Georgia Power Company
Grumman Road Private Industrial Landfill

Port Wentworth, Georgia
PERMIT #: 025-061D(LI)
Chatham County

SUPPLEMENTAL
2019 FIRST SEMIANNUAL GROUNDWATER MONITORING REPORT

Atlantic Coast Consulting, Inc.

PROFESSIONAL CERTIFICATION

This *Supplemental 2019 First Semiannual Groundwater Monitoring & Corrective Action Report*, Georgia Power Company – Grumman Road Private Industrial Landfill has been prepared in compliance with the Georgia Environmental Protection Division Rules for Solid Waste Management 391-3-4-.10 and 391-3-4-.14 by a qualified groundwater scientist or engineer with Atlantic Coast Consulting, Inc (ACC).

ACC certifies that all metals required by the existing EPD-approved Groundwater Monitoring Plan were below applicable Georgia primary maximum contaminant levels (MCLs) except for arsenic in the samples from GWC-15, GWC-16, and GWC-20. Concentrations of analytes in included in Appendix III of 40 CFR 257 analytes including: total dissolved solids (7 samples), sulfate (3 samples), and chloride (1 sample) exceeded relevant Georgia secondary MCLs (SMCLs).

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TABLE OF CONTENTS

Tables

Figures

Appendices

1.0 Introduction

In accordance with the Georgia Environmental Protection Division (GA EPD) Rules of Solid Waste Management 391-3-4-.10(6)(a)-(c), Atlantic Coast Consulting, Inc. (ACC) has prepared this Semiannual Groundwater Monitoring Report to document groundwater monitoring activities conducted during the first half of 2019 at Georgia Power Company's (GPC) Grumman Road Private Industrial Landfill (GRL). To specify groundwater monitoring requirements, GA EPD rule 391-3-4-.10(6)(a) incorporates by reference the United States Environmental Protection Agency (US EPA) Coal Combustion Residuals (CCR) Rule 40 Code of Federal Regulations (CFR) § 257 Subpart D.

The Site ceased accepting CCR prior to October 19, 2015 and is therefore not subject to Federal monitoring requirements. To comply with GA EPD's 391-3-4-.10, a permit application package for GRL was submitted to GA EPD in November 2018 and is currently under review. The list of analytes included in the groundwater monitoring program has been modified to meet the requirements of 40 CFR § 257 (i.e. incorporation of Appendix III and IV constituents into the routine monitoring program). This report includes the background data and the initial detection monitoring data for the Site. This is the initial detection monitoring event under the new monitoring program. The facility is continuing an Assessment of Corrective Measures (ACM) established under the existing permit.

1.1 Site Description and Background

GRL is located on Gulfstream Road, in Chatham County, Georgia, approximately 0.8 miles east of Savannah/Hilton Head International Airport and 1.3 miles west of the city of Port Wentworth. GRL occupies approximately 36 acres. Figure 1, Site Location Map, depicts the site location relative to the surrounding area. Figure 2, Well Location Map, depicts the general configuration of the site and the location of the monitoring wells.

1.2 Regional Geology and Hydrogeologic Setting

GRL is underlain by Atlantic Coastal Plain Physiographic Province strata consisting of unconsolidated to consolidated layers of sand, silt and clay and semi-consolidated to dense layers of limestone and dolomite. (Clarke et al, 2010). These sediments constitute three major aquifer systems, which are, from shallow to deep, the surficial aquifer system, the Brunswick aquifer system, and the Floridan aquifer system. In the coastal area, the surficial aquifer system consists of Miocene and younger interlayered sand, silt, clay and thin limestone beds (Clarke et al, 2010). The surficial aquifer system is unconfined and the fine silty sands and clay partings are found generally less than 80 feet below ground surface (bgs).

The surficial aquifer is underlain by a confining unit that separates the surficial aquifer from the Brunswick aquifer. The confining unit consists of silty clay and dense thin, phosphatic Miocene limestone. The Oligocene to Miocene Brunswick aquifer consists of two water-bearing zones. The upper Brunswick and lower Brunswick aquifers are separated by a low permeability, sandy phosphatic clay confining unit. The Brunswick aquifer is separated from the Upper Floridan aquifer with the Upper Confining unit and a non-water bearing limestone (NWBL) layer. The Floridan aquifer is confined by the overlying clay and NWBL layers.

Unit 1 (surficial aquifer) has a thickness ranging from approximately 22 feet to 28 feet across the site. Hydraulic conductivity is defined as the rate at which water can move through a permeable medium. In situ rising head and falling slug tests were performed at multiple locations

on the site. There is a limited range in hydraulic conductivity at these locations, indicating a fairly uniform medium across the upper aquifer or Unit 1 (typically range from 10^{-3} to 10^{-4} cm/sec). The average hydraulic conductivity is estimated at 2.7 x 10^{-3} cm/sec (7.6 feet/day) . The values from the field test fall within the standard range of hydraulic conductivity values associated with a silty sand.

Unit 2 is comprised of fine grain sandy silt and clayey sands and is considered an aquitard. The thickness of Unit 2 in the site area ranges from 5 feet to over 40 feet. Typically, Unit 2 has a lower permeability on the order of 10 times less (10^{-4} cm/sec-10^{-5} cm/sec) than that of Unit 1.

1.3 Groundwater Monitoring System and CCR Units

GRL received coal combustion fly ash (CCR) from GPC – Plant Kraft. The landfill operated under EPD solid waste handling permit number 025-061D and is comprised of four cells or parcels: Parcel A [originally operated under permit number 025-034D(L)(I)], B1, B2, and B3. CCR is no longer received at the landfill (as of October 15, 2015) and closure of parcels B1, B2, and B3 have been completed. Capping of the last remaining uncapped portion of Parcel A has recently been completed.

A groundwater monitoring plan was submitted and approved January 13, 2000. The initial approved detection groundwater monitoring network included 17 monitoring wells: upgradient wells GWA-7 and GWA-8, downgradient wells GWC-1 through GWC-6, and GWC-9 through GWC-17. As previously documented to EPD, in late 2018 three monitoring wells (GWC-4, GWC-5, and GWC-6) were replaced by locations (GWB-4R, GWB-5R, and GWB-6R) were also re-designated as side-gradient (i.e. “GWB” prefixes) locations. One location (GWC-3) was not replaced due to redundancy with GWC-20. These changes are detailed in the November 2018 permit application. Well installations have either been previously approved or pending permit application. Pursuant to §257.91, the monitoring system is designed to monitor groundwater passing the waste boundary of GRL within the uppermost aquifer. Wells were located to serve as upgradient and downgradient monitoring points based on groundwater flow direction (Table 1A, Monitoring Network Well Summary). Existing locations not included in the monitoring network are presented in Table 1B, Non-Network Well Summary.

An ACM to address SSIs for arsenic concentrations in several monitoring locations in the vicinity of Parcel A is ongoing and will continue to be documented to EPD.

2.0 GROUNDWATER MONITORING ACTIVITIES

The following describes monitoring-related activities performed in March 2019. Because this is the first Semiannual Groundwater Monitoring Report submitted for GRL, it also describes activities performed prior to 2019 to establish the groundwater monitoring program. Samples were collected from each well in the monitoring system shown on Figure 2.

Table 2, Groundwater Sampling Event Summary, presents a summary of groundwater sampling events completed at GRL during background monitoring through the first half of 2019. Locations associated with GRL were monitored for Appendix III constituents during the March 2019 semi-annual monitoring events. Eight rounds of background data were completed for the GRL monitoring locations including sampling for Appendix III and IV constituents; laboratory analytical reports for those results and for the first semi-annual event are presented in Appendix A, Laboratory Analytical and Field Sampling Reports.

2.1 Monitoring Well Installation/Maintenance

In accordance with the Georgia Rules for Solid Waste Management Chapter 391-3-4-.10 a groundwater monitoring system has been installed that (1) consists of a sufficient number of wells, (2) installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer, and (3) meets the performance standards of §257.91(a). In summary, groundwater monitoring includes the following:

- Two upgradient groundwater monitoring network wells (GWA-7 and GWA-8), three sidegradient monitoring network wells (GWB-4R, GWB-5R, and GWB-6R), and thirteen downgradient groundwater monitoring network wells (GWC-1, GWC-2, GWC-9, GWC-11, GWC-12, GWC-13, GWC-14, GWC-15, GWC-16, GWC-17, GWC-20, GWC-21, and GWC-22).

The number, spacing, and depths of the groundwater monitoring wells were selected by a qualified groundwater scientist based on the characterization of site-specific hydrogeologic conditions. Groundwater monitoring wells were designed to monitor the uppermost water-bearing zone. Monitoring well designations were determined based on measured groundwater levels at the site.

2.2 Detection Monitoring Program

To realign future sampling schedules, GPC supplemented an additional sampling event in March 2019. The March 2019 monitoring event is the tenth round of Appendix III data and is the initial detection monitoring event. This report provides data for the March 2019 monitoring event and reports it as the Supplemental 2019 First Groundwater Monitoring Report. Based on this revised schedule, a third sampling event for 2019 will be performed in in the second half of 2019 and the data will be reported in the 2019 second semi-annual groundwater monitoring report.

2.2.1 Background Monitoring for CCR Analytes

A minimum of eight (8) independent samples were collected from the network and analyzed for the constituents listed in Appendix III and IV. A table summarizing the results for each well is included in Table 5A, Summary of Background Groundwater Analytical Data – 2016 – 2018. Data reports for each sampling event are included in Appendix A, Laboratory Analytical and Field Sampling Reports.

2.2.2 Initial Detection Monitoring for CCR Analytes

Following completion of the nine independent sampling events for constituents listed in Appendix III or IV, groundwater samples were collected March 25-27, 2019 and analyzed for Appendix III constituents as part of the first semiannual detection monitoring event. Samples could not be collected in March 2019 from GWC-2 due to closure construction activities, which made the well inaccessible at that time. However, the well is again accessible and was sampled on July 30, 2019. A table summarizing the results for the well is included in Appendix A, Analytical Data Summary Tables. Data reports for the March 2019 sampling event are included in Appendix A.

2.2.3 Monitoring for Existing Approved Analytes

Eight inorganic analytes are required per the existing approved EPD-approved Groundwater Monitoring Plan were also collected as part of the March 2019 monitoring event. A table summarizing the results for the wells is included in Table 5C, Summary of Groundwater Analytical Data – March 2019. Pursuant to §257.90(e)(3), data reports for the March 2019 sampling event are included in Appendix A. Future monitoring will be conducted in accordance with the requirements of the Georgia Rules for Solid Waste Management Chapter 391-3-4-.10.

2.2.4 Additional Monitoring Event

Per communication with EPD, an event was completed in January 2019 for the collection of constituents listed in Appendix III as well as the eight historically required inorganic analytes. A table summarizing the results for the wells is included in Table 5B, Summary of Groundwater Analytical Data – January 2019. Data from that event were submitted to EPD under separate cover earlier this year.

3.0 SAMPLE METHODOLOGY AND ANALYSIS

The following sections describe the methods used to conduct groundwater monitoring at GRL.

3.1 Groundwater Flow Direction, Gradient, and Velocity

Prior to each sampling event, groundwater elevations are recorded from the certified well network and piezometers at GRL. Groundwater elevations recorded during the monitoring events are summarized in Table 3, Summary of Groundwater Elevations. Groundwater elevation data was used to develop Figure 3, March 2019 Potentiometric Surface Map, a potentiometric high exists near wells GWA-7 in the northern portion of the site and groundwater flows semi-radially from this high. In the southern portion of the site groundwater flows to the south and southeast. The groundwater flow patterns observed during the March 2019 monitoring event is consistent with historical patterns.

The groundwater flow velocity at Plant Yates was calculated using a derivation of Darcy's Law.

Specifically:

Equation

$$v = \frac{K\,(dh/dl)}{P_e}$$

where:
v = ground water velocity
K = hydraulic conductivity
dh/dl = hydraulic gradient
P_e = effective porosity

Groundwater flow velocities were calculated for the site based on hydraulic gradients, average hydraulic conductivity based on previous slug test data, and an estimated effective porosity of 0.20 (based on a review of several sources, including Driscoll, 1986; US EPA, 1989; Freeze and Cherry, 1979). Groundwater flow velocities have been calculated and are tabulated on Table 4, Groundwater Flow Velocity Calculations. The calculated flow velocity is 0.29 feet per day.

3.2 Groundwater Sampling

Groundwater samples were collected using low-flow sampling procedures in accordance with 40 CFR §257.93(a). Purging and sampling was primarily performed using peristaltic pumps. Tubing was lowered into the well so that the intake was at the midpoint of the well screen (or as appropriate determined by the water level). Peristaltic pump samples were collected using new disposable polyethylene tubing. All non-disposable equipment was decontaminated before use and between well locations.

Monitoring wells were purged and sampled using low-flow sampling procedures. A SmarTroll (In-Situ field instrument) was used to monitor and record field water quality parameters (pH, conductivity, oxidation-reduction potential, dissolved oxygen, and temperature) during well

purging prior to sampling. Turbidity was measured using a Hach 2100Q portable turbidimeter. Groundwater samples were collected when the following stabilization criteria were met:

- ± 0.1 standard units for pH
- ± 10% for specific conductance
- ± 10% for DO where DO > 0.5 mg/L. No criterion applies if DO < 0.5 mg/L.
- Turbidity measurements less than 10 nephelometric turbidity units (NTU)

Once stabilization was achieved, samples were collected directly into appropriately preserved laboratory-supplied sample containers. Sample bottles were placed in ice-packed coolers and submitted to Pace Analytical Services, LLC (Pace) of Peachtree Corners, Georgia and Greensburg, Pennsylvania following chain-of-custody protocol. Stabilization logs for each well during each monitoring event are included in Appendix A.

3.3 Laboratory Analyses

Groundwater samples were collected for both Appendix III and IV for background monitoring events. Groundwater samples collected in March 2019 for detection monitoring event were analyzed for Appendix III monitoring parameters. Analytical methods used for groundwater monitoring parameters are provided in laboratory reports in Appendix A.

Laboratory analyses were performed by Pace. Pace is accredited by the National Environmental Laboratory Accreditation Program (NELAP) and maintains a NELAP certification for all parameters analyzed for this project. In addition, Pace is certified to perform analysis by the State of Georgia. Laboratory reports and chain-of-custody records for the monitoring events are presented in Appendix A.

3.4 Quality Assurance and Quality Control

During each sampling event, quality assurance/quality control (QA/QC) samples are collected at a rate of one QA/QC sample per every 10 groundwater assessment samples. Equipment blanks (where non-dedicated sampling equipment is used) and duplicate samples were collected during each sampling event. QA/QC sample data were evaluated during data validation and are included in Appendix A.

Groundwater quality data in this report was validated in accordance with US EPA guidance (US EPA, 2011) and the analytical methods. Data validation generally consisted of reviewing sample integrity, holding times, laboratory method blanks, laboratory control samples, matrix spikes/matrix spike duplicate recoveries and relative percent differences, post digestions spikes, laboratory and field duplicate RPDs, field and equipment blanks, and reporting limits. Where appropriate, validation qualifiers and flags are applied to the data using US EPA procedures as guidance (US EPA, 2017).

Values followed by a "J" flag indicate that the value is an estimated analyte concentration detected between the method detection limit (MDL) and the laboratory reporting limit (PQL). The estimated value is positively identified but is below the lowest level that can be reliably achieved within specified limits of precision and accuracy under routine laboratory operating conditions. “J” flagged data are used to establish background statistical limits but are not used when performing statistical analyses.

4.0 STATISTICAL ANALYSIS

Statistical analysis of Appendix III groundwater monitoring data following the appropriate method.

4.1 Statistical Methods

The statistical method used at the site was developed by Groundwater Stats Consulting, LLC (GSC) using methodology presented in *Statistical Analysis of Groundwater Data at RCRA Facilities, Unified Guidance*, March 2009, US EPA 530/R-09-007 (US EPA, 2009). To develop the statistical method, analytical data collected during the background period were evaluated and used to develop statistical limits for each Appendix III parameter. Sanitas groundwater statistical software was used to perform the statistical analyses. Sanitas is a decision support software package that incorporates the statistical tests required of Subtitle C and D facilities by US EPA regulations.

4.1.1 Appendix III Constituents

Statistical tests used to evaluate the groundwater monitoring data consist of interwell prediction limits combined with a 1-of-2 verification resample plan for Appendix III parameters calcium, chloride, fluoride, pH, and sulfate. Monitoring results for boron and TDS were evaluated using intrawell prediction limits combined with a 1-of-3 verification resample plan. Interwell prediction limits pool upgradient well data to establish a background limit for an individual constituent, and the most recent sample from each downgradient well is compared to the same limit for each parameter. Intrawell prediction limits are constructed from historical data within a given well, and the most recent sample is compared to background. If the most recent sample exceeds its respective background statistical limit, an initial statistically significant increase (SSI) is identified. A summary of the statistical methodology used at the Site for routine groundwater monitoring is provided in Table 6, Summary of Statistical Methods.

4.1.2 EPD Permit-Required Metals

Statistical tests used to evaluate the groundwater monitoring data consist of intrawell prediction limits combined with a 1-of-2 verification resample plan for all required metals, except for arsenic at GWC-15, GWC-16, and GWC-20 and barium at GWC-9. Results for these metals are evaluated by trend tests. The occurrence of arsenic at these locations is being addressed by the ACM; barium is included in the list of Appendix IV analytes and will be appropriately evaluated either by an alternate source demonstration or by a statistical comparison to its groundwater protection standard if assessment monitoring is implanted. Intrawell prediction limits are constructed from historical data within a given well, and the most recent sample is compared to background. If the most recent sample exceeds its respective background statistical limit, an initial statistically significant increase (SSI) is identified. Table 6 includes a summary of the metals included in the EPD permit and the statistical method.

4.2 Statistical Analyses Results

Analytical data from the initial CCR detection monitoring event in March 2019 at GRL was statistically analyzed in accordance with the statistical methods. Resampling to confirm SSIs was not performed; therefore, initial SSIs are treated as verified. Historical data from GWC-4, GWC-5, and GWC-6 were appended to the corresponding replacement wells GWB-4R, GWB-5R, and GWB-6R. Wells and analytes with all data below the reporting limit do not require statistical analysis.

A summary of wells exhibiting 100% non-detects is included in Appendix B, Statistical Analyses. The statistical analysis and comparison to prediction limits are included as Appendix C.

Based on the statistical results presented in Appendix B, the following summarizes parameters exhibiting SSIs as follows:

- Boron: GWB-6R, GWC-13, GWC-16
- Calcium: GWB-4R, GWB-5R, GWC-1, GWC-12, GWC-14, GWC-15, GWC-16, GWC-17, GWC-20, GWC-21
- Chloride: GWC-17
- Fluoride: GWC-17
- pH: GWC-12, GWC-15
- Sulfate: GWB-4R, GWB-5R, GWB-6R, GWC-12, GWC-14, GWC-17
- TDS: GWB-5R and GWB-6R

Within 90 days from determining an SSI, GPC will either (1) prepare a demonstration that a source other than GRL was the cause, or (2) implement assessment monitoring per § 257.95. The site is already in assessment monitoring for the existing state permit, but the assessment monitoring program will be revised to comply with new EPD regulations.

4.3 Appendix IV Background Data

Appendix IV groundwater quality from downgradient wells will be compared to groundwater protection standards if assessment monitoring is implemented. GRL is currently performing detection monitoring and has not implemented assessment monitoring under the new regulations. An ACM for arsenic initiated under the existing permit is ongoing. Therefore, statistical analysis of the Appendix IV data (excluding the analytes required by the existing permit – see section 4.4) has not been performed.

4.4 Statistical Analyses Results for Parameters Required by Existing Permit

Analytes required by the existing state permit were added during this event. Consistent with prior monitoring events, the concentrations of arsenic in GWC-15, GWC-16, and GWC-20 exceeded the MCL. The arsenic MCL exceedances as well as barium in GWC-9 were evaluated using the Sen's Slope/Mann-Kendall trend test in lieu of intrawell prediction limits. Statistically significant increasing trends were identified for arsenic in GWC-15 and GWC-20 and barium in GWC-9. A decreasing trend was identified for arsenic in GWC-16. Wells GWC-15, GWC-16, and GWC-20 will continue to be addressed by the ongoing ACM.

The barium concentration in the sample from GWC-16 and the chromium concentration in the sample from GWB-5R exceeded the respective intrawell prediction limits. The exceedances were further evaluated using the Sen's Slope/Mann-Kendall trend test, and no significant increasing trend was identified in either case. The concentrations of barium at GWC-16 and chromium at GWB-5R are considered unverified SSIs. Barium and chromium are included in the list of Appendix IV analytes and will be evaluated will be appropriately evaluated either by an alternate source demonstration or by a statistical comparison to respective groundwater protection standards if assessment monitoring is implanted.

5.0 MONITORING PROGRAM STATUS

Statistical evaluations of the groundwater monitoring data for GRL identified SSIs of Appendix III groundwater monitoring parameters. In accordance with Chapter 391-3-4-.10(6)(a) GRL will prepare an alternate source demonstration or initiate assessment monitoring program within 90 days.

An ongoing ACM to address arsenic concentrations in three wells was established under the existing permit.

6.0 CONCLUSIONS AND FUTURE ACTIONS

Statistical evaluations of the groundwater monitoring data for GRL identified SSIs of Appendix III groundwater monitoring parameters. In accordance with GA EPD Rule 391-3-4-.10(6)(a), GPC will prepare an alternate source demonstration or initiate assessment monitoring program within 90 days.

An ongoing ACM to address arsenic concentrations in three wells was established under the existing permit and will continue contemporaneously with the adaptation of the new EPD requirements. The next monitoring event is planned for the second half of 2019.

7.0 REFERENCES

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