GROUNDWATER MONITORING PLAN

PLANT KRAFT
INACTIVE CCR LANDFILL
GRUMMAN ROAD ASH LANDFILL
CHATHAM COUNTY, GEORGIA

FOR

Georgia Power

NOVEMBER 2018

Atlantic Coast Consulting, Inc.

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I. CERTIFICATION

I hereby certify that this Groundwater Monitoring Plan was prepared by, or under the direct supervision of, a "Qualified Groundwater Scientist," in accordance with the Rules of Solid Waste Management. According to 391-3-4-.01(57), 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." The design of the groundwater monitoring system was developed in compliance with the Georgia Environmental Protection Division (EPD) Rules of Solid Waste Management, Chapter 391-3-4.10(6).

Signature: James M Frere

Date: 11/16/2018

Signature:

Date: 11/16/2018

1. INTRODUCTION

Groundwater monitoring is required by the Georgia Environmental Protection Division (EPD) to detect and quantify potential changes in groundwater chemistry. This Groundwater Monitoring Plan (plan) describes the groundwater monitoring program for the site. This plan meets the requirements of EPD rules and uses EPD's Manual for Ground Water Monitoring dated September 1991 as a guide. Groundwater monitoring well locations are presented on Figure 1 of Appendix A and well construction details on Table 1 of Appendix A.

Monitoring will occur in accordance with 391-3-4-.10 of the Georgia Solid Waste Management Rules. If the monitoring requirements specified in this plan conflict with EPD rules (391-3-4), the EPD rules will take precedent.

In accordance with the EPD 391-3-4.10(6), a detection monitoring well network for Plant Kraft Inactive CCR Landfill, Grumman Road Ash Landfill (GRL) has been installed. The existing monitoring wells were installed following the guidelines presented herein. Additionally, this plan documents the methods for future monitoring well installation and/or replacement, and procedures for well abandonment. As required by 391-3-4.10(6)(g), a minor modification will be submitted to the EPD prior to the unscheduled installation or abandonment of monitoring wells. Well installation and/or abandonment must be directed by a qualified groundwater scientist.

2. GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

The site is located in the Coastal Plain Physiographic Province of Georgia, a part of the Atlantic Coastal Plain which extends from New York to Florida. Surface elevations range from 42 feet mean sea level (MSL) to over 80 feet MSL at the highest point on Parcel B3.

The hydrogeology in the study area generally consists of Coastal Plain near surface soils and sediments that are composed of stratified clay, silt, sand and considerably deeper weathered limestone at depths over 500 feet. Sediments immediately underlying the GRL consist of variable interbedded sands, silts and clay. Further discussion of the hydrogeological conceptual site model is presented in the Grumman Road Industrial Landfill Hydrogeological Assessment Report.

Two main units (Unit 1 and Unit 2) are present in the upper 30 feet of soil in the site area. Unit 1 sand layer consists of interbedded sands and silty sands: this is the surficial aquifer. The thickness of Unit 1 varies from approximately 22 feet to 28 feet below ground surface (bgs). The average hydraulic conductivity (k) of Unit 1 is 2.7 x 10^{-3} cm/sec (7.65 ft/day). The effective porosity (n_e)was estimated at 0.20 and the average horizontal gradient (i) during the July 2018 sampling event was approximately 0.005 ft/ft. Therefore, the lateral groundwater flow velocity calculated using the equation:

V_{gw}= (k)(i)/n_e = (7.65 ft/day) (0.005 ft/ft)/0.20 = 0.19 feet/day or 69 feet/year.

Unit 1 is underlain by Unit 2, an aquitard comprised of light gray to olive gray silty sand and clayey sand. Unit 2 ranges in thickness from five feet to 40 feet. The hydraulic conductivity of Unit 2 is approximately one order of magnitude less at 10^{-4} cm/sec compared to Unit 1.

The potentiometric surface for the surficial aquifer illustrates that groundwater flow is generally from north to south. One exception is the north end of the GRL (Parcel B3) where the groundwater flows radially from the apex of the landfill. The potentiometric surface map for July 2018 is presented in Appendix A, Figure 2.

3. WELL LOCATIONS

Groundwater monitoring wells are installed to monitor the uppermost occurrence of groundwater beneath the site. Locations were selected based on the former waste unit layout and site geologic and hydrogeologic considerations. Locations were chosen to serve as upgradient (GWA designation), sidegradient (GWB designation) and downgradient (GWC designation) based on groundwater flow direction determined by potentiometric evaluation. The well naming nomenclature is based on Georgia EPD's Industrial Waste Disposal Site Design and Operations Plan – Supplemental Data for Solid Waste Handling Permit (undated).

Monitoring wells will generally be located outside of areas with frequent auto traffic; however, wells may be installed in heavily trafficked areas when necessary to meet the groundwater monitoring objectives of the EPD rules.

A map (Figure 1) depicting monitoring well locations is included in Appendix A, Monitoring System Details. Appendix A also includes Table 1, a tabulated list of individual monitoring wells with well construction details such as location coordinates, top-of-casing elevation, well depths and screened intervals, but also the stamped as-built survey map prepared with the new survey data collected in June 2018. Any change to the groundwater monitoring network must be made by a minor modification to the permit pursuant to 391-3-4-4.10(6)(g)7.

Upgradient monitoring wells that are included in the monitoring well network are as follows; GWA-7 and GWA-8. Sidegradient wells include; GWB-4R, GWB-5R and GWB-6R. Downgradient monitoring wells include; GWC-1, GWC-2, GWC-9, GWC-11 through GWC-17, and GWC-20 through GWC-22.

4. MONITORING WELL DRILLING, CONSTRUCTION, ABANDONMENT & REPORTING

The existing monitoring well network for GRL is in place. Existing monitoring wells will be installed using the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Design and Installation of Monitoring Wells as a general guide for best practices. Monitoring well construction data is provided on Table 1, Appendix A.

4.1 DRILLING

A variety of well drilling methods are available for the purpose of installing groundwater wells. Drilling methodology may include, but not be limited to: hollow stem augers, direct push, air rotary, mud rotary, or rotosonic techniques. The drilling method shall minimize the disturbance of subsurface materials and shall not cause impact to the groundwater. Borings will be advanced using an appropriate drilling technology capable of drilling and installing a well in site-specific geology. Drilling equipment shall be decontaminated before use and between borehole locations using the procedures described in the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Field Equipment Cleaning and Decontamination as a guide.

Sampling and/or coring may be used to help determine the stratigraphy and geology. Samples will be logged by a qualified groundwater scientist. Screen depths will be chosen based on the depth of the uppermost aquifer.

All drilling for any subsurface hydrologic investigation, installation or abandonment of groundwater wells will be performed by a driller that has, at the time of installation, a performance bond on file with the Water Well Standards Advisory Council.

4.2 DESIGN AND CONSTRUCTION

Well construction materials will be sufficiently durable to resist chemical and physical degradation and will not interfere with the quality of groundwater samples.

WELL CASINGS AND SCREENS

ASTM, NSF rated, Schedule 40, 2-inch diameter polyvinyl chloride (PVC) pipe with flush threaded connections will be used for the well riser and screens. Compounds that can cause PVC to deteriorate (e.g., organic compounds) are not expected at this facility. If conditions warrant, other appropriate materials may be used for construction with prior written approval from the EPD.

WELL INTAKE DESIGN

The design and construction of the intake of the groundwater wells shall: (1) allow sufficient groundwater flow to the well for sampling; (2) minimize the passage of formation materials (turbidity) into the well; and (3) ensure sufficient structural integrity to prevent the collapse of the intake structure.

Each groundwater monitoring well will include a well screen designed to limit the amount of formation material passing into the well when it is purged and sampled. Screens with 0.010-inch slots have proven effective for the earth materials at the site and will be used unless geologic conditions discovered at the time of installation dictate a different size. Screen length shall not exceed 10 feet without justification as to why a longer screen is necessary (e.g. significant variation in groundwater level). If the above prove ineffective for developing a well with sufficient yield or acceptable turbidity, further steps will be taken to assure that the well screen is appropriately sized for the formation material. This may include performing sieve analysis of the formation material and determining well screen slot size based on the grain size distribution.

Pre-packed dual-wall well screens may be used for well construction. Pre-packed well screens combine a centralized inner well screen, a developed filter sand pack, and an outer conductor screen in one integrated unit composed of inert materials. Pre-packed well screens will be installed following general industry standards and using the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Design and Installation of Monitoring Wells as a general guide. If the dual-wall pre-packed-screened wells do not yield sufficient water or are excessively turbid after development, further steps will be taken to assure that the well screen is appropriately sized for the formation material. This may include performing sieve analysis of the formation material and determining well screen slot size based on the grain size distribution.

FILTER PACK AND ANNULAR SEAL

The materials used to construct the filter pack will be clean quartz sand of a size that is appropriate for the screened formation. Fabric filters will not be used as filter pack material. Sufficient filter material will be placed in the hole and measurements taken to ensure that no bridging occurs. Upon placement of the filter pack, the well may be pumped to assure settlement of the pack. If pumping is performed, the top of filter pack depth will be measured and additional sand added if necessary. The filter pack will extend approximately one to two feet above the top of the well screen.

The materials used to seal the annular space must prevent hydraulic communication between strata and prevent migration from overlying areas into the well screen interval. A minimum of two feet of bentonite (chips, pellets, or slurry) will be placed immediately above the filter pack. The bentonite seal will extend up to the base of any overlying confining zone or the top of the water-bearing zone to prevent cementitous grout from entering the water-bearing or screened zone. If dry bentonite is used, the bentonite must be hydrated with potable water prior to grouting the remaining annulus.

The annulus above the bentonite seal will be grouted with a cement and bentonite mixture (approximately 94 pounds cement / 3 to 5 pounds bentonite / 6.5 gallons of potable water) placed via tremie pipe from the top of the bentonite seal. During grouting, care will be taken to assure that the bentonite seal is not disturbed by locating the base of the tremie pipe approximately 2 feet above the bentonite seal and injecting grout at low pressure/velocity.

PROTECTIVE CASING AND WELL COMPLETION

After allowing the grout to settle, the well will be finished by installing a flush-mount or above-ground protective casing as appropriate, and building a surface cap. The use of flush-mount wells will generally be limited to paved surfaces unless site operations warrant otherwise. The surface cap will extend from the top of the cementitous grout to ground surface, where it will become a concrete apron extending outward with a radius of at least 2.0 feet from the edge of the well casing and sloped to drain water away from the well.

Each well will be fitted with a cap that contains a hole or opening to allow the pressure in the well to equalize with atmospheric pressure. In wells with above-ground protection, the space between the well casing and the protective casing will be filled with coarse sand or pea-gravel to within approximately 6 inches of the top of the well casing. A small weep hole will be drilled at the base of the metal casing for the drainage of moisture from the casing. Above ground protective covers will be locked.

Protective bollards will be installed around each above-grade groundwater monitoring well. Well construction in high traffic areas will generally be limited unless site conditions warrant otherwise.

The groundwater monitoring well detail attached in Appendix B, Groundwater Monitoring Well Detail, illustrates the general design and construction details for a monitoring well.

WELL DEVELOPMENT

Wells will be developed by alternately purging and surging until relatively clear discharge water with little turbidity is observed. The goal will be to achieve a turbidity of less than 10 nephelometric turbidity units (NTUs); however, formation-specific conditions may not allow this target to be accomplished. Additionally, the stabilization criteria contained in Appendix C should be met. A variety of techniques may be used to develop site groundwater monitoring wells. The method used must create reversals or surges in flow to eliminate bridging by particles around the well screen. These reversals or surges can be created by using surge blocks, bailers, or pumps. The wells will be developed using a pump capable of inducing the stress necessary to achieve the development goals. All development equipment will be decontaminated prior to first use and between wells.

In low yielding wells, potable water may be added to the well to facilitate surging of the well screen interval and removal of fine-grained sediment. If water is added, the volume will be documented and at minimum, an equal volume purged from the well.

Many geologic formations contain clay and silt particles that are small enough to work their way through the wells' filter packs over time. Therefore, the turbidity of the groundwater from the monitoring wells may gradually increase over time after initial well development. As a result, the monitoring wells may have to be redeveloped periodically to remove the silt and clay that has worked its way into the filter pack of the monitoring wells. Each monitoring well should be redeveloped when sample turbidity values have significantly increased since initial development or since prior redevelopment. The redevelopment should be performed as described above.

4.3 ABANDONMENT

Monitoring wells will be abandoned using industry-accepted practices and using the *Manual For Groundwater Monitoring* (1991) and Georgia Water Well Standards Act (1985) as guides. The wells will be abandoned under the direction of a geologist or engineer registered in Georgia. Neat Portland cement or bentonite will be used as appropriate to complete abandonment and seal the well borehole. Any piezometers or groundwater wells located within the waste footprint will be over-drilled prior to abandonment.

4.4 DOCUMENTATION

The following information documenting the construction and development of each well will be submitted to EPD by a qualified groundwater scientist within 30 days after completing all planned well installations.

- Name of drilling contractor and type of drill rig
- Documentation that the driller, at the time the monitoring wells were installed, had a bond on file with the Water Well Advisory Council
- Dates of drilling and initial well emplacement
- Drilling method and drilling fluid if used
- Well location (±0.5 ft.)
- Borehole diameter and well casing diameter
- Well depth (±0.1 ft.)
- Lithologic logs
- Well casing materials
- Screen materials and design
- Screen length
- Screen slot size
- Filter pack material/size and volume
- Sealant materials and volume
- Documentation of ground surface elevation (±0.01 ft.)
- Documentation of top of casing elevation (±0.01 fl.)
- Schematic of the well with dimensions

5. GROUNDWATER MONITORING PARAMETERS AND FREQUENCY

The following describes groundwater sampling requirements with respect to parameters for analysis, sampling frequency, sample preservation and shipment, and analytical methods. Groundwater samples used to provide compliance monitoring data will not be filtered prior to collection.

Table 1, Groundwater Monitoring Parameters and Frequency, presents the groundwater monitoring parameters and sampling frequency. A minimum of eight independent samples from each groundwater well will be collected and analyzed for 40 CFR 257, Subpart D, Appendix III and Appendix IV test parameters to establish a background statistical dataset. Subsequently, in accordance with 391-3-4-.10(6), the monitoring frequency for the Appendix III parameters will be at least semi-annual during the active life of the facility and the post-closure care period. If required, assessment monitoring will be performed per Georgia Chapter 391-3-4-.10, Rules for Solid Waste Management.

When referenced throughout this plan, Appendix III and Appendix IV parameters refer to the parameters contained in Appendix III and Appendix IV of 40 CFR 257, Subpart D, 80 Fed. Reg. 21468 (April 17, 2015).

As shown on Table 2, Analytical Methods, the groundwater samples will be analyzed using methods specified in USEPA Manual SW-846, EPA 600/4-79-020, Standard Methods for the Examination of Water and Wastewater (SM18-20), USEPA Methods for the Chemical Analysis of Water and Wastes (MCAWW), American Society for Testing and Materials (ASTM), or other suitable analytical methods approved by the Georgia EPD. The method used will be able to reach a suitable practical quantification limit to detect natural background conditions at the facility. The groundwater samples will be analyzed by licensed and accredited laboratories through the National Environmental Laboratory Accreditation Conference (NELAC). Field instruments used to measure pH must be accurate and reproducible to within 0.1 Standard Units (S.U.).

TABLE 1
GROUNDWATER MONITORING PARAMETERS & FREQUENCY

MONITORING PARAMETER		GROUNDWATER MONITORING	
		Background	Semi-Annual Events
Field Parameters	Temperature	X	X
	pH	X	X
	Specific Conductance	X	X
	Turbidity	X	X
	Dissolved Oxygen	X	X
Appendix III (Detection)	Boron	X	X
	Calcium	X	X
	Chloride	X	X
	Fluoride	X	X
	pH	X	X
	Sulfate	X	X
	Total Dissolved Solids	X	X
Appendix IV (Assessment)	Antimony	X	Assessment sampling frequency and parameter list determined in accordance with Georgia Chapter 391-3-4.10(6)
	Arsenic	X	
	Barium	X	
	Beryllium	X	
	Cadmium	X	
	Chromium	X	
	Cobalt	X	
	Fluoride	X	
	Lead	X	
	Lithium	X	
	Mercury	X	
	Molybdenum	X	
	Selenium	X	
	Thallium	X	
	Radium 226 & 228	X	

TABLE 2
ANALYTICAL METHODS

Parameters	EPA Method Number
Boron	6010B/6020
Calcium	6010B/6020
Chloride	300.0/300.1/9250/9251/9253/9056A
Fluoride	300.0/300.1/9214/9056A
pH	150.1field/90405C
Sulfate	9035/9036/9038300.0/300.1/9056A
Total Dissolved Solids (TDS)	160/2540C
Antimony	EPA 7040/7041/6010B/6020
Arsenic	EPA 7060A/7061A/6010B/6020
Barium	EPA 7080A/7081/6010B/6020
Beryllium	EPA 7090/7091/6010B/6020
Cadmium	EPA 7130/7131A/6020
Chromium	EPA 7190/7191/6010B/6020
Cobalt	EPA 7200/7201/6010B/6020
Fluoride	300.0/300.1/9214/90569214
Lead	EPA 7420/7421/6010B/6020
Lithium	6010/6020B
Mercury	7470
Molybdenum	6010/6020B
Selenium	EPA 7740/7741A/6010B/6020
Thallium	EPA 7840/7841/6010/6020
Radium 226 and 228 combined	EPA 903/9320/9315

6. SAMPLE COLLECTION

During each sampling event, samples will be collected and handled in accordance with the procedures specified in Appendix C, Groundwater Sampling Procedures. Sampling procedures were developed using standard industry practice and USEPA Region 4 Field Branches Quality System and Technical Procedures as a guide. Low-flow sampling methodology will be utilized for sample collection. Alternative industry accepted sampling techniques may be used when appropriate with prior EPD approval.

For groundwater sampling, positive gas displacement Teflon or stainless-steel bladder pumps will be used for purging. If dedicated bladder pumps are not used, portable bladder pumps or peristaltic pumps (with dedicated or disposable tubing) may be used. When non-dedicated equipment is used, it will be decontaminated prior to use and between wells.

Groundwater wells that are determined to be dry for two consecutive sampling events should be replaced, unless an alternate schedule has been approved by EPD.

7. CHAIN-OF-CUSTODY

All samples will be handled under chain-of-custody (COC) procedures beginning in the field. The COC record will contain the following information:

- Sample identification numbers
- Signature of collector
- Date and time of collection
- Sample type
- Sample point identification
- Number of sample containers
- Signature of person(s) involved in the chain of possession
- Dates of possession by each individual

The samples will remain in the custody of assigned personnel, an assigned agent, or the laboratory. If the samples are transferred to other employees for delivery or transport, the sampler or possessor must relinquish possession and the samples must be received by the new owner.

If the samples are being shipped, a hard copy COC will be signed and enclosed within the shipping container.

Samplers must use COC forms provided by the analytical laboratory or use a COC form similarly formatted and containing the information listed above.

8. FIELD AND LABORATORY QUALITY ASSURANCE / QUALITY CONTROL

All field quality control samples will be prepared the same as compliance samples with regard to sample volume, containers, and preservation. The following quality control samples will be collected during each sampling event:

Field Equipment Rinsate Blanks - Where sampling equipment is not new or dedicated, an equipment rinsate blank will be collected at a rate of one blank per 10 samples using non-dedicated equipment.

Field Duplicates - Field duplicates are collected by filling additional containers at the same location, and the field duplicate is assigned a unique sample identification number. One blind field duplicate will be collected for every 20 samples.

Field Blanks - Field blanks are collected in the field using the same water source that is used for decontamination. The water is poured directly into the supplied sample containers in the field and submitted to the laboratory for analysis of target constituents. One field blank will be collected for every 20 samples.

The groundwater samples will be analyzed by licensed and accredited laboratories through the National Environmental Laboratory Accreditation Program (NELAP).

9. REPORTING RESULTS

A semi-annual groundwater report that documents the results of sampling and analysis will be submitted to EPD. Semi-annual groundwater monitoring reports will be submitted to the EPD within 90 days of receipt of the groundwater analytical data from the laboratory. At a minimum, semi-annual reports will include:

1. A narrative describing sampling activities and findings including a summary of the number of samples collected, the dates the samples were collected and whether the samples were required by the detection or assessment monitoring programs.
2. A brief overview of purging/sampling methodologies.
3. Discussion of results.
4. Recommendations for the future monitoring consistent with the Rules.
5. Potentiometric surface contour map for the aquifer(s) being monitored, signed and sealed by a Georgia-registered P.G. or P.E.
6. Table of as-built information for groundwater monitoring wells including top of casing elevations, ground elevations, screened elevations, current groundwater elevations and depth to water measurements.
7. Groundwater flow rate and direction calculations.
8. Identification of any groundwater wells that were installed or decommissioned during the preceding year, along with a narrative description of why these actions were taken.
9. A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels.
10. If applicable, semi-annual assessment monitoring results.
11. Any alternate source demonstration completed during the previous monitoring period, if applicable.
12. Laboratory Reports.
13. COC documentation.
14. Field sampling logs including field instrument calibration, indicator parameters and parameter stabilization data.
15. Documentation of non-functioning wells.

16. Table of current analytical results for each well, highlighting statistically significant increases and concentrations above maximum contaminant level (MCL).

17. Statistical analyses.

18. Certification by a qualified groundwater scientist.

10. STATISTICAL ANALYSIS

Groundwater quality data from each sampling event will be statistically evaluated to determine if there has been a statistically significant change in groundwater chemistry. Historical background data will be used to determine statistical limits.

According to EPD rules (391-3-4-.10(6)) the site must specify in the operating record the statistical methods to be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well. As authorized by the rule, statistical tests that will be used include:

1. A prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper prediction limit. (391-3-4-.14(18)(c)).

2. A control chart approach that gives control limits for each constituent. (391-3-4-.14(18)(d)).

3. Another statistical test method (such as prediction limits or control charts) that meets the performance standards of paragraph 391-3-4-.14(19) of the rule (391-3-4-.14(18)(e)). A justification for an alternative method will be placed in the operating record and the Director notified of the use of an alternative test. The justification will demonstrate that the alternative method meets the performance standards of 391-3-4-.14(19).

Based on site-specific conditions, statistical methods may be intra-well, inter-well, or combination of both.

A site-specific statistical analysis plan that provides details regarding the statistical methods to be used will be placed in the site's operating record pursuant to 391-3-4-.10(6). Figure 1, Statistical Analysis Plan Overview, includes a flowchart that depicts the process that will be followed to develop the site-specific plan. Figure 2, Decision Logic for Determining Appropriate Statistical Methods, depicts the decision logic that will be used to determine the appropriate method as required by 391-3-4-.10(6). Figure 3, Decision Logic For Computing Prediction Limits, presents the logic that will be used to calculate site-specific statistical limits and test compliance results against those limits.

FIGURE 1. STATISTICAL ANALYSIS PLAN OVERVIEW

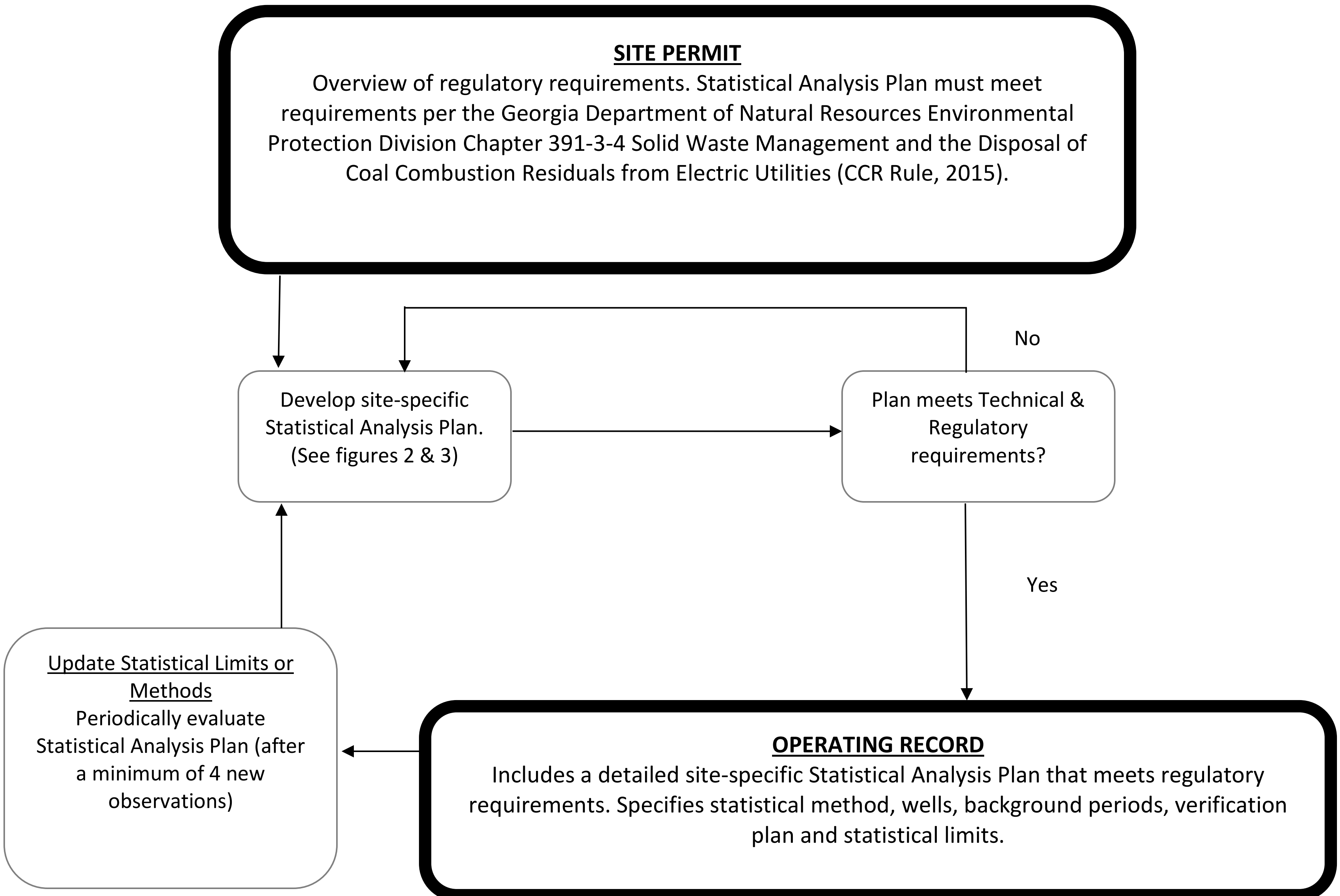


FIGURE 2. DECISION LOGIC FOR DETERMINING APPROPRIATE STATISTICAL METHOD

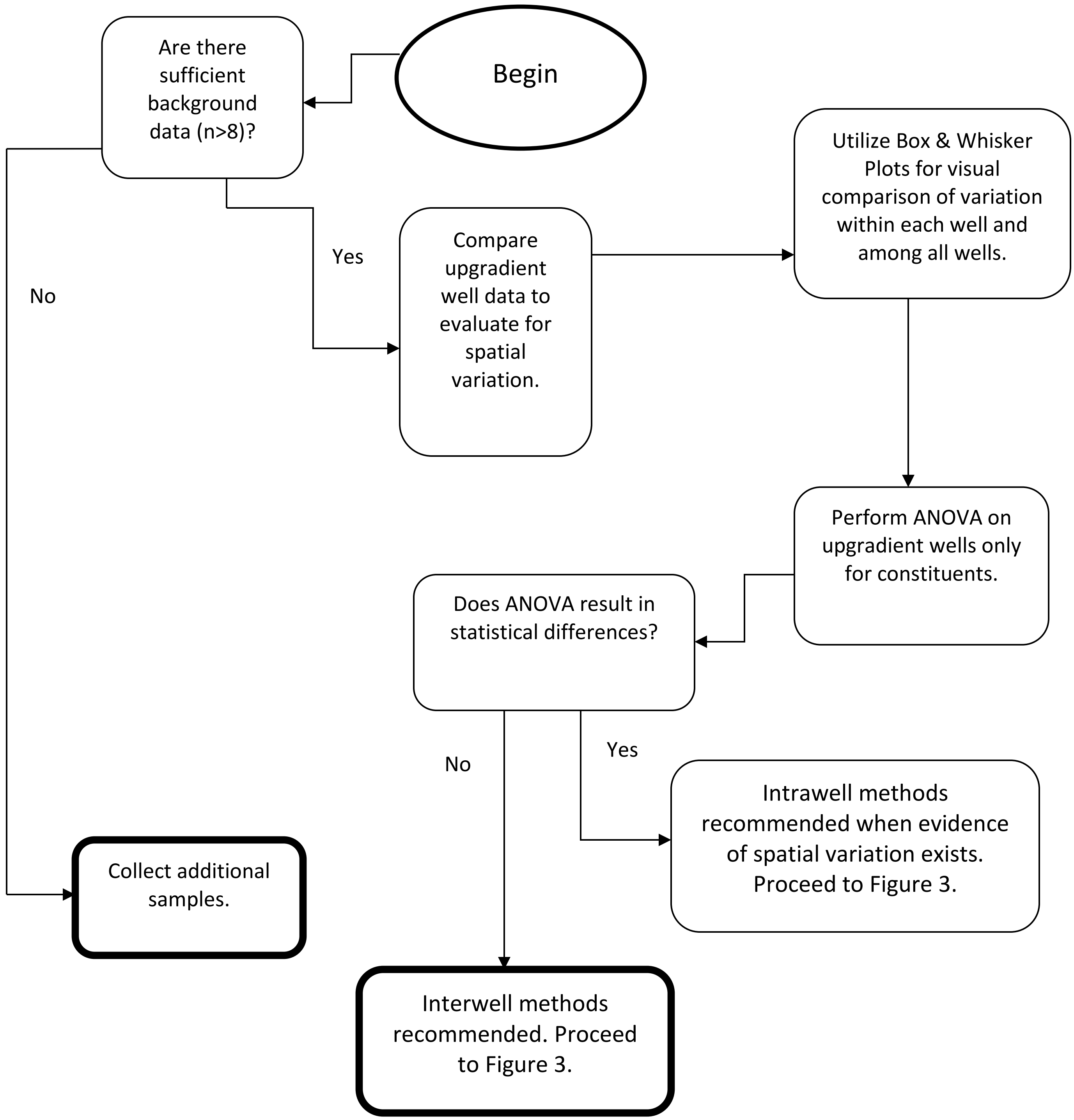
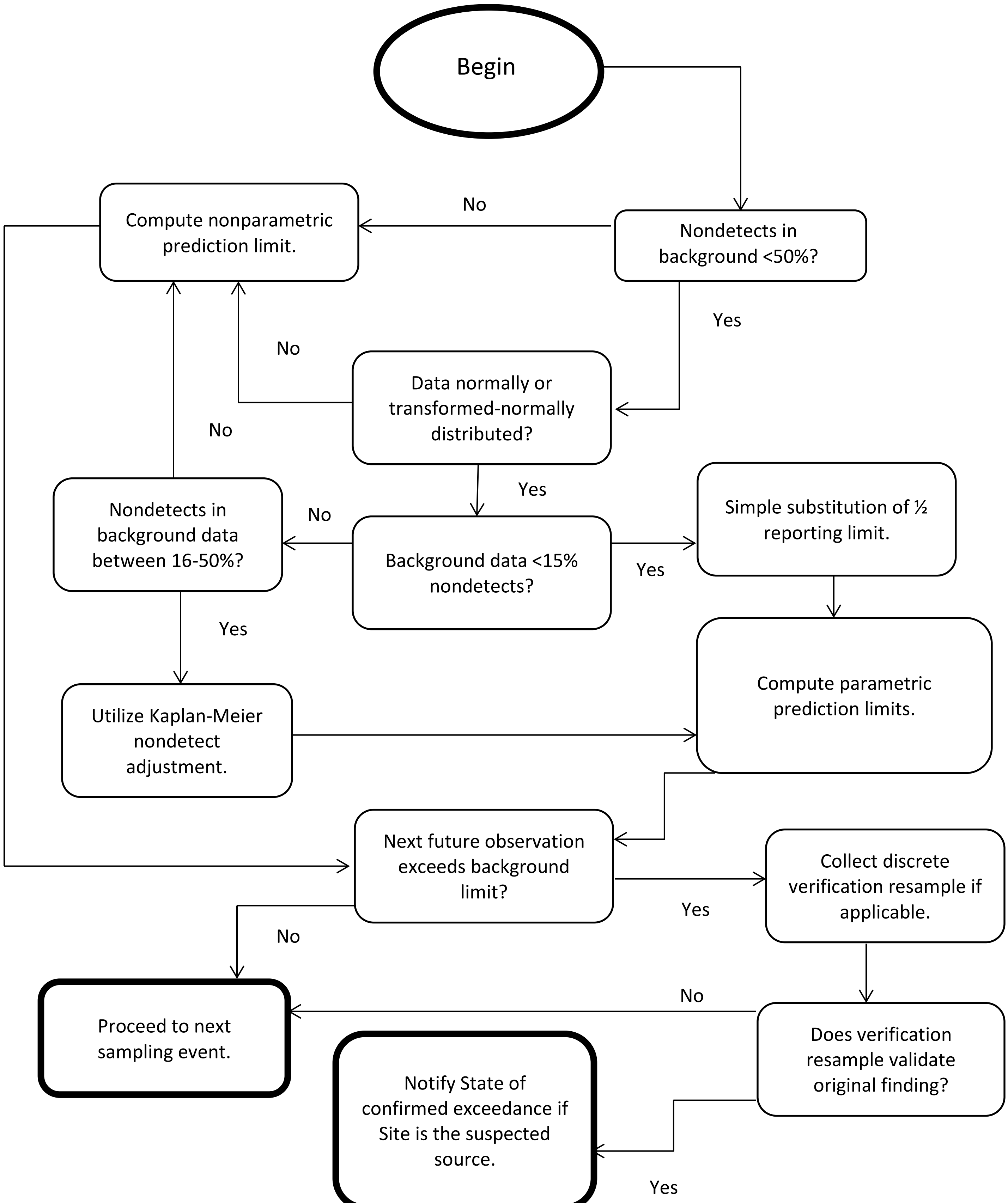


FIGURE 3. DECISION LOGIC FOR COMPUTING PREDICTION LIMITS



APPENDIX

A. MONITORING SYSTEM DETAILS
B. GROUNDWATER MONITORING WELL DETAIL
C. GROUNDWATER SAMPLING PROCEDURES

A. MONITORING SYSTEM DETAILS

Upgradient Monitoring Well ID	Total Depth (ft. BTOC)	Top of Casing Elevation (ft. MSL)	Easting	Northing	Screen Interval Elevation (ft. MSL)	Groundwater Elevation (ft. MSL) July 2018
GWA-7	21.2	47.10	960553.30	780887.99	26.1 – 31.1	39.99
GWA-8	20.8	46.84	960453.78	781167.66	26.9 – 31.9	37.90
Downgradient Monitoring Well ID	**Total Depth (ft. BTOC)**	**Top of Casing Elevation (ft. MSL)**	**Easting**	**Northing**	**Screen Interval Elevation (ft. MSL)**	**Groundwater Elevation (ft. MSL) July 2018**
GWC-1	28.2	50.30	960864.07	779574.06	22.5 – 27.5	31.04
GWC-2	31.4	49.15	960353.27	779433.44	17.9 – 22.9	32.43
GWB-4R	23.3	45.86	960771.51	779976.24	22.4 – 32.4	n/a
GWB-5R	26.5	47.82	960686.46	780294.37	21.3 – 31.3	n/a
GWB-6R	22.7	47.40	960610.31	780573.41	24.7 – 34.7	n/a
GWC-9	27.4	47.11	959954.35	781007.52	19.8 – 24.8	39.34
GWC-11	22.6	49.38	960115.63	780352.70	26.8 – 31.8	36.20
GWC-12	26.7	47.48	960175.37	780099.06	20.7 – 25.7	34.47
GWC-13	23.8	47.82	960268.64	779737.90	24.0 – 29.0	33.50
GWC-14	27.0	50.67	960423.84	778112.64	23.7 – 28.7	31.11
GWC-15	26.8	48.12	960660.49	778948.31	21.3 – 26.3	28.83
GWC-16	28.2	47.79	960956.85	779034.61	19.6 – 24.6	27.74
GWC-17	23.2	44.09	960041.65	781420.05	20.9 – 25.9	36.80
GWC-20	25.0	50.03	960950.04	779294.68	24.3 – 29.3	28.92
GWC-21	23.8	47.94	960941.58	779031.11	23.3 – 28.3	27.40
GWC-22	18.9	46.72	960057.05	780712.60	27.8 – 32.8	36.88

Note: Wells GWB-4R, GWB-5R and GWB-6R were not installed at the time and date of the July 9, 2018 water level round.

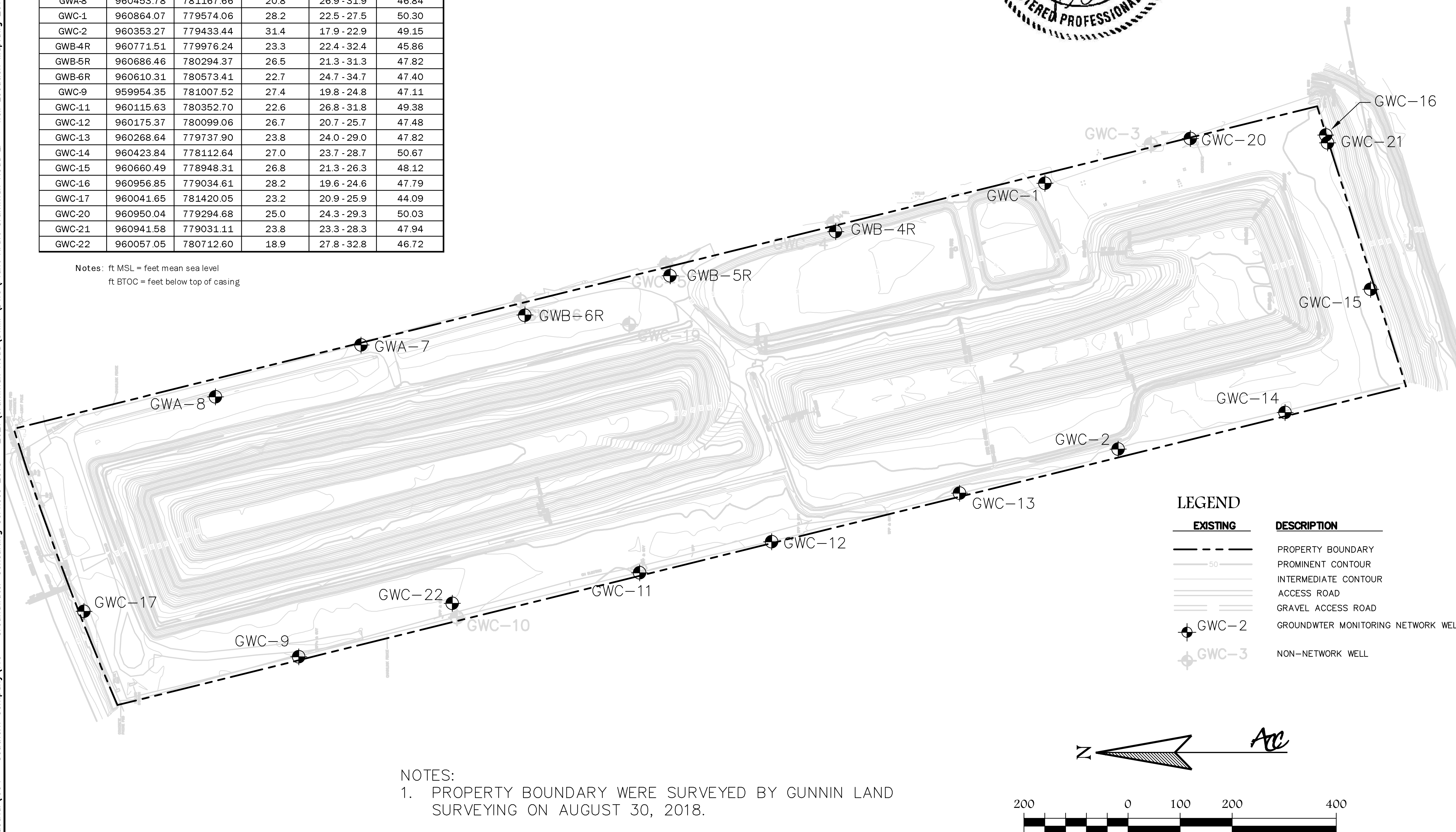
P:\Industrial\054 – Southern Company\110 – Groundwater Consulting Services 2018 – 2021\Grumman Road\GWMP\DWG\Plant Kraft Grumman Road LF – Well Location Map.dwg 2018-10-23 EVAN PERRY

Groundwater Monitoring Network Locations
Grumman Road Private Industrial Landfill

Monitoring Well ID	Easting	Northing	Total Depth (ft BTOC)	Screen Interval Elevation (ft MSL)	Top of Casing (ft MSL)
GWA-7	960553.30	780887.99	21.2	26.1 - 31.1	47.10
GWA-8	960453.78	781167.66	20.8	26.9 - 31.9	46.84
GWC-1	960864.07	779574.06	28.2	22.5 - 27.5	50.30
GWC-2	960353.27	779433.44	31.4	17.9 - 22.9	49.15
GWB-4R	960771.51	779976.24	23.3	22.4 - 32.4	45.86
GWB-5R	960686.46	780294.37	26.5	21.3 - 31.3	47.82
GWB-6R	960610.31	780573.41	22.7	24.7 - 34.7	47.40
GWC-9	959954.35	781007.52	27.4	19.8 - 24.8	47.11
GWC-11	960115.63	780352.70	22.6	26.8 - 31.8	49.38
GWC-12	960175.37	780099.06	26.7	20.7 - 25.7	47.48
GWC-13	960268.64	779737.90	23.8	24.0 - 29.0	47.82
GWC-14	960423.84	778112.64	27.0	23.7 - 28.7	50.67
GWC-15	960660.49	778948.31	26.8	21.3 - 26.3	48.12
GWC-16	960956.85	779034.61	28.2	19.6 - 24.6	47.79
GWC-17	960041.65	781420.05	23.2	20.9 - 25.9	44.09
GWC-20	960950.04	779294.68	25.0	24.3 - 29.3	50.03
GWC-21	960941.58	779031.11	23.8	23.3 - 28.3	47.94
GWC-22	960057.05	780712.60	18.9	27.8 - 32.8	46.72

Notes: ft MSL = feet mean sea level
ft BTOC = feet below top of casing

EVAN B. PERRY
GEORGIA REGISTERED PROFESSIONAL GEOLOGIST
No. 1744



NOTES:
1. PROPERTY BOUNDARY WERE SURVEYED BY GUNNIN LAND SURVEYING ON AUGUST 30, 2018.

ATLANTIC COAST CONSULTING, INC.
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PROJECT:
GRUMMAN ROAD PRIVATE INDUSTRIAL LANDFILL

120 GULFSTREAM ROAD
PORT WENTWORTH, GEORGIA

REVISIONS

Drawn by:	Checked by:
MM	EP

PROJECT NUMBER:
I054-107
October 2018

Monitoring Well Location Map

FIGURE 1

P:\Industrial\054 – Southern Company\110 – Groundwater Consulting Services 2018 – 2021\Grumman Road\GWMP\DWG\Plant Kraft Grumman Road LF – July 2018 Map.dwg 2018–09–07 MATT MALONE

Summary of Groundwater Elevations
Plant Kraft - Grumman Road Landfill
July 2018 Sampling Event

Monitoring Well ID	Easting	Northing	Total Depth (ft BTOC)	Screen Interval Elevation (ft MSL)	Top of Casing (ft MSL)	Depth to Water (ft BTOC)	Groundwater Elevation (ft MSL)
GWA-7	960553.30	780887.99	21.2	26.1 - 31.1	47.10	7.11	39.99
GWA-8	960453.78	781167.66	20.8	26.9 - 31.9	46.84	8.94	37.90
GWC-1	960864.07	779574.06	28.2	22.5 - 27.5	50.30	19.26	31.04
GWC-2	960353.27	779433.44	31.4	17.9 - 22.9	49.15	16.72	32.43
GWC-3	960938.90	779370.58	22.9	26.9 - 31.9	49.76	20.47	29.29
GWC-4	960787.86	779980.30	26.4	22.6 - 27.6	48.96	14.97	33.99
GWC-5	960707.98	780302.13	26.7	21.8 - 26.8	48.33	11.18	37.15
GWC-6	960637.83	780581.14	22.7	25.6 - 30.6	48.27	8.93	39.34
GWC-9	959954.35	781007.52	27.4	19.8 - 24.8	47.11	9.69	37.42
GWC-10	960030.15	780703.64	20.6	26.8 - 31.8	47.43	9.77	37.66
GWC-11	960115.63	780352.70	22.6	26.8 - 31.8	49.38	13.18	36.20
GWC-12	960175.37	780099.06	26.7	20.7 - 25.7	47.48	13.01	34.47
GWC-13	960268.64	779737.90	23.8	24.0 - 29.0	47.82	14.32	33.50
GWC-14	960423.84	778112.64	27.0	23.7 - 28.7	50.67	19.56	31.11
GWC-15	960660.49	778948.31	26.8	21.3 - 26.3	48.12	19.29	28.83
GWC-16	960956.85	779034.61	28.2	19.6 - 24.6	47.79	20.05	27.74
GWC-17	960041.65	781420.05	23.2	20.9 - 25.9	44.09	7.29	36.80
GWC-20	960950.04	779294.68	25.0	24.3 - 29.3	50.03	21.11	28.92
GWC-21	960941.58	779031.11	23.8	23.3 - 28.3	47.94	20.54	27.40
GWC-22	960057.05	780712.60	18.9	27.8 - 32.8	46.72	9.84	36.88

Notes: Depths to water measured on July 9, 2018.
Top of casing and screen interval elevations and well coordinates were surveyed on August 30, 2018.
Screen length is five feet in all wells.
ft MSL = feet mean sea level
ft BTOC = feet below top of casing

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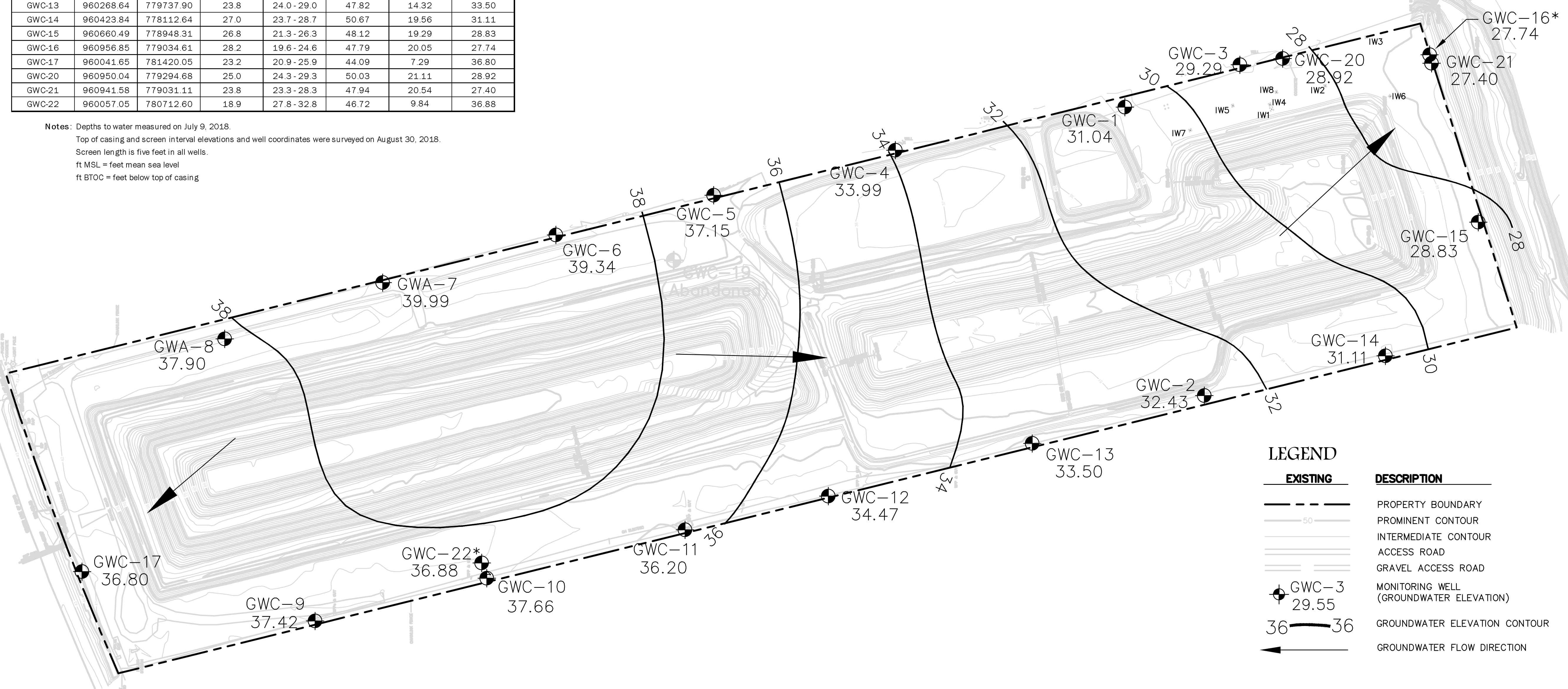

NOTES:
1. WELL LOCATIONS AND PROPERTY BOUNDARY WERE SURVEYED BY GUNNIN LAND SURVEYING ON AUGUST 30, 2018.
* NOT USED TO CONSTRUCT WATER TABLE CONTOUR MAP.

N

200 0 100 200 400

SCALE: 1" = 200' (IN FEET)

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PROJECT:

GRUMMAN ROAD ASH DISPOSAL FACILITY

120 GULFSTREAM ROAD
PORT WENTWORTH, GEORGIA

REVISIONS

Drawn by:	Checked by:
MM	EP

PROJECT NUMBER:

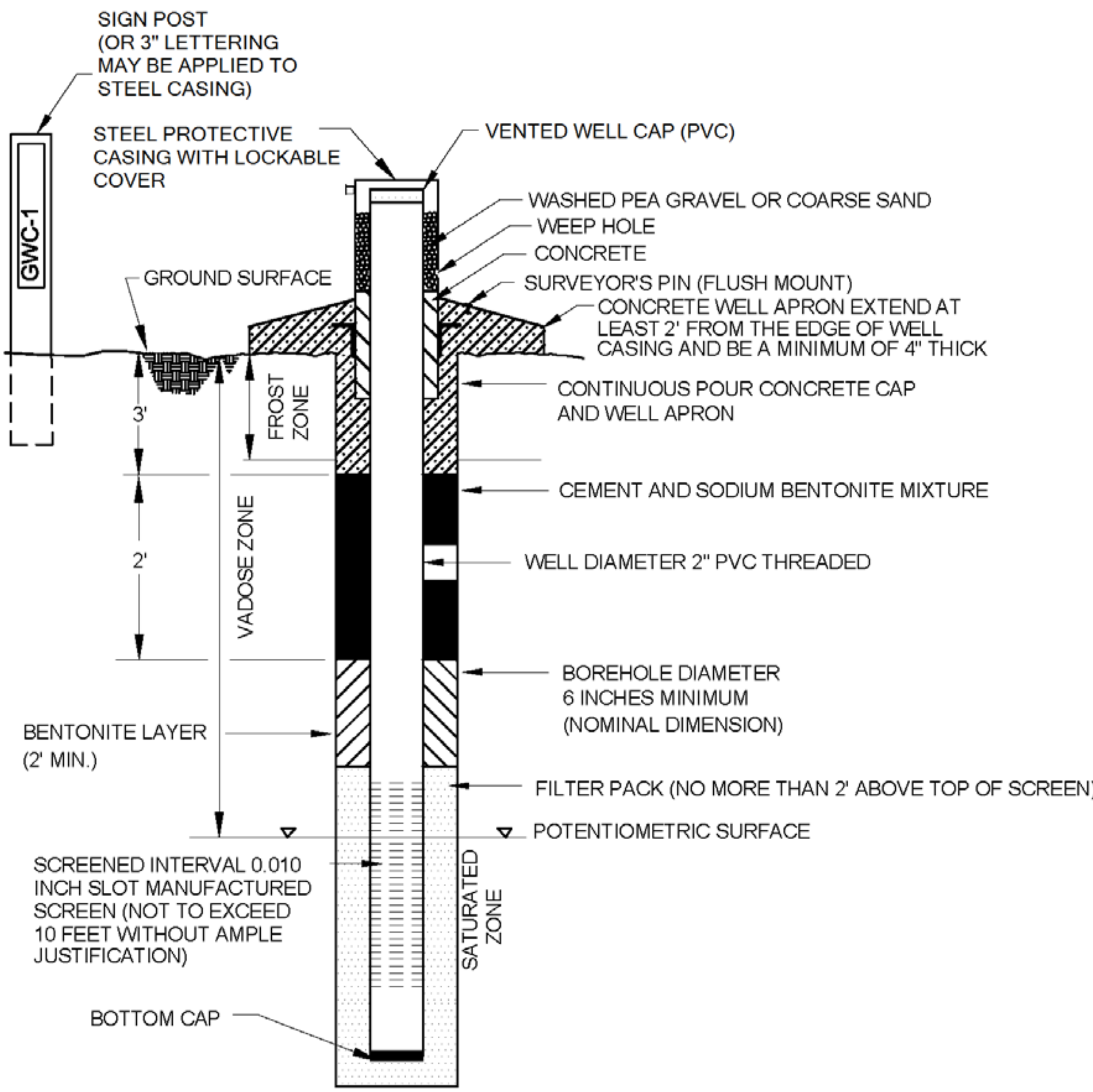
I054-110

September 2018

JULY 2018 POTENTIOMETRIC SURFACE MAP

FIGURE 2

B. GROUNDWATER MONITORING WELL DETAIL



GROUNDWATER MONITORING WELL (TYP.)

C. GROUNDWATER SAMPLING PROCEDURE

Groundwater sampling will be conducted using USEPA Region 4 Field Quality and Technical Procedures as a guide. The following procedures describe the general methods associated with groundwater sampling at the site. Prior to sampling, the well must be evacuated (purged) to ensure that representative groundwater is obtained. Any item coming in contact with the inside of the well casing or the well water will be kept in a clean container and handled only with gloved hands. The field team will follow the procedures below at each well to ensure that a representative sample is collected:

1. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations and notify GPC if it appears that the well has been compromised.

2. Measure and record the depth to water in all wells to be sampled prior to purging. Static water levels will be measured from each well, within a 24-hour period. The water level measuring device will be decontaminated prior to lowering in each well.

3. Install Pump: If a dedicated pump is not present, slowly lower the pump into the well to the midpoint of the well screen or a depth otherwise approved by the hydrogeologist or project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and suspension of any sediment present in the bottom of the well. Record the depth to which the pump is lowered. All non-dedicated pumps and wiring will be decontaminated before use and between well locations using procedures described in the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division (SESD) Operating Procedure for Field Equipment Cleaning and Decontamination as a guide.s

4. Measure Water Level: Immediately prior to purging, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

5. Purge Well: Begin pumping the well at approximately 100 to 500 milliliters per minute (ml/min). Monitor the water level continually. Maintain a steady flow rate that results in a stabilized water level with 0.3 ft. or less of variability. Avoid entraining air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

6. Monitor Indicator Parameters: Monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, ORP, and DO) approximately every three to five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings at a minimum:

    ±0.1 for pH

    ±10% for specific conductance (conductivity)

    ±10% for DO where DO>0.5mg/L. If DO<0.5mg/L no stabilization criteria apply

≤10 for turbidity

Temperature – Record only, not used for stabilization criteria

ORP – Record only, not used for stabilization criteria.

7. Collect samples at a flow rate between 50 and 250 ml/min and such that drawdown of the water level within the well is stable. Flow rate must be reduced if excessive drawdown is observed during sampling. All sample containers should be filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.

8. Compliance samples will be unfiltered; however, to determine if turbidity is affecting sample results, duplicate samples may be filtered in the field prior to being placed in a sample container, clearly marked as filtered and preserved. Filtering will be accomplished by the use of 0.45-micron filters on the sampling line. At least two filter volumes of sample will pass through before filling sample containers. Filtered samples are not considered compliance samples and are only used to evaluate the effects of turbidity.

9. All sample bottles will be filled, capped, and placed in an ice containing cooler immediately after sampling where temperature control is required. Samples that do not require temperature control will be placed in a clean and secure container.

10. Sample containers and preservative will be appropriate for the analytical method being used.

11. Information contained on sample container labels will include:

    a. Name of facility

    b. Date and time of sampling

    c. Sample description (well number)

    d. Sampler's initials

    e. Preservatives

    f. Analytical method(s)

12. After samples are collected, samplers will remove all non-dedicated equipment. Upon completion of all activity the well will be closed and locked.

13. Samples will be delivered to the laboratory following appropriate COC and temperature control requirements. The goal for sample delivery will be within 48 hours of collection; however, at no time will samples be analyzed after the method-prescribed hold time.

Throughout the sampling process new latex or nitrile gloves will be worn by the sampling personnel. A clean pair of new, disposable gloves will be worn each time a different location is sampled and new gloves donned prior to filling sample bottles. Gloves will be discarded after sampling each well and before sampling the next well.

The goal when sampling is to attain a turbidity of less than 5 NTU; however, samples may be collected where turbidity is less than 10 NTU and the stabilization criteria described above are met.

If sample turbidity is greater than 5 NTU and all other stabilization criteria have been met, samplers will continue purging for 3 additional hours in order to reduce the turbidity to 5 NTU or less.

- If turbidity remains above 5 NTU but is less than 10 NTU, and all other parameters are stabilized, the well can be sampled.
- Where turbidity remains above 10 NTU, an unfiltered sample will be collected followed by a filtered sample that has passed through an in-line 0.45-micron filter attached to the discharge (sample collection) tube. Data from filtered samples will only be used to quantify the effects of turbidity on sample results.

Samplers will identify the sample bottle as containing a filtered sample on the sample bottle label and on COC form.