.47, α)	133.1	Adjusted Chi Square Value (161.47, β)	132.7
95% Gamma Approximate UCL	0.0131	95% Gamma Adjusted UCL	0.0132

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00703	SD (KM)	0.0127
Variance (KM)	1.6099E-4	SE of Mean (KM)	0.00134
k hat (KM)	0.307	k star (KM)	0.304
nu hat (KM)	55.81	nu star (KM)	55.3
theta hat (KM)	0.0229	theta star (KM)	0.0231
80% gamma percentile (KM)	0.0108	90% gamma percentile (KM)	0.0207
95% gamma percentile (KM)	0.032	99% gamma percentile (KM)	0.0614

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (55.30, α)	39.21	Adjusted Chi Square Value (55.30, β)	39
95% KM Approximate Gamma UCL	0.00991	95% KM Adjusted Gamma UCL	0.00996

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.933	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk P Value	0.00515	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.108	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00705	Mean in Log Scale	-6.913
SD in Original Scale	0.0127	SD in Log Scale	2.288
95% t UCL (assumes normality of ROS data)	0.00927	95% Percentile Bootstrap UCL	0.00923
95% BCA Bootstrap UCL	0.00945	95% Bootstrap t UCL	0.00965
95% H-UCL (Log ROS)	0.0338		

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.953	KM Geo Mean	9.5596E-4
KM SD (logged)	2.229	95% Critical H Value (KM-Log)	3.686
KM Standard Error of Mean (logged)	0.237	95% H-UCL (KM -Log)	0.0273
KM SD (logged)	2.229	95% Critical H Value (KM-Log)	3.686
KM Standard Error of Mean (logged)	0.237		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00704	Mean in Log Scale	-6.831
SD in Original Scale	0.0127	SD in Log Scale	2.132
95% t UCL (Assumes normality)	0.00926	95% H-Stat UCL	0.0233

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL 0.00926

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cobalt (step 3)

General Statistics

Total Number of Observations	40	Number of Distinct Observations	19
Number of Detects	22	Number of Non-Detects	18
Number of Distinct Detects	14	Number of Distinct Non-Detects	5
Minimum Detect	8.6000E-5	Minimum Non-Detect	1.3000E-4
Maximum Detect	0.0021	Maximum Non-Detect	5.0000E-4
Variance Detects	1.7956E-7	Percent Non-Detects	45%
Mean Detects	0.00122	SD Detects	4.2374E-4
Median Detects	0.00125	CV Detects	0.348
Skewness Detects	-0.821	Kurtosis Detects	2.441
Mean of Logged Detects	-6.834	SD of Logged Detects	0.66

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.878	Detected Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.214	Detected Data appear Normal at 1% Significance Level	

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.1358E-4	KM Standard Error of Mean	1.0358E-4
90KM SD	6.3872E-4	95% KM (BCA) UCL	8.9816E-4
95% KM (t) UCL	8.8809E-4	95% KM (Percentile Bootstrap) UCL	8.8971E-4
95% KM (z) UCL	8.8395E-4	95% KM Bootstrap t UCL	8.8679E-4
90% KM Chebyshev UCL	0.00102	95% KM Chebyshev UCL	0.00117
97.5% KM Chebyshev UCL	0.00136	99% KM Chebyshev UCL	0.00174

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.233	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.747	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.294	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.186	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.176	k star (bias corrected MLE)	3.637
Theta hat (MLE)	2.9199E-4	Theta star (bias corrected MLE)	3.3528E-4
nu hat (MLE)	183.7	nu star (bias corrected)	160
Mean (detects)	0.00122		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	8.6000E-5	Mean	0.00517
Maximum	0.01	Median	0.0017
SD	0.00443	CV	0.858
k hat (MLE)	1.017	k star (bias corrected MLE)	0.958
Theta hat (MLE)	0.00508	Theta star (bias corrected MLE)	0.0054
nu hat (MLE)	81.39	nu star (bias corrected)	76.62
Adjusted Level of Significance (β)	0.044		
Approximate Chi Square Value (76.62, α)	57.46	Adjusted Chi Square Value (76.62, β)	56.83
95% Gamma Approximate UCL	0.0069	95% Gamma Adjusted UCL	0.00697

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.1358E-4	SD (KM)	6.3872E-4
Variance (KM)	4.0797E-7	SE of Mean (KM)	1.0358E-4
k hat (KM)	1.248	k star (KM)	1.171
nu hat (KM)	99.85	nu star (KM)	93.7
theta hat (KM)	5.7171E-4	theta star (KM)	6.0927E-4
80% gamma percentile (KM)	0.00113	90% gamma percentile (KM)	0.00158
95% gamma percentile (KM)	0.00202	99% gamma percentile (KM)	0.00304

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (93.70, α)	72.37	Adjusted Chi Square Value (93.70, β)	71.67
95% KM Approximate Gamma UCL	9.2383E-4	95% KM Adjusted Gamma UCL	9.3288E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.612	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.926	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.169	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.2746E-4	Mean in Log Scale	-7.364
SD in Original Scale	5.4250E-4	SD in Log Scale	0.797
95% t UCL (assumes normality of ROS data)	9.7198E-4	95% Percentile Bootstrap UCL	9.6916E-4
95% BCA Bootstrap UCL	9.6429E-4	95% Bootstrap t UCL	9.8172E-4
95% H-UCL (Log ROS)	0.00115		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.948	KM Geo Mean	3.5327E-4
KM SD (logged)	1.333	95% Critical H Value (KM-Log)	2.823
KM Standard Error of Mean (logged)	0.219	95% H-UCL (KM -Log)	0.00157
KM SD (logged)	1.333	95% Critical H Value (KM-Log)	2.823
KM Standard Error of Mean (logged)	0.219		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.3615E-4	Mean in Log Scale	-7.787
SD in Original Scale	6.2546E-4	SD in Log Scale	1.222
95% t UCL (Assumes normality)	9.0277E-4	95% H-Stat UCL	0.00148

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Appendix D-3b
Groundwater ProUCL Output - Cobalt
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA

Suggested UCL to Use

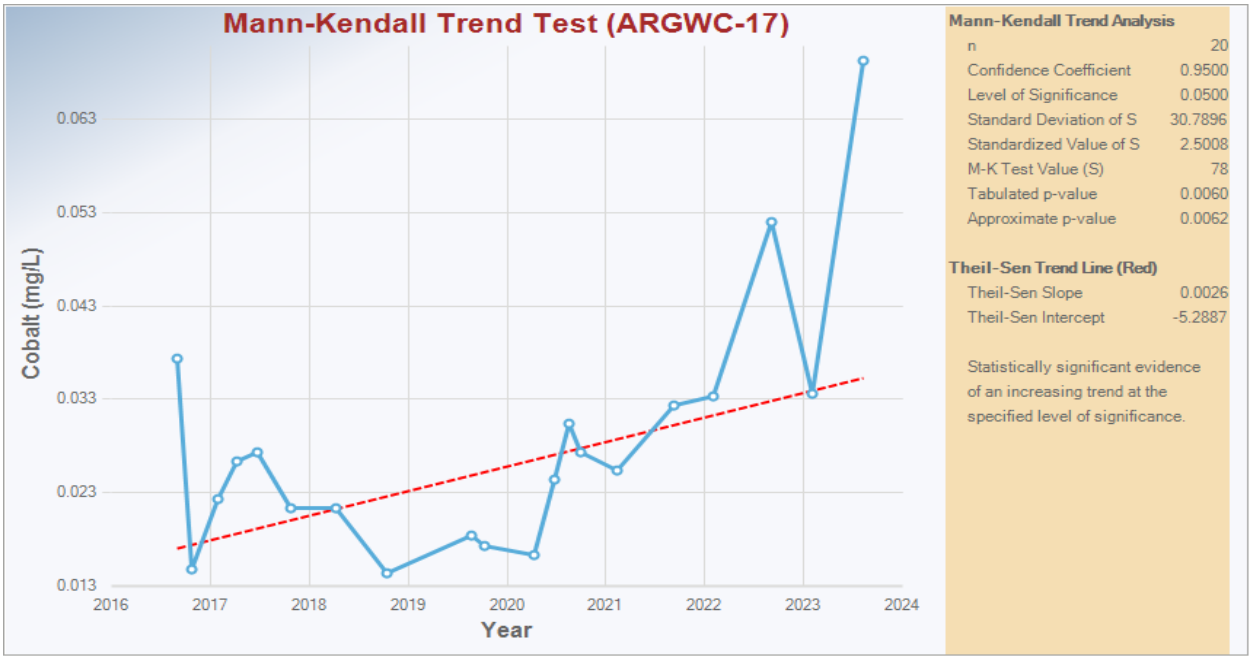
95% KM (t) UCL 8.8809E-4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix D-4

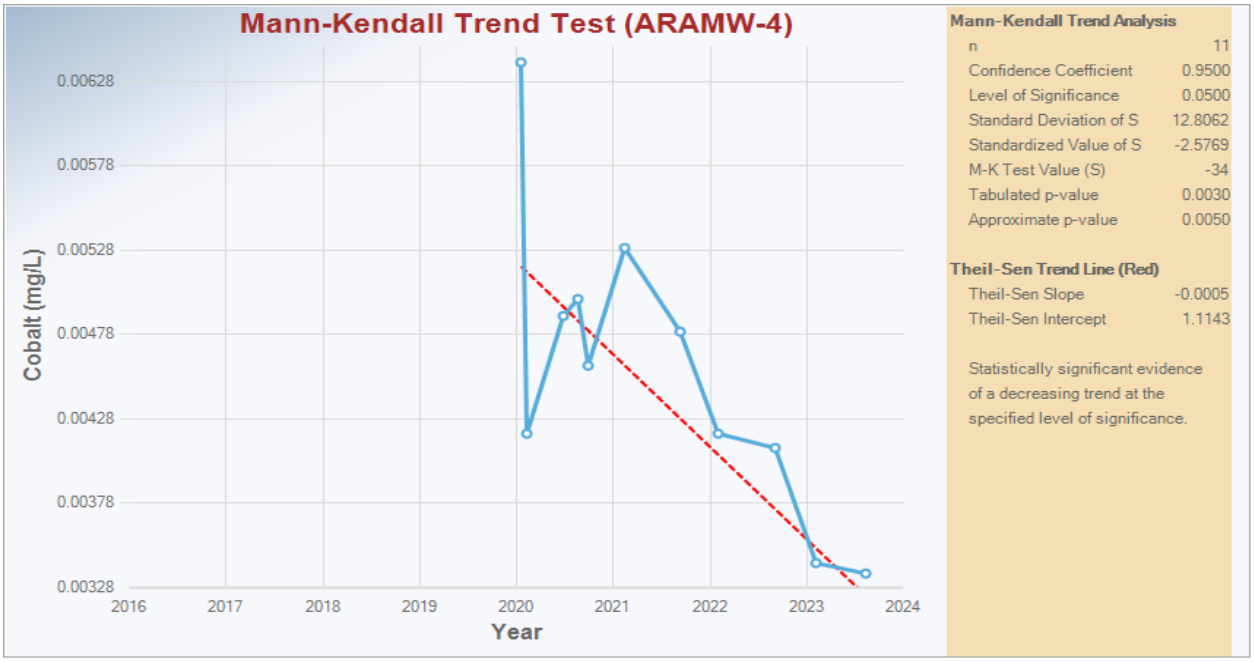
Groundwater Trend Graphs

Appendix D-4
Groundwater Mann-Kendall Trend Graph
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA



Mann-Kendall Trend Analysis	
n	20
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	30.7896
Standardized Value of S	2.5008
M-K Test Value (S)	78
Tabulated p-value	0.0060
Approximate p-value	0.0062
Theil-Sen Trend Line (Red)	
Theil-Sen Slope	0.0026
Theil-Sen Intercept	-5.2887

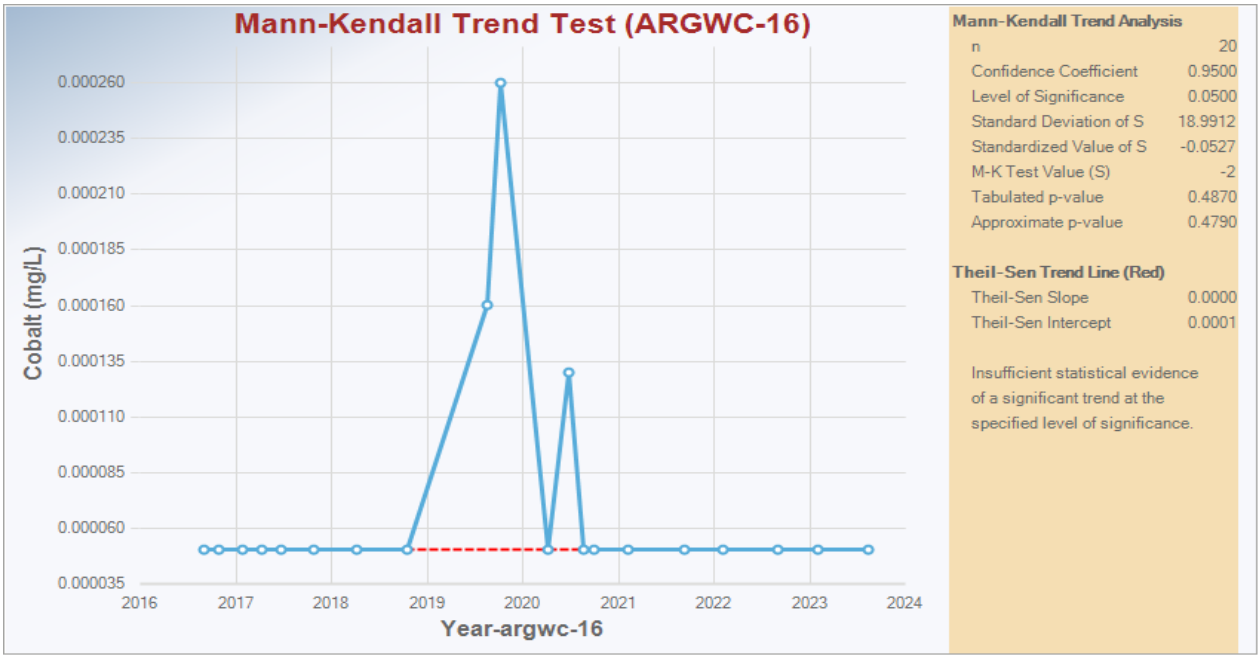
Statistically significant evidence of an increasing trend at the specified level of significance.

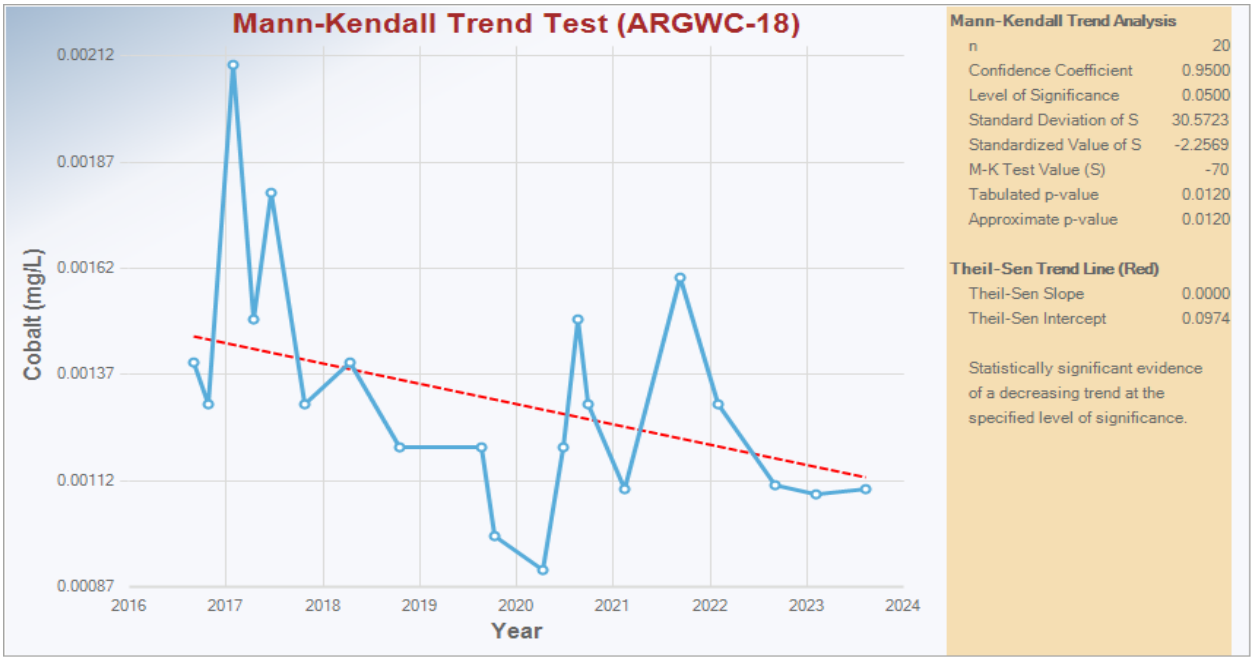


Mann-Kendall Trend Analysis	
n	11
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	12.8062
Standardized Value of S	-2.5769
M-K Test Value (S)	-34
Tabulated p-value	0.0030
Approximate p-value	0.0050
Theil-Sen Trend Line (Red)	
Theil-Sen Slope	-0.0005
Theil-Sen Intercept	1.1143

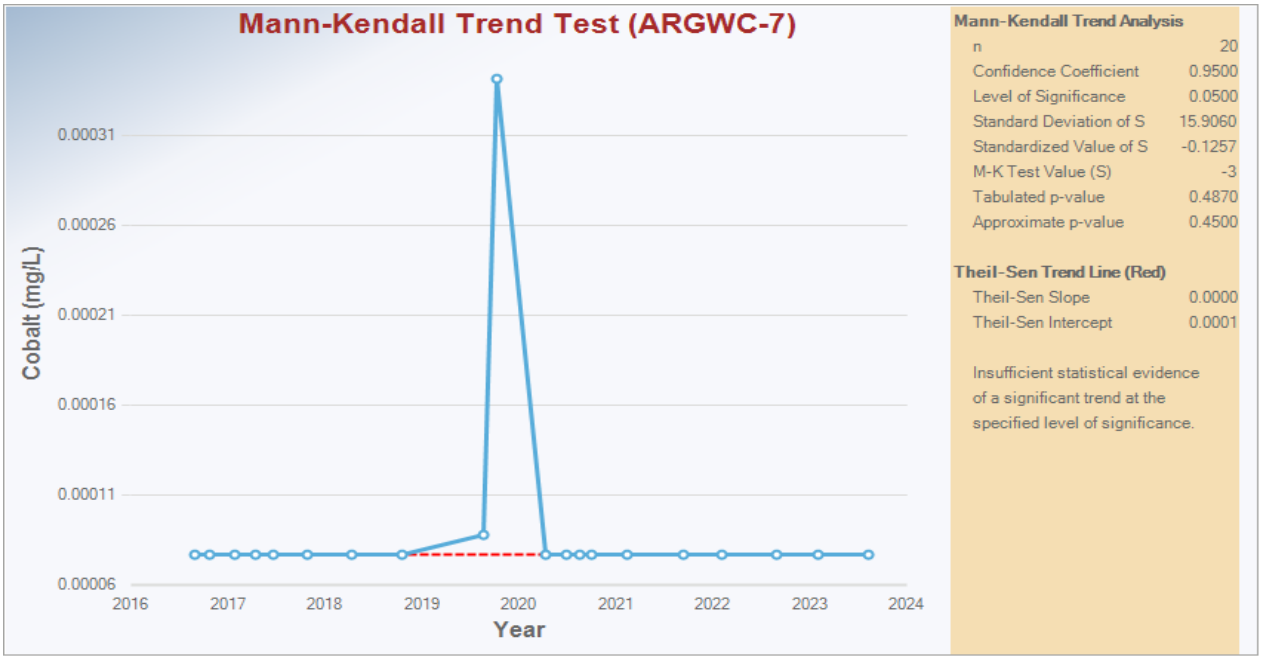
Statistically significant evidence of a decreasing trend at the specified level of significance.

Appendix D-4
Groundwater Mann-Kendall Trend Graph
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA





Appendix D-4
Groundwater Mann-Kendall Trend Graph
Arkwright AP-3 Risk Evaluation Report
Arkwright AP-3
Former Plant Arkwright, Bibb County, GA



APPENDIX C
REACTIVE TRANSPORT MODEL REPORT

REACTIVE TRANSPORT MODEL REPORT

Plant Arkwright Ash Pond 3 (AP-3) Landfill
and Monofill
Macon, Georgia

February 28, 2024

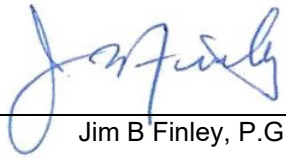
Prepared for:

Georgia Power

Prepared by:

Stantec Consulting Services Inc.
10745 Westside Way, Suite 250
Alpharetta, Georgia 30009-7640

Prepared by: 
Thai Phan, Ph.D.

Reviewed by: 
Jim B Finley, P.G., Ph.D.

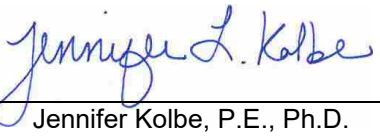
Approved by: 
Jennifer Kolbe, P.E., Ph.D.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Acronyms / Abbreviations

1-D	One dimensional
ACM	Assessment of Corrective Measures
AP-3	Ash Pond 3
CEC	Cation Exchange Capacity
CCR	Coal Combustion Residual
Co	Cobalt
ft	Feet
ft/day	Feet per day
g/mol	Grams per mole
GCSM	Geochemical Conceptual Site Model
Georgia Power	Georgia Power Company
GWPS	Groundwater Protection Standard
Hao	Hydrous aluminum oxide or gibbsite
Hfo	Iron hydroxide or ferrihydrite
m	meters
MNA	Monitored Natural Attenuation
mole/L	Mole per liter
ORP	Oxidation Reduction Potential
PHREEQC	pH, Redox, Equilibrium
PWR	Partially Weathered Rock
Redox	Reduction-oxidation
SEP	Sequential Extraction Procedure
SSL	Statistically Significant Level
Stantec	Stantec Consulting Services Inc.
s.u.	Standard units
µg/L	Microgram per liter

1 Introduction

1.1 Purpose

This reactive transport model report (Report) has been prepared for the Georgia Power Company (Georgia Power) Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill to support the remedy selection process and is included as Appendix C to the *Draft Remedy Selection Report – Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill* (Draft Remedy Selection Report) (Stantec 2023c). The purpose of this Report is to document the reactive transport model developed to evaluate potential remediation approaches to address a statistically significant level (SSL) of cobalt above the groundwater protection standard (GWPS) at one monitoring well at AP-3 Landfill and Monofill (ARGWC-17).

1.2 Site Background, Geology, and Hydrogeologic Setting

The Remedy Selection Report includes a description of the site background, including details related to closure of the coal combustion residual (CCR) units (AP-3 and Monofill). A Site location map is included in the Remedy Selection Report (Figure 1, Stantec 2023c). Figure 1 is an aerial photograph that shows the AP-3 Landfill and Monofill locations and the immediate surroundings.

Near surface geology and hydrogeologic conditions present in the vicinity of AP-3 Landfill and Monofill influence the geochemical nature and extent of the inorganic constituents present in area groundwater. The geologic and hydrogeologic conditions at AP-3 Landfill and Monofill considered in model development are based on information provided in the *Limited Hydrogeologic Assessment Report for Inactive CCR Landfill – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill* (Jacobs 2018) and updated with more recent AP-3 Landfill and Monofill area data (Stantec 2023b), as described in Section 3.1 of the Draft Remedy Selection Report (Stantec 2023c). The groundwater flow direction at AP-3 Landfill and Monofill is shown on Figure 2, and a cross section showing the subsurface geology near the SSL is included on Figure 3.

2 Geochemical Conceptual Site Model

An SSL of the Appendix IV constituent cobalt exceeding the GWPS has been detected in a single monitoring well (ARGWC-17) located at a downgradient location between AP-3 and the Monofill. The purpose of the geochemical conceptual site model (GCSM) is to provide an assessment of the site-specific geochemical conditions that influence the fate and transport of cobalt in groundwater, particularly within overburden material in the area coinciding with the screened interval of the ARGWC-17 well.

The GCSM for AP-3 Landfill and Monofill, is described in the Geochemical Conceptual Site Model Report – Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill, included as Appendix A of the Remedy Selection Report (Stantec 2023c).

3 1-D Geochemical Transport Model

Geochemical boundaries of the GCSM encompass the AP-3 Landfill and Monofill area at Plant Arkwright. Based on evaluations of groundwater chemistry, a conclusion in the GCSM is that the current elevated concentrations of cobalt at the downgradient monitoring well location ARGWC-17 are most likely due to influence from the AP-3 Landfill with limited influence from the Monofill. In current hydrologic conditions, the Monofill is effectively unsaturated and has no direct contact with the groundwater table with the implication that while there could be unsaturated flow between the Monofill and the groundwater table, the degree of influence is small compared to other components of the water balance. As indicated by the potentiometric surface of current groundwater conditions, there is a hydrologic flow path that could explain the influence on groundwater chemistry from CCR pore water in the AP-3 Landfill (Figure 2).

The groundwater quality measured in upgradient groundwater monitoring wells provides the basis for evaluating effects of CCR material on groundwater chemistry. A one dimensional (1-D) reactive transport model was developed for a transect between an upgradient groundwater monitoring well (ARGWA-12) of AP-3 and a downgradient well (ARGWC-17), where groundwater cobalt concentrations currently exceed the GWPS (Figures 1 and 2). The model was used to evaluate the effects and response periods for selected potential remediation approaches (monitored natural attenuation [MNA], and in-situ pH adjustment) on groundwater chemistry at AP-3 Landfill and Monofill. The reactive transport modeling approach, results, and sensitivity analysis are presented in the following sections.

3.1 Modeling Approach

The geochemical model is developed using information presented in the GCSM and consists of a 1-D groundwater flow path, the contributing sources and different water chemistries (upgradient groundwater and CCR pore water), and the geochemical properties of unconsolidated materials present in the subsurface of AP-3 Landfill and Monofill. The geochemical model has been calibrated to site-specific conditions and is being used to support the assessment of corrective measures (ACM) plan for groundwater remedy evaluation and selection process.

The geochemical model relies on groundwater flow direction and estimated groundwater velocities. Table 1 presents a summary of measured hydraulic gradients, hydraulic conductivities, and calculated groundwater velocities for the test locations associated with the AP-3 Landfill and Monofill site. Pre-closure conditions reflect the current status of AP-3 Landfill and Monofill and a groundwater table that is present in the overburden. Based on these conditions, post-closure groundwater flow direction and velocity at AP-3 Landfill and Monofill is inferred to remain consistent with pre-closure conditions.

3.2 1-D Geochemical Model Setup

Geochemical transport modeling that incorporates the information described above was completed using the PHREEQC computer code developed and supported by the United States Geological Survey (Parkhurst and Appelo 2013). PHREEQC, which stands for pH, Redox, Equilibrium, is a public domain computer program that allows aqueous speciation, batch reactions, 1-D transport, and inverse

geochemical reactions. While PHREEQC has the capability to simulate a wide-variety of geochemical processes, of most interest for the analysis presented here is the capability provided by PHREEQC to account for geochemical reaction between aqueous species and aquifer solids (mainly clay minerals and metal hydroxides) by adsorption that contributes to attenuation of constituents resulting in a reduction in concentration below the GWPS. Thermodynamic database used for the model was minteq_v4.dat. Surface master species and surface complexation equilibrium reactions for gibbsite were incorporated in the PHREEQC code (Karamalidis and Dzombak, 2010). The PHREEQC code used in this analysis is included in Appendix A.

One-dimensional transport modeling requires information about the groundwater flow direction and velocity, which is obtained from measured hydraulic gradients, hydraulic conductivities, and calculated groundwater velocities (Table 1).

3.2.1 MODEL DOMAIN

The model domain for geochemical modeling extends spatially from the mixing point at the edge of AP-3 (where upgradient groundwater and CCR pore water combine) to the groundwater monitoring well (ARGWC-17) located at a downgradient location between the AP-3 Landfill and the Monofill (Figure 1). A schematic diagram of the 1-D geochemical model for the B-B' transect is presented in Figure 3. Transect B-B' was drawn from the nearest logical upgradient well (ARGWA-12) to the target downgradient groundwater monitoring well (ARGWC-17). The model flow tube consists of 30 cells of 36 feet (ft) (11 meters [m]) in length along the approximately 1,000 ft (305 m) flow path (Figure 3). Time step is calculated using the average linear velocity of groundwater and length of each cell. Model steps (number of shifts) were calculated using the time step and simulation time that is consistent with the length of time over which there could be influence of AP-3 CCR pore water on groundwater chemistry. Time step and model step are calculated as the following:

$$\text{Time step} = \frac{\text{Cell length (ft)}}{\text{Groundwater veolocity } (\frac{\text{ft}}{\text{s}})} \qquad \text{Equation 1}$$

$$\text{Model step} = \frac{\text{Simulation time (s)}}{\text{Time step (s)}} \qquad \text{Equation 2}$$

The assumption is that sources contributing chemical mass and geochemical processes removing chemical mass are contained within the area described. Conceptually, CCR pore water from the AP-3 unit, represented by the average CCR pore water chemistry from piezometers AP3PZ-1A and AP3PZ-2A, mix with upgradient groundwater, represented by groundwater chemistry from ARGWA-12. The mixing proportion was calculated using chemically conservative constituents (e.g., boron). The resulting mixture migrates downgradient from the mixing point at the downgradient edge of the AP-3 Landfill toward the ARGWC-17 groundwater well. During downgradient migration, geochemical reactions occur between the groundwater and unconsolidated materials as described in Section 3.2.2.

3.2.2 GEOCHEMICAL PROPERTIES

Geochemical modeling for the AP-3 Landfill and Monofill at Plant Arkwright uses the groundwater chemistry from upgradient and downgradient groundwater monitoring wells, CCR pore water chemistry

from the AP-3 unit, and geochemical properties of unconsolidated materials. The geochemically reactive mineralogy of unconsolidated material (Tables 4 - 5 of the GCSM [Stantec 2023b]) was incorporated in the geochemical model to represent aquifer solids that could influence groundwater chemistry. Additionally, adsorption of CCR constituents by iron and aluminum hydroxides is included in the geochemical model via two-layer surface complexation modeling based on the theoretical description of Davis and Kent (1990). Further information related to associated constants required to run the geochemical model were developed by Dzombak and Morel (1990) for iron (hydrous ferric oxide [Hfo]) using iron hydroxide, and information developed by Karamalidis and Dzombak (2010) for aluminum (hydrous aluminum oxide [Hao]) using gibbsite.

Properties of the iron and aluminum adsorbing surfaces were obtained from select data generated from sequential extraction procedure (SEP) testing (Tables 6 and 7 of the GCSM [Stantec 2023b]) and relationships between the mass of iron/aluminum mineral surfaces and the abundance of adsorption sites on the mineral surfaces in units of moles of surface sites per mole of iron/aluminum. Manganese is known to have a high affinity for cobalt; however, site geochemical data indicate that the role of manganese oxides in cobalt attenuation is expected to be insignificant relative to that of iron and aluminum oxides (Stantec, 2023b). Thus, adsorption on manganese oxides is not considered in the model.

Surface sites for iron hydroxide are differentiated between weak and strong sites, referring to the strength of the bond between the surface and a constituent bound to the sites of hydrous ferric oxide. Weak and strong adsorption sites arise from the molecular composition of the iron hydroxides. Aluminum hydroxide is defined as having a single type of site available for adsorption as described in the theoretical description of the process (Karamalidis and Dzombak, 2011). An additional assumption is that the molecular weights of Hfo and Hao are 88.85 grams per mole (g/mol) and 78.00 g/mol, respectively. Iron or aluminum used in determining parameters for surface complexation calculations is the sum of iron or aluminum extracted in the non-crystalline and metal hydroxide steps of the SEP. Unconsolidated materials are assumed to have a bulk density of 1.93 kg/L and a porosity of 0.2 for estimating the water to rock ratio used to calculate the amount of minerals and surface sites per one liter of pore water for model inputs.

The resulting parameters applied in geochemical modeling for surface complexation (adsorption) modeling are shown in Table 2. Although specific unconsolidated material samples from different locations adjacent to AP-3 and Monofill were tested, the entire dataset was used to determine the minimum, maximum, and mean to incorporate the variability of the unconsolidated materials in the vicinity of AP-3 and Monofill. Additional details on the calculations of surface sites used in the model are shown in the table footnotes (Table 2).

3.2.3 TRANSPORT SETTINGS – PRE-CLOSURE AND POST-CLOSURE CONDITIONS

The geochemical model was run for 74 years in two distinct periods. The first period (14 years) represents development of pre-closure conditions, and the second period (60 years) corresponds to response of the groundwater system to post-closure conditions. The time periods were determined based on the understanding of groundwater flow (i.e., average linear velocity and travel distance from source to location at the downgradient waste boundary [ARGWC-17]) and age of the AP-3 Landfill. The approach

follows the conclusion in the GCSM that cobalt at ARGWC-17 originated primarily from an influence on groundwater chemistry in part by AP-3 CCR pore water.

The simulation time for the pre-closure period was established with the assumption that the effective hydrologic flow path extends from the downgradient edge of the AP-3 Landfill to the target groundwater monitoring well ARGWC-17. Furthermore, the simulation time needs to be consistent with the age of the Landfill. Specifically, the simulation time was calibrated by varying the groundwater velocity value within the range (0.051 feet per day (ft/day)–1.80 ft/day) estimated for groundwater flow in unconsolidated materials within AP-3 Landfill and Monofill at the Plant Arkwright (Table 1). The calibrated groundwater flow of 0.35 ft/day was selected for this base case based on the following constraints:

- Modeled concentrations of boron had to match the concentrations of boron in groundwater at the downgradient well (ARGWC-17) within the calibration period between April 2020 and February 2023 (51–110 micrograms/liter (µg/L)). Transport of the conservative constituent boron, which is also a CCR tracer, is primarily controlled by advection and dispersion. The arrival time of boron is used to infer the presence of the CCR pore water influenced groundwater at ARGWC-17 well, which is matched with the monitoring data for the calibration period (April 2020–February 2023). This approach assumes that CCR pore water influenced groundwater arrived at the downgradient well ARGWC-17 in 2020.

- The AP-3 Landfill did not receive CCR materials until 1970s (Stantec 2023b) and the CCR unit was closed in 2010. Stantec assumes that CCR pore water from AP-3 Landfill started to mix with upgradient groundwater (ARGWA-12) at the start of the model path beginning in 2010, which means that the model time (0 year) for pre-closure period corresponds to calendar year 2010.

- Based on the above constraints, Stantec assumed that at least 10 years is needed for the CCR pore water influenced groundwater to arrive the downgradient well ARGWC-17.

The simulation time for the second period (60 years), corresponding to post-closure period, was selected based on the following constraints:

- Groundwater flow post-closure is assumed to remain the same as the calibrated groundwater flow for the current conditions.

- The simulation time is long enough to determine the time required for the modeled concentration of cobalt to decline below the GWPS in the modeling scenarios for post-closure period (e.g., remediation scenarios and model sensitivity analysis).

3.3 Geochemical Model Calibration for Pre-closure Conditions

3.3.1 APPROACH

The geochemical model considers four geochemical processes that influence the predicted groundwater chemistry: (1) mixing of CCR pore water and upgradient groundwater, (2) thermodynamic equilibrium with select geochemically reactive mineral phases, (3) surface complexation, or adsorption, between cobalt in

groundwater and iron/aluminum hydroxide minerals, and (4) cation exchange between positively charged ions in groundwater and positively charged interlayer ions in clay minerals. Each of the listed categories of information are used and values adjusted within the observed range of measured data in the geochemical model to produce a reasonable comparison between predicted groundwater chemistry and observed groundwater chemistry. The objective of calibration is to create a geochemical model of the system that matches the measured groundwater chemistry at the downgradient monitoring well (ARGWC-17) over the calibration period (2020–2023; Stantec 2023b). Equally important is to create a model that will respond to changes in groundwater geochemistry of the system to reflect various remediation options considered during remedy selection.

Groundwater and CCR pore water chemistry are represented by the full suite of constituents measured in the laboratory, plus the field measurements of pH, oxidation reduction potential (ORP), and temperature. However, for purposes of calibration of the geochemical model, and determining the mixing fraction for CCR pore water and upgradient groundwater, only those constituents least affected by other geochemical reactions are considered for defining the range in mixing. Boron and chloride are considered non-reactive in that there are no other geochemical reactions (e.g., adsorption, cation exchange capacity [CEC], mineral equilibria) that change their concentrations after mixing of CCR pore water and upgradient groundwater. In this report, boron was used to determine the mixing fractions for the model due to the conservative behavior (Ruhl et al., 2012) and the indication of CCR influence at ARGWC-17 (Stantec 2023b).

Binary mixing (i.e., pore water and upgradient groundwater) is based on determining the proportions, as a percentage, of each source to produce the target concentration. Two unknowns must be determined, the percentages of each source in the mixture. With two equations and two unknowns, the mixing fractions for each source can be calculated. The following example for boron shows the basic method.

$$xC_B^{pw}+yC_B^{upgradient}=C_B^{ARGWC\text{-}17} \qquad \text{Equation 3}$$

$$x+y=1 \qquad \text{Equation 4}$$

Where:

C = concentration
pw = CCR pore water
B = boron
x = fraction of CCR pore water in the mixture
y = fraction of upgradient groundwater in the mixture

Solving Equation 4 for *x*, substituting into Equation 3, and algebraically manipulating to solve Equation 3 for *x* provides the calculated fraction of *x* (CCR pore water) in the mixture. The fraction of *y* in the mixture can then be determined using Equation 4.

Minerals identified in the unconsolidated materials characterization that could influence groundwater chemistry and the concentrations of select CCR constituents include iron and aluminum hydroxides. The presence of a given mineral, for example pyrite, is determined by mineralogical analysis. The amount of

mineral phase included in the model represents the estimated amount of the mineral available for the equilibrium reactions, defined using the results of mineralogical analysis and calculated water to solid ratio (Section 3.2.2). For example, cobalt in the aquifer is likely associated with multiple phases including adsorbed species on aquifer minerals as discussed in the GCSM report (Stantec 2023b). In the geochemical model, desorption of cobalt adsorbed on hydroxide minerals (Hfo and Hao) in the aquifer was used as a second source of cobalt in addition to cobalt sourced from CCR pore water. Calculated cobalt concentration of 2.9 µg/L in the hypothetical mixture of CCR pore water and upgradient groundwater was lower than the cobalt concentrations (16–52 µg/L) measured at the downgradient well (ARGWC-17). This infers that cobalt is released during transport within the unconsolidated materials, possibly through desorption as discussed in the GCSM (Stantec 2023b). In the geochemical model, adsorption/desorption onto Hfo and Hao is included as a calibration parameter for cobalt concentration. Cobalt adsorption is primarily controlled by the abundance of adsorption sites and groundwater pH. Given that cobalt adsorption and desorption is expected to be more sensitive to groundwater pH than the abundance of adsorption sites, groundwater pH was calibrated by changing the saturation index of pyrite (i.e., acidity produced from oxidation of pyrite) along the flow path instead of adjusting the adsorption sites (i.e., constant adsorption sites).

The ranges in amounts of iron and aluminum hydroxide available for surface complexation reactions (adsorption) are presented in Table 2. The observed ranges serve as the calibration ranges used to establish the probable amount of metal hydroxide present in the groundwater flow system. Changes in iron and aluminum hydroxide minerals were not coupled to the surface sites available for adsorption and desorption because the surface sites are a calibration parameter and the changes in the mineral mass associated with dissolution and precipitation reactions are negligible in comparison to the total abundance of surface sites in the unconsolidated materials. In addition to the range for available metal hydroxides, the range in CEC measured in unconsolidated materials and discussed in the GCSM (Stantec 2023b) was used as a calibration parameter in developing the geochemical model. Likewise, a range of estimated groundwater velocity reported in the GCSM (Stantec 2023b) was used as a calibration parameter. A copy of the PHREEQC code is presented in Appendix A.

3.3.2 PRE-CLOSURE CONDITION CALIBRATION RESULTS

Calibration of the geochemical model entails determining mixing ratios for CCR pore water and upgradient groundwater based on CCR material tracer boron and then adjusting other geochemical processes within the limits established by the available geochemical data to obtain a reasonable match between the model outputs with the observed conditions as reasonably as possible. The important advantage of this approach is to create a geochemical model that considers key processes (e.g., advective and dispersive transport, adsorption/desorption, cation exchange, pH variation along the flow path) and results in groundwater chemistry reasonably matching with measured groundwater chemistry at the downgradient well (ARGWC-17). Thus, the model is expected to reasonably respond to changes in the groundwater geochemistry of the system to reflect various remediation options considered during remedy selection. While the measured groundwater concentration can be used in a model to represent current conditions, mimicking the measured concentrations with a mixture of observed mineral phases and allowing probable geochemical reactions (e.g., adsorption), coupled with observed groundwater flow rates, improves the modeling process, and demonstrates the understanding of the geochemical system.

This approach also requires an evaluation of the sensitivity of geochemical parameters, as they are modified to mirror current conditions. The results of calibration of the geochemical model for AP-3 Landfill and Monofil at Plant Arkwright are presented in this section.

The transect alignment used for geochemical modeling at the AP-3 unit is shown in Figure 3. Cobalt concentrations are higher than the GWPS, and the focus of the pre-closure condition simulation is to create a model simulation that captures the main geochemical processes influencing the concentration of cobalt at the downgradient groundwater monitoring well location. However, the geochemical model also needs to consider other characteristics of groundwater chemistry, including pH, ORP, major ion concentrations, and CCR material tracers. The first two groundwater chemistry characteristics, pH and ORP, influence adsorption/desorption reactions, the stability of iron and aluminum hydroxide minerals, and the distribution of reduction-oxidation (redox) -sensitive species.

Predicted time-series concentrations of cobalt, CCR tracer boron, and pH at the downgradient groundwater monitoring well (ARGWC-17) are shown on Figure 4. The predicted concentrations during the calibration period (2020–2023) using the calibrated geochemical model were plotted as box plots for the comparison with the measured groundwater quality data within the same time (Figure 5). The reactive transport model results show that the predicted concentrations of cobalt and CCR tracer boron were within the ranges of the measured concentrations of the corresponding constituents at the downgradient well ARGWC-17 (Figure 5).

The predicted concentration of cobalt is primarily controlled by adsorption and desorption onto Hfo and Hao along the flow path (Figure 4). The aquifer was originally filled with upgradient groundwater (ARGWA-12) with the current pH value of 6.0 standard units (s.u.) and cobalt concentration of 0.3 µg/L. Cobalt is introduced by mixing upgradient groundwater with AP-3 pore water as described in the GCSM. However, hypothetical mixing does not result in cobalt concentrations at such level observed at the downgradient well. Thus, cobalt is expected to be additionally released through desorption from Hfo and Hao along the aquifer. While historical groundwater pH is unknown, the model assumes that historical groundwater was in equilibrium with aquifer minerals at a higher pH value (7.0 s.u.) to facilitate the adsorption of cobalt onto Hfo and Hao along the flow path. As flow of CCR influenced groundwater through the aquifer, adsorption and desorption of cobalt onto iron hydroxide minerals delay the stabilization of cobalt in comparison to boron, a more conservative constituent that is not influenced by adsorption. Overall, the release of previously adsorbed cobalt into CCR pore water influenced groundwater contributed to the increase in cobalt concentration at ARGWC-17 (Figure 4).

The modeling approach represents one of many mechanisms controlling the mobility of cobalt in groundwater at the AP-3 unit. Simulation of pre-closure conditions indicates a combination of the geochemical processes listed in the modeling approach (Section 3.3.1) providing a reasonable fit for calibration of the geochemical model to pre-closure conditions. The effect of these geochemical processes can explain the observed behavior of cobalt in groundwater. For purposes of using geochemical modeling as a tool to assess corrective measures for cobalt in site groundwater, the model is considered calibrated.

3.4 Geochemical Modeling for Post-Closure Conditions

3.4.1 APPROACH

Post-closure conditions were simulated by the second transport period (60 years) of the calibrated model. The calibrated parameters for pre-closure modeled conditions remain the same for the simulation of post-closure conditions through the second transport period. Post-closure model conditions simulate groundwater flow following the removal of the CCR material from AP-3 Landfill from the current location. As a result, the CCR pore water source is entirely removed. Upgradient groundwater post-closure at the start of the 1-D flow path is presented by a mixture of 99% upgradient groundwater and 1% residual CCR pore water-influenced groundwater (as defined during the first transport period), which reflects an understanding that there will be some residual AP-3 influenced groundwater in the system. The PHREEQC code for the post-closure period is presented in Appendix A. The post-closure model was used to predict changes in groundwater chemistry resulted from two different remediation scenarios: 1) monitored natural attenuation (MNA) and 2) in-situ pH adjustment followed by MNA.

3.4.1.1 Post-closure Monitored Natural Attenuation Scenario

The post-closure transport period under MNA scenario was run for 60 years to simulate the changes in groundwater chemistry after the removal of CCR material in AP-3 and the Monofill. Model parameters calibrated for pre-closure conditions remain the same for the post-closure transport period.

3.4.1.2 Post-closure In-situ pH Adjustment Scenario

The post-closure transport period under in-situ pH adjustment scenario was run for 60 years to simulate the changes in groundwater chemistry after the removal of CCR material in the AP-3 Landfill and the adjustment of groundwater pH to 7.0 s.u. at cell 29 within the flow path (30 cells in total), upgradient of the monitoring well (ARGWC-17) that is represented by cell 30 in the model (Figure 3). In-situ pH adjustment at cell 29 is simulated by fixing groundwater pH within this cell to 7.0 s.u. during the entire post-closure transport period. In-situ pH adjustment represents remediation measures such as injection of reagents such as sodium bicarbonate, sodium hydroxide, or lime or installation of a passive reactive barrier filled with limestone or other media which ultimately neutralize acidic groundwater to achieve pH 7.0 s.u. Model parameters calibrated for pre-closure conditions remain the same for the post-closure transport period.

3.4.2 RESULTS

3.4.2.1 Post-closure Monitored Natural Attenuation Conditions

The time-series model results for the groundwater boron and cobalt concentrations at monitoring well ARGWC-17 are presented in Figure 6. The concentration of boron is predicted to remain constant for about seven years post AP-3 closure, due to the length of flow path, then decrease and eventually reach the upgradient groundwater concentrations in about 12 years after the removal of AP-3. Likewise, pH values are predicted to hold steady at a value of 5.2 s.u. following closure of AP-3. Unlike CCR tracer boron's concentration trend, the concentration of cobalt is predicted to increase for approximately seven

years after AP-3 closure because of ongoing desorption, then gradually decrease due to gradual increase in the influence of upgradient groundwater that is low in cobalt (< 0.3 µg/L). Approximately 27 years after closure of AP-3, the concentration of cobalt at ARGWC-17 is predicted to reach a level below the GWPS (6 µg/L). The duration for cobalt to reach a concentration below GWPS is controlled by the desorption of cobalt from iron hydroxide in addition to the estimated groundwater velocity post-closure and assumed dispersion.

3.4.2.2 Post-closure In-situ pH Adjustment Scenario

Under the in-situ pH adjustment scenario, an increase in pH value upgradient of the monitoring well (ARGWC-17) facilitated the adsorption of cobalt onto hydroxide minerals in the aquifer (e.g., Hfo and Hao). As a result, cobalt concentration in groundwater at the downgradient well dropped quickly within the first year post-closure (the first model time step) and remained stable at the levels below the GWPS of 6 µg/L (Figure 6). In-situ pH adjustment generally did not affect the temporal decreasing trend of boron concentration in the monitoring well (ARGWC-17) as observed under MNA scenario. Likewise, pH at ARGWC-17 well remained at a relatively constant value of approximately 5.2 s.u. as observed in the pre-closure period. Overall, the model results for post-closure conditions under in-situ pH adjustment scenario demonstrated that pH is a critical factor controlling the adsorption and desorption of cobalt onto oxide minerals. Cobalt adsorption is enhanced under circumneutral to basic pH (e.g., pH above 6.5), as demonstrated in experimental studies (e.g., Landry et al., 2009).

3.5 Sensitivity Analysis

The modeling results for both pre-closure and post-closure conditions showed that groundwater velocity, pH, and aquifer properties such as abundance of hydroxide minerals are expected to affect the predicted time required for cobalt to meet GWPS. Thus, these parameters would be critical components of the geochemical model and warrant sensitivity analysis in support of site assessment for remedy selection. Model results for sensitivity analysis are summarized in Table 3 and discussed in the following subsections.

3.5.1 GROUNDWATER VELOCITY

Sensitivity analysis was performed for post-closure conditions using the same calibrated model for the base case scenario (pre-closure conditions) two groundwater flow velocities: a half (0.5X model scenario) and two times (2X model scenario) the groundwater flow velocity calibrated for pre-closure conditions (Table 3). Specifically, groundwater flow velocities associated with each scenario are:

- 0.5X model scenario: 0.5 x 0.35 = 0.175 ft/day
- Base case scenario: 0.35 ft/day
- 2X model scenario: 2 x 0.35 = 0.7 ft/day

Time-series plots (Figure 7) show the sensitivity of groundwater flow on the predicted groundwater chemistry at the downgradient monitoring well (ARGWC-17). Under 0.5X groundwater velocity scenario

(0.175 ft/day), the predicted duration for cobalt concentration declining to a level below the GWPS was about 54 years, which is much longer than the base case scenario. In contrast, the 2X groundwater velocity scenario predicts that about 12 years are needed for cobalt to reach a concentration below the GWPS. Future hydrogeologic data collected in support of the remedy selection will be evaluated and, if warranted, used to re-evaluate the predicted time frame to reach GWPS and adapt the corrective action strategy.

3.5.2 GROUNDWATER pH

Cobalt adsorption onto hydroxide minerals is most effective at pH values above 6.5 (e.g., Landry et al., 2009), which is expected to represent the range of historical (i.e., prior to AP-3 closure) groundwater pH values at which cobalt adsorption took place. The cobalt available for adsorption historically could either be derived from a natural source or from the CCR pore water. Cobalt released through desorption under acidic groundwater pH is expected to be the source of cobalt observed at downgradient groundwater monitoring well locations. Thus, cobalt concentrations in groundwater are controlled by both historical and current groundwater pH values along the flow path that were calibrated to match the predicted cobalt concentration with the observed cobalt concentration at the downgradient well for the base case scenario (pre-closure conditions).

3.5.2.1 Historical Groundwater pH

Under the base case scenario, historical groundwater pH was set to 7.0 s.u. to calibrate the amount of cobalt adsorbed onto hydroxide minerals that was available for desorption during interactions with CCR pore water-influenced groundwater. When historical groundwater pH was decreased by 0.5 unit, from 7.0 s.u. to 6.5 s.u., adsorbed cobalt onto iron hydroxide minerals was decreased by about five times. As a result, modeled cobalt concentrations (3.6 – 7.2 µg/L) were underpredicted in comparison to cobalt concentrations observed at the downgradient well (16 – 52 µg/L; ARGWC-17). The predicted time to achieve GWPS for cobalt was 18 years (Table 3), which is shorter than the base case (27 years). When historical groundwater pH was increased by 0.5 unit, from 7.0 s.u. to 7.5 s.u., adsorbed cobalt onto iron hydroxide minerals was increased by about three times. As a result, modeled cobalt concentrations (98 – 104 µg/L) were overpredicted in comparison to cobalt concentrations observed at the downgradient well (16 – 52 µg/L; ARGWC-17). The predicted time to achieve GWPS for cobalt was 32 years (Table 3), which was longer than the base case (27 years). Overall, historical groundwater pH is expected to affect the amount of cobalt adsorbed onto hydroxide minerals in the aquifer. Subsequently, the higher the amount of adsorbed cobalt, the longer time needed for cobalt to reach GWPS under a monitored natural attenuation scenario.

3.5.2.2 Current Groundwater pH

Groundwater pH along the flow path (4.90 – 6.10 s.u.) was calibrated for base case (pre-closure conditions) by changing the saturation index of pyrite mineral along the model cells. Sensitivity analysis on the current groundwater pH was completed by varying pH values within 0.15 s.u. of the calibrated value so that the pH values were still within the range primarily influencing the degree of cobalt adsorption/desorption (~4.5 – 6.5 s.u.). When current groundwater pH along the flow path was decreased

by approximately 0.15 unit (4.76 – 5.92 s.u.), modeled cobalt concentrations (64 – 76 µg/L) were overpredicted in comparison to cobalt concentration observed at the downgradient well (16 – 52 µg/L; ARGWC-17). In addition, modeled cobalt concentration exhibited a decreasing trend over the calibration period; whereas measured cobalt groundwater concentration at the downgradient well exhibited an increasing trend. The predicted time to achieve the GWPS for cobalt was 11 years (Table 3) which was shorter than the base case (27 years). In contrast, when current groundwater pH was increased by approximately 0.15 unit (5.06 – 6.22 s.u.), modeled cobalt concentrations (7.3 – 8.6 µg/L) were underpredicted in comparison to the cobalt concentration observed at the downgradient well. Under this scenario, the predicted time to decrease below the GWPS for cobalt (34 years) was longer than the base case (27 years; Table 3). Overall, groundwater pH greatly affects the behavior of cobalt in groundwater with a shorter time to reach GWPS and higher cobalt concentration under more acidic groundwater pH and a longer time to reach GWPS and lower cobalt concentration under mildly acidic groundwater pH values. Under neutral to alkaline pH values, cobalt is effectively attenuated, thus, the time for cobalt to reach GWPS would be primarily controlled by groundwater velocity.

3.5.3 ABUNDANCE OF HYDROXIDE MINERALS

In addition to groundwater pH, cobalt adsorption capacity by iron hydroxide minerals in the unconsolidated materials at the downgradient side of the AP-3 Landfill unit, as measured by the total number of adsorption sites, is theoretically directly proportional to the amount of iron hydroxide mineral present in the aquifer. A similar argument holds for the effectiveness of aluminum hydroxide. Sensitivity analysis was performed for post-closure conditions using the same calibrated model for the base case scenario (pre-closure conditions) for two values of the hydroxide mineral abundances: a half (0.5X model scenario) and two times (2X model scenario) the abundance of iron and aluminum hydroxide minerals calibrated for pre-closure conditions. Under 0.5X scenario, modeled cobalt concentrations (29 – 37 µg/L) were greater than the cobalt concentrations predicted under base case scenario. However, the predicted concentrations of cobalt under the 0.5X scenario and the base case scenario were both comparable with the measured concentrations at the downgradient well (ARGWC-17). The time for cobalt to reach the GWPS was 11 years, shorter than the base case (27 years; Table 3). Under the 2X scenario, modeled cobalt concentrations (16.5 – 16.7 µg/L) were lower than the cobalt concentrations predicted under the base case scenario and measured concentrations at the downgradient well (ARGWC-17). The time for cobalt to reach the GWPS was 57 years, longer than the base case (27 years; Table 3). Overall, both pre-closure and post-closure model results were sensitive to the abundance of hydroxide minerals in the aquifer that was varied from half to twice the calibrated value for the base case scenario. The higher the amount of hydroxide minerals, the greater potential for cobalt to adsorb, subsequently, the longer it takes for cobalt to reach the GWPS under monitored natural attenuation scenario.

3.6 Modeling Uncertainty and Limitations

Development of the geochemical model for the AP-3 and Monofill CCR management units at Plant Arkwright is based on combining information from the hydrogeologic analysis of groundwater flow, measurement of groundwater chemistry, measurement of CCR pore water chemistry, and analysis of the unconsolidated material geochemistry. The hydrogeologic and geochemical data were incorporated into a geochemical modeling computer program (PHREEQC) constructed to represent the GCSM. There are

uncertainties inherent to each step of data collection and analysis with the cumulative uncertainty offset by sensitivity testing of the final geochemical model.

The calibrated geochemical model is not an exact match of actual field conditions; however, the calibrated model produces results (predicted groundwater chemistry) that are consistent with the measured groundwater chemistry. Therefore, the geochemical model provides a reasonable basis for evaluating the effects of various CCR management unit closure options and potential groundwater remedies to support the ACM Plan. While geochemical modeling results allow reasonable comparison of ACM Plan alternatives, the geochemical modeling results are not absolute, but are comparative.

4 Geochemical Modeling Conclusions

The 1-D reactive transport model for the AP-3 and Monofill groundwater system was developed using the PHREEQC computer modeling program. Inputs for the geochemical model were derived from existing groundwater quality data (upgradient, CCR pore water, and downgradient), geochemical properties of unconsolidated materials, and estimates of linear groundwater velocity. Results using the calibrated geochemical transport model show that with AP-3 pore water as a secondary source of cobalt observed at down gradient well ARGWC-17, the primary geochemical process contributing to cobalt concentrations in groundwater is likely the desorption of cobalt that was previously adsorbed onto iron hydroxide. The predicted time for cobalt to reach values below the GWPS under MNA conditions is about 27 years. If adjustments were made to in-situ pH causing an increase in pH, the time would be shorter, as indicated in the in-situ pH adjustment scenario for the post-closure condition.

Sensitivity analysis using two groundwater velocity values, half (0.5X) and two times (2X) of the groundwater velocity calibrated for base case scenario, shows that under high velocity conditions, the cobalt GWPS would be obtained in about 12 years. High velocity condition scenario simulates conditions under which groundwater velocity increased post-closure, possibly due to an increase in groundwater recharge within the AP-3 Landfill and Monofill area, upgradient of the ARGWC-17 well. However, it would take about 54 years to reach cobalt GWPS under low velocity conditions. Overall, the calibrated linear groundwater velocity for pre-closure period produces results most consistent with the timeline of operations at Plant Arkwright. In addition to groundwater velocity, the time for cobalt to reach the GWPS is also sensitive to groundwater pH and the abundance of hydroxide minerals as these parameters influence the adsorption and desorption of cobalt.

5 References

Davis, J.A., and Kent, D.B. (1990). Surface Complexation Modeling in Aqueous Geochemistry. In M.F.

Driscoll, F.G., 1986. Groundwater and Wells (2nd ed.), Johnson Filtration Systems, Inc., St. Paul, Minnesota, 1089p.

Dzombak, D.A. and Morel, F.M.M. (1990). Surface Complexation Modeling: Hydrous Ferric Oxide. Wiley & Sons, New York. 393 pp.

Freeze, R.A. and J.A. Cherry, 1979. Groundwater, Prentice Hall, Englewood Cliffs, New Jersey, 604p.@

Jacobs, 2018. Limited Hydrogeological Assessment Report for Inactive CCR Landfill – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, February 28, 2022.

Karamalidis and Dzombak, D.A. (2010). *Surface Complexation Modeling: Gibbsite.* Wiley & Sons, New York. 312 pp.

Landry, C. J., Koretsky, C. M., Lund, T. J., Schaller, M., & Das, S. (2009). Surface complexation modeling of Co (II) adsorption on mixtures of hydrous ferric oxide, quartz and kaolinite. Geochimica et Cosmochimica Acta, 73(13), 3723-3737.

Parkhurst, D.L. and Appelo, C.A.J. (2013). *Description of input and examples for PHREEQC version 3 - a computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations.* US Geological Survey Techniques and Methods, book 6, chap A43, p 497. Available only at <http://pubs.usgs.gov/tm/06/a43.

Ruhl, L., Vengosh, A., Dwyer, G.S., Hsu-Kim, H., Schwartz, G., Romanski, A. and Smith, S.D., 2012. The impact of coal combustion residue effluent on water resources: A North Carolina example. Environmental Science & Technology, 46(21), pp.12226-12233.

Stantec Consulting Services Inc. (Stantec), 2023a. Semi-Annual Groundwater Monitoring and Corrective Action Report – Georgia Power Company Plant Arkwright Ash Pond Ash Pond 3 Landfill and Monofill, February 28, 2023.

Stantec Consulting Services Inc. (Stantec), 2023b. Geochemical Conceptual Site Model Report – Georgia Power Company Plant Arkwright Ash Pond 3 Landfill and Monofill, February 28, 2024.

Stantec Consulting Services Inc. (Stantec), 2023c Remedy Selection Report – Plant Arkwright Ash Pond 3 (AP-3) Landfill and Monofill, February 28, 2024.

US EPA. 1989. Interim Final RCRA Facility Investigation (RFI) Guidance, Volume II OF IV, Soil, Ground Water and Subsurface Gas Releases, EPA 530/SW-89-031, May 1989, Waste Management Division, Office of Solid Waste, U.S. Environmental Protection Agency.

TABLES

TABLE 1
GROUNDWATER FLOW VELOCITIES
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Location	Lithology	K_h (cm/s)	K_h (ft/d)		n_e		i (ft/ft)		Average Linear Velocity at Tested Well Location (ft/d)
AP-3 Landfill and Monofill									
ARGWC-17	Overburden: Silty Sand to Sandy Silt	1.15E-03	3.26	[1]	0.10	[2]	0.011	[3]	**0.359**
ARGWC-18	Overburden: Silty Sand to Sandy Silt	1.63E-04	0.462	[1]	0.10	[2]	0.011	[3]	**0.051**
ARGWA-24	Overburden: Silty Sand to Sandy Silt	5.79E-03	16.4	[1]	0.10	[2]	0.011	[3]	**1.804**
CCRLF-3	Overburden: Silty Sand to Coarse Sand	5.26E-04	1.49	[1]	0.20	[2]	0.011	[3]	**0.082**
					Summary Statistics				
					minimum				**0.051**
					maximum				**1.80**
					mean				**0.574**
					geometric mean				**0.228**

Notes:

[1] Result provided in Table 4 of the. *Semi-Annual Remedy Selection and Design Progress Report, Georgia Power Company – Plant Arkwright Ash Pond 3 Landfill and Monofill,* Macon, Georgia, July 30 , 2021

[2] Estimated effective porosity values of 10% was selected for the silty sands/sandy silts overburden based on a review of several sources, including Driscoll, 1986; US EPA, 1989; Freeze and Cherry, 1979.

[3] Average hydraulic gradient caluclated based on recent hydraulic gradient calculated from September 2021, August 2022, and, January 2023 groundwater elevations at AP-2 DAS monitoring wells (ARGWA-20 to ARGWC-21) screened in the uppermost aquifer.

"kh" - horizontal hydraulic control

"ne" - effective porosity

"i" - horizontal hydraulic gradient

"cm/s" - centimeters per second

"ft/d" - feet per day

"ft/ft" - feet per foot

TABLE 2
SURFACE COMPLEXATION PARAMETERS FOR GEOCHEMICAL MODELING
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Parameter	Unit	Ferrihydrite			Gibbsite		
		Minimum	Mean	Maximum	Minimum	Mean	Maximum
Geometric Mean of Aquifer Solids Composition	mg/kg X[1]	2300	2500	2700	220	315	410
	mol X (per kg solids)[2]	0.041	0.045	0.048	0.008	0.012	0.015
Surface Site Concentration[3]	mol weak sites / mol X[2]	0.2	0.2	0.2	0.41	0.41	0.41
	mol strong sites / mol X	0.005	0.005	0.005	---		
Surface Sites[4]	mol weak/kg	0.008	0.009	0.010	0.003	0.005	0.006
	mol strong/kg	0.00021	0.00022	0.00024	---		
Surface Sites[4]	mol weak/L	0.0636	0.0691	0.0746	0.0258	0.0370	0.0481
	mol strong/L	0.00159	0.00173	0.00187	---		
Mass Ferrihydrite or Gibbsite[5]	g/kg	3.66	3.98	4.30	0.64	0.91	1.19
Mass Ferrihydrite or Gibbsite[5]	g/L	28.2	30.7	33.2	4.9	7.0	9.2

Notes

1 –milligrams per kilogram (mg/kg) of X where X is either iron (ferrihydrite) or aluminum (gibbsite)

2 – moles (mol) of X per kilogram (kg)

3 – Surface site concentrations for ferrihydrite and gibbsite are from Dzombak and Morel (1990) and Karamalidis and Dzombak (2011), respectively

4 – Surface sites are calculate by multiplying the surface site concentration (mol weak sites/mol X or mol strong sites/mol X) with the number of mol of X per kg of unconsolidated material (mol X/kg). For example, mean surface sites of ferrihydrite (0.009 mol weak site) is obtained by multiplying 0.045 mol Fe/kg with 0.2 mol weak site/mol Fe. Bulk density and porosity of unconsolidate materials are assumed to be 1.93 kg/L and 0.2, respectively. In this case, 1L of pore water (i.e., groundwater) is in contact with 1.93 × (1 - 0.2) / 0.2 = 7.72 kg unconsolidated material. Thus, surface sites available for 1L of pore water is calculated by multiplying surface sites (mol/kg) to the equivalent unconsoliated material mass (7.72 kg)

5 – Mass of ferrihydrite or gibbsite is calculated by multiplying the number of mol of Fe or Al with the molecular mass of ferrihydrite (88.85 g/mol) or gibbsite (78.00 g/mol), respectively. It is assumed that one mol of Fe or Al is equivalent to one mol of ferrihydrite or Gibbsite, respectively. For example, mass of ferrihydrite (mean value = 3.98 g) is obtained by multiplying 0.045 mol Fe/kg with 88.85 g/mol. Similar to surface sites, equivalent mass of ferrihydrite and gibbsite available for 1L of pore water is calculated by multiplying mass in one kg of unconsoliated material (g/kg) to the equivalent unconsolidated material mass (7.72 kg). The mass of ferrihydrite and gibbsite is used as a calibration parameter

TABLE 3
MODEL SENSITIVITY ANALYSIS
Georgia Power Company - Plant Arkwright
Ash Pond 3 Landfill and Monofill
Macon, Georgia

Parameter	Model Scenario		Time for Cobalt to Reach GWPS Value
	Scenario Name	Input Value	Year
Groundwater Velocity (ft/day)	0.5X	0.175	54
	Base Case	0.350	27
	2X	0.700	12
Historic Groundwater pH Along Flow Path (s.u.)[1]	Low Historic pH	6.5	18
	Base Case	7.0	27
	High Historic pH	7.5	32
Current Groundwater pH Along Flow Path (s.u.)[2]	Low Current pH	4.76 - 5.92	11
	Base Case	4.90 - 6.10	27
	High Current pH	5.06 - 6.22	34
Abundance of Hydroxide Minerals (g/L)	0.5X	Hfo = 15.4; Hao = 3.52	11
	Base Case	Hfo = 30.7; Hao = 7.03	27
	2X	Hfo = 61.4; Hao = 14.1	57

Notes:

ft/day = feet per day

s.u. = standard units

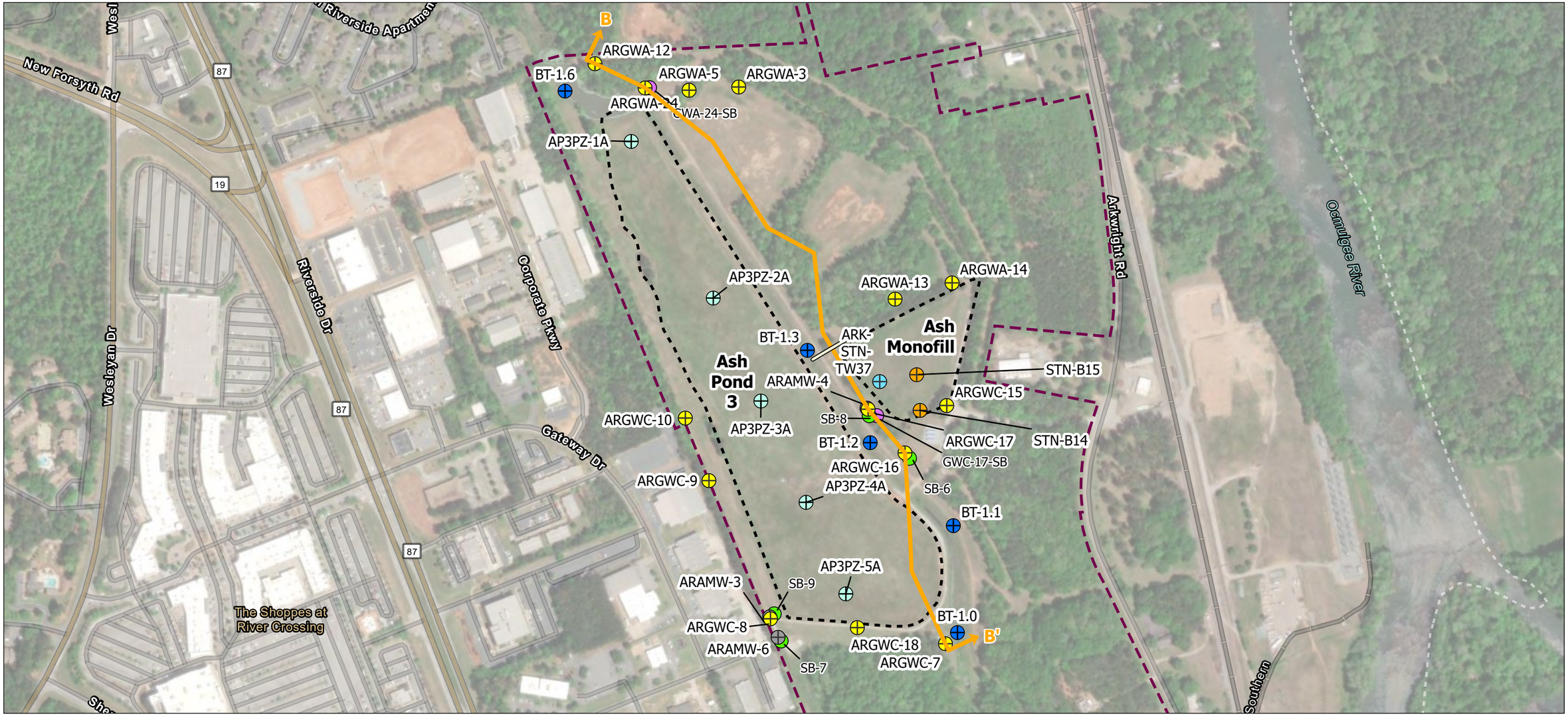
g/L = gram per liter

mole/L = mole per liter

[1]Historical groundwater pH refers to the pH at which cobalt adsorption took place prior to placement of CCR materials in AP-3 Landfill and Monofill. Higher historical groundwater pH results in more adsorbed cobalt present in the system, and therefore requires a longer timeframe for groundwater concentrations to decrease below GWPSs.

[2]Current groundwater pH refers to the pH along the flow path upgradient of monitoring well AR. Higher current groundwater pH results in a greater proportion of cobalt remaining in the sorbed phase. The increased sorbed concentration results in a lower cobalt concentration in groundwater, but requires a longer timeframe for groundwater concentrations to decrease below GWPSs.

FIGURES



Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Surface Water Samples, Monitoring Wells, Piezometers, Property Boundary, and Beaverdam Creek locations provided by Southern Company Services and Wood Environment & Infrastructure Solutions
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Porewater Piezometer
- Soil Boring (Approximate Location)
- Temporary Well (Approximate Location)
- Surface Water Sampling Location
- Stantec September-October 2022 Sample
- Wood September 2021 Sample
- Approximate Property Boundary
- Cross Section Alignment (B-B')
- Cross Section B-B' Match Line (see Figure 2)
- Ash Pond 3 and Ash Monofill Approximate Limits of Waste

0 450 900 Feet

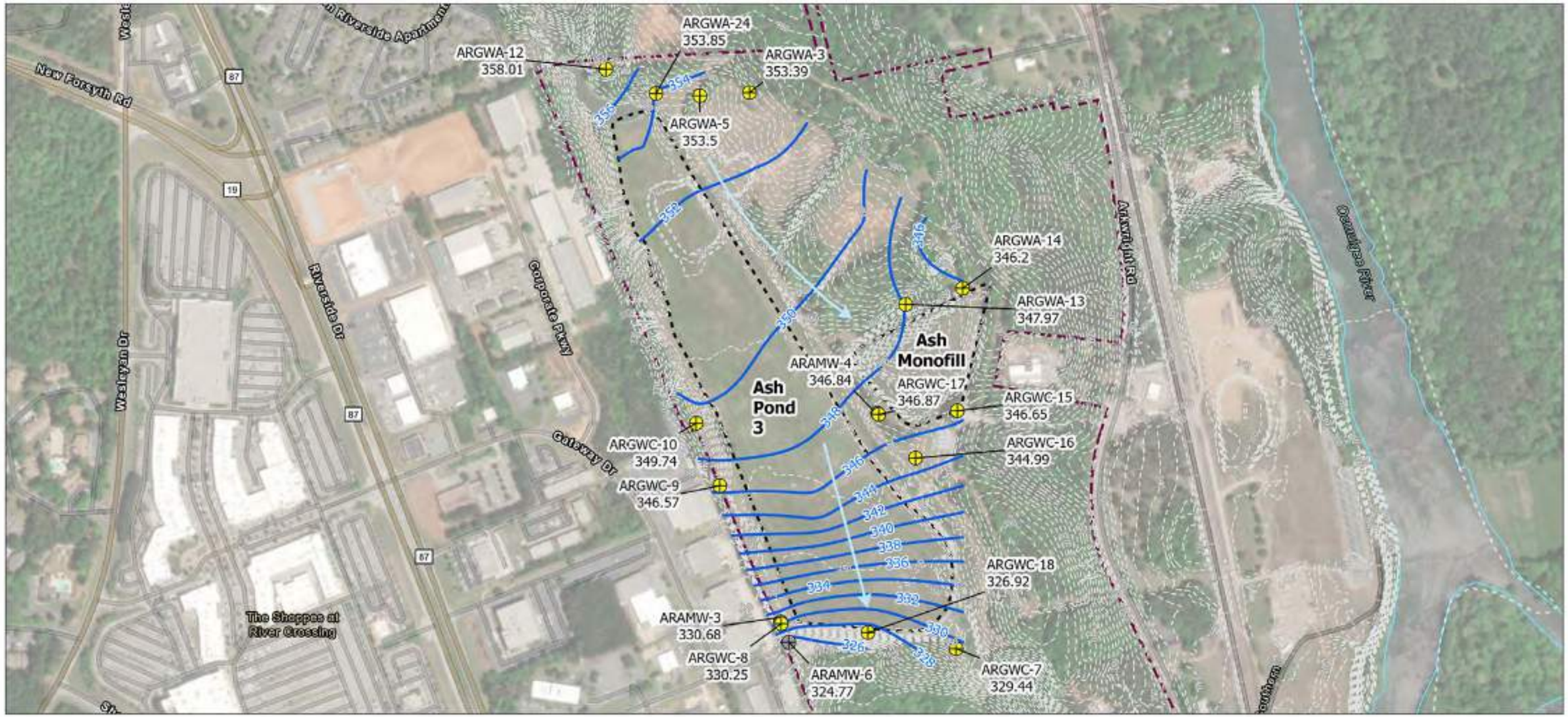
(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

Project Location	Prepared by DMB on 8/30/2023
Macon, Georgia	TR by TR on 8/30/2023
	IR by JK on 8/30/2023
Client/Project	175569434
Georgia Power	
Reactive Transport Model Report	
Plant Arkwright Ash Pond 3 Landfill and Monofill	
Figure No.	
1	
Title	
AP-3 Landfill and Monofill Site Layout with Cross Section B-B' Alignment	



Notes

1. Coordinate System: NAD 1983 StatePlane Georgia West FIPS 1002 Feet
2. Data Sources: Ash Pond Boundaries, Monitoring Wells, Property Boundary, Topography, and Beaverdam Creek provided by Southern Company Services and Wood Environment & Infrastructure Solutions. Contours, Flow Arrow, and Ocmulgee River provided by Stantec
3. Background: Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Legend

- Detection Monitoring Well
- Assessment Monitoring Well
- Interpreted Groundwater Flow Direction
- Potentiometric Surface Contour Jan 2023 (ft NAVD88)
- Ocmulgee River (Approximate)
- Topographic Contour 2018 (2 ft interval)
- Approximate Property Boundary
- Ash Pond 3 and Ash Monofill Approximate Limits of Waste

357.23 Groundwater Elevation (ft NAVD88)

0 450 900 Feet

(At original document size of 11x17)
1:5,400

N

Stantec

Georgia Power

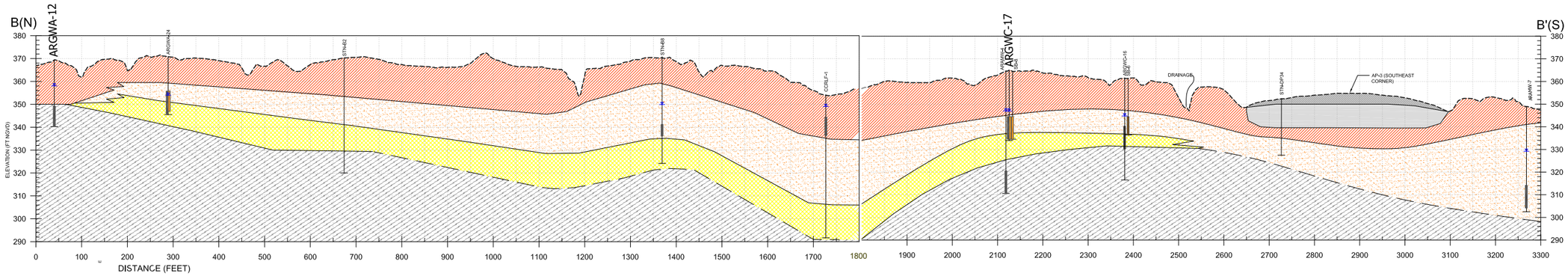
Project Location:
Macon, Georgia

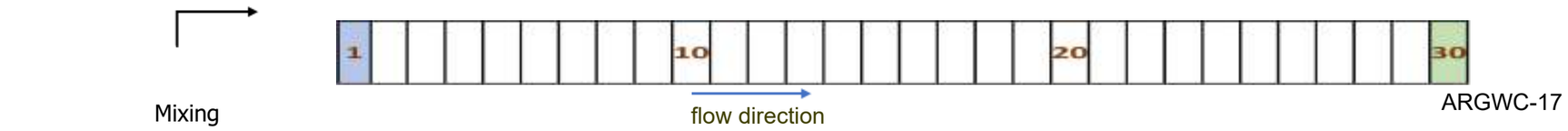
Prepared by DMB on 8/29/2023
TR by TR on 8/29/2023
IR by JK on 8/29/2023

Client/Project 175569434
Georgia Power
Reactive Transport Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
2

Title
Potentiometric Surface Contour Map AP-3 - January 30, 2023





Cells	Mineral	Model Saturation Index	Adsorption Mineral	Cation Exchange (meq/100g)
1 – 3	Ferrihydrite Pyrite	0 -85	Ferrihydrite and Gibbsite	13
4 – 10	Ferrihydrite Pyrite	0 -95		
11 – 20	Ferrihydrite Pyrite	0 -87		
21 –26	Ferrihydrite Pyrite	0 -103		
27 –29	Ferrihydrite Pyrite	0 -145		
30	Ferrihydrite Pyrite	0 -127		

Notes

1. Calibrated values are within the observed geochemical properties including mineralogy results, elemental concentration results, and sequential extraction results
2. Pyrite was used to control the groundwater pH that influences the adsorption and desorption of cobalt along the flow path. The amount of pyrite required for reaching the calibrated pH value was less than the X-ray Powder Diffraction detection limit (1%)
3. The length of the model flow path is not to scale
4. The cross-section does not entirely depict groundwater flow path directly through AP-3 towards ARGWC-17 as conceptualized in the 1-D conceptual transport model.

Cross Section B-B′ provided for reference. See Figure 4B in the AP-3 Landfill and Monofill Remedy Selection Report for Details.

Stantec

Georgia Power

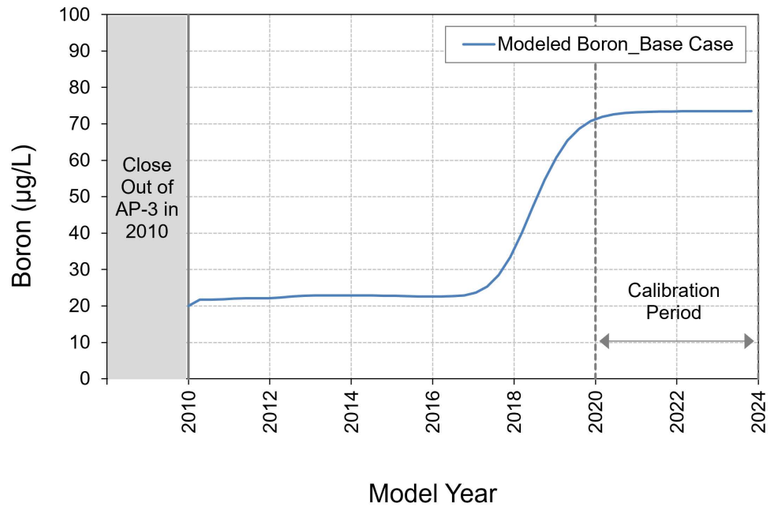
Project Location
Macon, Georgia

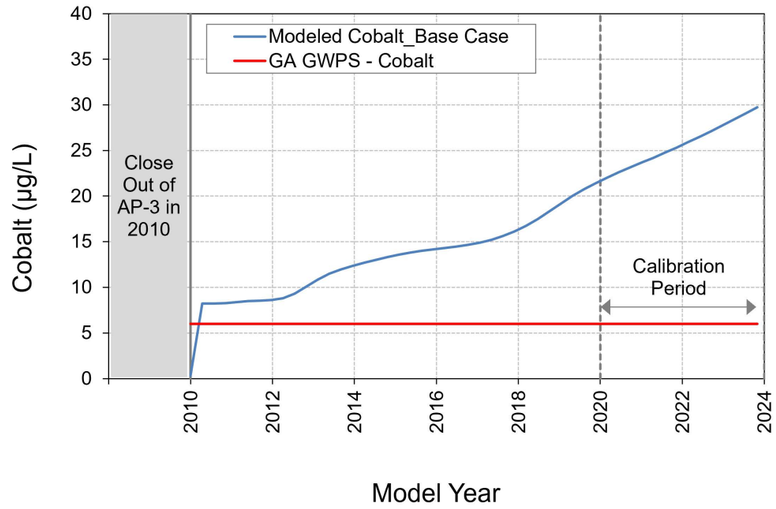
Prepared by DMB on 8/30/2023
TR by PD on 8/30/2023
IR by ES on 8/30/2023

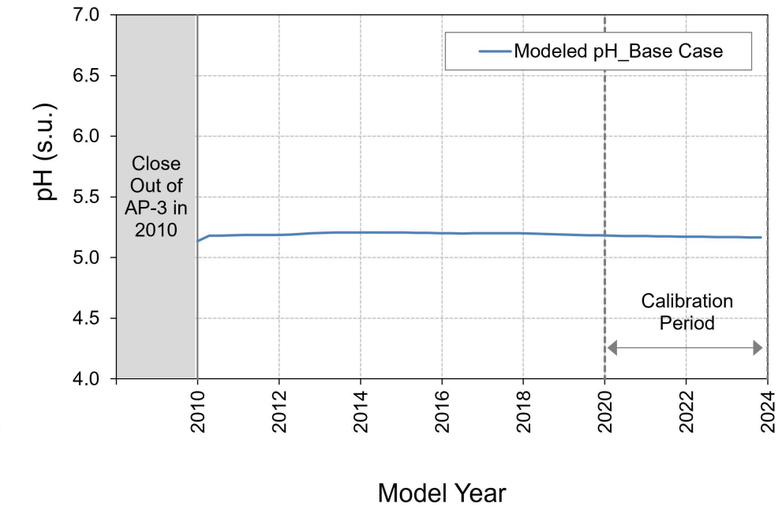
Client/Project 172678281
Georgia Power
Reactive Transport Modeling Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
3

Title
Schematic Diagram of the 1-D Geochemical Model for the BB' Transect







Notes
1. µg/L - micrograms per liter
2. pH - acidity
3. s.u. - standard units

Stantec

Georgia Power

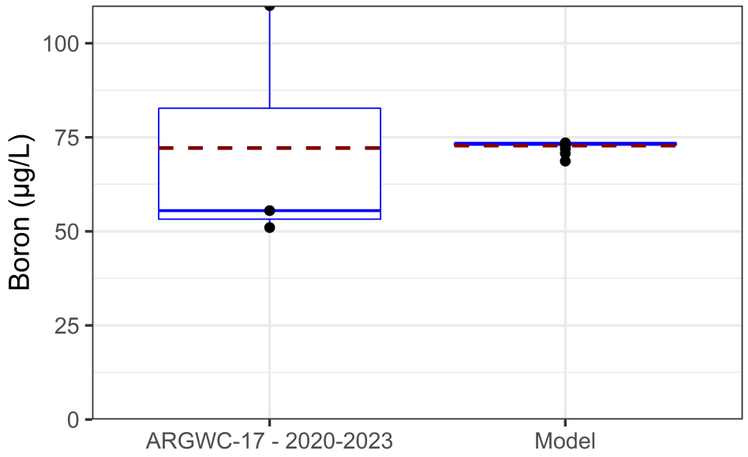
Project Location
Macon, Georgia

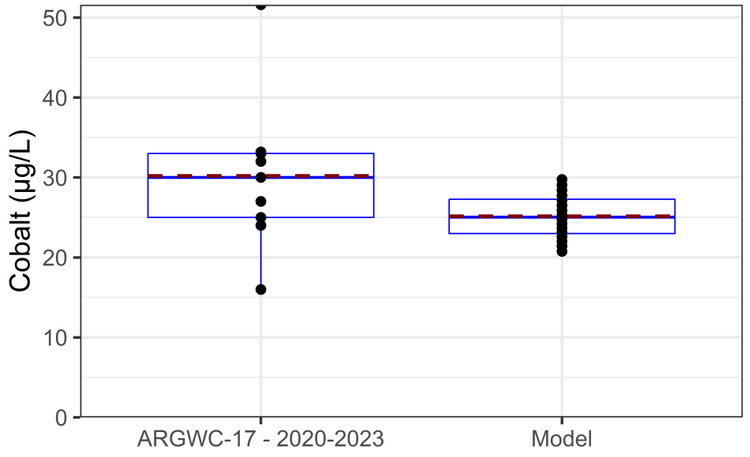
Prepared by DMB on 9/29/2023
TR by TR on 9/29/2023
IR by JK on 9/29/2023

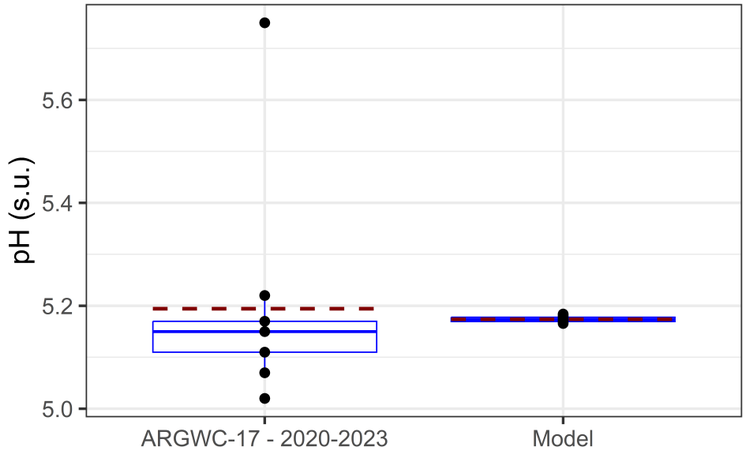
Client/Project 175569434
Georgia Power
Reactive Transport Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

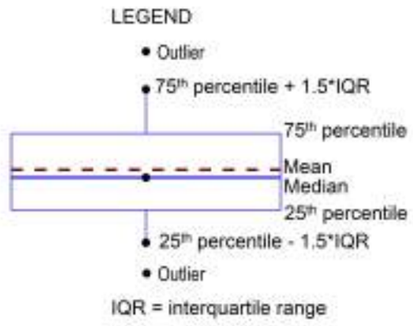
Figure No.
4

Title
Predicted Groundwater Chemistry at ARGWC-17 - Pre-closure Conditions









Notes

1. µg/L - milligrams per liter
2. pH - acidity
3. s.u. - standard units
4. Model results for the 2020 - 2023 period are plotted as box plots for comparison to groundwater chemistry data measured at the downgradient well (ARGWC-17) during the same period

Stantec

Georgia Power

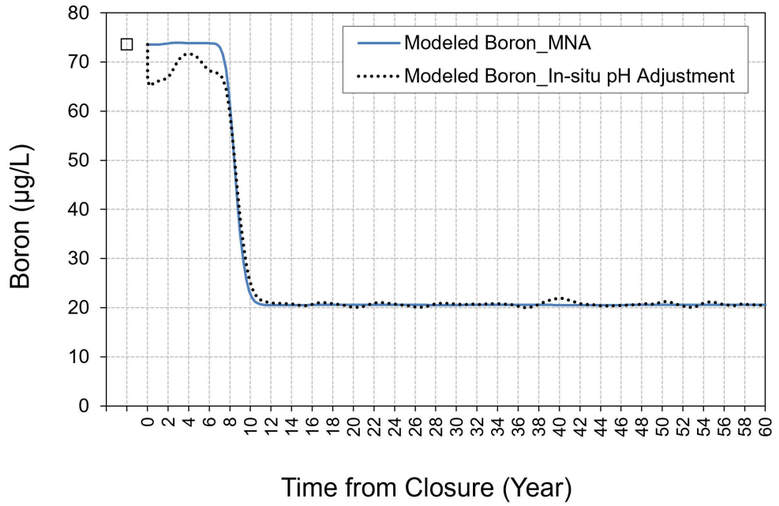
Project Location
Macon, Georgia

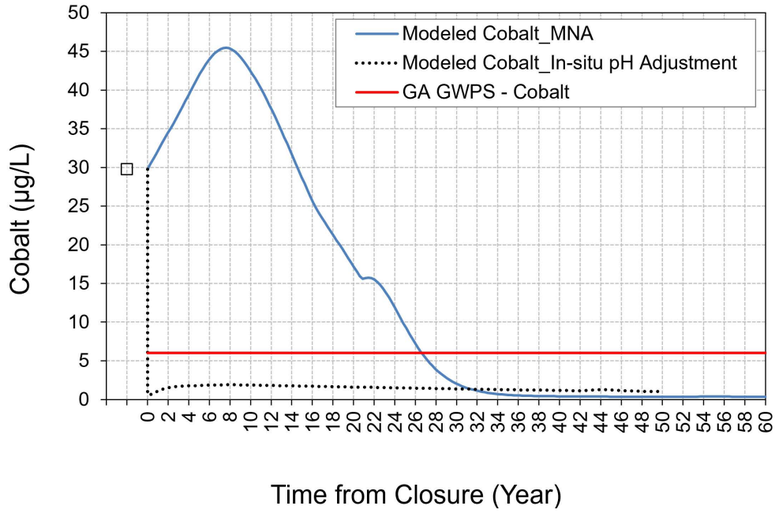
Prepared by DMB on 9/29/2023
TR by TR on 9/29/2023
IR by JK on 9/29/2023

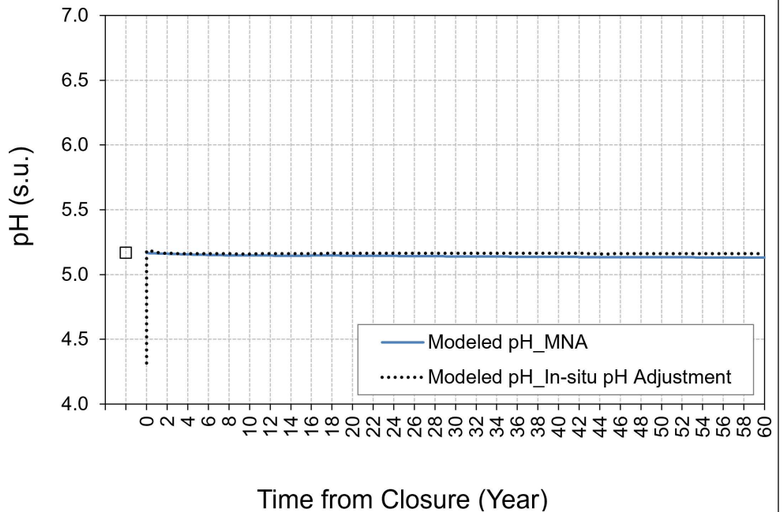
Client/Project 175569434
Georgia Power
Reactive Transport Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
5

Title
Comparison between Measured and Predicted Groundwater Chemistry at ARGWC-17 - Pre-closure Conditions







Notes

1. µg/L - micrograms per liter
2. pH - acidity
3. s.u. - standard units
4. MNA - Monitored Natural Attenuation
5. In-situ pH Adjustment - Remediation measures such as chemical injection or installation of a passive reactive barrier to maintain pH value of 7 s.u. about 11 m upgradient of ARGWC-17 well (i.e., pH was fixed at 7.0 s.u. for model cell 14)
6. Geochemical model for post-closure period starts at 0 year when remediation (source removal) is complete and upgradient groundwater starts flowing through
7. Model results for the end of pre-closure period (before remediation) are shown for reference (open square symbol)

Stantec

Georgia Power

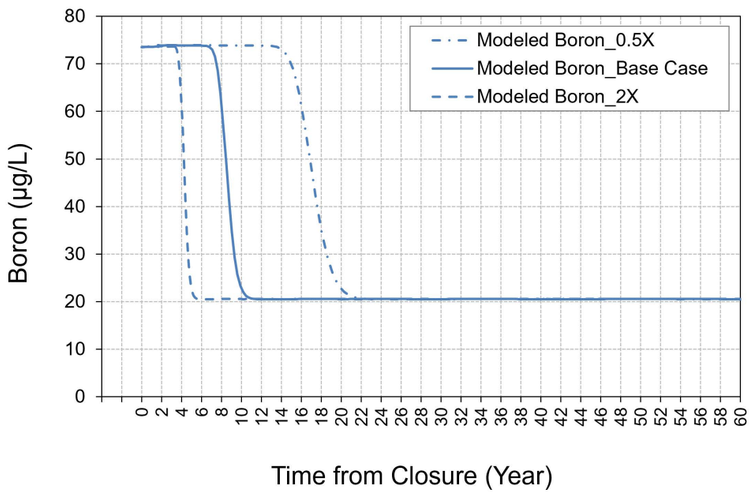
Project Location
Macon, Georgia

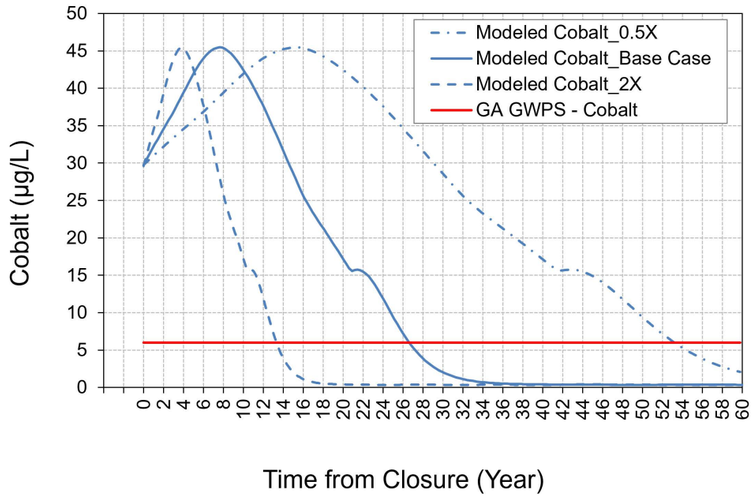
Prepared by DMB on 9/29/2023
TR by TR on 9/29/2023
IR by JK on 9/29/2023

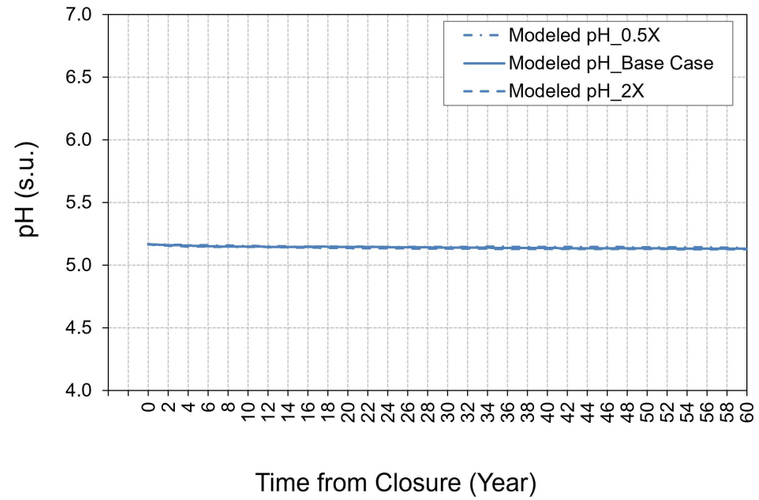
Client/Project 175569434
Georgia Power
Reactive Transport Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
6

Title
Predicted Groundwater Chemistry at ARGWC-17 - Post-closure Conditions under Monitored Natural Attenuation and In-situ pH Adjustment Scenarios







Notes

1. µg/L - micrograms per liter
2. pH - acidity
3. s.u. - standard units
4. Geochemical model for post-closure period starts at 0 year when remediation (source removal) is complete and upgradient groundwater starts flowing through
5. Sensitivity of groundwater flow was evaluated for two groundwater velocities, a half (0.5X model scenario) and two times of (2X model scenario) groundwater velocity in the base case scenario

Stantec

Georgia Power

Project Location
Macon, Georgia

Prepared by DMB on 9/29/2023
TR by TR on 9/29/2023
IR by JK on 9/29/2023

Client/Project
175569434
Georgia Power
Reactive Transport Model Report
Plant Arkwright Ash Pond 3 Landfill and Monofill

Figure No.
7

Title
Sensitivity of Groundwater Flow Velocity on Predicted Groundwater Chemistry at ARGWC-17 - Post-closure Conditions

APPENDIX A
PHREEQC CODE

```
TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Monitored Natural Attenuation)

PHASES
pe_Fix              # allows fixing pe
                    e- = e-
                    log_k  0.0

pH_Fix              # allows fixing pH
                    H+ = H+
                    log_k  0.0

END
SURFACE_MASTER_SPECIES
      Hfo_s  Hfo_sOH
      Hfo_w  Hfo_wOH
      Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                    log_k 0.0
HaoOH + H+ = HaoOH2+
                    log_k 7.17
HaoOH = HaoO- + H+
                    log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                    log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                    Log_k 1.57
EXCHANGE_MASTER_SPECIES
      X      X-

EXCHANGE_SPECIES
      X- = X-
      log_k         0.0

      Na+ + X- = NaX
      log_k         0.0

      K+ + X- = KX
      log_k         0.7

      Li+ + X- = LiX
      log_k         -0.08

      H+ + X- = HX
      log_k         1.0

      Ca+2 + 2X- = CaX2
      log_k         0.8

      Mg+2 + 2X- = MgX2
      log_k         0.6

      Mn+2 + 2X- = MnX2
      log_k         0.52

      Fe+2 + 2X- = FeX2
      log_k         0.44

                    SELECTED_OUTPUT
                    -file               AP-3_BASE.txt
                    -selected_out       TRUE
                    -solution                   TRUE
                    -user_punch                 TRUE
                    -water                      TRUE
                    USER_PUNCH
                    -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                    -start
                          10 PUNCH    -LA("H+")
                          20 PUNCH    S-LA("e-")*59.2
                          30 PUNCH    Alk*50.0355*1000
                          40 PUNCH    TOT("Cl")*GFW("Cl")*1E3
                          50 PUNCH    TOT("S(6)")*96.06*1E3
                          60 PUNCH    TOT("Ca")*GFW("Ca")*1E3
                          70 PUNCH    TOT("Mg")*GFW("Mg")*1E3
                          80 PUNCH    TOT("Na")*GFW("Na")*1E3
                          90 PUNCH    TOT("K")*GFW("K")*1E3
                         100 PUNCH    TOT("F")*GFW("F")*1E3
                         110 PUNCH    TOT("Al")*GFW("Al")*1E6
                         120 PUNCH    TOT("As")*GFW("As")*1E6
                         130 PUNCH    TOT("B")*GFW("B")*1E6
                         140 PUNCH    TOT("Co")*GFW("Co")*1E6
                         150 PUNCH    TOT("Fe")*GFW("Fe")*1E6
                         160 PUNCH    TOT("Li")*GFW("Li")*1E6
                         170 PUNCH    TOT("Mn")*GFW("Mn")*1E6
                         180 PUNCH    TOT("Mo")*GFW("Mo")*1E6
                         190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93
                         200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93
                         210 PUNCH    mol("HX")*1E3
                         220 PUNCH    mol("LiX")*1E3
                         230 PUNCH    mol("NaX")*1E3
                         240 PUNCH    mol("CaX2")*1E3
                         250 PUNCH    (STEP_NO + .5)/15
                         260 PUNCH    mol("CaX2")*1E6
                         270 PUNCH    mol("CaX2")*1E6
                         280 PUNCH    mol("CaX2")*1E6
                         290 PUNCH    mol("CaX2")*1E6
                         300 PUNCH    mol("CaX2")*1E6
END
SOLUTION 990
   temp              22.8
   pH                6.6
   pe                2.3
   redox             pe
   units             mg/kgw
   density           1.0
   Alkalinity        191.5       as Ca.5(CO3).5
   As                0.001             #assumed DL; not measured
   B                 0.51
   Ca                101.12
   Cl                5.71
   Co                0.024
   F                 0.373
   Fe                32.2
   K                 16.3
   Li                0.195
   Mg                25.4
   Mn                3.2
   Mo                0.144
   Na                16.6
   S(6)              184.5
   -water                  1 #kg
```

```
#   the first transport represents pre-closure conc
#   the second transport represents post-closure
#   attenuation scenario

#   pH
#   Eh
#   Alkalinity
#   Cl
#   SO4
#   Ca
#   Mg
#   Na
#   K
#   F
#   Al
#   As
#   B
#   Co
#   Fe
#   Li
#   Mn
#   Mo
#   mg/kg of sorbed Co, used to compare with SE
#   mg/kg of sorbed As, used to compare with SE
#   mmol of HX
#   mmol of LiX
#   mmol of NaX
#   mmol of CaX2
#   pore volume
#
#
#
#
#

# Average of AP3PZ-1A & AP3PZ-2A based on gv
```

```
END

SOLUTION 991                                                                                         # upgradient wells: ARGWA-12 (overburden)
        units           mg/kgw
        temp            19.3
        pH              6.0
        pe              5.9
        Alkalinity      71.0    as Ca.5(CO3).5
        As              0.00100         #reporting limit
        B               0.020
        Ca              13.78
        Cl              13.07
        Co              0.0003          #reporting limit
        F               0.17
        Fe              0.07            #most recent value
        K               2.37
        Li              0.005
        Mg              8.958
        Mn              0.001           #reporting limit for recent samples
        Mo              0.0006          #reporting limit for recent samples
        Na              11.52
        S(6)            7.84
        -water          1       #kg
END

TITLE Mix TW with Aquifer GW
        MIX 1
                990     0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                991     0.89
        SAVE Solution 992
END
        USE Solution 992
EQUILIBRIUM_PHASES 992
   #Ferrihydrite        0       0
        SAVE Solution 0
END

        TITLE Downgradient Transport Simulation
SOLUTION 1-30                           # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
        units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
        temp            19.3
        pH              7.0             # allow Co to adsorb on ferrihydrite and gibbsite
        pe              5.9
        Alkalinity      71.0
        As              0.001
        B               0.020
        Ca              13.8
        Cl              13.1
        Co              0.0003
        F               0.166
        Fe              0.066
        K               2.374
        Li              0.005
        Mg              8.96
        Mn              0.001
        Mo              0.0006
        Na              11.5
        S(6)            7.8
        -water          1.0
END

EQUILIBRIUM_PHASES 1-3
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -85.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 4-10
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -95.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 11-20
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -87.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 21-26
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -103.0  0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 27-29
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -145    0.39
   pe_Fix               -8.4 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 30
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -127    0.39    # calibrated to match pH observed at ARGWC-17
   pe_Fix               -8.4 O2(g)      # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34            # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                            # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03
SURFACE 11-20                           # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.030
SURFACE 21-29                           # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03

TRANSPORT
    -cells              30
    -shifts             49
    -time_step          8.91E+06                # seconds
    -lengths            30*11
    -dispersivities     30*1.1
    -correct_disp       TRUE
    -flow_direction     forward
    -boundary_con       flux flux
    -thermal_diffus     2       3.00E-10
```

```
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -punch_freque              1
    -dump_freque              25
    -dump_restart              1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99            # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                   213
    -lengths                30*11
    -dispersivities         30*1.1
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -dump_freque              107
    -punch_freque              1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (In-situ pH Adjustment)

```
#   the first transport represents pre-closure conditions
#   the second transport represents post-closure conditions under in-situ pH adjus
PHASES
pe_Fix          # allows fixing pe
                e- = e-
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
        Hfo_s  Hfo_sOH
        Hfo_w  Hfo_wOH
        Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
        X       X-

EXCHANGE_SPECIES
        X- = X-
        log_k           0.0

        Na+ + X- = NaX
        log_k           0.0

        K+ + X- = KX
        log_k           0.7

        Li+ + X- = LiX
        log_k           -0.08

        H+ + X- = HX
        log_k           1.0

        Ca+2 + 2X- = CaX2
        log_k           0.8

        Mg+2 + 2X- = MgX2
        log_k           0.6

        Mn+2 + 2X- = MnX2
        log_k           0.52

        Fe+2 + 2X- = FeX2
        log_k           0.44

                SELECTED_OUTPUT
                -file                   AP-3_BASE_INJECTION.txt
                -selected_out           TRUE
                -solution                         TRUE
                -user_punch                       TRUE
                -water                            TRUE
                USER_PUNCH
                -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUI
                -start
                        10 PUNCH     -LA("H+")                                     #  pH
                        20 PUNCH     S-LA("e-")*59.2                               #  Eh
                        30 PUNCH     Alk*50.0355*1000                              #  Alkalinity
                        40 PUNCH     TOT("Cl")*GFW("Cl")*1E3                       #  Cl
                        50 PUNCH     TOT("S(6)")*96.06*1E3                         #  SO4
                        60 PUNCH     TOT("Ca")*GFW("Ca")*1E3                       #  Ca
                        70 PUNCH     TOT("Mg")*GFW("Mg")*1E3                       #  Mg
                        80 PUNCH     TOT("Na")*GFW("Na")*1E3                       #  Na
                        90 PUNCH     TOT("K")*GFW("K")*1E3                         #  K
                       100 PUNCH     TOT("F")*GFW("F")*1E3                         #  F
                       110 PUNCH     TOT("Al")*GFW("Al")*1E6                       #  Al
                       120 PUNCH     TOT("As")*GFW("As")*1E6                       #  As
                       130 PUNCH     TOT("B")*GFW("B")*1E6                         #  B
                       140 PUNCH     TOT("Co")*GFW("Co")*1E6                       #  Co
                       150 PUNCH     TOT("Fe")*GFW("Fe")*1E6                       #  Fe
                       160 PUNCH     TOT("Li")*GFW("Li")*1E6                       #  Li
                       170 PUNCH     TOT("Mn")*GFW("Mn")*1E6                       #  Mn
                       180 PUNCH     TOT("Mo")*GFW("Mo")*1E6                       #  Mo
                       190 PUNCH     (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93   #  mg/kg of sorbed Co, used to compare with SEP results
                       200 PUNCH     (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93#  mg/kg of sorbed As, used to compare with SEP results
                       210 PUNCH     mol("HX")*1E3                                 #  mmol of HX
                       220 PUNCH     mol("LiX")*1E3                                #  mmol of LiX
                       230 PUNCH     mol("NaX")*1E3                                #  mmol of NaX
                       240 PUNCH     mol("CaX2")*1E3                               #  mmol of CaX2
                       250 PUNCH     (STEP_NO + .5)/15                             #  pore volume
                       260 PUNCH     mol("CaX2")*1E6                               #
                       270 PUNCH     mol("CoS(beta)")                              #
                       280 PUNCH     mol("CaX2")*1E3                               #
                       290 PUNCH     mol("CaX2")*1E3                               #
                       300 PUNCH     mol("CaX2")*1E3                               #
END
SOLUTION 990                                                # Average of AP3PZ-1A & AP3PZ-2A based on gw stream tube
    temp                22.8
    pH                  6.6
    pe                  2.3
    redox               pe
    units               mg/kgw
    density             1.0
    Alkalinity          191.5       as Ca.5(CO3).5
    As                  0.001               #assumed DL; not measured
    B                   0.51
    Ca                  101.12
    Cl                  5.71
    Co                  0.024
    F                   0.373
    Fe                  32.2
    K                   16.3
    Li                  0.195
    Mg                  25.4
    Mn                  3.2
    Mo                  0.144
    Na                  16.6
    S(6)                184.5
    -water                          1 #kg
END

SOLUTION 991                                                # upgradient wells: ARGWA-12 (overburden)
                units               mg/kgw
                temp                19.3
                pH                  6.0
                pe                  5.9
                Alkalinity          71.0    as Ca.5(CO3).5
                As                  0.00100         #reporting limit
                B                   0.020
                Ca                  13.78
                Cl                  13.07
                Co                  0.0003          #RL; in model set to 0.001
                F                   0.17
```

```
                Fe                  0.07            #most recent value
                K                   2.37
                Li                  0.005
                Mg                  8.958
                Mn                  0.001           #reporting limit for recent samples
                Mo                  0.0006          #reporting limit for recent samples
                Na                  11.52
                S(6)                7.84
                -water              1       #kg
END

TITLE Mix TW with Aquifer GW
                MIX 1
                        990         0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                        991         0.89
                SAVE Solution 992
END
                USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite         0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
                SAVE Solution 0
END

                TITLE Downgradient Transport Simulation
SOLUTION 1-30                                       # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality from
                units               mg/kgw          # the upgradient well ARGWA-12 (overburden)
                temp                19.3
                pH                  7.0             # allow Co to adsorb on ferrihydrite and gibbsite
                pe                  5.9
                Alkalinity          71.0
                As                  0.001
                B                   0.020
                Ca                  13.8
                Cl                  13.1
                Co                  0.0003
                F                   0.166
                Fe                  0.066
                K                   2.374
                Li                  0.005
                Mg                  8.96
                Mn                  0.001
                Mo                  0.0006
                Na                  11.5
                S(6)                7.8
                -water              1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -85.0       0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -95.0       0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -87.0       0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -103.0      0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -145        0.39
  pe_Fix                -8.4 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -127        0.39            # calibrated to match pH observed at ARGWC-17
  pe_Fix                -8.4 O2(g)                  # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34                        # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                        # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03
SURFACE 11-20                                       # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.030
END
SURFACE 21-29                                       # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.71
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03
END

TRANSPORT
  -cells            30
  -shifts           49
  -time_step        8.91E+06                        # seconds
  -lengths          30*11
  -dispersivities   30*1.1
  -correct_disp     TRUE
  -flow_direction   forward
  -boundary_con     flux flux
  -thermal_diffus   2           3.00E-10
  -print_cells      1-30
  -print_frequenc   1
  -punch_cells      1-30
  -punch_frequei    1
  -dump_frequer     25
  -dump_restart     1

END
                USE Solution 992
                USE Solution 991
                MIX 2
                        992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                        991         0.99            # fraction of upgradient water
                SAVE Solution 0
END
EQUILIBRIUM_PHASES 1-3
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -85.0       0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite          0           0               # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -95.0       0.39            # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)                  # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 11-20
```

```
  Ferrihydrite              0          0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                  -87.0        0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                   -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix                  -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite              0          0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -103.0        0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                   -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix                  -5.2 HF
EQUILIBRIUM_PHASES 27-28
  Ferrihydrite              0          0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                  -145         0.39    # calibrated to match pH observed at ARAMW-7
  pe_Fix                   -8.4 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix                  -5.2 HF
EQUILIBRIUM_PHASES 29
  pH_Fix                   -7.0 Ca(OH2)        #In-situ pH Adjustment
EQUILIBRIUM_PHASES 30
  Ferrihydrite              0          0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                  -127         0.39    # calibrated to match pH observed at ARAMW-7
  pe_Fix                   -8.4 O2(g)          # fixed to match ORP observed at upgradient well
EXCHANGE 1-30
X                          0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                   # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02      600     30.71
Hfo_sOH          1.73E-03      600
HaoOH            0.00E+00      600      7.03
SURFACE 11-20                                  # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02      600     30.705
Hfo_sOH          1.73E-03      600
HaoOH            3.70E-02      600     7.030
END
SURFACE 21-29                                  # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02      600     30.71
Hfo_sOH          1.73E-03      600
HaoOH            3.70E-02      600      7.03
END

TRANSPORT
   -shifts              213
   -lengths           30*11
   -dispersivities    30*1.1
   -print_cells         1-30
   -print_frequenc       1
   -punch_cells         1-30
   -dump_frequer        107
   -punch_freque         1

                USER_GRAPH 1
                -chart_title "Cobalt"
                -axis_titles "Years" "Concentration (ug/L)"
                -axis_scale x_axis 0 auto auto auto
                -connect_simulations TRUE
                -initial_solutions     FALSE
                -batch AP3_V01_Co.png true true
                -start
                10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                -end

                USER_GRAPH 2
                -chart_title "Boron"
                -axis_titles "Years" "Concentration (ug/L)"
                -axis_scale x_axis 0 auto auto auto
                -connect_simulations TRUE
                -initial_solutions     FALSE
                -batch AP3_V01_B.png true true
                -start
                10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Groundwater Velocity 0.5X Scenario)

```
PHASES                                      #   the first transport represents pre-closure conditions
pe_Fix          # allows fixing pe          #   the second transport represents post-closure conditions
                e- = e-                     #    under Groundwater Velocity 0.5X Scenario
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
    Hfo_s  Hfo_sOH
    Hfo_w  Hfo_wOH
    Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
    X      X-

EXCHANGE_SPECIES
    X- = X-
    log_k        0.0

    Na+ + X- = NaX
    log_k        0.0

    K+ + X- = KX
    log_k        0.7

    Li+ + X- = LiX
    log_k        -0.08

    H+ + X- = HX
    log_k        1.0

    Ca+2 + 2X- = CaX2
    log_k        0.8

    Mg+2 + 2X- = MgX2
    log_k        0.6

    Mn+2 + 2X- = MnX2
    log_k        0.52

    Fe+2 + 2X- = FeX2
    log_k        0.44

                SELECTED_OUTPUT
                -file               AP-3_0.5X.txt
                -selected_out         TRUE
                -solution                     TRUE
                -user_punch                   TRUE
                -water                        TRUE
                USER_PUNCH
                -headings       pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                      10 PUNCH    -LA("H+")                                    #  pH
                      20 PUNCH    S-LA("e-")*59.2                              #  Eh
                      30 PUNCH    Alk*50.0355*1000                             #  Alkalinity
                      40 PUNCH    TOT("Cl")*GFW("Cl")*1E3                      #  Cl
                      50 PUNCH    TOT("S(6)")*96.06*1E3                        #  SO4
                      60 PUNCH    TOT("Ca")*GFW("Ca")*1E3                      #  Ca
                      70 PUNCH    TOT("Mg")*GFW("Mg")*1E3                      #  Mg
                      80 PUNCH    TOT("Na")*GFW("Na")*1E3                      #  Na
                      90 PUNCH    TOT("K")*GFW("K")*1E3                        #  K
                     100 PUNCH    TOT("F")*GFW("F")*1E3                        #  F
                     110 PUNCH    TOT("Al")*GFW("Al")*1E6                      #  Al
                     120 PUNCH    TOT("As")*GFW("As")*1E6                      #  As
                     130 PUNCH    TOT("B")*GFW("B")*1E6                        #  B
                     140 PUNCH    TOT("Co")*GFW("Co")*1E6                      #  Co
                     150 PUNCH    TOT("Fe")*GFW("Fe")*1E6                      #  Fe
                     160 PUNCH    TOT("Li")*GFW("Li")*1E6                      #  Li
                     170 PUNCH    TOT("Mn")*GFW("Mn")*1E6                      #  Mn
                     180 PUNCH    TOT("Mo")*GFW("Mo")*1E6                      #  Mo
                     190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93       #  mg/kg of sorbed Co
                     200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93    #  mg/kg of sorbed As
                     210 PUNCH    mol("HX")*1E3                                #  mmol of HX
                     220 PUNCH    mol("LiX")*1E3
                     230 PUNCH    mol("NaX")*1E3
                     240 PUNCH    mol("CaX2")*1E3
                     250 PUNCH    (STEP_NO + .5)/15
                     260 PUNCH    mol("CaX2")*1E6
                     270 PUNCH    mol("CoS(beta)")
                     280 PUNCH    mol("CaX2")*1E3
                     290 PUNCH    mol("CaX2")*1E3
                     300 PUNCH    mol("CaX2")*1E3
END
SOLUTION 990    # Average of AP3PZ-1A & AP3PZ-2A based on gw stream tube
   temp                22.8
   pH                   6.6
   pe                   2.3
```

```
    redox                pe
    units                mg/kgw
    density              1.0
    Alkalinity           191.5       as Ca.5(CO3).5
    As                   0.001                   #assumed DL; not measured
    B                    0.51
    Ca                   101.12
    Cl                   5.71
    Co                   0.024
    F                    0.373
    Fe                   32.2
    K                    16.3
    Li                   0.195
    Mg                   25.4
    Mn                   3.2
    Mo                   0.144
    Na                   16.6
    S(6)                 184.5
    -water                       1 #kg
END

SOLUTION 991    # upgradient wells: ARGWA-12 (overburden)
                units                mg/kgw
                temp                 19.3
                pH                   6.0
                pe                   5.9
                Alkalinity           71.0    as Ca.5(CO3).5
                As                   0.00100         #reporting limit
                B                    0.020
                Ca                   13.78
                Cl                   13.07
                Co                   0.0003          #RL; in model set to 0.001
                F                    0.17
                Fe                   0.07            #most recent value
                K                    2.37
                Li                   0.005
                Mg                   8.958
                Mn                   0.001           #reporting limit for recent samples
                Mo                   0.0006          #reporting limit for recent samples
                Na                   11.52
                S(6)                 7.84
                -water               1       #kg
END

TITLE Mix TW with Aquifer GW
                MIX 1
                             990        0.11        # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                             991        0.89
                SAVE Solution 992
END
                USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite              0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
                SAVE Solution 0
END

                TITLE Downgradient Transport Simulation
SOLUTION 1-30                                       # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality from
                units                mg/kgw         # the upgradient well ARGWA-12 (overburden)
                temp                 19.3
                pH                   7.0            # allow Co to adsorb on ferrihydrite and gibbsite
                pe                   5.9
                Alkalinity           71.0
                As                   0.001
                B                    0.020
                Ca                   13.8
                Cl                   13.1
                Co                   0.0003
                F                    0.166
                Fe                   0.066
                K                    2.374
                Li                   0.005
                Mg                   8.96
                Mn                   0.001
                Mo                   0.0006
                Na                   11.5
                S(6)                 7.8
                -water               1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite               0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                   -85.0        0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                    -5.9 O2(g)              # fixed to match ORP observed at upgradient well
  #pH_Fix                   -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite               0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                   -95.0        0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                    -5.9 O2(g)              # fixed to match ORP observed at upgradient well
  #pH_Fix                   -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite               0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                   -87.0        0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                    -5.9 O2(g)              # fixed to match ORP observed at upgradient well
  #pH_Fix                   -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite               0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                  -103.0        0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                    -5.9 O2(g)              # fixed to match ORP observed at upgradient well
  #pH_Fix                   -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite               0          0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
```

```
   Pyrite                    -145      0.39
   pe_Fix                    -8.4 O2(g)              # fixed to match ORP observed at upgradient well
   #pH_Fix                   -5.2 HF
EQUILIBRIUM_PHASES 30
   Ferrihydrite                 0         0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite                    -127      0.39          # calibrated to match pH observed at ARGWC-17
   pe_Fix                    -8.4 O2(g)              # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                            0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                         # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH              6.91E-02        600      30.7
Hfo_sOH              1.73E-03        600
HaoOH                3.70E-02        600      7.03
SURFACE 11-20                                        # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH              6.91E-02        600      30.7
Hfo_sOH              1.73E-03        600
HaoOH                3.70E-02        600      7.03
END
SURFACE 21-29                                        # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH              6.91E-02        600     30.71
Hfo_sOH              1.73E-03        600
HaoOH                3.70E-02        600      7.03
END

TRANSPORT
   -cells                 30
   -shifts                49
   -time_step       8.91E+06                     # seconds
   -lengths             30*11
   -dispersivities      30*1.1
   -correct_disp        TRUE
   -flow_direction      forward
   -boundary_con        flux flux
   -thermal_diffus          2          3.00E-10
   -print_cells           1-30
   -print_frequenc          1
   -punch_cells           1-30
   -punch_frequer           1
   -dump_frequer           25
   -dump_restart            1

END
                  USE Solution 992
                  USE Solution 991
                  MIX 2
                              992       0.01       # fraction of CCR pore water and upgradient water mixture remaining after remediation
                              991       0.99       # fraction of upgradient water
                  SAVE Solution 0
END
TRANSPORT
   -cells                 30
   -shifts               106
   -time_step       1.78E+07                     # seconds
   -lengths             30*11
   -dispersivities      30*1.1
   -print_cells           1-30
   -print_frequenc          1
   -punch_cells           1-30
   -dump_frequer           54
   -punch_frequer           1

                  USER_GRAPH 1
                  -chart_title "Cobalt"
                  -axis_titles "Years" "Concentration (ug/L)"
                  -axis_scale x_axis 0 auto auto auto
                  -connect_simulations TRUE
                  -initial_solutions     FALSE
                  -batch AP3_V01_Co.png true true
                  -start
                  10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                  -end

                  USER_GRAPH 2
                  -chart_title "Boron"
                  -axis_titles "Years" "Concentration (ug/L)"
                  -axis_scale x_axis 0 auto auto auto
                  -connect_simulations TRUE
                  -initial_solutions     FALSE
                  -batch AP3_V01_B.png true true
                  -start
                  10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                  -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Groundwater Velocity 2X Scenario)

```
PHASES                                  #   the first transport represents pre-closure conditions


pe_Fix          # allows fixing pe      #   the second transport represents post-closure conditions under Groundwater Velocity 2X scenario
                e- = e-
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
     Hfo_s  Hfo_sOH
     Hfo_w  Hfo_wOH
     Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
     X      X-

EXCHANGE_SPECIES
     X- = X-
     log_k          0.0

     Na+ + X- = NaX
     log_k          0.0

     K+ + X- = KX
     log_k          0.7

     Li+ + X- = LiX
     log_k          -0.08

     H+ + X- = HX
     log_k          1.0

     Ca+2 + 2X- = CaX2
     log_k          0.8

     Mg+2 + 2X- = MgX2
     log_k          0.6

     Mn+2 + 2X- = MnX2
     log_k          0.52

     Fe+2 + 2X- = FeX2
     log_k          0.44

                SELECTED_OUTPUT
                -file               AP-3_2X.txt
                -selected_out         TRUE
                -solution                     TRUE
                -user_punch                   TRUE
                -water                        TRUE
                USER_PUNCH
                -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                     10 PUNCH    -LA("H+")                                   #  pH
                     20 PUNCH    S-LA("e-")*59.2                             #  Eh
                     30 PUNCH    Alk*50.0355*1000                            #  Alkalini
                     40 PUNCH    TOT("Cl")*GFW("Cl")*1E3                     #  Cl
                     50 PUNCH    TOT("S(6)")*96.06*1E3                       #  SO4
                     60 PUNCH    TOT("Ca")*GFW("Ca")*1E3                     #  Ca
                     70 PUNCH    TOT("Mg")*GFW("Mg")*1E3                     #  Mg
                     80 PUNCH    TOT("Na")*GFW("Na")*1E3                     #  Na
                     90 PUNCH    TOT("K")*GFW("K")*1E3                       #  K
                    100 PUNCH    TOT("F")*GFW("F")*1E3                       #  F
                    110 PUNCH    TOT("Al")*GFW("Al")*1E6                     #  Al
                    120 PUNCH    TOT("As")*GFW("As")*1E6                     #  As
                    130 PUNCH    TOT("B")*GFW("B")*1E6                       #  B
                    140 PUNCH    TOT("Co")*GFW("Co")*1E6                     #  Co
                    150 PUNCH    TOT("Fe")*GFW("Fe")*1E6                     #  Fe
                    160 PUNCH    TOT("Li")*GFW("Li")*1E6                     #  Li
                    170 PUNCH    TOT("Mn")*GFW("Mn")*1E6                     #  Mn
                    180 PUNCH    TOT("Mo")*GFW("Mo")*1E6                     #  Mo
                    190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93      #  mg/kg
                    200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93      #  mg/kg
                    210 PUNCH    mol("HX")*1E3                               #  mmol c
                    220 PUNCH    mol("LiX")*1E3
                    230 PUNCH    mol("NaX")*1E3
                    240 PUNCH    mol("CaX2")*1E3
                    250 PUNCH    (STEP_NO + .5)/15
                    260 PUNCH    mol("CaX2")*1E6
                    270 PUNCH    mol("CoS(beta)")
                    280 PUNCH    mol("CaX2")*1E3
                    290 PUNCH    mol("CaX2")*1E3
                    300 PUNCH    mol("CaX2")*1E3
END
SOLUTION 990    # Average of AP3PZ-1A & AP3PZ-2A based on gw stream tube
   temp                22.8
   pH                  6.6
   pe                  2.3
   redox               pe
```

```
    units                   mg/kgw
    density                   1.0
    Alkalinity              191.5       as Ca.5(CO3).5
    As                      0.001                   #assumed DL; not measured
    B                        0.51
    Ca                      101.12
    Cl                       5.71
    Co                      0.024
    F                       0.373
    Fe                       32.2
    K                        16.3
    Li                      0.195
    Mg                       25.4
    Mn                        3.2
    Mo                      0.144
    Na                       16.6
    S(6)                     184.5
    -water                          1 #kg
END

SOLUTION 991    # upgradient wells: ARGWA-12 (overburden)
                    units               mg/kgw
                    temp                  19.3
                    pH                     6.0
                    pe                     5.9
                    Alkalinity            71.0      as Ca.5(CO3).5
                    As                 0.00100          #reporting limit
                    B                     0.020
                    Ca                    13.78
                    Cl                    13.07
                    Co                   0.0003          #RL; in model set to 0.001
                    F                     0.17
                    Fe                    0.07          #most recent value
                    K                     2.37
                    Li                   0.005
                    Mg                   8.958
                    Mn                   0.001          #reporting limit for recent samples
                    Mo                  0.0006          #reporting limit for recent samples
                    Na                   11.52
                    S(6)                  7.84
                    -water                   1      #kg
END

TITLE Mix TW with Aquifer GW
                    MIX 1
                                990       0.11          # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                                991       0.89
                    SAVE Solution 992
END
                    USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
                    SAVE Solution 0
END

                    TITLE Downgradient Transport Simulation
SOLUTION 1-30                                         # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
                    units               mg/kgw        # from the upgradient well ARGWA-12 (overburden)
                    temp                  19.3
                    pH                     7.0          # allow Co to adsorb on ferrihydrite and gibbsite
                    pe                     5.9
                    Alkalinity            71.0
                    As                   0.001
                    B                     0.020
                    Ca                     13.8
                    Cl                     13.1
                    Co                   0.0003
                    F                     0.166
                    Fe                    0.066
                    K                     2.374
                    Li                   0.005
                    Mg                    8.96
                    Mn                   0.001
                    Mo                  0.0006
                    Na                    11.5
                    S(6)                   7.8
                    -water                 1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                    -85.0       0.39          # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                     -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                    -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                    -95.0       0.39          # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                     -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                    -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                    -87.0       0.39          # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                     -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                    -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                   -103.0       0.39          # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                     -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                    -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite                  0          0          # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                     -145       0.39
  pe_Fix                     -8.4 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                    -5.2 HF
EQUILIBRIUM_PHASES 30
```

```
  Ferrihydrite              0          0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -127       0.39       # calibrated to match pH observed at ARGWC-17
  pe_Fix                 -8.4 O2(g)            # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                        0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                   # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02        600     30.71
Hfo_sOH          1.73E-03        600
HaoOH            3.70E-02        600      7.03
SURFACE 11-20                                  # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02        600     ####
Hfo_sOH          1.73E-03        600
HaoOH            3.70E-02        600     7.030
END
SURFACE 21-30                                  # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH          6.91E-02        600     30.71
Hfo_sOH          1.73E-03        600
HaoOH            3.70E-02        600      7.03
END

TRANSPORT
   -cells              30
   -shifts             49
   -time_step      8.91E+06                    # seconds
   -lengths          30*11
   -dispersivities   30*1.1
   -correct_disp      TRUE
   -flow_direction  forward
   -boundary_con    flux flux
   -thermal_diffus       2          3.00E-10
   -print_cells       1-30
   -print_frequenc       1
   -punch_cells       1-30
   -punch_freque         1
   -dump_frequer        25
   -dump_restart         1

END
                  USE Solution 992
                  USE Solution 991
                  MIX 2
                           992       0.01      # fraction of CCR pore water and upgradient water mixture remaining after remediation
                           991       0.99      # fraction of upgradient water
                  SAVE Solution 0
END
TRANSPORT
   -cells              30
   -shifts            425
   -time_step      4.45E+06                    # seconds
   -lengths          30*11
   -dispersivities   30*1.1
   -print_cells       1-30
   -print_frequenc       1
   -punch_cells       1-30
   -dump_frequer       213
   -punch_freque         1

                  USER_GRAPH 1
                  -chart_title "Cobalt"
                  -axis_titles "Years" "Concentration (ug/L)"
                  -axis_scale x_axis 0 auto auto auto
                  -connect_simulations TRUE
                  -initial_solutions     FALSE
                  -batch AP3_V01_Co.png true true
                  -start
                  10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                  -end

                  USER_GRAPH 2
                  -chart_title "Boron"
                  -axis_titles "Years" "Concentration (ug/L)"
                  -axis_scale x_axis 0 auto auto auto
                  -connect_simulations TRUE
                  -initial_solutions     FALSE
                  -batch AP3_V01_B.png true true
                  -start
                  10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                  -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Historical Groundwater pH LOW Scenario)

```
PHASES                                  #       the first transport represent pre-closure conditions


pe_Fix          # allows fixing pe      #       the second transport represent post-closure conditions under monitored natural
                e- = e-                 #       Historical Groundwater pH - Low Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
        Hfo_s  Hfo_sOH
        Hfo_w  Hfo_wOH
        Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
        X       X-

EXCHANGE_SPECIES
        X- = X-
        log_k           0.0

        Na+ + X- = NaX
        log_k           0.0

        K+ + X- = KX
        log_k           0.7

        Li+ + X- = LiX
        log_k           -0.08

        H+ + X- = HX
        log_k           1.0

        Ca+2 + 2X- = CaX2
        log_k           0.8

        Mg+2 + 2X- = MgX2
        log_k           0.6

        Mn+2 + 2X- = MnX2
        log_k           0.52

        Fe+2 + 2X- = FeX2
        log_k           0.44

                SELECTED_OUTPUT
                -file                   AP-3_Historic_pH_LOW.txt
                -selected_out           TRUE
                -solution                       TRUE
                -user_punch                     TRUE
                -water                          TRUE
                USER_PUNCH
                -headings               pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                                10 PUNCH        -LA("H+")                                                                                                                                       #  pH
                                20 PUNCH        S-LA("e-")*59.2                                                                                                                                 #  Eh
                                30 PUNCH        Alk*50.0355*1000                                                                                                                                #  Alkalinity
                                40 PUNCH        TOT("Cl")*GFW("Cl")*1E3                                                                                                                         #  Cl
                                50 PUNCH        TOT("S(6)")*96.06*1E3                                                                                                                           #  SO4
                                60 PUNCH        TOT("Ca")*GFW("Ca")*1E3                                                                                                                         #  Ca
                                70 PUNCH        TOT("Mg")*GFW("Mg")*1E3                                                                                                                         #  Mg
                                80 PUNCH        TOT("Na")*GFW("Na")*1E3                                                                                                                         #  Na
                                90 PUNCH        TOT("K")*GFW("K")*1E3                                                                                                                           #  K
                               100 PUNCH        TOT("F")*GFW("F")*1E3                                                                                                                           #  F
                               110 PUNCH        TOT("Al")*GFW("Al")*1E6                                                                                                                         #  Al
                               120 PUNCH        TOT("As")*GFW("As")*1E6                                                                                                                         #  As
                               130 PUNCH        TOT("B")*GFW("B")*1E6                                                                                                                           #  B
                               140 PUNCH        TOT("Co")*GFW("Co")*1E6                                                                                                                         #  Co
                               150 PUNCH        TOT("Fe")*GFW("Fe")*1E6                                                                                                                         #  Fe
                               160 PUNCH        TOT("Li")*GFW("Li")*1E6                                                                                                                         #  Li
                               170 PUNCH        TOT("Mn")*GFW("Mn")*1E6                                                                                                                         #  Mn
                               180 PUNCH        TOT("Mo")*GFW("Mo")*1E6                                                                                                                         #  Mo
                               190 PUNCH        (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93                                                                                      #  mg/kg of sorbed Co, u
                               200 PUNCH        (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93  #  mg/kg of sorbed As, u
                               210 PUNCH        mol("HX")*1E3                                                                                                                                   #  mmol of HX
                               220 PUNCH        mol("LiX")*1E3                                                                                                                                  #  mmol of LiX
                               230 PUNCH        mol("NaX")*1E3                                                                                                                                  #  mmol of NaX
                               240 PUNCH        mol("CaX2")*1E3                                                                                                                                 #  mmol of CaX2
                               250 PUNCH        (STEP_NO + .5)/15                                                                                                                               #  pore volume
                               260 PUNCH        mol("CaX2")*1E6                                                                                                                                 #
                               270 PUNCH        mol("CaX2")*1E6                                                                                                                                 #
                               280 PUNCH        mol("CaX2")*1E6                                                                                                                                 #
                               290 PUNCH        mol("CaX2")*1E6                                                                                                                                 #
                               300 PUNCH        mol("CaX2")*1E6                                                                                                                                 #
END
SOLUTION 990                                                                                                                                                                                    # Average of AP3PZ-1A &
    temp                22.8
    pH                  6.6
    pe                  2.3
    redox               pe
    units               mg/kgw
    density             1.0
    Alkalinity          191.5       as Ca.5(CO3).5
    As                  0.001               #assumed DL; not measured
    B                   0.51
    Ca                  101.12
    Cl                  5.71
```

```
    Co              0.024
    F               0.373
    Fe              32.2
    K               16.3
    Li              0.195
    Mg              25.4
    Mn              3.2
    Mo              0.144
    Na              16.6
    S(6)            184.5
    -water                  1 #kg
END

SOLUTION 991                                                                                    # upgradient wells: ARGW
            units           mg/kgw
            temp            19.3
            pH              6.0
            pe              5.9
            Alkalinity      71.0    as Ca.5(CO3).5
            As              0.00100         #reporting limit
            B               0.020
            Ca              13.78
            Cl              13.07
            Co              0.0003          #reporting limit
            F               0.17
            Fe              0.07            #most recent value
            K               2.37
            Li              0.005
            Mg              8.958
            Mn              0.001           #reporting limit for recent samples
            Mo              0.0006          #reporting limit for recent samples
            Na              11.52
            S(6)            7.84
            -water          1       #kg
END

TITLE Mix TW with Aquifer GW
            MIX 1
                    990     0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                    991     0.89
            SAVE Solution 992
END
            USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite             0       0
            SAVE Solution 0
END

            TITLE Downgradient Transport Simulation
SOLUTION 1-30                               # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
            units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
            temp            19.3
            pH              6.5             # calibrated value to allow Co to adsorb on ferrihydrite and gibsite
            pe              5.9
            Alkalinity      71.0
            As              0.001
            B               0.020
            Ca              13.8
            Cl              13.1
            Co              0.0003
            F               0.166
            Fe              0.066
            K               2.374
            Li              0.005
            Mg              8.96
            Mn              0.001
            Mo              0.0006
            Na              11.5
            S(6)            7.8
            -water          1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -85.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -95.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -87.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite               -103.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -145       0.39
  pe_Fix                 -8.4 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -127       0.39    # calibrated to match pH observed at ARGWC-17
  pe_Fix                 -8.4 O2(g)         # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34                # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02    600     30.7
Hfo_sOH         1.73E-03    600
HaoOH           3.70E-02    600     7.03
SURFACE 11-20                               # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
```

```
 -equil with 1
Hfo_wOH              6.91E-02          600        30.7
Hfo_sOH              1.73E-03          600
HaoOH                3.70E-02          600       7.030
SURFACE 21-29                                          # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH              6.91E-02          600        30.7
Hfo_sOH              1.73E-03          600
HaoOH                3.70E-02          600        7.03

TRANSPORT
    -cells                 30
    -shifts                49
    -time_step       8.91E+06                      # seconds
    -lengths             30*11
    -dispersivities      30*1.1
    -correct_disp         TRUE
    -flow_direction     forward
    -boundary_con       flux flux
    -thermal_diffus          2          3.00E-10
    -print_cells           1-30
    -print_frequenc           1
    -punch_cells           1-30
    -punch_frequer            1
    -dump_frequen            25
    -dump_restart             1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01          # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99          # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                213
    -lengths             30*11
    -dispersivities      30*1.1
    -print_cells           1-30
    -print_frequenc           1
    -punch_cells           1-30
    -dump_frequen           107
    -punch_frequer            1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions      FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions      FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Historical Groundwater pH High Scenario)

```
PHASES                                  #     the first transport represent pre-closure conditions


pe_Fix          # allows fixing pe      #     the second transport represent post-closure conditions under monitored natural attenuation scenario
                e- = e-                 #     Historical Groundwater pH High Scenario - Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
    Hfo_s  Hfo_sOH
    Hfo_w  Hfo_wOH
    Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
    X      X-

EXCHANGE_SPECIES
    X- = X-
    log_k       0.0

    Na+ + X- = NaX
    log_k       0.0

    K+ + X- = KX
    log_k       0.7

    Li+ + X- = LiX
    log_k       -0.08

    H+ + X- = HX
    log_k       1.0

    Ca+2 + 2X- = CaX2
    log_k       0.8

    Mg+2 + 2X- = MgX2
    log_k       0.6

    Mn+2 + 2X- = MnX2
    log_k       0.52

    Fe+2 + 2X- = FeX2
    log_k       0.44

                SELECTED_OUTPUT
                -file               AP-3_Historic_pH_HIGH.txt
                -selected_out       TRUE
                -solution                     TRUE
                -user_punch                   TRUE
                -water                        TRUE
                USER_PUNCH
                -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                        10 PUNCH   -LA("H+")                                  #  pH
                        20 PUNCH   S-LA("e-")*59.2                            #  Eh
                        30 PUNCH   Alk*50.0355*1000                           #  Alkalinity
                        40 PUNCH   TOT("Cl")*GFW("Cl")*1E3                    #  Cl
                        50 PUNCH   TOT("S(6)")*96.06*1E3                      #  SO4
                        60 PUNCH   TOT("Ca")*GFW("Ca")*1E3                    #  Ca
                        70 PUNCH   TOT("Mg")*GFW("Mg")*1E3                    #  Mg
                        80 PUNCH   TOT("Na")*GFW("Na")*1E3                    #  Na
                        90 PUNCH   TOT("K")*GFW("K")*1E3                      #  K
                       100 PUNCH   TOT("F")*GFW("F")*1E3                      #  F
                       110 PUNCH   TOT("Al")*GFW("Al")*1E6                    #  Al
                       120 PUNCH   TOT("As")*GFW("As")*1E6                    #  As
                       130 PUNCH   TOT("B")*GFW("B")*1E6                      #  B
                       140 PUNCH   TOT("Co")*GFW("Co")*1E6                    #  Co
                       150 PUNCH   TOT("Fe")*GFW("Fe")*1E6                    #  Fe
                       160 PUNCH   TOT("Li")*GFW("Li")*1E6                    #  Li
                       170 PUNCH   TOT("Mn")*GFW("Mn")*1E6                    #  Mn
                       180 PUNCH   TOT("Mo")*GFW("Mo")*1E6                    #  Mo
                       190 PUNCH   (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93     #  mg/kg of sorb
                       200 PUNCH   (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93     #  mg/kg of sorb
                       210 PUNCH   mol("HX")*1E3                              #  mmol of HX
                       220 PUNCH   mol("LiX")*1E3                             #  mmol of LiX
                       230 PUNCH   mol("NaX")*1E3                             #  mmol of NaX
                       240 PUNCH   mol("CaX2")*1E3                            #  mmol of CaX2
                       250 PUNCH   (STEP_NO + .5)/15                          #  pore volume
                       260 PUNCH   mol("CaX2")*1E6                            #
                       270 PUNCH   mol("CaX2")*1E6                            #
                       280 PUNCH   mol("CaX2")*1E6                            #
                       290 PUNCH   mol("CaX2")*1E6                            #
                       300 PUNCH   mol("CaX2")*1E6                            #
END
SOLUTION 990                                                                  # Average of AP3I
   temp            22.8
   pH              6.6
   pe              2.3
   redox           pe
   units           mg/kgw
   density         1.0
   Alkalinity      191.5     as Ca.5(CO3).5
   As              0.001          #assumed DL; not measured
   B               0.51
   Ca              101.12
   Cl              5.71
```

```
    Co                       0.024
    F                        0.373
    Fe                       32.2
    K                        16.3
    Li                       0.195
    Mg                       25.4
    Mn                       3.2
    Mo                       0.144
    Na                       16.6
    S(6)                     184.5
    -water                           1 #kg
END

SOLUTION 991                                                                                            # upgradient well:
                units            mg/kgw
                temp             19.3
                pH               6.0
                pe               5.9
                Alkalinity       71.0     as Ca.5(CO3).5
                As               0.00100          #reporting limit
                B                0.020
                Ca               13.78
                Cl               13.07
                Co               0.0003           #reporting limit
                F                0.17
                Fe               0.07             #most recent value
                K                2.37
                Li               0.005
                Mg               8.958
                Mn               0.001            #reporting limit for recent samples
                Mo               0.0006           #reporting limit for recent samples
                Na               11.52
                S(6)             7.84
                -water           1        #kg
END

TITLE Mix TW with Aquifer GW
                MIX 1
                      990     0.11                # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                      991     0.89
                SAVE Solution 992
END
                USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite              0        0
                SAVE Solution 0
END

                TITLE Downgradient Transport Simulation
SOLUTION 1-30                                     # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
                units            mg/kgw           #from the upgradient well ARGWA-12 (overburden)
                temp             19.3
                pH               7.5              # calibrated value to allow Co to adsorb on ferrihydrite and gibsite
                pe               5.9
                Alkalinity       71.0
                As               0.001
                B                0.020
                Ca               13.8
                Cl               13.1
                Co               0.0003
                F                0.166
                Fe               0.066
                K                2.374
                Li               0.005
                Mg               8.96
                Mn               0.001
                Mo               0.0006
                Na               11.5
                S(6)             7.8
                -water           1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite                -85.0      0.39           # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite                -95.0      0.39           # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite                -87.0      0.39           # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite               -103.0      0.39           # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite                 -145      0.39
  pe_Fix                 -8.4 O2(g)               # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite               0        0           # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing condition:
  Pyrite                 -127      0.39           # calibrated to match pH observed at ARGWC-17
  pe_Fix                 -8.4 O2(g)               # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                        0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                      # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02     600     30.7
Hfo_sOH         1.73E-03     600
HaoOH           3.70E-02     600     7.03
SURFACE 11-20                                     # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
```

```
 -equil with 1
Hfo_wOH              6.91E-02          600        30.7
Hfo_sOH              1.73E-03          600
HaoOH                3.70E-02          600       7.030
SURFACE 21-29                                          # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH              6.91E-02          600        30.7
Hfo_sOH              1.73E-03          600
HaoOH                3.70E-02          600        7.03

TRANSPORT
    -cells                 30
    -shifts                49
    -time_step       8.91E+06                      # seconds
    -lengths             30*11
    -dispersivities      30*1.1
    -correct_disp         TRUE
    -flow_direction     forward
    -boundary_con       flux flux
    -thermal_diffus          2          3.00E-10
    -print_cells           1-30
    -print_frequenc           1
    -punch_cells           1-30
    -punch_frequer            1
    -dump_frequen            25
    -dump_restart             1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01          # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99          # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                213
    -lengths             30*11
    -dispersivities      30*1.1
    -print_cells           1-30
    -print_frequenc           1
    -punch_cells           1-30
    -dump_frequen           107
    -punch_frequer            1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions      FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions      FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Current Groundwater pH Scenario)

```
PHASES                                  #   the first transport represent pre-closure conditions
pe_Fix          # allows fixing pe      #   the second transport represent post-closure conditions under monitored natural attenuation scenario
                e- = e-                 #   Current Groundwater pH Scenario - Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
      Hfo_s  Hfo_sOH
      Hfo_w  Hfo_wOH
      Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
      X     X-

EXCHANGE_SPECIES
      X- = X-
      log_k         0.0

      Na+ + X- = NaX
      log_k         0.0

      K+ + X- = KX
      log_k         0.7

      Li+ + X- = LiX
      log_k         -0.08

      H+ + X- = HX
      log_k         1.0

      Ca+2 + 2X- = CaX2
      log_k         0.8

      Mg+2 + 2X- = MgX2
      log_k         0.6

      Mn+2 + 2X- = MnX2
      log_k         0.52

      Fe+2 + 2X- = FeX2
      log_k         0.44

                SELECTED_OUTPUT
                -file               AP-3_BASE_Current_pH_LOW.txt
                -selected_out       TRUE
                -solution                    TRUE
                -user_punch                  TRUE
                -water                       TRUE
                USER_PUNCH
                -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                     10 PUNCH   -LA("H+")                                    #  pH
                     20 PUNCH   S-LA("e-")*59.2                              #  Eh
                     30 PUNCH   Alk*50.0355*1000                             #  Alkalinity
                     40 PUNCH   TOT("Cl")*GFW("Cl")*1E3                      #  Cl
                     50 PUNCH   TOT("S(6)")*96.06*1E3                        #  SO4
                     60 PUNCH   TOT("Ca")*GFW("Ca")*1E3                      #  Ca
                     70 PUNCH   TOT("Mg")*GFW("Mg")*1E3                      #  Mg
                     80 PUNCH   TOT("Na")*GFW("Na")*1E3                      #  Na
                     90 PUNCH   TOT("K")*GFW("K")*1E3                        #  K
                    100 PUNCH   TOT("F")*GFW("F")*1E3                        #  F
                    110 PUNCH   TOT("Al")*GFW("Al")*1E6                      #  Al
                    120 PUNCH   TOT("As")*GFW("As")*1E6                      #  As
                    130 PUNCH   TOT("B")*GFW("B")*1E6                        #  B
                    140 PUNCH   TOT("Co")*GFW("Co")*1E6                      #  Co
                    150 PUNCH   TOT("Fe")*GFW("Fe")*1E6                      #  Fe
                    160 PUNCH   TOT("Li")*GFW("Li")*1E6                      #  Li
                    170 PUNCH   TOT("Mn")*GFW("Mn")*1E6                      #  Mn
                    180 PUNCH   TOT("Mo")*GFW("Mo")*1E6                      #  Mo
                    190 PUNCH   (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93    #  mg/kg of sorbed Co, used to compare with SE
                    200 PUNCH   (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93    #  mg/kg of sorbed As, used to compare with SEI
                    210 PUNCH   mol("HX")*1E3                                #  mmol of HX
                    220 PUNCH   mol("LiX")*1E3                               #  mmol of LiX
                    230 PUNCH   mol("NaX")*1E3                               #  mmol of NaX
                    240 PUNCH   mol("CaX2")*1E3                              #  mmol of CaX2
                    250 PUNCH   (STEP_NO + .5)/15                            #  pore volume
                    260 PUNCH   mol("CaX2")*1E6                              #
                    270 PUNCH   mol("CaX2")*1E6                              #
                    280 PUNCH   mol("CaX2")*1E6                              #
                    290 PUNCH   mol("CaX2")*1E6                              #
                    300 PUNCH   mol("CaX2")*1E6                              #
END
SOLUTION 990                                                                 # Average of AP3PZ-1A & AP3PZ-2A based on gw
   temp              22.8
   pH                6.6
   pe                2.3
   redox             pe
   units             mg/kgw
   density           1.0
   Alkalinity        191.5      as Ca.5(CO3).5
   As                0.001             #assumed DL; not measured
   B                 0.51
   Ca                101.12
   Cl                5.71
   Co                0.024
   F                 0.373
   Fe                32.2
   K                 16.3
   Li                0.195
   Mg                25.4
   Mn                3.2
   Mo                0.144
   Na                16.6
   S(6)              184.5
   -water                  1 #kg
```

```
END

SOLUTION 991                                                       # upgradient wells: ARGWA-12 (overburden)
        units           mg/kgw
        temp            19.3
        pH              6.0
        pe              5.9
        Alkalinity      71.0    as Ca.5(CO3).5
        As              0.00100         #reporting limit
        B               0.020
        Ca              13.78
        Cl              13.07
        Co              0.0003          #reporting limit
        F               0.17
        Fe              0.07            #most recent value
        K               2.37
        Li              0.005
        Mg              8.958
        Mn              0.001           #reporting limit for recent samples
        Mo              0.0006          #reporting limit for recent samples
        Na              11.52
        S(6)            7.84
        -water          1       #kg
END

TITLE Mix TW with Aquifer GW
        MIX 1
                990     0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                991     0.89
        SAVE Solution 992
END
        USE Solution 992
EQUILIBRIUM_PHASES 992
   #Ferrihydrite        0       0
        SAVE Solution 0
END

        TITLE Downgradient Transport Simulation
SOLUTION 1-30                           # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
        units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
        temp            19.3
        pH              7.0             # allow Co to adsorb on ferrihydrite and gibbsite
        pe              5.9
        Alkalinity      71.0
        As              0.001
        B               0.020
        Ca              13.8
        Cl              13.1
        Co              0.0003
        F               0.166
        Fe              0.066
        K               2.374
        Li              0.005
        Mg              8.96
        Mn              0.001
        Mo              0.0006
        Na              11.5
        S(6)            7.8
        -water          1.0
END

EQUILIBRIUM_PHASES 1-3
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -82.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 4-10
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -92.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 11-20
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -84.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 21-26
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -100.0  0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
   pe_Fix               -5.9 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 27-29
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -141    0.39
   pe_Fix               -8.4 O2(g)      # fixed to match ORP observed at upgradient well
   #pH_Fix              -5.2 HF
EQUILIBRIUM_PHASES 30
   Ferrihydrite         0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
   Pyrite               -127    0.39    # calibrated to match pH observed at ARGWC-17
   pe_Fix               -8.4 O2(g)      # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                            # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.7
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03
SURFACE 11-20                           # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.7
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03
SURFACE 21-29                           # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         6.91E-02        600     30.7
Hfo_sOH         1.73E-03        600
HaoOH           3.70E-02        600     7.03

TRANSPORT
    -cells              30
    -shifts             49
    -time_step          8.91E+06                # seconds
    -lengths            30*11
    -dispersivities     30*1.1
    -correct_disp       TRUE
    -flow_direction     forward
    -boundary_con       flux flux
    -thermal_diffus     2       3.00E-10
```

```
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -punch_freque              1
    -dump_freque              25
    -dump_restart              1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99            # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                   213
    -lengths                30*11
    -dispersivities         30*1.1
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -dump_freque              107
    -punch_freque              1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

```
TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Current Groundwater pH High Scenario)

PHASES                                      #    the first transport represent pre-closure conditions
pe_Fix          # allows fixing pe          #    the second transport represent post-closure conditions under monitored natural attenuation scenario
                e- = e-                     #    Current Groundwater pH High Scenario - Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
     Hfo_s  Hfo_sOH
     Hfo_w  Hfo_wOH
     Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
     X      X-

EXCHANGE_SPECIES
     X- = X-
     log_k       0.0

     Na+ + X- = NaX
     log_k       0.0

     K+ + X- = KX
     log_k       0.7

     Li+ + X- = LiX
     log_k       -0.08

     H+ + X- = HX
     log_k       1.0

     Ca+2 + 2X- = CaX2
     log_k       0.8

     Mg+2 + 2X- = MgX2
     log_k       0.6

     Mn+2 + 2X- = MnX2
     log_k       0.52

     Fe+2 + 2X- = FeX2
     log_k       0.44

                SELECTED_OUTPUT
                -file             AP-3_BASE_Current_pH_HIGH.txt
                -selected_out       TRUE
                -solution                   TRUE
                -user_punch                 TRUE
                -water                      TRUE
                USER_PUNCH
                -headings         pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                             10 PUNCH    -LA("H+")                                      #  pH
                             20 PUNCH    S-LA("e-")*59.2                                #  Eh
                             30 PUNCH    Alk*50.0355*1000                               #  Alkalinity
                             40 PUNCH    TOT("Cl")*GFW("Cl")*1E3                        #  Cl
                             50 PUNCH    TOT("S(6)")*96.06*1E3                          #  SO4
                             60 PUNCH    TOT("Ca")*GFW("Ca")*1E3                        #  Ca
                             70 PUNCH    TOT("Mg")*GFW("Mg")*1E3                        #  Mg
                             80 PUNCH    TOT("Na")*GFW("Na")*1E3                        #  Na
                             90 PUNCH    TOT("K")*GFW("K")*1E3                          #  K
                            100 PUNCH    TOT("F")*GFW("F")*1E3                          #  F
                            110 PUNCH    TOT("Al")*GFW("Al")*1E6                        #  Al
                            120 PUNCH    TOT("As")*GFW("As")*1E6                        #  As
                            130 PUNCH    TOT("B")*GFW("B")*1E6                          #  B
                            140 PUNCH    TOT("Co")*GFW("Co")*1E6                        #  Co
                            150 PUNCH    TOT("Fe")*GFW("Fe")*1E6                        #  Fe
                            160 PUNCH    TOT("Li")*GFW("Li")*1E6                        #  Li
                            170 PUNCH    TOT("Mn")*GFW("Mn")*1E6                        #  Mn
                            180 PUNCH    TOT("Mo")*GFW("Mo")*1E6                        #  Mo
                            190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93        #  mg/kg of sorbed Co, used to compare v
                            200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93    #  mg/kg of sorbed As, used to compare v
                            210 PUNCH    mol("HX")*1E3                                  #  mmol of HX
                            220 PUNCH    mol("LiX")*1E3                                 #  mmol of LiX
                            230 PUNCH    mol("NaX")*1E3                                 #  mmol of NaX
                            240 PUNCH    mol("CaX2")*1E3                                #  mmol of CaX2
                            250 PUNCH    (STEP_NO + .5)/15                              #  pore volume
                            260 PUNCH    mol("CaX2")*1E6                                #
                            270 PUNCH    mol("CaX2")*1E6                                #
                            280 PUNCH    mol("CaX2")*1E6                                #
                            290 PUNCH    mol("CaX2")*1E6                                #
                            300 PUNCH    mol("CaX2")*1E6                                #
END
SOLUTION 990                                                                            # Average of AP3PZ-1A & AP3PZ-2A based
   temp             22.8
   pH               6.6
   pe               2.3
   redox            pe
   units            mg/kgw
   density          1.0
   Alkalinity       191.5      as Ca.5(CO3).5
   As               0.001             #assumed DL; not measured
   B                0.51
   Ca               101.12
   Cl               5.71
   Co               0.024
   F                0.373
   Fe               32.2
   K                16.3
   Li               0.195
   Mg               25.4
   Mn               3.2
   Mo               0.144
   Na               16.6
   S(6)             184.5
   -water                      1 #kg
```

```
END

SOLUTION 991                                                                                                        # upgradient wells: ARGWA-12 (overburde
            units           mg/kgw
            temp              19.3
            pH                 6.0
            pe                 5.9
            Alkalinity        71.0    as Ca.5(CO3).5
            As             0.00100          #reporting limit
            B                0.020
            Ca               13.78
            Cl               13.07
            Co              0.0003          #reporting limit
            F                 0.17
            Fe                0.07          #most recent value
            K                 2.37
            Li               0.005
            Mg               8.958
            Mn               0.001          #reporting limit for recent samples
            Mo              0.0006          #reporting limit for recent samples
            Na               11.52
            S(6)              7.84
            -water               1     #kg
END

TITLE Mix TW with Aquifer GW
            MIX 1
                     990      0.11          # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                     991      0.89
            SAVE Solution 992
END
            USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite            0       0
            SAVE Solution 0
END

            TITLE Downgradient Transport Simulation
SOLUTION 1-30                               # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
            units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
            temp              19.3
            pH                 7.0          # allow Co to adsorb on ferrihydrite and gibbsite
            pe                 5.9
            Alkalinity        71.0
            As               0.001
            B                0.020
            Ca                13.8
            Cl                13.1
            Co              0.0003
            F                0.166
            Fe               0.066
            K                2.374
            Li               0.005
            Mg                8.96
            Mn               0.001
            Mo              0.0006
            Na                11.5
            S(6)               7.8
            -water             1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite               -88.0    0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite               -98.0    0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite               -90.0    0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite              -106.0    0.39        # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -148    0.39
  pe_Fix                -8.4 O2(g)          # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite             0       0        # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -127    0.39        # calibrated to match pH observed at ARGWC-17
  pe_Fix                -8.4 O2(g)          # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                   0.34                    # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH      6.91E-02     600     30.7
Hfo_sOH      1.73E-03     600
HaoOH        3.70E-02     600     7.03
SURFACE 11-20                               # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH      6.91E-02     600     30.7
Hfo_sOH      1.73E-03     600
HaoOH        3.70E-02     600     7.03
SURFACE 21-29                               # adsorption equilibrium with Ferrihydrite and Gibsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH      6.91E-02     600     30.7
Hfo_sOH      1.73E-03     600
HaoOH        3.70E-02     600     7.03

TRANSPORT
   -cells               30
   -shifts              49
   -time_step     8.91E+06                  # seconds
   -lengths          30*11
   -dispersivities  30*1.1
   -correct_disp      TRUE
   -flow_direction  forward
   -boundary_con   flux flux
   -thermal_diffus      2      3.00E-10
```

```
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -punch_freque              1
    -dump_freque              25
    -dump_restart              1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99            # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                   213
    -lengths                30*11
    -dispersivities         30*1.1
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -dump_freque              107
    -punch_freque              1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Abundance of Hydroxide Minerals Low Scenario)

```
PHASES                                          #       the first transport represent pre-closure conditions
pe_Fix          # allows fixing pe              #       the second transport represent post-closure conditions under monitored natural attenuation scenario
                e- = e-                         #       Abundance of Hydroxide Minerals Low Scenario - Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
        Hfo_s  Hfo_sOH
        Hfo_w  Hfo_wOH
        Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
        X       X-

EXCHANGE_SPECIES
        X- = X-
        log_k           0.0

        Na+ + X- = NaX
        log_k           0.0

        K+ + X- = KX
        log_k           0.7

        Li+ + X- = LiX
        log_k           -0.08

        H+ + X- = HX
        log_k           1.0

        Ca+2 + 2X- = CaX2
        log_k           0.8

        Mg+2 + 2X- = MgX2
        log_k           0.6

        Mn+2 + 2X- = MnX2
        log_k           0.52

        Fe+2 + 2X- = FeX2
        log_k           0.44

                SELECTED_OUTPUT
                -file                   AP-3_HFO_LOW.txt
                -selected_out           TRUE
                -solution                       TRUE
                -user_punch                     TRUE
                -water                          TRUE
                USER_PUNCH
                -headings       pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                        10 PUNCH    -LA("H+")                                   #  pH
                        20 PUNCH    S-LA("e-")*59.2                             #  Eh
                        30 PUNCH    Alk*50.0355*1000                            #  Alkalinity
                        40 PUNCH    TOT("Cl")*GFW("Cl")*1E3                     #  Cl
                        50 PUNCH    TOT("S(6)")*96.06*1E3                       #  SO4
                        60 PUNCH    TOT("Ca")*GFW("Ca")*1E3                     #  Ca
                        70 PUNCH    TOT("Mg")*GFW("Mg")*1E3                     #  Mg
                        80 PUNCH    TOT("Na")*GFW("Na")*1E3                     #  Na
                        90 PUNCH    TOT("K")*GFW("K")*1E3                       #  K
                       100 PUNCH    TOT("F")*GFW("F")*1E3                       #  F
                       110 PUNCH    TOT("Al")*GFW("Al")*1E6                     #  Al
                       120 PUNCH    TOT("As")*GFW("As")*1E6                     #  As
                       130 PUNCH    TOT("B")*GFW("B")*1E6                       #  B
                       140 PUNCH    TOT("Co")*GFW("Co")*1E6                     #  Co
                       150 PUNCH    TOT("Fe")*GFW("Fe")*1E6                     #  Fe
                       160 PUNCH    TOT("Li")*GFW("Li")*1E6                     #  Li
                       170 PUNCH    TOT("Mn")*GFW("Mn")*1E6                     #  Mn
                       180 PUNCH    TOT("Mo")*GFW("Mo")*1E6                     #  Mo
                       190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93   #  mg/kg of sorbed Co, used to compare with SE
                       200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93   #  mg/kg of sorbed As, used to compare with SE
                       210 PUNCH    mol("HX")*1E3                               #  mmol of HX
                       220 PUNCH    mol("LiX")*1E3                              #  mmol of LiX
                       230 PUNCH    mol("NaX")*1E3                              #  mmol of NaX
                       240 PUNCH    mol("CaX2")*1E3                             #  mmol of CaX2
                       250 PUNCH    (STEP_NO + .5)/15                           #  pore volume
                       260 PUNCH    mol("CaX2")*1E6                             #
                       270 PUNCH    mol("CaX2")*1E6                             #
                       280 PUNCH    mol("CaX2")*1E6                             #
                       290 PUNCH    mol("CaX2")*1E6                             #
                       300 PUNCH    mol("CaX2")*1E6                             #
END
SOLUTION 990                                                                    # Average of AP3PZ-1A & AP3PZ-2A based on gw
    temp                22.8
    pH                  6.6
    pe                  2.3
    redox               pe
    units               mg/kgw
    density             1.0
    Alkalinity          191.5       as Ca.5(CO3).5
    As                  0.001               #assumed DL; not measured
    B                   0.51
    Ca                  101.12
    Cl                  5.71
    Co                  0.024
    F                   0.373
    Fe                  32.2
    K                   16.3
    Li                  0.195
    Mg                  25.4
    Mn                  3.2
    Mo                  0.144
    Na                  16.6
    S(6)                184.5
    -water                      1 #kg
```

```
END

SOLUTION 991                                                                    # upgradient wells: ARGWA-12 (overburden)
        units           mg/kgw
        temp            19.3
        pH              6.0
        pe              5.9
        Alkalinity      71.0    as Ca.5(CO3).5
        As              0.00100         #reporting limit
        B               0.020
        Ca              13.78
        Cl              13.07
        Co              0.0003          #reporting limit
        F               0.17
        Fe              0.07            #most recent value
        K               2.37
        Li              0.005
        Mg              8.958
        Mn              0.001           #reporting limit for recent samples
        Mo              0.0006          #reporting limit for recent samples
        Na              11.52
        S(6)            7.84
        -water          1       #kg
END

TITLE Mix TW with Aquifer GW
        MIX 1
                990     0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                991     0.89
        SAVE Solution 992
END
        USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite         0       0
        SAVE Solution 0
END

        TITLE Downgradient Transport Simulation
SOLUTION 1-30                           # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
        units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
        temp            19.3
        pH              7.0             # calibrated value to allow Co to adsorb on ferrihydrite and gibsite
        pe              5.9
        Alkalinity      71.0
        As              0.001
        B               0.020
        Ca              13.8
        Cl              13.1
        Co              0.0003
        F               0.166
        Fe              0.066
        K               2.374
        Li              0.005
        Mg              8.96
        Mn              0.001
        Mo              0.0006
        Na              11.5
        S(6)            7.8
        -water          1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -85.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)      # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -95.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)      # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -87.0   0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)      # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -103.0  0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                -5.9 O2(g)      # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -145    0.39
  pe_Fix                -8.4 O2(g)      # fixed to match ORP observed at upgradient well
  #pH_Fix               -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite          0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -127    0.39    # calibrated to match pH observed at ARGWC-17
  pe_Fix                -8.4 O2(g)      # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                            # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         3.46E-02        600     15.4
Hfo_sOH         8.64E-04        600
HaoOH           3.70E-02        600     3.52
SURFACE 11-20                           # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         3.46E-02        600     15.4
Hfo_sOH         8.64E-04        600
HaoOH           3.70E-02        600     3.52
SURFACE 21-29                           # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         3.46E-02        600     15.4
Hfo_sOH         8.64E-04        600
HaoOH           3.70E-02        600     3.52

TRANSPORT
    -cells              30
    -shifts             49
    -time_step          8.91E+06                # seconds
    -lengths            30*11
    -dispersivities     30*1.1
    -correct_disp       TRUE
    -flow_direction     forward
    -boundary_con       flux flux
    -thermal_diffus     2       3.00E-10
```

```
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -punch_freque              1
    -dump_freque              25
    -dump_restart              1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99            # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                   213
    -lengths                30*11
    -dispersivities         30*1.1
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -dump_freque              107
    -punch_freque              1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```

TITLE - AP-3 Transect Pre-closure (Base Case) and Post-closure (Abundance of Hydroxide Minerals High Scenario)

```
PHASES                                          #   the first transport represent pre-closure conditions
pe_Fix          # allows fixing pe              #   the second transport represent post-closure conditions under monitored natural attenuation scenario
                e- = e-                         #   Abundance of Hydroxide Minerals Low Scenario - Sensitivity Analysis
                log_k  0.0

pH_Fix          # allows fixing pH
                H+ = H+
                log_k  0.0

END
SURFACE_MASTER_SPECIES
     Hfo_s  Hfo_sOH
     Hfo_w  Hfo_wOH
     Hao    HaoOH
SURFACE_SPECIES
HaoOH = HaoOH
                log_k 0.0
HaoOH + H+ = HaoOH2+
                log_k 7.17
HaoOH = HaoO- + H+
                log_k 11.18
HaoOH + Co+2 = HaoOCo+ + H+
                log_k -2.52
HaoOH + H3BO3 = HaoH2BO3 + H2O
                Log_k 1.57
EXCHANGE_MASTER_SPECIES
     X      X-

EXCHANGE_SPECIES
     X- = X-
     log_k        0.0

     Na+ + X- = NaX
     log_k        0.0

     K+ + X- = KX
     log_k        0.7

     Li+ + X- = LiX
     log_k        -0.08

     H+ + X- = HX
     log_k        1.0

     Ca+2 + 2X- = CaX2
     log_k        0.8

     Mg+2 + 2X- = MgX2
     log_k        0.6

     Mn+2 + 2X- = MnX2
     log_k        0.52

     Fe+2 + 2X- = FeX2
     log_k        0.44

                SELECTED_OUTPUT
                -file               AP-3_HFO_HIGH.txt
                -selected_out       TRUE
                -solution                    TRUE
                -user_punch                  TRUE
                -water                       TRUE
                USER_PUNCH
                -headings           pH Eh Alkalinity Cl SO4 Ca Mg Na K F Al As B Co Fe Li Mn Mo Sorbed_Co Sorbed_As HX LiX NaX CaX2 Pore_Vol SI_Ferrihydrite CaX2 CaX2 CAL SUL
                -start
                           10 PUNCH    -LA("H+")                                        #  pH
                           20 PUNCH    S-LA("e-")*59.2                                  #  Eh
                           30 PUNCH    Alk*50.0355*1000                                 #  Alkalinity
                           40 PUNCH    TOT("Cl")*GFW("Cl")*1E3                          #  Cl
                           50 PUNCH    TOT("S(6)")*96.06*1E3                            #  SO4
                           60 PUNCH    TOT("Ca")*GFW("Ca")*1E3                          #  Ca
                           70 PUNCH    TOT("Mg")*GFW("Mg")*1E3                          #  Mg
                           80 PUNCH    TOT("Na")*GFW("Na")*1E3                          #  Na
                           90 PUNCH    TOT("K")*GFW("K")*1E3                            #  K
                          100 PUNCH    TOT("F")*GFW("F")*1E3                            #  F
                          110 PUNCH    TOT("Al")*GFW("Al")*1E6                          #  Al
                          120 PUNCH    TOT("As")*GFW("As")*1E6                          #  As
                          130 PUNCH    TOT("B")*GFW("B")*1E6                            #  B
                          140 PUNCH    TOT("Co")*GFW("Co")*1E6                          #  Co
                          150 PUNCH    TOT("Fe")*GFW("Fe")*1E6                          #  Fe
                          160 PUNCH    TOT("Li")*GFW("Li")*1E6                          #  Li
                          170 PUNCH    TOT("Mn")*GFW("Mn")*1E6                          #  Mn
                          180 PUNCH    TOT("Mo")*GFW("Mo")*1E6                          #  Mo
                          190 PUNCH    (mol("Hfo_sOCo+")+mol("Hfo_wOCo+"))*GFW("Co")*1E3*0.2/1.93    #  mg/kg of sorbed Co, used to compare with SEI
                          200 PUNCH    (mol("Hfo_sH2AsO4")+mol("Hfo_sHAsO4-")+mol("Hfo_sOHAsO4-3")+mol("Hfo_wH2AsO4")+mol("Hfo_wHAsO4-")+mol("Hfo_wOHAsO4-3"))*GFW("As")*1E3*0.2/1.93    #  mg/kg of sorbed As, used to compare with SEI
                          210 PUNCH    mol("HX")*1E3                                    #  mmol of HX
                          220 PUNCH    mol("LiX")*1E3                                   #  mmol of LiX
                          230 PUNCH    mol("NaX")*1E3                                   #  mmol of NaX
                          240 PUNCH    mol("CaX2")*1E3                                  #  mmol of CaX2
                          250 PUNCH    (STEP_NO + .5)/15                                #  pore volume
                          260 PUNCH    mol("CaX2")*1E6                                  #
                          270 PUNCH    mol("CaX2")*1E6                                  #
                          280 PUNCH    mol("CaX2")*1E6                                  #
                          290 PUNCH    mol("CaX2")*1E6                                  #
                          300 PUNCH    mol("CaX2")*1E6                                  #
END
SOLUTION 990                                                                            # Average of AP3PZ-1A & AP3PZ-2A based on gw
    temp              22.8
    pH                6.6
    pe                2.3
    redox             pe
    units             mg/kgw
    density           1.0
    Alkalinity        191.5      as Ca.5(CO3).5
    As                0.001             #assumed DL; not measured
    B                 0.51
    Ca                101.12
    Cl                5.71
    Co                0.024
    F                 0.373
    Fe                32.2
    K                 16.3
    Li                0.195
    Mg                25.4
    Mn                3.2
    Mo                0.144
    Na                16.6
    S(6)              184.5
    -water                     1 #kg
```

```
END

SOLUTION 991                                                                                   # upgradient wells: ARGWA-12 (overburden)
            units           mg/kgw
            temp            19.3
            pH              6.0
            pe              5.9
            Alkalinity      71.0    as Ca.5(CO3).5
            As              0.00100         #reporting limit
            B               0.020
            Ca              13.78
            Cl              13.07
            Co              0.0003          #reporting limit
            F               0.17
            Fe              0.07            #most recent value
            K               2.37
            Li              0.005
            Mg              8.958
            Mn              0.001           #reporting limit for recent samples
            Mo              0.0006          #reporting limit for recent samples
            Na              11.52
            S(6)            7.84
            -water          1       #kg
END

TITLE Mix TW with Aquifer GW
            MIX 1
                    990     0.11            # determined by the mixing ratio for B; checked against inverse modeling in PHREEQC
                    991     0.89
            SAVE Solution 992
END
            USE Solution 992
EQUILIBRIUM_PHASES 992
  #Ferrihydrite             0       0
            SAVE Solution 0
END

            TITLE Downgradient Transport Simulation
SOLUTION 1-30                               # fill aquifer with the water observed under baseline conditions (prior to the deposition of AP-3), assumed to be the water quality
            units           mg/kgw          #from the upgradient well ARGWA-12 (overburden)
            temp            19.3
            pH              7.0             # calibrated value to allow Co to adsorb on ferrihydrite and gibsite
            pe              5.9
            Alkalinity      71.0
            As              0.001
            B               0.020
            Ca              13.8
            Cl              13.1
            Co              0.0003
            F               0.166
            Fe              0.066
            K               2.374
            Li              0.005
            Mg              8.96
            Mn              0.001
            Mo              0.0006
            Na              11.5
            S(6)            7.8
            -water          1.0
END

EQUILIBRIUM_PHASES 1-3
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -85.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 4-10
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -95.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 11-20
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                -87.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 21-26
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite               -103.0       0.39    # calibrated to achieve optimized pH for Co adsorption/desorption
  pe_Fix                 -5.9 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 27-29
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -145       0.39
  pe_Fix                 -8.4 O2(g)         # fixed to match ORP observed at upgradient well
  #pH_Fix                -5.2 HF
EQUILIBRIUM_PHASES 30
  Ferrihydrite              0       0       # forced to precipitate only if oversaturated; not detected by XRD but included here as it is commonly observed in aquifer under oxidizing conditions
  Pyrite                 -127       0.39    # calibrated to match pH observed at ARGWC-17
  pe_Fix                 -8.4 O2(g)         # fixed to match ORP observed at upgradient well

EXCHANGE 1-30
X                       0.34 # eq of exchange sites per one liter (kg) of water
-equilibrate with Solution 1

SURFACE 1-10                                # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         1.38E-01        600     61.4
Hfo_sOH         3.46E-03        600
HaoOH           3.70E-02        600     14.1
SURFACE 11-20                               # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         1.38E-01        600     61.4
Hfo_sOH         3.46E-03        600
HaoOH           3.70E-02        600     14.1
SURFACE 21-29                               # adsorption equilibrium with Ferrihydrite and Gibbsite (aquifer dry density of 1.93 kg/L and porosity of 0.2 were assumed for calculations)
 -equil with 1
Hfo_wOH         1.38E-01        600     61.4
Hfo_sOH         3.46E-03        600
HaoOH           3.70E-02        600     14.1

TRANSPORT
   -cells               30
   -shifts              49
   -time_step           8.91E+06            # seconds
   -lengths             30*11
   -dispersivities      30*1.1
   -correct_disp        TRUE
   -flow_direction      forward
   -boundary_con        flux flux
   -thermal_diffus      2           3.00E-10
```

```
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -punch_freque              1
    -dump_freque              25
    -dump_restart              1

END
                    USE Solution 992
                    USE Solution 991
                    MIX 2
                                992         0.01            # fraction of CCR pore water and upgradient water mixture remaining after remediation
                                991         0.99            # fraction of upgradient water
                    SAVE Solution 0
END
TRANSPORT
    -shifts                   213
    -lengths                30*11
    -dispersivities         30*1.1
    -print_cells              1-30
    -print_frequenc            1
    -punch_cells              1-30
    -dump_freque              107
    -punch_freque              1

                    USER_GRAPH 1
                    -chart_title "Cobalt"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_Co.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("Co")*GFW("Co")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

                    USER_GRAPH 2
                    -chart_title "Boron"
                    -axis_titles "Years" "Concentration (ug/L)"
                    -axis_scale x_axis 0 auto auto auto
                    -connect_simulations TRUE
                    -initial_solutions     FALSE
                    -batch AP3_V01_B.png true true
                    -start
                    10 PLOT_XY (TOTAL_TIME/3.17E+07)-0,TOT("B")*GFW("B")*1E6,color= Blue, symbol = Circle, symbol_size = 5, y-axis = 1, line_width = 1
                    -end

END
```