

Richard E. Dunn, Director

Land Protection Branch
4244 International Parkway
Suite 104
Atlanta, Georgia 30354
404-362-2537

May 18, 2017

John Workman
Senior Engineering Manager
Waste Management
1850 Parkway Place, Suite 600
Marietta, Georgia 30067

**SUBJECT: Banks County - R&B Landfill, Inc.
Permit Number 006-009D(MSWL)
CCR Management Plan - Approval**

Dear Mr. Workman:

The Georgia Environmental Protection Division (EPD) received your *Request for Minor Modification to Solid Waste Handling Permit* (Minor Modification) to adopt a Coal Combustion Residuals (CCR) Management Plan on April 7, 2017, with revisions on May 9 and May 16, 2017. The request is hereby approved.

The approved CCR Management Plan is now part of the facility's Design and Operational Plan, and is therefore made part of the Solid Waste Handling Permit by Condition #2 of the Permit. Operating in compliance with the Permit with respect to CCR management requires strict adherence to the procedures of the approved Plan and requires that CCR received at the facility does not differ from that described in the Plan and is not received in amounts that exceed that given in the Plan.

Under the plan approved today, this facility may receive CCR for one year. An updated CCR Management Plan must be received no later than March 1, 2018 and incorporated into your D&O Plan in no less than one year or you must cease receipt of CCR on May 21, 2018.

EPD is returning approved Design and Operational Plan sheets with this approval letter. One copy of plans will be retained here, and one sent to the Northeast District office, for EPD's files. If you have any questions regarding this letter, please contact Chad Hall at (404) 362-4893.

Sincerely,



Chad Hall, PhD, PE
Manager
Industrial & Municipal Solid Waste Unit

cc: Honorable John Wilkinson, Georgia Senate District 50
Honorable Dan Gasaway, Georgia House District 28
Honorable Jimmy Hooper, Chairman, Banks County Board of Commissioners
Beth Headrick, PE, Atlantic Coast Consulting
Jeff Cown, William Cook, Christy Kehn-Lewis, EPD

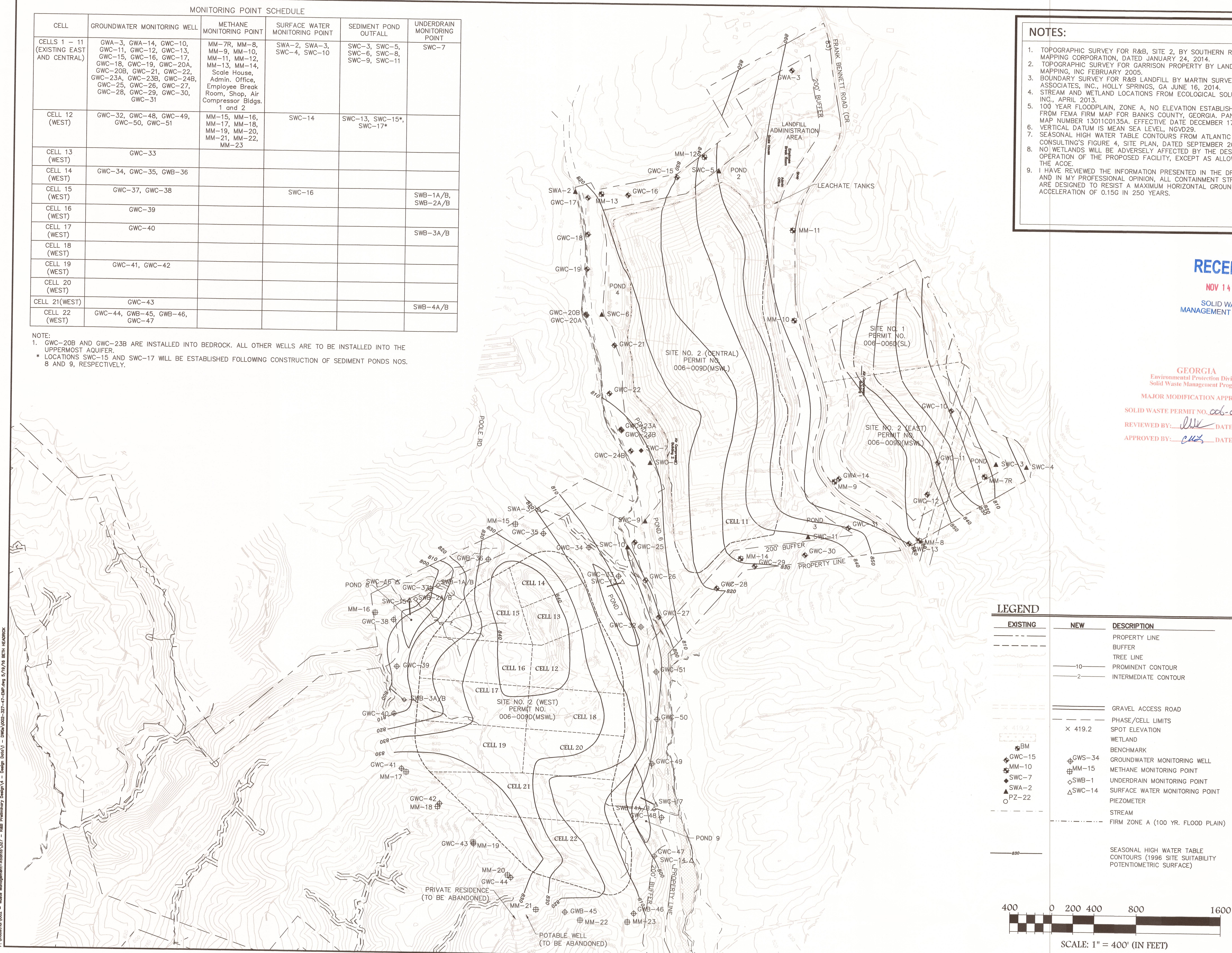
File: Banks County 006-009D(MSWL) (PER file)
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P:\Validation\002 - Waste Management-Misc\002 - 002 Preliminary Design\4 - Design Data\1 - DWG\002-327-47-001.dwg 5/19/16 BETH HEJROCK

MONITORING POINT SCHEDULE

CELL	GROUNDWATER MONITORING WELL	METHANE MONITORING POINT	SURFACE WATER MONITORING POINT	SEDIMENT POND OUTFALL	UNDERDRAIN MONITORING POINT
CELLS 1 - 11 (EXISTING EAST AND CENTRAL)	GWA-3, GWA-14, GWC-10, GWC-11, GWC-12, GWC-13, GWC-15, GWC-16, GWC-17, GWC-18, GWC-19, GWC-20A, GWC-20B, GWC-21, GWC-22, GWC-23A, GWC-23B, GWC-24B, GWC-25, GWC-26, GWC-27, GWC-28, GWC-29, GWC-30, GWC-31	MM-7R, MM-8, MM-9, MM-10, MM-11, MM-12, MM-13, MM-14, Scale House, Admin. Office, Employee Break Room, Shop, Air Compressor Bldgs. 1 and 2	SWA-2, SWA-3, SWC-4, SWC-10	SWC-3, SWC-5, SWC-6, SWC-8, SWC-9, SWC-11	SWC-7
CELL 12 (WEST)	GWC-32, GWC-48, GWC-49, GWC-50, GWC-51	MM-15, MM-16, MM-17, MM-18, MM-19, MM-20, MM-21, MM-22, MM-23	SWC-14	SWC-13, SWC-15*, SWC-17*	
CELL 13 (WEST)	GWC-33				
CELL 14 (WEST)	GWC-34, GWC-35, GWC-36				
CELL 15 (WEST)	GWC-37, GWC-38		SWC-16		
CELL 16 (WEST)	GWC-39				SWB-1A/B, SWB-2A/B
CELL 17 (WEST)	GWC-40				SWB-3A/B
CELL 18 (WEST)					
CELL 19 (WEST)	GWC-41, GWC-42				
CELL 20 (WEST)					
CELL 21(WEST)	GWC-43				
CELL 22 (WEST)	GWC-44, GWC-45, GWC-46, GWC-47				SWB-4A/B

NOTE:
1. GWC-20B AND GWC-23B ARE INSTALLED INTO BEDROCK. ALL OTHER WELLS ARE TO BE INSTALLED INTO THE UPPERMOST AQUIFER.
* LOCATIONS SWC-15 AND SWC-17 WILL BE ESTABLISHED FOLLOWING CONSTRUCTION OF SEDIMENT PONDS NOS. 8 AND 9, RESPECTIVELY.



NOTES:

1. TOPOGRAPHIC SURVEY FOR R&B, SITE 2, BY SOUTHERN RESOURCES MAPPING CORPORATION, DATED JANUARY 24, 2014.
2. TOPOGRAPHIC SURVEY FOR GARRISON PROPERTY BY LANDAIR MAPPING, INC FEBRUARY 2005.
3. BOUNDARY SURVEY FOR R&B LANDFILL BY MARTIN SURVEY ASSOCIATES, INC., HOLLY SPRINGS, GA JUNE 16, 2014.
4. STREAM AND WETLAND LOCATIONS FROM ECOLOGICAL SOLUTIONS, INC., APRIL 2013.
5. 100 YEAR FLOODPLAIN, ZONE A, NO ELEVATION ESTABLISHED, IS FROM FEMA FIRM MAP FOR BANKS COUNTY, GEORGIA. PANEL 135, MAP NUMBER 13011C0135A. EFFECTIVE DATE DECEMBER 17, 2010.
6. VERTICAL DATUM IS MEAN SEA LEVEL, NGVD29.
7. SEASONAL HIGH WATER TABLE CONTOURS FROM ATLANTIC COAST CONSULTING'S FIGURE 4, SITE PLAN, DATED SEPTEMBER 2013.
8. NO WETLANDS WILL BE ADVERSELY AFFECTED BY THE DESIGN AND OPERATION OF THE PROPOSED FACILITY, EXCEPT AS ALLOWED BY THE ACOE.
9. I HAVE REVIEWED THE INFORMATION PRESENTED IN THE DRAWING, AND IN MY PROFESSIONAL OPINION, ALL CONTAINMENT STRUCTURES ARE DESIGNED TO RESIST A MAXIMUM HORIZONTAL GROUND ACCELERATION OF 0.15G IN 250 YEARS.

RECEIVED

NOV 14 2016

SOLID WASTE MANAGEMENT PROGRAM

GEORGIA
Environmental Protection Division
Solid Waste Management Program
MAJOR MODIFICATION APPROVAL

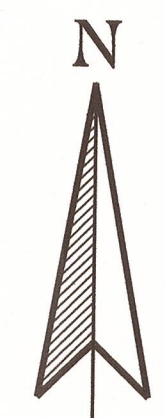
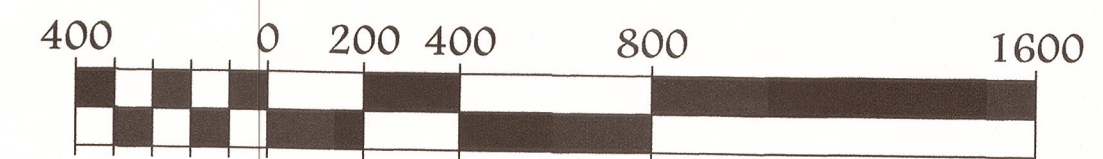
SOLID WASTE PERMIT NO. 006-009D(MSWL)

REVIEWED BY: CLW DATE: 3/17/17

APPROVED BY: CLW DATE: 3/17/17

LEGEND

EXISTING	NEW	DESCRIPTION
---	---	PROPERTY LINE
---	---	BUFFER
---	---	TREE LINE
---	---	PROMINENT CONTOUR
---	---	INTERMEDIATE CONTOUR
---	---	GRAVEL ACCESS ROAD
---	---	PHASE/CELL LIMITS
---	---	SPOT ELEVATION
---	---	WETLAND
---	---	BENCHMARK
---	---	GROUNDWATER MONITORING WELL
---	---	METHANE MONITORING POINT
---	---	UNDERDRAIN MONITORING POINT
---	---	SURFACE WATER MONITORING POINT
---	---	PIEZOMETER
---	---	STREAM
---	---	FIRM ZONE A (100 YR. FLOOD PLAIN)
---	---	SEASONAL HIGH WATER TABLE CONTOURS (1996 SITE SUITABILITY POTENTIOMETRIC SURFACE)



ACC



ATLANTIC COAST CONSULTING, INC.
630 Colonial Park Dr.
Suite 110
Roswell, GA 30075
p. 770-594-5998
f. 770-594-5967
www.atlcc.net



PROJECT:
R&B LANDFILL
HORIZONTAL
EXPANSION

BANKS COUNTY, GEORGIA



610 BENNETT ROAD
HOMER, GEORGIA 30547

REVISIONS

0. Issued for Permitting	08/06/2014
1. Revised per EPD Comments	05/15/2015
2. Revised per EPD Comments	03/11/2016
3. Revised per EPD Comments	05/19/2016

Drawn by: BFH Checked by: JEH

PROJECT NUMBER:

1002-327

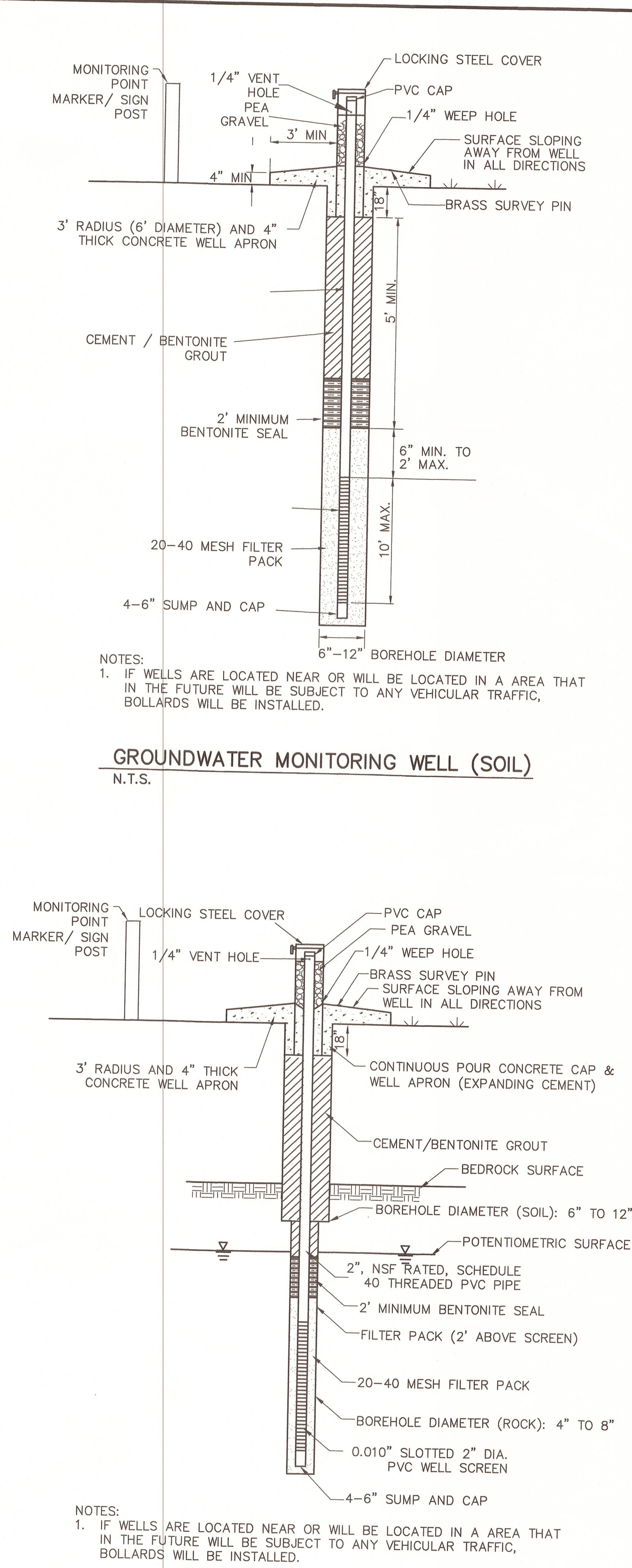
August 2014

ENVIRONMENTAL
MONITORING PLAN

Sheet 47 of 54

P:\Undated\1002-327-48-Groundwater.dwg 10/14/16 BETH HEADWORK

- GROUNDWATER MONITORING PLAN**
- I. **OBJECTIVE:**
THE OBJECTIVE OF GROUNDWATER MONITORING IS TO DETECT AND QUANTIFY CONTAMINATION AND PROVIDE DATA TO EVALUATE THE EFFECTIVENESS OF ENGINEERED DISPOSAL SYSTEMS. MONITORING WILL FOCUS ON THE AREA CLOSEST TO THE BOUNDARY OF THE WASTE MANAGEMENT SYSTEM TO DETECT POLLUTANTS AS SOON AS POSSIBLE. MONITORING IN UPGRADEMENT AREAS IS PERFORMED TO CHARACTERIZE BACKGROUND WATER QUALITY. MONITORING IN DOWNGRADEMENT AREAS IS PERFORMED TO DETECT POTENTIAL POLLUTANTS.
- II. **GROUNDWATER MONITORING NETWORK DESIGN:**
THE WATER MONITORING PLAN FOR THE R&B LANDFILL SITE 2 IS BASED ON THE SITE-SPECIFIC DATA OBTAINED IN SITE INVESTIGATION PERFORMED BY ATLANTIC COAST CONSULTING, INC. (SITE ACCEPTABILITY REPORT, DATED JANUARY 2014). THE GROUNDWATER MONITORING PLAN WAS DESIGNED IN ACCORDANCE WITH THE GEORGIA EPD'S MANUAL FOR GROUNDWATER MONITORING, SEPTEMBER 1991 AND OTHER MORE RECENT PERTINENT GUIDANCE WHERE NOTED.
THE GROUNDWATER MONITORING PLAN FOR THE LANDFILL INCLUDES FORTY-FIVE GROUNDWATER MONITORING WELLS, AS SHOWN ON SHEET 47. THE MONITORING NETWORK INCLUDES TWO UPGRADEMENT WELLS: GWA-3 AND GWA-14; THREE SIDEGRADEMENT WELLS: GWB-36, GWB-45, GWB-46; AND FORTY DOWNGRADEMENT WELLS: GWC-10, GWC-11, GWC-12, GWC-13, GWC-15, GWC-16, GWC-17, GWC-18, GWC-19, GWC-20A, GWC-20B, GWC-21, GWC-22, GWC-23A, GWC-23B, GWC-24B, GWC-25, GWC-26, GWC-27, GWC-28, GWC-29, GWC-30, GWC-31, GWC-32, GWC-33, GWC-34, GWC-35, GWC-37, GWC-38, GWC-39, GWC-40, GWC-41, GWC-42, GWC-43, GWC-44, GWC-47, GWC-48, GWC-49, GWC-50, AND GWC-51.
THE INSTALLATION OF WELLS, LOCATED AS SHOWN ON SHEET 47, WILL BE PHASED ACCORDING TO THE SCHEDULE ON SHEET 47. ALL WELLS WILL BE ACCESSIBLE BY TRUCK, ALL-TERRAIN VEHICLE, OR FOOT FOR MONITORING AND INSPECTION.
THE SURFACE WATER MONITORING PLAN INCLUDES UPGRADEMENT MONITORING POINTS SWA-2 AND SWA-3 AND DOWNGRADEMENT POINTS SWC-4, SWC-10, SWC-14, AND SWC-16; AND SEDIMENT POND OUTFALL MONITORING POINTS: SWC-5, SWC-6, SWC-8, SWC-9, SWC-11, SWC-13, SWC-15, AND SWC-17. THE TABLE ON SHEET 47 PROVIDES A SCHEDULE FOR SURFACE WATER MONITORING POINT ESTABLISHMENT AND ABANDONMENT.
UNDERDRAIN SAMPLING LOCATIONS ARE PRESENTED ON SHEET 47. UNDERDRAIN DISCHARGE (IF ANY) IS DIRECTED TOWARD FIVE LOCATIONS IDENTIFIED AS SWB-1 THROUGH SWB-4 AND SWC-7. LOCATIONS SWB-1 THROUGH SWB-4 ARE CONSTRUCTED WITH AN UPPER CONVEYANCE PIPE, SUFFIXED "A", AND LOWER UNDERDRAIN PIPE, SUFFIXED "B". THE LOCATIONS WILL BE ESTABLISHED FOLLOWING THE CONSTRUCTION OF THE RELEVANT UNDERDRAIN SEGMENTS SHOWN ON SHEET 47 AND INCLUDED IN THE FACILITY'S ROUTINE MONITORING PROGRAM.
- III. **TEST PARAMETERS AND FREQUENCY OF TESTING**
SAMPLES SHALL BE COLLECTED FROM THE GROUNDWATER MONITORING WELLS AND TESTED ACCORDING TO WELL CLASSIFICATION. GROUNDWATER WELLS ARE CLASSIFIED AS EITHER DETECTION OR ASSESSMENT MONITORING. THE LOCATIONS OF THE SAMPLING POINTS ARE SHOWN ON SHEET 47.
ALL GROUNDWATER WELLS AT THE FACILITY WILL BE SAMPLED SEMI-ANNUALLY, REGARDLESS OF CLASSIFICATION FOR THE LIST OF ANALYTES INCLUDED IN APPENDIX I OF THE GEORGIA RULES FOR SOLID WASTE MANAGEMENT 391-3-4-.14 (APPENDIX I). SEE APPENDIX I REQUIREMENTS LISTED IN TABLE 1. DUE TO THE POTENTIAL TO RECEIVE COAL COMBUSTION RESIDUAL (CCR) MATERIAL GENERATED BY AN ELECTRIC UTILITY OR INDEPENDENT POWER PRODUCER THAT FALL WITHIN THE NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE 2212 WELLS ASSOCIATED WITH CELL 11 AND THE WESTERN CELL AREA WILL RECEIVE SEMI-ANNUAL ANALYSIS FOR THE LIST OF PARAMETERS INCLUDED IN APPENDIX II OF 40 CFR 257 (IN ADDITION TO THE PARAMETERS INCLUDED IN APPENDIX I OF THE RULES FOR SOLID WASTE MANAGEMENT). PARAMETERS INCLUDED IN APPENDIX III OF 40 CFR 257 ARE SHOWN IN TABLE 2 OF THE GROUNDWATER MONITORING PLAN (GWMP). WELLS ASSOCIATED WITH CELL 11 OF THE CENTRAL CELL AREA (GWC-25 THROUGH GWC-31) AND WELLS LOCATED DOWNGRADEMENT OR SIDEGRADEMENT TO WESTERN CELL AREA CELLS 12 THROUGH 22 (GWC-32 THROUGH GWC-35, GWB-36, GWC-37 THROUGH GWC-44, GWB-45, GWC-46, AND GWC-47 THROUGH GWC-51) WILL REQUIRE THE ANALYSES SHOWN IN TABLE 2 (IN ADDITION TO TABLE 1). BASED ON THE CHOSEN STATISTICAL ANALYSIS METHOD THE FACILITY MAY NEED TO COLLECT SAMPLES FOR APPENDIX III OF 40 CFR 257 CONSTITUENTS FROM BACKGROUND MONITORING WELLS. IF AN INTER-WELL STATISTICAL COMPARISON METHOD IS SELECTED, THE LIST OF ANALYTES FOR UPGRADEMENT WELLS ASSOCIATED WITH CELL 11 AND THE WESTERN CELL AREA WILL BE EXPANDED TO INCLUDE APPENDIX III CONSTITUENTS.
- A) **GROUNDWATER DETECTION MONITORING**
SEMI-ANNUAL MONITORING REQUIREMENTS:
(1) APPENDIX I VOLATILE ORGANIC COMPOUNDS (VOCs)
(2) APPENDIX I METALS
(3) 40 CFR APPENDIX III ANALYSES*
TRIGGER TO ENTER TYPE 1 ASSESSMENT MONITORING:
VERIFIED DETECTION OF A VOC OR A STATISTICAL EXCEEDANCE OF AN APPENDIX I METAL
TRIGGER TO ENTER TYPE 2 ASSESSMENT MONITORING:
VERIFIED STATISTICAL EXCEEDANCE OF 40 CFR 257 ANALYTE.
* ONLY APPLICABLE TO WELLS ASSOCIATED WITH CELLS THAT RECEIVE CCR MATERIAL.
- B) **TYPE 1 ASSESSMENT MONITORING**
SEMI-ANNUAL MONITORING REQUIREMENTS:
(1) APPENDIX I VOLATILE ORGANIC COMPOUNDS (VOCs)
(2) APPENDIX I METALS
(3) OPTIONAL INDICATOR PARAMETERS ADDED AT SITE DISCRETION
(4) ANY APPENDIX II SPECIFIC PARAMETERS DETECTED AND VERIFIED DURING FULL APPENDIX II EVENTS, SEE BELOW:
ANNUAL MONITORING REQUIREMENTS:
(5) FULL LIST OF APPENDIX II ANALYTES
(6) OPTIONAL INDICATOR PARAMETERS ADDED AT SITE DISCRETION
- C) **TYPE 2 ASSESSMENT MONITORING**
SEMI-ANNUAL MONITORING REQUIREMENTS:
(1) APPENDIX I VOLATILE ORGANIC COMPOUNDS (VOCs)
(2) APPENDIX I METALS
(3) 40 CFR 257 APPENDIX III ANALYTES
(4) OPTIONAL INDICATOR PARAMETERS ADDED AT SITE DISCRETION
(5) ANY 40 CFR 257 APPENDIX IV SPECIFIC PARAMETERS DETECTED AND VERIFIED DURING FULL APPENDIX IV EVENTS, SEE BELOW:
ANNUAL MONITORING REQUIREMENT
(6) ITEMS 1 THROUGH 4 ABOVE PLUS LIST OF 40 CFR 257 IV ANALYTES
- IV. **GROUNDWATER MONITORING WELL INSTALLATION:**
A) **MONITORING WELL DRILLING METHODS:**
THE MONITORING WELLS WILL BE DRILLED BY A DRILLING CONTRACTOR WHO HAS A VALID AND CURRENT BOND WITH THE GEORGIA WATER WELL STANDARDS ADVISORY COUNCIL. ALL DRILLING WILL BE SUPERVISED BY A PROFESSIONAL GEOLOGIST OR PROFESSIONAL GEOTECHNICAL ENGINEER REGISTERED IN THE STATE OF GEORGIA.
THE DRILLING METHOD USED TO INSTALL THE MONITORING WELL WILL BE DETERMINED BASED ON AN EVALUATION OF SITE CONDITIONS. RECOMMENDED METHODS INCLUDE: HOLLOW-STEM AUGER, ROTASONIC, ROCK CORING, AND AIR ROTARY. OF UTMOST IMPORTANCE IS THAT THE DRILLING METHOD MINIMIZES THE DISTURBANCE OF SUBSURFACE MATERIALS AND WILL NOT CAUSE CONTAMINATION OF THE GROUNDWATER. THE BORING DIAMETER MAY RANGE FROM A MINIMUM OF 4-INCHES TO A MAXIMUM OF 12-INCHES (DEPENDING ON DRILLING METHOD UTILIZED).
A BORING LOG NOTING THE ABOVE INFORMATION ALONG WITH OTHER OBSERVATIONS MADE DURING THE DRILLING AS REQUIRED BY THE EPD MANUAL FOR GROUNDWATER MONITORING WILL BE PREPARED BY THE PROFESSIONAL GEOLOGIST OR GEOTECHNICAL ENGINEER REGISTERED IN THE STATE OF GEORGIA. SOILS WILL BE DESCRIBED IN ACCORDANCE WITH UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) NOMENCLATURE AT A MINIMUM OF FIVE FOOT INCREMENTS.
ALL DRILLING EQUIPMENT WILL BE STEAM CLEANED BEFORE USE AND BETWEEN EACH WELL INSTALLATION.
- B) **WELL MATERIALS**
THE FOLLOWING WELL MATERIALS WILL BE USED FOR CONSTRUCTION OF THE GROUNDWATER MONITORING WELLS.
1. SCREEN: WELL SCREEN WILL CONSIST OF A 10-FOOT SECTION OF FLUSH THREADED 2-INCH I.D. SCHEDULE 40 PVC SCREEN WITH FACTORY THREADED 0.010-INCH SLOTS. FIELD SLOTTING IS NOT PERMITTED.
2. CASING: FLUSH THREADED, 2-INCH I.D. SCHEDULE 40 PVC WELL CASING WILL EXTEND FROM THE TOP OF THE SCREEN TO APPROXIMATELY 3 FEET ABOVE THE GROUND SURFACE.
NOTE: WELL SCREENS AND CASING WILL BE COMPOSED OF NEW ASTM, NSF RATED PVC. THE OWNER/OPERATOR WILL BE RESPONSIBLE FOR THE RELIABILITY OF DATA COLLECTED FROM THE WELLS.
3. SUMP AND END CAP: A 4-6-INCH FACTORY THREADED SUMP AND END CAP WILL BE ATTACHED TO THE BOTTOM OF THE WELL SCREEN.
4. FILTER PACK: FILTER PACK MATERIALS WILL CONSIST OF CLEAN, QUARTZ SAND WITH A NO. 20 - 40 GRADATION OR THE CLOSEST COMMERCIALY AVAILABLE EQUIVALENT. IF 20/40 SAND IS NOT USED FOR THE FILTER PACK, PROPER DOCUMENTATION SHOWING SUITABILITY OF THE MATERIAL WILL BE SUBMITTED TO EPD FOR REVIEW. IN ADDITION, THE MONITORING WELL INSTALLATION REPORT WILL INCLUDE A SIGNED AND SEALED CERTIFICATION STATEMENT THAT ATTESTS THAT THE DEVIATION FROM THE D&O PLAN WILL NOT IMPACT THE QUALITY OF FUTURE GROUNDWATER MONITORING SAMPLES. THE SAND WILL BE BROUGHT TO THE SITE IN SEALED BAGS WHICH WILL ONLY BE OPENED IMMEDIATELY PRIOR TO PLACEMENT IN THE WELL. THE FILTER PACK SAND SHOULD EXTEND NOT MORE THAN 2 FEET ABOVE THE TOP OF THE WELL SCREEN. FILTER PACK IS TO BE INSTALLED THROUGH TREMIE PIPE FOR DEPTHS GREATER THAN FIVE FEET BELOW GROUND SURFACE.
5. ANNULAR SEALANT: A MINIMUM 2-FOOT THICK, BENTONITE SEALANT WILL BE PLACED IMMEDIATELY ABOVE THE FILTER PACK. THIS MATERIAL SHALL BE CHEMICALLY RESISTANT TO ENSURE THE SEAL INTEGRITY OF THE WELL AND CHEMICALLY INERT SO IT DOES NOT AFFECT THE WATER QUALITY. SEALS PLACED WITHIN 5 FEET OF THE GROUND SURFACE MAY BE DROPPED FROM THE GROUND SURFACE. DEEPER SEALS WILL BE PLACED WITH A TREMIE PIPE. SEALS INSTALLED ABOVE WATER TABLE WILL BE HYDRATED ACCORDING TO THE MANUFACTURER'S SPECIFICATION WITH POTABLE WATER.
6. GROUT: THE WELL ANNULUS, FROM THE TOP OF THE BENTONITE SEALANT TO A POINT 18 INCHES BELOW THE GROUND SURFACE WILL BE GROUTED WITH A NON-SHRINK MIXTURE OF TYPE I PORTLAND CEMENT AND BENTONITE (3 TO 6 PERCENT BENTONITE). GROUT MAY BE POURED FROM THE GROUND SURFACE TO DEPTHS UP TO 5 FEET. IF GROUT IS REQUIRED AT DEEPER DEPTHS, A TREMIE PIPE SHALL BE USED.
7. WELL APRON: A CONCRETE WELL APRON, A MINIMUM OF 4 INCHES THICK, EXTENDING 18 INCHES INTO THE BOREHOLE ANNULUS AND AT LEAST 3 FEET FROM THE BOREHOLE WILL BE CONSTRUCTED. THE WELL APRON WILL BE CONSTRUCTED WITH POURED CONCRETE. THE SURFACE OF THE WELL APRON WILL SLOPE AWAY FROM THE BOREHOLE IN ALL DIRECTIONS. A SURVEYOR'S PIN REFERENCE POINT WILL EMBEDDED IN THE WELL APRON.
8. WELL COVER: A LOCKING, VENTED, PROTECTIVE STEEL OR ALUMINUM WELL COVER WILL BE INSTALLED WITH THE BASE OF THE WELL COVER CONCRETED INTO THE WELL APRON. A WEEP HOLE WILL BE LOCATED NEAR THE BASE OF THE EXPOSED ALUMINUM COVER. THE INSIDE OF THE WELL COVER WILL BE FILLED WITH PEA GRAVEL TO JUST BELOW THE TOP OF THE PVC PIPE.
9. VENT HOLE: A 1/4" HOLE WILL BE DRILLED APPROXIMATELY 2-INCHES BELOW THE TOP OF THE PVC PIPE TO ALLOW FOR THE GROUNDWATER TO CONTINUOUSLY EQUILIBRATE WITH ATMOSPHERIC CONDITIONS.
10. WELL CAP: MOST WELLS HAVE DEDICATED BLADDER PUMPS WITH INTEGRAL CAPS THAT PREVENT DEBRIS FROM ENTERING THE WELL WHEN IN USE. FOR SAMPLING, FOR WELLS WITHOUT DEDICATED PUMPS, A PVC CAP SHOULD COVER THE TOP OF THE WELL PVC PIPE WHEN THE WELL IS NOT IN USE.
11. MARKER POST: A MARKER POST CONSISTING OF METAL OR PRESSURE-TREATED LUMBER WILL BE INSTALLED. THE MARKER POST WILL BE INSTALLED NEAR THE WELL. THE WELL DESIGNATION WILL BE INDICATED ON THE MARKER POST. ALTERNATIVELY, THE METAL CASING MAY LABELED DIRECTLY WITH TWO INCH LETTERING.
- C) **WELL DEVELOPMENT:** FOLLOWING COMPLETION OF THE WELL INSTALLATION, EACH WELL IS TO BE DEVELOPED BY USING A SURGE BLOCK AND PURGE PUMP. A MINIMUM OF AT LEAST THREE WELL VOLUMES WILL BE REMOVED (ADDITIONAL WELL VOLUME AS NECESSARY). IF DURING THE COURSE OF DEVELOPMENT THE WELL IS PUMPED TO DRYNESS OR NEAR DRYNESS, THE WATER TABLE WILL BE ALLOWED TO RECOVER TO ITS STATIC WATER LEVEL PRIOR TO INITIATION OF THE NEXT DEVELOPMENT PERIOD. THE GROUNDWATER pH, SPECIFIC CONDUCTANCE, TEMPERATURE, DISSOLVED OXYGEN, AND OXIDATION REDUCTION POTENTIAL (ORP) WILL BE RECORDED DURING DEVELOPMENT. DEVELOPMENT OF THE WELL WILL CONTINUE UNTIL THREE CONSECUTIVE STABILIZE PARAMETER READINGS ARE OBTAINED (PER METHODOLOGY OUTLINED IN GROUNDWATER SAMPLING AND ANALYSIS PLAN - SECTION A, WELL PREPARATION) AND UNTIL TURBIDITY OF THE WELL IS 5 N.T.U. OR LESS. IF THE 5 N.T.U. STANDARD CANNOT BE OBTAINED, A PROFESSIONAL GEOLOGIST OR PROFESSIONAL GEOTECHNICAL ENGINEER MUST CERTIFY WITH SUPPORTING DOCUMENTATION THAT THE WELL DEVELOPMENT IS THE BEST OBTAINABLE IN THE GEOLOGIC MATERIAL IN WHICH THE WELL IS SCREENED. A MINIMUM OF 24 HOURS SHOULD BE ALLOWED FOR GROUT TO CURE PRIOR TO UNDERTAKING DEVELOPMENT ACTIVITIES. AT LEAST 24 HOURS AFTER COMPLETION OF DEVELOPMENT OF THE WELLS, THE STATIC WATER LEVEL IN EACH WELL WILL BE MEASURED UTILIZING AN ELECTRIC WATER LEVEL MEASURING TAPE.
- D) **SURVEY:** UPON COMPLETION OF THE WELL INSTALLATION, THE LOCATION (SURVEY PIN) AND ELEVATIONS (SURVEY PIN, TOP OF PVC, AND TOP OF METAL CASING) OF THE WELLS WILL BE SURVEYED UNDER THE DIRECTION OF A GEORGIA REGISTERED LAND SURVEYOR. THE WELL LOCATIONS AND ELEVATIONS WILL BE ESTABLISHED RELATIVE TO NORTH AMERICAN DATUM 27 OR 83 AND USGS DATUM, RESPECTIVELY.
- E) **DOCUMENTATION:** WITHIN 30 DAYS OF COMPLETION OF DEVELOPMENT OF THE WELLS, A REPORT ON WELL INSTALLATION WILL BE SUBMITTED TO THE GEORGIA EPD BY THE REGISTERED GEOLOGIST OR GEOTECHNICAL ENGINEER RESPONSIBLE FOR THE WELL INSTALLATION. THE DOCUMENTATION SHALL INCLUDE, BUT NOT BE LIMITED TO, THE ITEMS LISTED BELOW: A POTENTIOMETRIC SURFACE MAP, DOCUMENTATION OF PROPER WELL DEVELOPMENT, AND DESCRIPTIONS OF WELL INSTALLATION PROCEDURES (INCLUDING DESCRIPTION OF ANY DRILLING FLUIDS USED) WILL BE INCLUDED.
• NAME OF DRILLERS, IDENTIFICATION OF DRILL RIG;
• START/STOP TIME AND STOP/START DATE OF CONSTRUCTION;
• DRILLING METHOD AND DRILLING FLUID (PRIMARILY DRILLING MUDS) USED;
• WELL LOCATION (± 0.5 FT);
• BOREHOLE DIAMETER AND WELL CASING DIAMETER;
• WELL DEPTH (± 0.1 FT.);
• DRILLING AND LITHOLOGIC LOGS;
• CASING MATERIALS*;
• SCREEN MATERIALS AND DESIGN;
• CASING AND SCREEN JOINT TYPE;
• SCREEN SLOT SIZE/LENGTH;
• FILTER PACK MATERIAL*/SIZE;
• FILTER PACK VOLUME;
• FILTER PACK PLACEMENT METHOD;
• SEALANT MATERIALS*;
• SEALANT VOLUME;
• SEALANT PLACEMENT METHOD;
• SURFACE SEAL DESIGN/CONSTRUCTION;
• WELL DEVELOPMENT PROCEDURE;
• DOCUMENTATION OF PH, SPEC. COND., AND TEMP STABILIZATION;
• DOCUMENTATION THAT TURBIDITY OF 5 NTU OR LOWEST ACHIEVABLE WAS OBTAINED;
• TYPE OF PROTECTIVE WELL CAP;
• GROUND SURFACE ELEVATION (± 0.01 FT.);
• TOP OF CASING ELEVATION (± 0.01 FT.); AND
• DETAIL OF WELL (INCLUDE DIMENSIONS);
• COPY OF THE DRILLING CONTRACTOR'S BOND ON FILE WITH THE GEORGIA WATER WELL ADVISORY COUNCIL;
• DOCUMENTATION OF ANY IRREGULARITIES ENCOUNTERED WHILE DRILLING; AND
• DOCUMENTATION OF ANY DEVIATIONS FROM THE APPROVED D&O PLAN.
- * SAMPLES OF MATERIALS, ADEQUATE FOR LEACHING/SORPTION TESTS SHOULD BE RETAINED.
- F) **WELL ABANDONMENT:** SHOULD IT BECOME NECESSARY TO ABANDON A GROUNDWATER MONITORING WELL, PIEZOMETER, METHANE WELL, OR OTHER ENGINEERING BORING, THE WELL WILL BE PLUGGED AND SEALED AS STIPULATED IN THE STATE OF GEORGIA WELL STANDARDS ACT OF 1985 AS AMENDED 1995, THE GEORGIA DEPARTMENT OF NATURAL RESOURCES MANUAL FOR GROUNDWATER MONITORING, DATED SEPTEMBER 1991 AND THE FACILITY'S APPROVED DESIGN AND OPERATIONS PLAN. ONLY CHEMICALLY INERT AND IMPERMEABLE MATERIALS SUCH AS NEAT CEMENT AND/OR BENTONITE CLAY WILL BE USED IN THE PLUGGING OF WELLS. THE GENERAL PROCEDURE FOR PLUGGING SHALLOW MONITORING WELLS (GROUNDWATER, EXPLORATORY, AND METHANE) COMPLETED IN WATER TABLE AQUIFERS OUTSIDE OF THE WASTE LIMIT INCLUDES THREE STEPS (AS TAKEN FROM GEORGIA EPD MANUAL FOR GROUNDWATER MONITORING SEPTEMBER 1991).
• REMOVAL OF OBSTRUCTIONS IN THE WELL THAT COULD INTERFERE WITH THE PLUGGING OPERATION AND THOROUGH FLUSHING OF THE WELL TO PURGE RESIDUAL DRILLING FLUIDS AND OTHER FINE DETRITUS,
• REMOVAL OF THE WELL CASING (WHERE PRACTICAL) TO ENSURE PLACEMENT OF AN EFFECTIVE SEAL - AS A MINIMUM WHEN THE CASING IS NOT PROPERLY GROUTED, THE UPPER 20 FEET OF CASING MUST BE REMOVED,
• SEALING OF THE WELL WITH AN IMPERMEABLE FILLER SUCH AS NEAT CEMENT. GEORGIA EPD SHOULD BE CONSULTED PRIOR TO ABANDONMENT OF WELLS.
- THE PROCEDURE FOR OVERDRILLING AND PLUGGING IS AS FOLLOWS:
1. ENSURE THAT ADEQUATE SURVEY CONTROL EXISTS FOR EACH WELL AND OBTAIN A COPY OF THE ORIGINAL WELL CONSTRUCTION LOG.
2. WELL DECOMMISSIONING DRILLING EQUIPMENT, AUGERS, WATER LEVEL MARKER, AND OTHER TOOLS MUST BE STEAM CLEANED AND DECONTAMINATED PRIOR TO USE.
3. THE DEPTH OF THE WELL SHALL BE MEASURED AND COMPARED TO THE ANTICIPATED WELL DEPTH TO DETERMINE IF ANY OBSTRUCTIONS ARE IN THE WELL. IF THE WELL IS OBSTRUCTED, THE OBSTRUCTION WILL BE REMOVED PRIOR TO SEALING THE WELL, IF POSSIBLE.
4. EXPECTED GROUT VOLUME CALCULATIONS SHALL BE COMPLETED USING THE DEPTH INFORMATION DERIVED FROM STEPS 1 AND 3. THE EXPECTED VOLUMES SHALL BE RECORDED FOR RECONCILIATION WITH THE FINAL GROUT VOLUMES USED.
5. REMOVE THE PROTECTIVE CASING. POSITION THE DRILL RIG DIRECTLY OVER THE WELL AND ATTACH A CHAIN TO THE OUTER PROTECTIVE CASING. PULL DIRECTLY UPWARD ON THE PROTECTIVE CASING. OFTEN FOR SHALLOW WELLS THIS PROCEDURE WILL ALSO ALLOW UP THE INNER-CASING AND ANNULAR MATERIALS. IF THIS OCCURS, CONTINUE TO PULL ALL WELL MATERIALS OUT, AS PRACTICABLE.
6. REMOVE THE WELL CASING AND ASSOCIATED ANNULAR MATERIALS. TYPICALLY, REMOVAL IS ACCOMPLISHED THROUGH OVERDRILLING USING A HOLLOW STEM AUGER (HSA) DRILL RIG EQUIPPED WITH AN AUGER BIT THAT EXCEEDS THE DIAMETER OF THE ORIGINAL BIT (1.25 TIMES THE ORIGINAL AUGER DIAMETER) USED TO CONSTRUCT THE WELL. THE OVERDRILLING SHALL PROGRESS SLOWLY TO ENSURE THAT THE DRILLING OPERATION REMAINS CENTERED OVER THE WELL/BORING. ONCE THE BASE OF THE WELL IS REACHED AND WELL MATERIALS HAVE BEEN REMOVED, THE AUGER OR DRILLING EQUIPMENT SHALL BE LEFT IN PLACE TO PREVENT CAVE IN OF MATERIALS, WHILE PROCEEDING TO STEP 7.
7. UPON REMOVAL OF THE CASING, WELL SCREEN AND ANNULAR MATERIALS, THE RESULTING BORING SHALL BE TREMIE GROUTED. THE GROUT SHALL BE A HIGH SOLIDS BENTONITE GROUT. THE GROUT MIXTURE SHALL CONTAIN AS HIGH A BENTONITE CONTENT AS CAN BE REASONABLE PUMPED (30% BENTONITE BY WEIGHT). GROUT SHALL BE MIXED TO A UNIFORM CONSISTENCY. THE GROUT SHALL BE PUMPED INTO THE BORING THROUGH A TREMIE PIPE PLACED AT THE BOTTOM OF THE BORING. THE AUGER FLIGHTS SHALL BE LEFT IN PLACE UNTIL THE TREMIE LINE IS SITUATED AT THE BOTTOM OF THE BORING. GROUTING SHALL PROCEED IN A CONTINUOUS AND EXPEDITIOUS MANNER BY CONCURRENTLY PULLING THE AUGER FLIGHTS AND PUMPING GROUT UNTIL THE GROUT LEVEL IS WITHIN TWO FEET OF THE GROUND SURFACE. BOTH THE BOTTOM OF THE TREMIE PIPE AND THE BASE OF THE AUGER FLIGHTS MUST REMAIN SUBMERGED IN GROUT WHILE THE WELL IS GROUTED. AFTER THE GROUT HAS SETTLED FOR 24 HOURS, THE BOREHOLE MUST BE CHECKED FOR GROUT SETTLEMENT, AND IF NECESSARY, TOPPED OFF WITH THE APPROPRIATE GROUT MIXTURE. THE FINAL LEVEL OF THE GROUT SHALL BE WITHIN TWO FEET OF THE GROUND SURFACE. THE TOP TWO FEET OF THE BOREHOLE SHALL BE ABANDONED BY ADDING AND COMPACTING NATIVE SOILS. EQUIPMENT USED FOR WELL DECOMMISSIONING SHALL BE STEAM CLEANED AND DECONTAMINATED BETWEEN DECOMMISSIONING LOCATIONS.
8. UPON COMPLETION OF DECOMMISSIONING ACTIVITIES, WELL-DECOMMISSIONING MATERIALS AND EQUIPMENT WILL BE REMOVED FROM THE SITE AND THE SITE WILL BE RESTORED. OVER-DRILLED MATERIALS AND CUTTINGS SHALL BE PROPERLY DISPOSED.
9. AFTER THE MONITORING WELL OR PIEZOMETER HAS BEEN DECOMMISSIONED, A RECORD MUST BE PREPARED AND SUBMITTED TO EPD WITHIN 45 DAYS (APPLIES TO LOCATIONS INSIDE AND OUTSIDE OF THE WASTE FOOTPRINT). THE RECORD MUST CONTAIN THE FOLLOWING INFORMATION, AT A MINIMUM:
• NAME AND ADDRESS OF PROPERTY OWNER;
• WELL IDENTIFICATIONS;
• NAME, LICENSE OR REGISTRATION NUMBER OF THE CONTRACTOR DOING THE WORK, NAME AND BOND NUMBER OF THE DRILLING CONTRACTOR PERFORMING THE WORK;
• DATE WORK WAS COMPLETED;
• A DESCRIPTION OF THE GEOLOGICAL MATERIAL PENETRATED BY THE WELL (I.E., COPY OF THE ORIGINAL BORING LOG);
• THE ORIGINAL WELL OR BORING DEPTH, AND CURRENT WELL OR BORING DEPTH;
• THE APPROXIMATE DATE OF CONSTRUCTION;
• THE GROUT OR SEALING MATERIALS, TYPE QUANTITIES, AND INTERVALS;
• THE CASING TYPE, DIAMETER, AND DEPTH, IF PRESENT;
• THE SCREEN OR OPEN HOLE DEPTH INTERVAL, IF PRESENT;
• A DESCRIPTION OF ANY OBSTRUCTION, IF PRESENT;
• A DESCRIPTION OF ANY DEVIATIONS FROM THE ABOVE PROCEDURES, OR OTHER UNUSUAL CONDITIONS ENCOUNTERED OR ACTIONS TAKEN; AND
• A STATEMENT AS TO WHETHER OR NOT ALL WELL MATERIALS WERE REMOVED AND IF NOT A DETAILED EXPLANATION OF THE TYPE OF MATERIALS LEFT IN PLACE AND THEIR APPROXIMATE ELEVATION, TYPE, CONDITION, ETC.
- G) A REGISTERED GEOLOGIST OR GEOTECHNICAL ENGINEER SHALL CERTIFY TO EPD THAT THE WELL DESIGN, INSTALLATION, DEVELOPMENT, AND ABANDONMENT COMPLIES WITH THE RULES FOR SOLID WASTE MANAGEMENT, "MANUAL FOR GROUNDWATER MONITORING, SEPTEMBER 1991."



NOTES:
1. IF WELLS ARE LOCATED NEAR OR WILL BE LOCATED IN A AREA THAT IN THE FUTURE WILL BE SUBJECT TO ANY VEHICULAR TRAFFIC, BOLLARDS WILL BE INSTALLED.

GROUNDWATER MONITORING WELL (BEDROCK)
N.T.S.

RECEIVED
NOV 14 2016
SOLID WASTE MANAGEMENT PROGRAM
GEORGIA Environmental Protection Division Solid Waste Management Program
MAJOR MODIFICATION APPROVAL
SOLID WASTE PERMIT NO. 006-0090(MRW)
REVIEWED BY: [Signature] DATE: 3/17/17
APPROVED BY: [Signature] DATE: 3/17/17

I, EVAN B. PERRY, CERTIFY THAT I AM A QUALIFIED GROUNDWATER SCIENTIST DEMONSTRATED BY A GEORGIA STATE REGISTERED PROFESSIONAL GEOLOGIST CERTIFICATION. I HAVE SUFFICIENT TRAINING AND EXPERIENCE IN GROUNDWATER HYDROLOGY AND RELATED FIELDS TO MAKE SOUND PROFESSIONAL JUDGMENTS REGARDING GROUNDWATER MONITORING AND CONTAMINANT FATE AND TRANSPORT. I FURTHER CERTIFY THAT THE DESIGN OF THE GROUNDWATER MONITORING SYSTEM WAS DESIGNED IN COMPLIANCE WITH THE RULES OF SOLID WASTE MANAGEMENT, CHAPTER 391-3-4, AS SPECIFIED IN [391-3-4-.14(11)2.(b)].
EVAN B. PERRY
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BANKS COUNTY, GEORGIA

610 BENNETT ROAD
HOMER, GEORGIA 30547

REVISIONS	
0. Issued for Permitting	08/06/2014
1. Revised per EPD Comments	05/15/2015
2. Revised per EPD Comments	03/11/2016
3. Revised per EPD Comments	05/19/2016
4. Revised per EPD Comments	10/14/2016

Drawn by: **BFH** Checked by: **JEH**

PROJECT NUMBER:
I002-327
August 2014

GROUNDWATER MONITORING PLAN

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P:\Industrial\002 - Waste Management - Atlanta\327 - R&B Preliminary Design\4 - Design Data\1 - Data\002-327-30-Drawings\dwg 10/14/16 EBP.H. REV000X

9. ASSESSMENT MONITORING: IF THE GWPS IS BASED ON EITHER THE MCL OR THE AGWPS, THEN COMPARE THE 95% LOWER CONFIDENCE LIMIT (LCL) OF THE MEAN OF AT LEAST THE FOUR MOST RECENT SAMPLES FROM EACH DOWNGRADIENT WELL TO EVALUATE WHETHER THE REGULATED UNIT IS IN COMPLIANCE WITH THE GROUNDWATER PROTECTION STANDARDS ESTABLISHED UNDER THE GEORGIA RULES FOR SAFE DRINKING WATER 391-3-5-.18 (I.E. WHERE THERE IS A COMPOUND DETECTED AT A STATISTICALLY SIGNIFICANT LEVEL ABOVE A GWPS), AN EXCEEDANCE IS VERIFIED IF THE LCL IS ABOVE THE REGULATORY GWPS OR THE AGWPS.
10. THE 95% LCL OF THE MEAN OF AT LEAST THE FOUR MOST RECENT MEASUREMENTS IS COMPUTED. NON-DETECTS ARE REPLACED BY ONE HALF THE REPORTING LIMIT SINCE THERE ARE ONLY FOUR SAMPLES. A NORMAL LCL IS USED SINCE FOUR SAMPLES ARE INSUFFICIENT TO DETERMINE THE DISTRIBUTION FORM OF THE DATA.
11. IF THERE ARE MORE THAN FOUR MEASUREMENTS, THE DATA ARE TESTED FOR TRENDS USING SENS TEST. USE THE FOUR MOST RECENT MEASUREMENTS IF THERE ARE INCREASING TRENDS. USE ALL MEASUREMENTS COLLECTED AFTER THE INITIAL STATISTICAL EXCEEDANCE IF THERE ARE NO INCREASING TRENDS.
12. IF THE GWPS IS BASED ON BACKGROUND, THEN COMPARE EACH INDIVIDUAL NEW DOWNGRADIENT MEASUREMENT TO BACKGROUND TO EVALUATE IF THE REGULATED UNIT IS IN COMPLIANCE WITH THE GROUNDWATER PROTECTION STANDARDS UNDER THE GEORGIA RULES FOR SAFE DRINKING WATER (I.E. COMPARE THE RESULTS TO BACKGROUND PREDICTION LIMITS). NOTE THAT FOR A GWPS BASED ON BACKGROUND, AN INITIAL EXCEEDANCE MUST BE VERIFIED BY OBTAINING AN INDEPENDENT NEW VERIFICATION SAMPLE FROM THE AFFECTED WELL. AN EXCEEDANCE IS VERIFIED IF BOTH THE INITIAL AND THE VERIFICATION RESAMPLE EXCEED THE GWPS.

XI. FIVE YEAR MONITORING WELL EVALUATION:

IN ACCORDANCE WITH THE GEORGIA WATER WELL STANDARDS ACT OF 1985, AS AMENDED 1995, AT LEAST ONCE EVERY FIVE YEARS, THE OWNER OF THE PROPERTY ON WHICH A MONITORING WELL IS CONSTRUCTED SHALL HAVE THE MONITORING WELL INSPECTED BY A PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST, WHO SHALL DIRECT APPROPRIATE REMEDIAL CORRECTIVE WORK TO BE PERFORMED IF THE WELL DOES NOT CONFORM TO STANDARDS.

APPENDIX I
SAMPLING PROCEDURES:

- A) SPLIT SAMPLES:
IN ORDER TO KEEP SAMPLE HANDLING TO A MINIMUM, THE PARALLEL SPLITTING PROCEDURE SHOULD BE USED.
PARALLEL SPLIT:
1. THE 2 SAMPLE BOTTLES FOR A GIVEN TEST ARE LINED UP AND CAPS REMOVED.
2. ONE-HALF BAILERFUL IS POURED INTO EACH BOTTLE. THIS IS CONTINUED FOR EACH UNTIL THE 2 SAMPLE BOTTLES ARE FULL. THEY ARE THEN CAPPED AS USUAL.
3. THE 2 SAMPLE BOTTLES FOR ANOTHER TEST ARE THEN LINED UP, AND FILLED AS IN STEP 2.
4. THIS PROCEDURE IS CONTINUED UNTIL ALL TEST BOTTLES FOR A GIVEN WELL ARE FILLED FOR BOTH PARTIES.

- B) LOW-FLOW MINIMAL DRAWDOWN PROCEDURE
THE OBJECTIVE OF LOW-FLOW/MINIMAL DRAWDOWN PURGING IS TO OBTAIN GROUNDWATER SAMPLES THAT ARE MORE REPRESENTATIVE OF AQUIFER CONDITIONS THAN WHAT CAN BE PROVIDED BY BAILING OR USE OF EXCESSIVE PUMPING RATES. THIS METHOD USES A PUMP TO PURGE WATER AT A CONSTANT RATE TO ACHIEVE FIELD PARAMETER STABILIZATION. FIELD PARAMETERS ARE MEASURED AT PERIODIC INTERVALS (DEPENDING ON ALIQUOT TURNOVER RATES) DURING PURGING WITH A FLOW CELL OR OTHER CONTAINER. UPON ACHIEVEMENT OF PARAMETER STABILIZATION (DETAILED BELOW), THE DISCHARGE TUBING IS DISCONNECTED FROM THE FLOW CELL AND A SAMPLE IS COLLECTED.

1. EQUIPMENT
WHERE FEASIBLE, DEDICATED BLADDER PUMPS WITH PTFE-LINED TUBING ARE INSTALLED IN SITE WELLS. PUMPS ARE INSTALLED IN THE SCREENED INTERVAL OF THE WELL, A MINIMUM OF ONE FOOT ABOVE THE BOTTOM. GROUNDWATER MONITORING WELLS WITHOUT A DEDICATED PUMP WILL REQUIRE THE USE OF NON-DEDICATED PUMPS (BAILERS ARE NOT TO BE USED FOR LOW-FLOW PURGING). NON-DEDICATED SUBMERSIBLE PUMPS SHOULD BE CONSTRUCTED OF STAINLESS STEEL AND EQUIPPED WITH PTFE-LINED SAMPLING TUBING. PERISTALTIC PUMPS SHOULD BE EQUIPPED WITH PTFE TUBING FROM THE PUMP HEAD TO THE WELL. IF A VACUUM JUG ASSEMBLY IS UTILIZED FOR SAMPLING WITH A PERISTALTIC PUMP, IT SHOULD ALSO BE CONSTRUCTED OF PTFE. FLOW CELLS ARE RECOMMENDED, BUT NOT REQUIRED. FIELD PROBES WILL BE CALIBRATED ON A DAILY BASIS PRIOR TO SAMPLING AND SHOULD BE CHECKED FOR DRIFT AT THE END OF THE DAY. NON-DEDICATED EQUIPMENT USED DURING THE PURGING AND SAMPLING PROCESS MUST BE DECONTAMINATED PRIOR TO EACH USE. DECONTAMINATION PROCEDURES WILL BE PERFORMED USING THE USEPA REGION IV, SCIENCE AND ECOSYSTEM SUPPORT DIVISION OPERATION PROCEDURE, "OPERATING PROCEDURE FOR FIELD EQUIPMENT CLEANING AND DECONTAMINATION", DATED DECEMBER 20, 2011, DOCUMENT NUMBER SESOPROC-205-R2, AS AMENDED. THE FLOW CELL/CONTAINER DOES NOT REQUIRE DECONTAMINATION BETWEEN WELLS. THE ACT OF PURGING REMOVES ANY LIQUIDS FROM OTHER WELLS. SAMPLING TAKES PLACE AFTER DISCONNECTING THE FLOW CELL.

2. PURGE VOLUMES AND MONITORING FREQUENCY
LOW-FLOW SAMPLING DOES NOT REQUIRE THE CALCULATION OF THE WATER VOLUME IN THE WELL (THOUGH IT IS STANDARD PROTOCOL TO DO SO). THE VOLUMES OF THE TUBING, PUMP, AND/OR FLOW CELL ARE USED TO CALCULATE FIELD MEASUREMENT FREQUENCY. THE TECHNICIAN SHOULD EITHER RECORD THE KNOWN VOLUME OF THE FLOW CELL OR CALCULATE THE VOLUME OF THE PUMP AND SAMPLE TUBING (TYPICALLY CONVERTED TO LITERS). THE FREQUENCY OF FIELD READINGS IS BASED ON THE TIME REQUIRED TO PURGE EITHER ONE VOLUME OF THE FLOW CELL OR ONE VOLUME OF THE PUMP AND TUBING EQUIPMENT. FOR EXAMPLE, A 175-ML VOLUME FLOW CELL PURGED AT A RATE OF 200 ML/MINUTE WILL BE PURGED IN ONE MINUTE; READINGS SHOULD BE AT LEAST ONE MINUTE APART. IF A CONTAINER OTHER THAN A FLOW CELL IS USED, THEN THE FREQUENCY OF FIELD MEASUREMENTS SHOULD BE BASED ON THE TIME REQUIRED TO PURGE ONE VOLUME OF THE PUMP AND ASSOCIATED TUBING. IN EITHER CASE, ENSURE THAT THE FIELD PARAMETERS ARE MEASURED ON INDEPENDENT SAMPLES. A GRAPHIC PRESENTING A MEANS TO ESTIMATE TYPICAL READING SEPARATION TIMES IS PROVIDED BELOW.

Table
Purge Time Matrix

	Purge Rate (mL/min)					
	250	300	350	400	450	500
Well Depth (ft)						
25	3.0	2.0	2.0	2.0	1.0	1.0
50	4.0	3.0	3.0	2.0	2.0	2.0
75	5.0	4.0	3.0	3.0	3.0	2.0
100	6.0	5.0	4.0	4.0	3.0	2.0

Assumes a 3/8" diameter tubing, 10 mL/ft volume.
Assumes a full-size P1101 QED Pump, 400 mL volume.
Purge time in minutes = (well depth * 10 mL/ft + 400 mL) / (purge rate) mL/min.

3. PURGE RATES
THE OBJECTIVE OF THE PURGING PROCESS IS TO REMOVE STAGNANT WATER FROM A WELL PRIOR TO SAMPLING. CALCULATE FLOW RATE BY MEASURING THE TIME IT TAKES TO FILL A CALIBRATED CONTAINER. MONITOR DRAWDOWN BY MEASURING THE TOP OF THE WATER COLUMN WHILE PUMPING. DRAWDOWN IS STABILIZED DURING PURGING AT A RATE AS CLOSE AS PRACTICAL TO THE AQUIFER RECHARGE RATE.
- MEASURE THE WATER LEVEL PRIOR TO INITIATING THE PURGE;
 - CALCULATE FLOW CELL (OR TUBE) VOLUMES AND DETERMINE MEASURING FREQUENCY;
 - CONNECT THE FLOW CELL TO THE DISCHARGE TUBE FROM THE PUMP;
 - BEGIN PURGE AT A MAX OF 500 ML/MIN (OR AT A RATE DETERMINED FROM PREVIOUS EVENTS);
 - MAINTAIN THE WATER LEVEL TAPE AT THE TOP OF THE WATER TABLE WHILE PUMPING; RECORD WATER LEVELS DURING PURGE TO MONITOR DRAWDOWN;
 - IF DRAWDOWN HAS STABILIZED, START THE PARAMETER STABILIZATION PROCESS;
 - IF THE WATER LEVEL DROPS, REDUCE PURGE RATE BY 100 ml/MIN INCREMENTS UNTIL WATER LEVELS STABILIZE OR UNTIL THE LOWEST PUMPING RATE IS ACHIEVED;
 - IF AT MINIMUM PUMPING RATE, PROCEED TO PARAMETER STABILIZATION
- DRAWDOWN SHOULD NOT FALL BELOW THE TOP OF THE PUMP DURING PURGING AND SAMPLING. FLOW RATES AND DRAWDOWN ARE RECORDED ON A FIELD LOG, FIELD FORM OR WITH A DATA LOGGER.
4. PARAMETER STABILIZATION
PARAMETER STABILIZATION ENSURES THAT STAGNANT WATER IS PURGED AND SAMPLED GROUNDWATER IS REPRESENTATIVE. THE PROCEDURES ARE AS FOLLOWS:
- MEASURE THE FIELD PARAMETERS, TURBIDITY AND TEMPERATURE OF THE PURGED WATER;
 - RECORD pH, SPECIFIC CONDUCTANCE, DISSOLVED OXYGEN, AND OXIDATION-REDUCTION POTENTIAL (ORP) OF THE WATER DURING PURGING;
 - OBSERVE AND RECORD THE DRAWDOWN; AND
 - RECORD THE PURGE RATE AND VOLUME OF WATER REMOVED.

A WELL IS ADEQUATELY PURGED WHEN THE TEMPERATURE, pH, SPECIFIC CONDUCTANCE, OXIDATION-REDUCTION POTENTIAL (ORP) AND DISSOLVED OXYGEN STABILIZE FOR A MINIMUM OF 3 CONSECUTIVE READINGS. STABILIZATION OCCURS AS FOLLOWS:

pH +/- 0.2 pH UNITS
CONDUCTANCE +/- 3% OF READING
DISSOLVED OXYGEN +/- 10.0% OF READING OR 0.2 mg/l, WHICHEVER IS GREATER
ORP +/- 20 mV
TEMPERATURE IS NOT A GOOD INDICATOR OF STABILIZATION, BUT SHOULD BE MEASURED AND RECORDED AT THE TIME OF EACH PARAMETER SET READING.

A FINAL SAMPLE TURBIDITY OF 10 NTU OR LESS SHOULD BE ACHIEVED FOR SAMPLES COLLECTED USING LOW FLOW METHODOLOGY. IF TURBIDITY CONTINUES TO DROP AFTER REACHING 10 NTU, PURGING SHOULD CONTINUE UNTIL THE LOWEST STABILIZED LEVEL IS ACHIEVED.
WELLS WILL BE SAMPLED IMMEDIATELY UPON COMPLETION OF PURGING OPERATIONS. THE PURGE RATE SHOULD REMAIN CONSTANT DURING SAMPLING (GENERALLY LESS THAN 500 mL/min). FOR VOCs, LOWER SAMPLING RATES (100-200 mL/min) MAY BE REQUIRED. THE PROCEDURES ARE AS FOLLOWS:

- RECORD FIELD PARAMETERS PRIOR TO SAMPLING;
- RECORD DEPTH TO WATER LEVELS PRIOR TO SAMPLING;
- RECORD THE FLOW RATE USING A CALIBRATED MEASURING DEVICE;
- DISCONNECT THE FLOW CELL, OTHER PURGING EQUIPMENT FROM THE PUMP DISCHARGE TUBE;
- COLLECT SAMPLES FROM THE PUMP DISCHARGE TUBE;
- COLLECT LARGE VOLUME SAMPLES FIRST (e.g. LITER BOTTLES FOR METALS) AND VOC SAMPLES LAST;
- FOR VOCs REDUCE TO 100-200 mL/min PRIOR TO COLLECTION.

IN THE EVENT THAT A PERISTALTIC PUMP IS UTILIZED FOR SAMPLING, ORGANIC COMPOUND SAMPLES SHOULD NOT BE COLLECTED FROM THE PUMP HEAD TUBING. THE COLLECTION OF ORGANIC COMPOUND SAMPLES SHOULD BE CONDUCTED IN A MANNER THAT WILL PREVENT LOSS OF ORGANIC ANALYSES BY DEGASSING AT THE PUMP HEAD. COLLECTION OF ORGANIC ANALYSES FROM A PERISTALTIC PUMP SHOULD BE COLLECTED IN ACCORDANCE WITH THE METHODOLOGY OUTLINED IN THE USEPA REGION IV SEDS PUBLICATION, "FIELD BRANCHES QUALITY SYSTEM AND TECHNICAL PROCEDURES".

5. LOW-FLOW PURGING/SAMPLING - UNABLE TO ACHIEVE PARAMETER STABILIZATION
IF, AFTER THREE WELL VOLUMES HAVE BEEN REMOVED, THE CHEMICAL PARAMETERS HAVE NOT STABILIZED ACCORDING TO THE ABOVE CRITERIA, TWO ADDITIONAL WELL VOLUMES SHOULD BE REMOVED. MONITORING OF INDICATOR PARAMETERS SHOULD CONTINUE DURING ADDITIONAL PURGING. IF PARAMETER STABILIZATION IS STILL NOT ACHIEVED AFTER FIVE WELL VOLUMES ARE PURGED, THE SAMPLING TEAM CAN COLLECT A SAMPLE. THE CONDITIONS OF SAMPLING WILL BE NOTED IN THE FIELD LOG OR FIELD FORMS.
6. LOW-YIELD FORMATIONS
IN SOME SITUATIONS, EVEN WITH VERY SLOW PURGE RATES, THE WELL DRAWDOWN MAY NOT STABILIZE AND THE WELL MAY BE PUMPED DRY. PUMPING TO DRYNESS GENERALLY CONSTITUTES AN ADEQUATE PURGE, AND THE WELL CAN BE SAMPLED PROVIDED THERE IS SUFFICIENT RECOVERY (ENOUGH VOLUME TO ALLOW FILLING OF SAMPLE CONTAINERS). IT IS NOT NECESSARY THAT THE WELL BE EVACUATED THREE TIMES BEFORE IT IS SAMPLED. PUMPING WELL TO DRYNESS SHOULD BE AVOIDED EXCEPT IN CASES WHERE IT IS INEVITABLE DUE TO DOCUMENTED LOW YIELD CONDITIONS.
7. FIELD RECORDS
FIELD INFORMATION MUST BE RECORDED DURING PURGING AND SAMPLING. AT A MINIMUM, THE FOLLOWING INFORMATION SHOULD BE INCLUDED IN THE FIELD FORMS FOR EACH GROUNDWATER MONITORING WELL. INFORMATION INCLUDES:
- PURGE VOLUMES;
 - DEPTH TO WATER
 - FIELD MEASUREMENTS DURING PURGING AND AT THE TIME OF SAMPLE COLLECTION; AND
 - GENERAL WEATHER CONDITIONS OR OTHER COMMENTS;
- THESE DATA ARE TO BE RECORDED ON FIELD FORMS AND/OR IN A DATA LOGGER AND SUPPLIED WITH THE LABORATORY ANALYTICAL REPORTS.

I, EVAN B. PERRY, CERTIFY THAT I AM A QUALIFIED GROUNDWATER SCIENTIST DEMONSTRATED BY A GEORGIA STATE REGISTERED PROFESSIONAL GEOLOGIST CERTIFICATION. I HAVE SUFFICIENT TRAINING AND EXPERIENCE IN GROUNDWATER HYDROLOGY AND RELATED FIELDS TO MAKE SOUND PROFESSIONAL JUDGMENTS REGARDING GROUNDWATER MONITORING AND CONTAMINANT FATE AND TRANSPORT. I FURTHER CERTIFY THAT THE DESIGN OF THE GROUNDWATER MONITORING SYSTEM WAS DESIGNED IN COMPLIANCE WITH THE RULES OF SOLID WASTE MANAGEMENT, CHAPTER 391-3-4, AS SPECIFIED IN [391-3-4-.14(1)(2)(b)].

EVAN. B. PERRY
GEORGIA P.G. REGISTRATION NO. 1744

TABLE 1
APPENDIX I ANALYTICAL REQUIREMENTS

PARAMETER SUITE	MINIMUM SAMPLE VOLUME	CONTAINER TYPE	TEST METHODS*	PRESERVATIVES	HOLD TIME
APPENDIX I VOLATILE ORGANIC COMPOUNDS	40 mL	G, T	8260	HCL AND/OR 4° C	7-14 DAYS
APPENDIX I METALS	250 mL	P	6010 OR 6020	HNO ₃	180 DAYS

NOTES:

1. APPENDIX I OF THE GEORGIA RULES FOR SOLID WASTE MANAGEMENT 391-3-4-.14.
2. ASSESSMENT MONITORING ANALYTES ARE INCLUDED IN APPENDIX II OF THE GEORGIA RULES FOR SOLID WASTE MANAGEMENT 391-3-4-.14. THE NELAP CERTIFIED LABORATORY PERFORMING THE ANALYSIS SHOULD BE CONSULTED REGARDING ANALYTICAL REQUIREMENTS FOR THE APPLICABLE PARAMETER SUITES.
3. VALUE LISTED IS THE MINIMUM REQUIREMENT; ADDITIONAL VOLUME MAY BE PROVIDED IF REQUESTED BY ANALYTICAL LABORATORY.
4. METHOD 8011 MAY BE SUBSTITUTED FOR 8260B TO ANALYZE FOR:
- 1,2-DIBROMO-3-CHLOROPROPANE (DBCP) AND 1,2-DIBROMOETHANE (EDB).
5. THE USE OF HCL AS A PRESERVATIVE INCREASES THE HOLDING TIME FROM 7 TO 14 DAYS.
6. REPORTING LIMITS (RLs)/PRACTICAL QUANTITATION LIMITS (PQLs) FOR THE ANALYTICAL METHODS ASSOCIATED WITH THE APPENDIX I AND II CONSTITUENTS WILL BE EQUAL TO (OR LESS THAN) THE ESTABLISHED USEPA DRINKING WATER MAXIMUM CONTAMINANT LEVELS (MCL) OR APPLICABLE GROUNDWATER PROTECTION STANDARDS. IN THE EVENT THAT RLs/PQLs CANNOT ACHIEVE THE APPROPRIATE STANDARD, SUPPORTING DOCUMENTATION FROM THE ANALYTICAL LABORATORY WILL BE PROVIDED.
- G = GLASS
P = POLYETHYLENE
T = TEFLON-LINED SEPTA
HCL = HYDROCHLORIC ACID
HNO₃ = NITRIC ACID

TABLE 2
40 CFR 257 APPENDIX III ANALYTICAL REQUIREMENTS

PARAMETER SUITE	CONTAINER TYPE	TEST METHODS*	PRESERVATIVES	HOLD TIME
BORON, CALCIUM	P	6010 OR 6020	HNO ₃	180 DAYS
CHLORIDE, FLUORIDE, SULFATE	P	300.0	4° C	28 DAYS
pH	NONE	FIELD MEASURE- MENT	NONE	NONE
TOTAL DISSOLVED SOLIDS	P	SM 2540C	4° C	7 DAYS

NOTES:

P = POLYETHYLENE
ASSESSMENT MONITORING ANALYTES ARE INCLUDED IN APPENDIX IV OF 40 CFR 257. THE NELAP CERTIFIED LABORATORY PERFORMING THE ANALYSIS SHOULD BE CONSULTED REGARDING ANALYTICAL REQUIREMENTS FOR THE APPLICABLE PARAMETER SUITES.
ANALYSIS METHODS FROM "TEST METHODS FOR EVALUATING SOLID WASTE, PHYSICAL/CHEMICAL METHODS" SW-846 THIRD ED. USEPA, SEPT. 1986.

TABLE 3
SURFACE WATER PARAMETERS ANALYTICAL REQUIREMENTS

PARAMETER SUITE	CONTAINER TYPE	TEST METHODS*	PRESERVATIVES	HOLD TIME
pH		FIELD MEASUREMENT		
SPECIFIC CONDUCTANCE		FIELD MEASUREMENT		
TEMPERATURE		FIELD MEASUREMENT		
TURBIDITY		FIELD MEASUREMENT		
CHLORIDE	P	300.0	4° C	28 DAYS
TOTAL ORGANIC CARBON	G, T	9060	HCL & 4° C	
CHEMICAL OXYGEN DEMAND	T, P	410.4	H2SO4 & 4° C	
DISSOLVED OXYGEN	FIELD MEASUREMENT			
TOTAL ARSENIC	P	6010/6020	HNO3	180 DAYS
TOTAL BARIUM	P	6010/6020	HNO3	
TOTAL CADMIUM	P	6010/6020	HNO3	
TOTAL CHROMIUM	P	6010/6020	HNO3	
TOTAL CYANIDE	P	9012	NaOH	
TOTAL LEAD	P	6010/6020	HNO3	
TOTAL MERCURY	P	6010/6020	HNO3	
TOTAL NICKEL	P	6010/6020	HNO3	
TOTAL SELENIUM	P	6010/6020	HNO3	
TOTAL SILVER	P	6010/6020	HNO3	
TOTAL ZINC	P	6010/6020	HNO3	

NOTES:

G = GLASS
P = POLYETHYLENE
T = TEFLON-LINED SEPTA
HCL = HYDROCHLORIC ACID
H₂SO₄ = SULFURIC ACID
HNO₃ = NITRIC ACID
NaOH = SODIUM HYDROXIDE

ANALYTES INCLUDED IN APPENDIX III OF 40 CFR 257 AND SHOWN IN TABLE 2 WILL BE ADDED TO LOCATIONS ASSOCIATED WITH CELL 11 AND THE WESTERN CELL AREA.

ANALYSIS METHODS FROM "TEST METHODS FOR EVALUATING SOLID WASTE, PHYSICAL/CHEMICAL METHODS" SW-846 THIRD ED. USEPA, SEPT. 1986.

* ANALYTICAL METHODS USED AND REFERENCED FOR MEETING ENVIRONMENTAL TESTING REQUIREMENTS EVOLVE OVER TIME DUE TO CHANGES IN TECHNOLOGY, UPDATES AND ADDITIONS TO PUBLISHED METHODOLOGY, AND WHEN REGULATIONS CHANGE TO REQUIRE REFERENCE TO DIFFERENT METHODS. IN MANY INSTANCES THERE ARE EQUIVALENT METHODS FOR THE SAME ANALYTE. PUBLISHED BY DIFFERENT AUTHORITIES ON METHOD DEVELOPMENT. E.G. THE U.S. EPA OFFICE OF WATER, U.S. EPA OFFICE OF SOLID WASTE, STANDARD METHODS, AND ASTM. ANALYTICAL METHODS LISTED IN THE PLAN MAY BE SUBSTITUTED PROVIDED THAT THE ALTERNATE METHODS ARE GENERALLY APPROVED FOR USE, PROVIDE TECHNICALLY DEFENSIBLE DATA, AND ARE APPROPRIATE FOR THE MEDIA BEING TESTED. THE USE OF ALTERNATIVE APPROVED METHODS IS CONSIDERED AN ACCEPTABLE DEVIATION FROM THE PRESCRIBED METHODS IN THE GWMP AND WILL NOT BE CONSIDERED A VIOLATION OF THE REQUIREMENTS OF THE GWMP.

TABLE 4
SAMPLE ANALYSIS SCHEDULE

LOCATIONS	1st Semi-Annual Event	2nd Semi-Annual Event
GROUNDWATER		
GWA-3, GWA-14, GWA-16, GWA-17, GWA-20B, GWA-21, GWA-10, GWA-12, GWA-13, GWA-14, GWA-18, GWA-19, GWA-20A, GWA-22, GWA-23A, GWA-23B, GWA-24B	Constituents listed in Appendix I of 40 CFR 258	Constituents listed in Appendix I of 40 CFR 258
GWC-11, GWC-15	Constituents listed in Appendix I of 40 CFR 258 (includes Appendix I)	Constituents listed in Appendix I of 40 CFR 258
GWC-25, GWC-26, GWC-27, GWC-28, GWC-29, GWC-30, GWC-31, GWC-32, GWC-33, GWC-34, GWC-35, GWC-36, GWC-37, GWC-38, GWC-39, GWC-40, GWC-41, GWC-42, GWC-43, GWC-44, GWC-45, GWC-46, GWC-47, GWC-48, GWC-49, GWC-50, GWC-51	Constituents listed in Appendix I of 40 CFR 258, plus those listed in Appendix III of 40 CFR 257	Constituents listed in Appendix I of 40 CFR 258, plus those listed in Appendix III of 40 CFR 257
CONVEYANCE/UNDERDRAIN		
SWC-7	Constituents listed in Appendix I of 40 CFR 258	Constituents listed in Appendix I of 40 CFR 258
SWB-1A/B, SWB-2A/B, SWB-3A/B, SWB-4A/B	Constituents listed in Appendix I of 40 CFR 258, plus those listed in Appendix III of 40 CFR 257	Constituents listed in Appendix I of 40 CFR 258, plus those listed in Appendix III of 40 CFR 257
SURFACE WATER		
SWA-3, SWC-4	Constituents listed in Table 3 of this Sheet	Constituents listed in Table 3 of this Sheet
SWA-2, SWC-10, SWC-14, SWC-16	Constituents listed in Table 3 of this Sheet, plus those listed in Appendix III of 40 CFR 257	Constituents listed in Table 3 of this Sheet, plus those listed in Appendix III of 40 CFR 257
SEDIMENT PONDS		
SWC-3, SWC-5, SWC-6, SWC-8, SWC-9	Constituents listed in Table 3 of this Sheet	Constituents listed in Table 3 of this Sheet
GEORGIA Environmental Protection Division Solid Waste Management Program SWC-11, SWC-13, SWC-15, SWC-17 MAJOR MODIFICATION APPROVAL SOLID WASTE PERMIT NO. 006-090 (MSW)	Constituents listed in Table 3 of this Sheet, plus those listed in Appendix III of 40 CFR 257	Constituents listed in Table 3 of this Sheet, plus those listed in Appendix III of 40 CFR 257
REVIEWED BY: <i>[Signature]</i> DATE: 3/17/17 APPROVED BY: <i>[Signature]</i> DATE: 3/17/17 LEACHATE		
CCR CELL LEACHATE (DELL 11 AND WESTERN CELL AREA)	Total Alkalinity, Specific Conductance, Total Dissolved Solids, Chemical Oxygen Demand, Metals included in Appendix I of 40 CFR 258, Constituents listed in Appendix III of 40 CFR 257	Total Alkalinity, Specific Conductance, Total Dissolved Solids, Chemical Oxygen Demand, Metals included in Appendix I of 40 CFR 258, Constituents listed in Appendix III of 40 CFR 257
SOLID WASTE MANAGEMENT PROGRAM MSW CELL LEACHATE	Total Alkalinity, Specific Conductance, Total Dissolved Solids, Chemical Oxygen Demand, Constituents included in Appendix I of 40 CFR 258	Total Alkalinity, Specific Conductance, Total Dissolved Solids, Chemical Oxygen Demand, Constituents included in Appendix I of 40 CFR 258

NOTES:

1. THE LIST OF ANALYTES PRESENTED IN THIS TABLE IS CURRENT AS OF THE TIME OF PERMITTING (OCTOBER 2016). FUTURE CHANCES TO THIS LIST MAY OCCUR (E.G. DESIGNATION OF FUTURE CELLS FOR CCR PLACEMENT THAT NECESSITATE THE ADDITION OF APPENDIX III CONSTITUENTS TO SIDE/DOWNGRADIENT WELLS, DOWNSTREAM SURFACE WATER POINTS, SEDIMENT POND OUTFALLS, OR COVEYANCES/UNDERDRAINS OR WELLS MOVING INTO OR OUT OF ASSESSMENT MONITORING). THESE CHANGES WILL BE REFLECTED IN ROUTINE SEMI-ANNUAL GROUNDWATER AND SURFACE WATER MONITORING REPORTS.

2. SEDIMENT POND OUTFALLS ARE ALSO REGULATED BY EPD UNDER THE FACILITY'S NPDES PERMIT. THE PERMIT REQUIREMENTS (GAR050000) IN PLACE AS OF OCTOBER 2016 REQUIRE ANNUAL MONITORING FOR BIOLOGICAL OXYGEN DEMAND (BOD), TOTAL SUSPENDED SOLIDS, AMMONIA, ALPHA-TERPINOL, BENZOIC ACID, p-CRESOL, PHENOL, TOTAL ZINC, AND pH DURING A QUALIFYING STORM EVENT. AN ALTERNATE LIST MAY BE SUBSTITUTED IF ACCEPTABLE TO EPD. FUTURE ANALYSIS LISTS ARE SUBJECT TO CHANGE AS PERMITS EXPIRE AND ARE RENEWED.



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PROJECT:
R&B LANDFILL
HORIZONTAL
EXPANSION
BANKS COUNTY, GEORGIA



610 BENNETT ROAD
HOMER, GEORGIA 30547

REVISIONS

0. Issued for Permitting	08/06/2014
1. Revised per EPD Comments	05/15/2015
2. Revised per EPD Comments	03/11/2016
3. Revised per EPD Comments	05/19/2016
4. Revised per EPD Comments	10/14/2016

Drawn by: BFH
Checked by: JEH

PROJECT NUMBER:

I002-327

August 2014

GROUNDWATER
MONITORING PLAN

P:\Industrial\0002 - Waste Management-Atlanta\415 - WMM CCR Plans\R&B\2-Design Data\1 - DWGs\0002-327-46-Odor Management Plan.dwg 5/15/17 BETH HEADRICK

STEP 1-WASTE ACCEPTANCE

- ## STEP 2—LANDFILL COVER

- THE FINAL COVER SYSTEM WILL PROVIDE FOR A MORE EFFECTIVE BARRIER TO GAS AND ODOR MIGRATION AHEAD OF SCHEDULE. HOWEVER, CONSTRUCTION OF THE FINAL COVER SYSTEM IS PLANNED TO FOLLOW THE CAPPING SCHEDULE OUTLINED ON SHEET #5. IF SIGNIFICANT AREAS ARE AT FINAL GRADE, THE LOCAL MAY BE CLOSED TO TRAFFIC TO ALLOW CONSTRUCTION OF THE FINAL CLOSURE. CONSTRUCTION MAY BE DEFERRED TO THE NEXT CONSTRUCTION SEASON, A TYPICAL CONSTRUCTION SEASON IS BETWEEN JUNE AND OCTOBER. THE AREAS ALREADY UNDER A FINAL COVER SYSTEM WILL BE INSPECTED FOR EROSION RILLS AND DAMAGE TO THE COVER SYSTEM. THE SITE MANAGER OR DESIGNER WILL VERIFY THAT THE FINAL COVER SYSTEM IS SATISFACTORY. ONCE DAMAGE AREA IS IDENTIFIED ANY REPAIR WORK WILL BE INITIATED IMMEDIATELY.

A GCCS WILL BE INSTALLED AT THE R&B LANDFILL IN ORDER TO COLLECT LANDFILL GAS AND ODORS GENERATED BY THE WASTE AS IT GOES THROUGH THE DECOMPOSITION PROCESS. THE GCCS WILL BE INSTALLED IN PHASES AND AT TIMES AS REQUIRED BY THE LANDFILL'S TITLE V PERMIT, OR SOONER IF SITE-SPECIFIC REASONS (ODORS) DICTATE. THE LAYOUT OF THE GCCS IS SHOWN ON SHEET 35 OF THESE PLANS.

PRIOR TO THE CONSTRUCTION OF ANY PHASE OF THE GCCS THAT MAY RESULT IN THE EXCAVATION OR DISTURBANCE OF ANY ASBESTOS CONTAINING WASTE DEPOSITED AT THE FACILITY, WRITTEN NOTIFICATION OF THE CONSTRUCTION ACTIVITY WILL BE MADE TO THE EPD AIR BRANCH AT LEAST 45 DAYS PRIOR TO COMMENCING THE ACTIVITY.

STEP 3—ODOR COUNTERACTANTS

- #### STEP 4—ACTIVE LANDFILL GAS EXTRACTION SYSTEM

- ## STANDARD OPERATING PROCEDURES DURING TRENCHING OR EXCAVATION OF WASTE MATERIALS

1. CONSTRUCTION ACTIVITIES WILL BE STAGED TO ALLOW THE CONSTRUCTION CREW TO SEQUENCE THEIR ACTIVITIES IMMEDIATELY AFTER A TRENCH IS OPENED.
2. AS SOON AS THE ON-SITE CONSTRUCTION QUALITY ASSURANCE (COA) PERSONNEL HAVE APPROVED THE TIE-IN OR OTHER CONSTRUCTION ACTIVITIES WITHIN THE EXCAVATION, THE TRENCH WILL BE BACKFILLED WITH THE SPECIFIED MATERIAL.
3. ALL OPEN TRENCHES WILL BE BACKFILLED WITH SOIL AT THE END OF THE WORKING DAY
4. A TEMPORARY ODOR CONTROL MISTING DEVICE MAY BE PLACED NEAR TRENCHING OR WASTE EXCAVATION ACTIVITIES.

SOLID WASTE
MANAGEMENT PROGRAM

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CONSTRUCTION QUALITY ASSURANCE PLAN CONTINUED FROM SHEET 52

FOR THOSE TESTS WHERE RESULTS ARE REPORTED FOR BOTH MACHINE AND CROSS DIRECTION, EACH RESULT WILL BE COMPARED TO THE LISTED SPECIFICATION TO DETERMINE ACCEPTANCE. THE FOLLOWING PROCEDURE WILL BE USED FOR INTERPRETING RESULTS:

- IF THE VALUE MEETS THE STATED SPECIFICATION, THEN THE ROLL AND THE LOTS WILL BE ACCEPTED FOR USE IN THE LINERS FOR THE JOB SITE.
- IF THE RESULT DOES NOT MEET THE SPECIFICATION, THE ROLL AND ALL OTHER ROLLS BETWEEN OTHER PASSING TESTS SHALL BE REJECTED. AT THE DISCRETION OF THE PROJECT MANAGER, THE ROLL OR ROLLS MAY BE RETESTED USING ADDITIONAL SAMPLES, WHICH BOUND THE FAIL TEST. TWO ADDITIONAL TESTS MUST BE PERFORMED FOR THE FAILED TEST PROCEDURE. IF BOTH OF THE RETESTS ARE ACCEPTABLE, THEN THE MATERIAL BETWEEN PREVIOUS AND SUBSEQUENT PASSING TESTS IS UNSUITABLE AND SHALL BE REJECTED.

4.5 RECOMPACTED LINER BASE
THE RECOMPACTED LINER BASE OF THE LANDFILL AS SHOWN OF THE DRAWINGS SHALL CONSIST OF A MINIMUM OF 2.0 FEET OF LOW PERMEABILITY NATURAL OR AMENDED SOIL LINER MATERIAL.

PRIOR TO ACCEPTANCE OF ANY MATERIAL FOR USE AS RECOMPACTED LINER BASE, THE SOILS QUALITY ASSURANCE MANAGER WILL VISIT THE POTENTIAL BORROW AREA(S) TO VISUALLY OBSERVE AND FIELD CLASSIFY THE MATERIAL. UPON PRELIMINARY ACCEPTANCE BY THE SOILS QUALITY ASSURANCE MANAGER, BASED ON FIELD CLASSIFICATION, A SAMPLE OF REPRESENTATIVE MATERIAL FROM EACH BORROW SOURCE WILL BE OBTAINED AND TRANSPORTED TO THE SOIL TESTING LABORATORY FOR PRE-QUALIFICATION TESTING.

EACH SERIES OF PREQUALIFICATION TESTS WILL CONSIST OF DETERMINATIONS OF NATURAL MOISTURE CONTENT, GRAIN SIZE DISTRIBUTION, ATTERBERG LIMITS, MOISTURE- DENSITY RELATIONSHIP AND HYDRAULIC CONDUCTIVITY. THE LOW PERMEABILITY SOIL USED FOR LINER CONSTRUCTION SHALL HAVE AN IN-PLACE COMPACTED SATURATED HYDRAULIC CONDUCTIVITY EQUAL TO OR LESS THAN 1×10^{-5} CM/SEC. WITHIN THE DENSITY AND MOISTURE CONTENT RANGE SPECIFIED FOR CONSTRUCTION, THE UPPER 6 INCHES OF THE RECOMPACTED LINER BASE SHALL BE FREE OF PARTICLES GREATER THAN .25 INCHES IN ANY DIMENSION. THE LOWER 18 INCHES OF RECOMPACTED LINER BASE SHALL BE FREE OF STONES OR OTHER PARTICLES GREATER THAN 3 INCHES IN DIAMETER. THE RECOMPACTED LINER BASE SHALL BE FREE OF ROOTS OR OTHER UNSUITABLE MATERIALS AS DETERMINED BY THE SOILS QUALITY ASSURANCE CONSULTANT.

TABLE 3 PRESENTS THE MINIMUM TESTING FREQUENCY OF PREQUALIFICATION TESTING FOR THE BORROW SOURCE.

TABLE 3 MATERIAL PROPERTY REQUIREMENTS BORROW SOURCE RECOMPACTED LINER BASE			
ITEM	ASTM	TEST FREQUENCY	REQUIREMENTS
WATER CONTENT	D-2216,D-4643, D-4944, D-4954	1 TEST PER 1,000 CU YD AND EACH CHANGE IN MATERIAL TYPE	NA
ATTERBERG LIMITS	D-4318-84	1 TEST PER 5,000 CU YD AND EACH CHANGE IN MATERIAL TYPE	NA
SIEVE ANALYSIS	D-422-63	1 TEST PER 1,000 CU YD AND EACH CHANGE IN MATERIAL TYPE	TOP 6"≤ ½" LOWER 18"≤ 3"
STANDARD PROCTOR	D-698	1 TEST PER 5,000 CU YD AND EACH CHANGE IN MATERIAL TYPE	NA
RECOMPACTED HYDRAULIC CONDUCTIVITY	D-5084	1 TEST PER 10,000 CU YD AND EACH CHANGE IN MATERIAL TYPE	1 X 10 ⁻⁵ CM/SEC (MAXIMUM)

4.6 PROTECTIVE COVER SOIL - PREQUALIFICATION TESTING
THE PROTECTIVE COVER LAYER USED AS PART OF THE LEACHATE COLLECTION SYSTEM SHALL CONSIST OF A MINIMUM TWO FOOT PROTECTIVE LAYER OF SOIL MATERIAL WITH AN UNSPECIFIED HYDRAULIC CONDUCTIVITY. THE MATERIAL SHALL CONTAIN NO AGGREGATE, ROCKS, DEBRIS, PLANT MATERIAL, OR OTHER SOLID MATERIAL LARGER THAN 3 INCH DIAMETER. THE LEACHATE COLLECTION MATERIAL CALCIUM CARBONATE CONTENT SHALL BE LESS THAN 5 PERCENT IN WEIGHT. A DOUBLE-SIDED GEOCOMPOSITE DRAINAGE LAYER (A GEONET HEAT BONDED TO A GEOTEXTILE ON EACH SIDE) SHALL BE PLACED UNDER THE 2 FOOT PROTECTIVE SOIL LAYER. SOIL PLACEMENT OVER THE GEOCOMPOSITE WILL BE PERFORMED BY PUSHING SOIL UPSLOPE. PREQUALIFICATION TESTING OF THE PROTECTIVE COVER SOIL SHALL BE IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:

ITEM	ASTM	TEST FREQUENCY	MINIMUM REQUIREMENTS
SIEVE ANALYSIS	D-422-63	1 PER BORROW SOURCE	≤ 3"
CALCIUM CARBONATE	D-4373	1 PER BORROW SOURCE	< 5%
RECOMPACTED HYDRAULIC CONDUCTIVITY	D-5084	NONE	N/A

4.7 LEACHATE COLLECTION PIPING
THE PIPING SHALL BE 6" HDPE (PE4710 SDR 11 FOR MSW CELLS AND CELLS 11A & B AND PE4710 SDR 9 FOR COR CELLS IN WEST DISPOSAL AREA) PERFORATED AS SHOWN ON THE DRAWINGS. THE STONE ENVELOPE SHALL MEET REQUIREMENTS OF SECTION 4.10.

4.8 GEOTEXTILES
THE GEOTEXTILES USED IN CONSTRUCTION SHALL BE 8 OZ/SY AND MEET THE REQUIREMENTS OF TABLE 4.

TABLE 4 GEOTEXTILE PROPERTIES AND TEST METHODS				
PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	REQUIRED TEST VALUE
MASS/UNIT AREA	ASTM D5261	1 PER 100,000 SF	1 PER 250,000 SF	8 OZ/SY
APPARENT OPENING SIZE ⁽¹⁾	ASTM D4751	1 PER 540,000 SF	1 PER PROJECT	0.18 MM
GRAB STRENGTH	ASTM D4632	1 PER 100,000 SF	1 PER 250,000 SF	220 LBS
CBR PUNCTURE	ASTM D6241	1 PER 100,000 SF	1 PER 250,000 SF	575 LBS
UV RESISTANCE ⁽²⁾	ASTM D4355	1 PER RESIN FORMULATION	N/A	70%
PERMITTIVITY	ASTM D4491	1 PER 540,000 SF	1 PER PROJECT	1.3 SEC ⁻¹

NOTES:

- AOS AND PERMITTIVITY SHALL ONLY BE TESTED FOR GEOTEXTILES USED IN FILTER APPLICATIONS. REQUIRED TEST VALUES SHOWN FOR AOS IS MAXIMUM. ALL OTHER REQUIRED TEST VALUES ARE MINIMUM VALUES.
- AFTER 500 HOURS OF EXPOSURE.

4.9 GEOCOMPOSITE
THE GEOCOMPOSITE WILL BE CONSTRUCTED WITH A HDPE GEONET THAT HAS A 8 OZ. NON-WOVEN GEOTEXTILE HEAT BONDED TO BOTH SIDES. THE GEONET WILL BE MANUFACTURED TO MEET MINIMUM PHYSICAL, MECHANICAL, AND CHEMICAL PROPERTIES REQUIRED TO PROVIDE LONG-TERM DRAINAGE PERFORMANCE. THE FOLLOWING PROPERTIES, TEST METHODS AND TEST FREQUENCIES SHALL BE USED BY THE MANUFACTURERS AND QUALITY ASSURANCE MANAGER:

GEONET PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	REQUIRED TEST VALUE
DENSITY (MIN. AVE.)	ASTM D792 OR ASTM D1505	1 PER 100,000 SF	1 PER 250,000 SF	0.940 G/CC
COMPRESSIVE STRENGTH (MIN. AVE.)	ASTM D6364	1 PER 100,000 SF	1 PER 250,000 SF	(SEE NOTE 3)
CARBON BLACK CONTENT (RANGE)	ASTM D1603 ⁽²⁾	1 PER 100,000 SF	1 PER 250,000 SF	2-3%

GEOCOMPOSITE PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	REQUIRED TEST VALUE
PEEL STRENGTH (MIN. AVE.)	ASTM D7005	1 PER 100,000 SF	1 PER 250,000 SF	0.75 LB/IN
TRANSMISSIVITY ⁽¹⁾ (MIN.)	ASTM D4716	1 PER PROJECT	1 PER PROJECT	(SEE NOTE 1)

1) TRANSMISSIVITY SHALL BE MEASURED IN A 12-INCH X 12-INCH BOX WITH ADJACENT CONDITIONS MATCHING DETAIL, 100 HOUR DURATION AND 0.1 GRADIENT. FOR MSW CELL BASE LINER GEOCOMPOSITE THE VALUE SHALL BE AT LEAST 2.07×10^{-3} M²/SEC AT 700 PSF, 8.89×10^{-4} M²/SEC AT 3,500 PSF, 2.37×10^{-4} M²/SEC AT 14,700 PSF AND 2.96×10^{-4} M²/SEC AT 18,900 PSF. FOR COR CELL BASE LINER GEOCOMPOSITE THE VALUE SHALL BE AT LEAST 1.86×10^{-3} M²/SEC AT 1,150 PSF, 8.89×10^{-4} M²/SEC AT 5,750 PSF, 2.51×10^{-4} M²/SEC AT 14,950 PSF, 2.07×10^{-4} M²/SEC AT 24,150 PS AND 1.63×10^{-4} M²/SEC AT 31,050 PSF. THE TRANSMISSIVITY OF THE MATERIALS INSTALLED SHALL BE EQUAL TO OR GREATER THAN THE CONDITIONS STATED ABOVE BASED ON THE SPECIFIC CONDITION LOADING EXPECTED AT EACH LANDFILL AREA. FOR FINAL COVER GEOCOMPOSITE THE VALUE SHALL BE AT LEAST 1.30×10^{-3} M²/SEC AT 250 PSF.

2) OTHER METHODS SUCH AS D4218 (MUFFLE FURNACE) OR MICROWAVE METHODS ARE ACCEPTABLE IF AN APPROPRIATE CORRELATION TO D1603 (TUBE FURNACE) CAN BE ESTABLISHED.

3) COMPRESSIVE STRENGTH REQUIRED VARIES BY LOCATION. MSW CELL BASE LINER GEONET WITH MAXIMUM HEIGHT OF WASTE OF 210 FEET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 15,000 PSF, GEONET WITH MAXIMUM HEIGHT OF WASTE OF MORE THAN 210 FEET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 20,000 PSF. COR CELL BASE LINER GEONET WITH MAXIMUM HEIGHT OF WASTE OF 130 FEET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 15,000 PSF, GEONET WITH MAXIMUM HEIGHT OF WASTE OF 210 FEET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 25,000 PSF, AND GEONET WITH MAXIMUM HEIGHT OF WASTE OF MORE THAN 210 FEET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 31,100 PSF. THE FINAL COVER GEONET SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 1,000 PSF.

4.10 LEACHATE COLLECTION GRAVEL

THE LEACHATE COLLECTION GRAVEL ENVELOPE SURROUNDING THE LEACHATE COLLECTION PIPES SHALL CONSIST OF WASHED GRAVEL AND SHALL BE CLEAN, ROUNDED, SUBSTANTIALLY NON-CARBONATE AGGREGATE, SIZE NO.4 PER GEORGIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR CONSTRUCTION OF ROADS AND BRIDGES, TABLE 800.01.H. THE LEACHATE COLLECTION GRAVEL CALCIUM CARBONATE CONTENT SHALL BE LESS THAN 5 PERCENT BY WEIGHT.

THE MATERIAL SUPPLIER SHALL PROVIDE THE QUALITY ASSURANCE MANAGER A REPRESENTATIVE SAMPLE OF MATERIAL FOR QUALITY ASSURANCE TESTING. EACH SOURCE SHALL BE TESTED AT LEAST ONCE FOR GRADATION AND CALCIUM CARBONATE CONTENT.

THE GEOTEXTILE SHALL BE REMOVED FROM THE UPPER SURFACES OF THE THE LEACHATE COLLECTION PARALLEL ENVELOPE TO ALLOW DIRECT CONTACT WITH MSW WHEN WASTE DISPOSAL IS INITIATED. ALTERNATELY WHEN COR WASTE IS GROWTH, THE GEOTEXTILE SHALL BE IN DIRECT CONTACT WITH THE LEACHATE COLLECTION GRAVEL ENVELOPE. THE GEOTEXTILE WILL REMAIN TO PREVENT DIRECT CONTACT BETWEEN THE COR WASTE AND GRAVEL.

4.11 PROTECTIVE COVER SOIL - CONSTRUCTION TESTING

THE COVER SOIL SHALL CONSIST OF 2 FEET OF EITHER ON-SITE OR OFF-SITE MATERIAL WITH A MAXIMUM PARTICLE SIZE OF 3 INCHES. THE PROTECTIVE COVER SOIL SHALL HAVE NO SPECIFIED PERMEABILITY. SOIL PLACEMENT OVER THE GEOCOMPOSITE WILL BE PERFORMED BY PUSHING SOIL UPSLOPE. DURING CONSTRUCTION TESTING OF THE PROTECTIVE COVER SOIL SHALL BE IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:

ITEM	ASTM	TEST FREQUENCY	MINIMUM REQUIREMENTS
SIEVE ANALYSIS	D-422-63	1 PER 1,500 CU YD	≤ 3"
RECOMPACTED HYDRAULIC CONDUCTIVITY	D-5804	NONE	N/A

4.12 FINAL COVER- COMPACTED SOIL LAYER

THE COMPACTED SOIL LAYER SHALL BE A MINIMUM OF 18 INCHES OF EITHER ON-SITE OR OFF-SITE MATERIAL WITH A MAXIMUM PARTICLE SIZE OF 3 INCHES IN THE LOWER 6 INCH LIFT AND A MAXIMUM OF 0.25 INCHES IN THE UPPER 6 INCH LIFT. THE SOIL COVER HAS NO SPECIFIED PERMEABILITY AND SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF THE MAXIMUM DRY DENSITY DETERMINED BY ASTM D698, STANDARD PROCTOR DURING COMPACTION. THE THICKNESS OF COMPACTED LIFTS SHALL NOT EXCEED 6-INCHES.

PRIOR TO ACCEPTANCE OF ANY MATERIAL FOR USE IN THE COMPACTED SOIL LAYER, THE SOILS QUALITY ASSURANCE MANAGER WILL VISIT THE POTENTIAL BORROW AREA(S) TO VISUALLY OBSERVE AND FIELD CLASSIFY THE MATERIAL. UPON PRELIMINARY ACCEPTANCE BY THE SOILS QUALITY ASSURANCE MANAGER, BASED ON FIELD CLASSIFICATION, A SAMPLE OF REPRESENTATIVE MATERIAL FROM EACH BORROW SOURCE WILL BE OBTAINED AND TRANSPORTED TO THE SOILS TESTING LABORATORY FOR PREQUALIFICATION TESTING. TESTING OF THE COMPACTED SOIL LAYER SHALL BE CONDUCTED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:

ITEM	ASTM	TEST FREQUENCY	MINIMUM REQUIREMENTS
NUCLEAR DESITY/MOISTURE	D-2922-91	1 TEST PER 10,000 SF PER LIFT	95% COMPACTION
DENSITY	D-1556 OR D-2937	EVERY 25 TH NUCLEAR DENSITY TEST	95% COMPACTION
MOISTURE	D-2216 OR D-4643	EVERY 10 TH NUCLEAR DENSITY TEST	N/A
SIEVE ANALYSIS	D-422-63	1 PER 1,500 CU YD	TOP 6" ≤ ½" BOTTOM 6" ≤ 3"
STANDARD PROCTOR	D-698	1 PER BORROW SOURCE	N/A
RECOMPACTED HYDRAULIC CONDUCTIVITY	D-5804	NONE	N/A

4.13 FINAL COVER- GENERAL FILL LAYER

SOIL FOR THE FINAL COVER GENERAL FILL LAYER SHALL CONSIST OF 18-INCHES OF EITHER ON-SITE OR OFF-SITE MATERIAL. CONSTRUCTION QUALITY ASSURANCE FOR THE FINAL COVER GENERAL FILL SOILS SHALL ADHERE TO THE LIMITATIONS AND REQUIREMENTS OF THE PROTECTIVE COVER SOIL LAYER REGARDING PARTICLE SIZE AND PLACEMENT OF MATERIAL. FURTHER, THE GENERAL FILL LAYER MUST BE ABLE TO SUSTAIN VEGETATIVE GROWTH, MINIMIZE EROSION, AND PROTECT THE INTEGRITY OF THE UNDERLYING COMPONENTS OF THE FINAL COVER SYSTEM. TESTING OF THE GENERAL FILL LAYER SHALL BE CONDUCTED IN ACCORDANCE WITH THE TABLE BELOW:

ITEM	ASTM	FREQUENCY
SIEVE ANALYSIS	D-422-63	1,500 CU YD

4.14 INTERFACE FRICTION TESTING

PRIOR TO STARTING A CELL FLOOR OR FINAL COVER CONSTRUCTION PROJECT, THE SELECTED MATERIALS SHALL BE TESTED BY DIRECT SHEAR METHODS AT A MINIMUM FREQUENCY OF 1 TEST PER CELL FOR GEOSYNTHETIC INTERFACES, TESTING SHALL BE IN ACCORDANCE WITH ASTM D5321. FOR GCL INTERFACES, TESTING SHALL BE IN ACCORDANCE WITH ASTM D6243. THE COHESIVE SOIL LINER MATERIAL SHALL BE REMOLED IN ACCORDANCE WITH THE PERMEABILITY TESTING REQUIREMENTS. THE CONDITIONS FOR THE SOIL LINER AND GCL AGAINST THE GEOMEMBRANE AND THE GCL VS THE SOIL LINER MATERIAL SHALL BE AS FOLLOWS: CONSOLIDATED AND INUNDATED FOR 24 HOURS AND SHEAR AT 0.04 IN/MIN WITH AN UNDRAINED CONDITION.

THE CONDITIONS FOR THE GEOMEMBRANE AND THE GEOCOMPOSITE VS THE PROTECTIVE COVER MATERIAL, AS WELL AS THE GEOMEMBRANE VS THE GEOCOMPOSITE SHALL BE AS FOLLOWS: WETTED INTERFACE AND CONSOLIDATE FOR 30 MINUTES AND SHEAR AT 0.04 IN/MIN WITH A DRAINED CONDITION. THE NORMAL STRESSES USED FOR ALL TESTS SHALL INCLUDE THE FOLLOWING: 5 PSI, 50 PSI AND 100 PSI. THE MINIMUM HORIZONTAL DISPLACEMENT SHOULD BE 3 INCHES. ALL TESTING SHALL BE COMPLETED AND RESULTS APPROVED BY THE ENGINEER PRIOR TO FINAL APPROVAL OF THE PROPOSED CONSTRUCTION MATERIALS. THE RESULTS SHALL DEMONSTRATE THAT THE MINIMUM PEAK FRICTION ANGLE FOR ANY INTERFACE CONDITION IN THE CELL FLOOR LINER SYSTEM IS 20° OR GREATER AND THE FINAL COVER SYSTEM IS 24.5° OR GREATER. IF THE RESULTS DO NOT MEET THE MINIMUM REQUIREMENTS, THE DESIGN ENGINEER MAY EVALUATE ALTERNATE MATERIALS OR RE-EVALUATE THE SYSTEM STABILITY AND MINIMUM REQUIREMENTS.

5.0 CONSTRUCTION

5.1 EARTHWORK

5.1.1 SUBGRADE PREPARATION & STRUCTURAL FILL PLACEMENT

THE CONTRACTOR WILL BE RESPONSIBLE FOR PREPARING THE SUBGRADE FOR CONSTRUCTION OF OVERLYING COMPONENTS ACCORDING TO THE APPROVED GRADES. THE SOILS QUALITY ASSURANCE MANAGER WILL REPRESENT TO THE PROJECT MANAGER THAT:

- A LICENSED GEORGIA PROFESSIONAL ENGINEER OR LAND SURVEYOR HAS DETERMINED THAT LINES AND GRADES ARE IN ACCORDANCE WITH DESIGN PLANS.
- THERE ARE NO AREAS EXCESSIVELY SOFTENED BY HIGH WATER CONTENT.
- ANY SUBGRADE AREAS, WHICH WERE UNSTABLE UNDER THE LOADING OF THE COMPACTION EQUIPMENT, HAVE BEEN CORRECTED BY RECOMPACTION OR REMOVAL AND REPLACEMENT WITH STRUCTURAL FILL.

AFTER EXCAVATION TO SUBGRADE ELEVATION, THE CONTRACTOR SHALL PROOF-ROLL THE ENTIRE SUBGRADE WITH LOADED, RUBBER-TIRED SCRAPERS OR OFF ROAD TRUCKS. UNSTABLE AREAS IDENTIFIED DURING PROOF-ROLLING SHALL BE RE-ROLLED TO PROVIDE A SUBGRADE SUFFICIENTLY STABLE TO SUPPORT THE COMPACTION OF OVERLYING MATERIALS. REMOVED MATERIALS WILL BE REPLACED WITH STRUCTURAL FILL MATERIALS CAPABLE OF SUPPORTING THE COMPACTION OF OVERLYING MATERIALS, AND SHALL BE PLACED TO A MAXIMUM 6-INCH THICK COMPACTED LIFT AT A MINIMUM COMPACTION OF 95% OF THE MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D-698, STANDARD PROCTOR.

TABLE 4 SUMMARIZES THE MINIMUM TESTING FREQUENCY REQUIREMENTS FOR COMPACTED STRUCTURAL FILL.

TABLE 6 STRUCTURAL FILL TESTING REQUIREMENTS	
ITEM	FREQUENCY
NUCLEAR DENSITY/MOISTURE (ASTM D-2922-91)	1 TEST PER 10,000 SQUARE FEET PER LIFT
DENSITY (ASTM D-1556 OR D-2937)	EVERY 25TH NUCLEAR DENSITY TEST
MOISTURE (ASTM D-2216 OR D-4643)	EVERY 10TH NUCLEAR MOISTURE TEST
SUBGRADE ELEVATIONS	100 FT. GRID INTERVAL

THE SOILS QUALITY ASSURANCE MANAGER WILL MAINTAIN AN ON-GOING SAMPLING AND TESTING PROGRAM DURING CONSTRUCTION TO DOCUMENT THAT MOISTURE/ DENSITY CURVES ARE REPRESENTATIVE OF THE COMPACTED SOIL. DENSITY TESTS SHALL BE PERFORMED MORE FREQUENTLY AT THE DISCRETION OF THE SOILS QUALITY ASSURANCE CONSULTANT TO PROPERLY CONTROL FIELD COMPACTION OPERATIONS.

5.1.2 RECOMPACTED LINER BASE

THE CONTRACTOR WILL BE RESPONSIBLE FOR CONSTRUCTING THE RECOMPACTED LINER BASE ACCORDING TO THE FOLLOWING SPECIFICATIONS, AND MAINTAINING THE LINES AND GRADES SHOWN ON THE DRAWINGS.

5.1.2.1 MATERIAL PROPERTIES

THE RECOMPACTED LINER BASE MATERIALS SHALL MEET THE REQUIREMENTS AS OUTLINED IN SECTION 4.5. DURING CONSTRUCTION OF THE RECOMPACTED LINER BASE, THE SOILS QUALITY ASSURANCE MANAGER WILL OBTAIN SAMPLES OF THE LINER MATERIAL JUST AFTER COMPACTION. SAMPLES WILL BE OBTAINED ON A MORE FREQUENT BASIS WHEN, IN THE JUDGEMENT OF THE SOILS QUALITY ASSURANCE MANAGER, THE LOW PERMEABILITY SOIL MATERIAL HAS CHANGED.

TABLE 7 SUMMARIZES THE MINIMUM LABORATORY TESTING REQUIREMENTS FOR THE LOW PERMEABILITY SOIL LINER JUST AFTER COMPACTION:

TABLE 7 RECOMPACTED LINER BASE TESTING REQUIREMENTS		
PARAMETER	TEST METHOD	MINIMUM TESTING FREQUENCY
PERMEABILITY	ASTM D-5084	1 TEST PER 40,000 SF PER LIFT AND 1 TEST PER 800 LF PER LIFT OF SIDEWALL
ATTERBERG LIMITS	ASTM D-4318	1 TEST PER 40,000 SF PER LIFT AND 1 TEST PER 800 LF PER LIFT OF SIDEWALL
DRY DENSITY	ASTM D-2922	1 TEST PER 40,000 SF PER LIFT AND 1 TEST PER 800 LF PER LIFT OF SIDEWALL
MOISTURE CONTENT	ASTM D-2216	1 TEST PER 40,000 SF PER LIFT AND 1 TEST PER 800 LF PER LIFT OF SIDEWALL
CONSTRUCTION OVERSIGHT	OBSERVATION	CONTINUOUS

THE SOILS QUALITY ASSURANCE MANAGER WILL MAINTAIN AN ON-GOING SAMPLING AND TESTING PROGRAM DURING CONSTRUCTION TO MONITOR MOISTURE/DENSITY CURVES. SO THAT REPRESENTATIVE SOIL DATA IS BEING USED TO ESTIMATE RELATIVE COMPACTION. MORE FREQUENT COMPACTION CURVES OR ONE-POINT MOISTURE/DENSITY TESTS MAY BE PERFORMED AT THE DISCRETION OF THE SOILS QUALITY ASSURANCE MANAGER TO PROPERLY CONTROL FIELD COMPACTION OPERATIONS. THE SOILS QUALITY ASSURANCE MANAGER WILL VISUALLY CHECK LINER MATERIALS ENTERING THE SITE FOR COLOR, TEXTURE, ROCKS AND FOREIGN DEBRIS.

5.1.2.2 CONSTRUCTION

THE RECOMPACTED LINER BASE WILL BE PLACED AND COMPACTED ACCORDING TO THE FOLLOWING REQUIREMENTS:

- THE RECOMPACTED LINER BASE LIFTS SHALL BE UNIFORM IN THICKNESS AND SHALL NOT EXCEED SIX INCHES IN THICKNESS AFTER COMPACTION. THE COMPACTION EQUIPMENT SHALL BE A PROPERLY BALLASTED PENETRATING FOOT COMPACTOR WITH A PEG LENGTH THAT WILL FULLY PENETRATE THE LOW PERMEABILITY SOIL LIFTS IN LOOSE MEASURE.
- ALL LIFTS SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY, AND ABOVE THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D-698, STANDARD PROCTOR TO ACHIEVE A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1×10^{-5} CM/SEC.
- ADJUSTMENTS TO THE MOISTURE CONTENT MAY BE ALLOWED IF IT IS FOUND BY LABORATORY REVOLVED PERMEABILITIES THAT A HIGHER IN-PLACE DENSITY OR CHANGE IN MOISTURE CONTENT IS REQUIRED TO MAINTAIN A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1×10^{-5} CM/SEC.
- HAND MANIPULATED COMPACTION EQUIPMENT (VIBRATING DRUMS OR MECHANICAL TAMPERS) SHALL BE USED FOR WORKING IN CONFINED AREAS AND ADJACENT TO STRUCTURES.
- THE DAILY WORK AREA SHOULD EXTEND TO SUCH A DISTANCE NECESSARY TO MINIMIZE DESICCATION AND CRUSTING OF THE LIFT SURFACE. THE FINISHED SURFACE SHOULD BE SMOOTH ROLLED AT THE END OF THE DAY TO PROMOTE PRECIPITATION RUNOFF.
- IF DESICCATION, CRUSTING, OR SEALING BY ROLLING OF THE LIFT SURFACE OCCURS PRIOR TO PLACEMENT OF THE NEXT LIFT, THE AREA SHALL BE SCARIFIED TO A MINIMUM DEPTH OF ONE INCH OR UNTIL SUFFICIENTLY MOIST MATERIALS ARE ENCOUNTERED, WHICHEVER IS GREATER. ALSO, THE ADDITION OF WATER TO SURFACES PRIOR TO PLACEMENT OF ADDITIONAL CLAY MAY BE UTILIZED WHEN NECESSARY TO MAINTAIN UNIFORMLY MOIST SOIL CONDITIONS.

5.1.2.3 COMPACTION CONTROL

IN ORDER TO CONTROL THE MOISTURE CONTENT AND DENSITY OF THE RECOMPACTED LINER BASE, THE SOILS QUALITY ASSURANCE MONITOR WILL:

- CONDUCT IN-PLACE DENSITY AND MOISTURE CONTENT TESTS UTILIZING THE NUCLEAR DENSITY GAUGE AND/OR DRIVE CYLINDER METHODS AT A MINIMUM FREQUENCY OF ONE TEST PER 10,000 SQUARE FEET PER 6-INCH LIFT OF SOIL AND ONE TEST PER 200 LINEAR FEET OF PERMANENT SIDEWALL PER 6-INCH LIFT OF SOIL. A GRID PATTERN OF 100-FOOT WILL BE ESTABLISHED THAT INCLUDES SIDE SLOPES TO LOCATE SAMPLES.
- CONDUCT A DIRECT OR MICROWAVE OVEN MOISTURE CONTENT TEST (ASTM D-2216 OR ASTM D-4643) FOR EVERY TEN (10) NUCLEAR MOISTURE CONTENT TEST (ASTM D-3017).

- CONDUCT A DRIVE CYLINDER TEST (ASTM D-2937) FOR EVERY TWENTY-FIVE (25) NUCLEAR DENSITY TESTS (ASTM D-2922).
- COLLECT UNDISTURBED SAMPLES AT A FREQUENCY OF ONE TEST PER 40,000 SQUARE FEET PER 6-INCH LIFT OF SOIL LINER PLUS ONE TEST PER 800 LINEAR FEET PER 6-INCH LIFT OF SOIL LINER ON PERMANENT SIDEWALL. UNDISTURBED SAMPLES SHALL BE TESTED FOR MOISTURE CONTENT (ASTM D-2216), ATTERBERG LIMITS (ASTM D-4318), DRY DENSITY (ASTM D-2922), HYDRAULIC CONDUCTIVITY (ASTM D-5084).
- ALL PENETRATIONS IN THE RECOMPACTED LINER BASE SHALL BE FILLED WITH BENTONITE PELLETS PRIOR TO PLACEMENT OF NEXT LIFT.

IF SAMPLES FAIL TO MEET THE REQUIREMENTS, THE AREAS OF THE LOW PERMEABILITY SOIL LIFTS FROM WHICH THE SAMPLES WERE OBTAINED SHALL BE REWORKED AND RETESTED UNTIL PASSING RESULTS ARE OBTAINED OR THE FAILING MATERIAL WILL BE REMOVED FROM THE SITE. THE REPAIRED AREA MUST BE RETESTED TO DEMONSTRATE COMPLIANCE WITH THE SPECIFICATIONS. PASSING TESTS ARE REQUIRED BEFORE SUBSEQUENT LIFTS OF SOIL LINER MATERIAL MAY BE PLACED.

5.1.2.4 PROTECTION OF WORK

DURING CONSTRUCTION, THE RECOMPACTED LINER BASE SHOULD BE PROTECTED FROM DETRIMENTAL CLIMATIC EFFECTS BY INCORPORATING THE FOLLOWING PROCEDURE:

- NO FROZEN RECOMPACTED LINER BASE MATERIAL SHALL BE PLACED.
- RECOMPACTED LINER BASE MATERIAL SHALL NOT BE PLACED ON A PREVIOUS LIFT OF RECOMPACTED LINER BASE MATERIAL, WHICH IS FROZEN. FROZEN IN-PLACE RECOMPACTED LINER BASE MATERIAL SHALL BE REMOVED PRIOR TO PLACEMENT OF ADDITIONAL RECOMPACTED LINER BASE MATERIAL.
- RECOMPACTED LINER BASE MATERIAL WHICH HAS BEEN SUBJECTED TO A FREEZE/THAW CYCLE(S) SHALL BE SCARIFIED AND/OR DISKED PRIOR TO RECOMPACTION AND PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS OF RECOMPACTED LINER BASE MATERIAL.
- EXPPOSED FINISHED LIFTS OF RECOMPACTED LINER BASE MATERIAL SHOULD BE SPRINKLED WITH WATER DAILY TO MINIMIZE DESICCATION, AS NECESSARY.
- AT THE END OF EACH DAY'S CONSTRUCTION ACTIVITIES, COMPLETED LIFTS OR SECTIONS OF COMPACTED LINER BASE SHOULD BE SEALED BY ROLLING WITH A RUBBER TIRE OR SMOOTH-DRUM ROLLER OR BY BACK DRAGGING WITH A BULLDOZER, AND SHOULD BE SPRINKLED WITH WATER.
- PROPER GRADING SHOULD BE PROVIDED AT THE END OF EACH WORKDAY TO ASSURE ADEQUATE RUNOFF IN THE EVENT OF OVERNIGHT RAIN.

5.2 GEOSYNTHETIC CLAY LINER INSTALLATION

THE GEOSYNTHETIC CLAY LINER SHALL BE INSTALLED BY OVERLAPPING A MINIMUM OF 6 INCHES ALONG THE LENGTH OF THE ROLLS AND A MINIMUM OF 12 INCHES ALONG THE WIDTH OF THE ROLL. NO HORIZONTAL SEAMS SHALL BE ON SIDESLOPES STEEPER THAN 20% EXCEPT AS APPROVED BY THE GEOSYNTHETICS QUALITY MANAGER.

THE GEOSYNTHETIC CLAY LINER SHALL NOT BE INSTALLED ON STANDING WATER OR DURING PRECIPITATION OR OTHER CONDITIONS THAT MAY CAUSE HYDRATION OF THE GEOSYNTHETIC CLAY LINER. GEOMEMBRANE SHALL NOT BE PLACED ON ANY GEOSYNTHETIC CLAY LINER WHICH HAS BEEN PREMATURELY HYDRATED.

5.3 GEOMEMBRANE INSTALLATION

5.3.1 TRANSPORTATION, HANDLING, AND STORAGE
TRANSPORTATION OF THE GEOMEMBRANE IS THE RESPONSIBILITY OF THE MANUFACTURER, THE GEOMEMBRANE INSTALLER, OR OTHER PARTY AS DECIDED BY THE PROJECT MANAGER. ALL HANDLING ON-SITE AFTER UNLOADING IS THE RESPONSIBILITY OF THE GEOMEMBRANE INSTALLER. THE GEOSYNTHETICS QUALITY ASSURANCE MONITOR WILL MONITOR THE HANDLING PROCEDURES WITH REGARD TO:

- THE ADEQUACY OF ON-SITE HANDLING OF EQUIPMENT TO MINIMIZE RISK OF DAMAGE TO BOTH THE GEOMEMBRANE AND UNDERLYING LOW PERMEABILITY SOIL; AND,
- THE CAREFUL HANDLING OF THE GEOMEMBRANE BY THE INSTALLER'S PERSONNEL.

UPON DELIVERY AT THE SITE, THE GEOMEMBRANE INSTALLER, IN THE PRESENCE OF THE GEOSYNTHETICS QUALITY ASSURANCE MONITOR (ACTING AS AN OBSERVER), WILL OBSERVE EXPOSED ROLL SURFACES FOR DEFECTS AND/OR DAMAGE. VISUAL OBSERVATION SHOULD BE CONDUCTED WITHOUT UNROLLING (UNFOLDING) ROLLS UNLESS DEFECTS OR DAMAGE ARE FOUND ON THE SURFACE OR ARE SUSPECTED. THE ROLLS SHALL BE STORED IN A SECURE AREA AND PROTECTED FROM DAMAGE. THE GEOSYNTHETICS QUALITY ASSURANCE MONITOR WILL INDICATE/REPORT TO THE PROJECT MANAGER:

- THAT THE ROLLS ARE TAGGED WITH THE PROPER IDENTIFICATION, INCLUDING ROLL NUMBERS;
- ROLL OR PORTIONS THEREOF, WHICH IN THE OPINION OF THE GEOSYNTHETICS QUALITY ASSURANCE MONITOR SHOULD BE REJECTED AND REMOVED FROM THE SITE BECAUSE OF VISUALLY OBVIOUS FLAWS; AND,
- ROLLS WHICH INCLUDE FLAWS, WHICH MAY BE REPAIRABLE.

CONFORMANCE TESTING OF THE GEOMEMBRANE MATERIAL MUST BE PERFORMED BY THE GEOSYNTHETIC QUALITY ASSURANCE MANAGER AT A FREQUENCY OF 1 PER 100,000 SF TO DOCUMENT THAT THE GEOMEMBRANE MATERIAL TESTED SATISFIES THE MINIMUM MATERIAL PROPERTY REQUIREMENTS ESTABLISHED IN SECTION 4.4.

5.3.2 SURFACE PREPARATION

THE CONTRACTOR WILL BE RESPONSIBLE FOR PREPARING THE SURFACE TO RECEIVE GEOMEMBRANE ACCORDING TO THE SPECIFICATIONS. THE SOILS QUALITY ASSURANCE MANAGER WILL DOCUMENT THAT:

- A QUALIFIED PROFESSIONAL ENGINEER OR LAND SURVEYOR HAS DETERMINED THAT LINES AND GRADES ARE IN CONFORMANCE WITH DESIGN PLAN;
- THE SURFACES TO BE LINED HAVE BEEN ROLLED AND COMPACTED SO AS TO BE FREE OF MAJOR IRREGULARITIES, PROTRUSIONS, LOOSE SOIL, AND ABRUPT CHANGES IN GRADES;
- THE SURFACE SHALL BE FREE OF STONES OR OTHER PARTICLES GREATER THAN 0.25-INCHES IN DIAMETER, WHICH MAY BE DAMAGING TO THE GEOMEMBRANE;
- THERE ARE NO AREAS EXCESSIVELY SOFTENED BY HIGH WATER CONTENT; AND
- AREAS, WHICH WERE UNSTABLE UNDER THE LOADING OF THE COMPACTION EQUIPMENT, HAVE BEEN CORRECTED BY RECOMPACTION OR REMOVAL AND REPLACEMENT WITH APPROPRIATE MATERIAL.

THE GEOMEMBRANE INSTALLER WILL CERTIFY THAT THE SURFACE ON WHICH EACH GEOMEMBRANE WILL BE INSTALLED IS ACCEPTABLE. THIS WRITTEN SUBGRADE ACCEPTANCE WILL BE GIVEN BY THE GEOMEMBRANE INSTALLER TO THE GEOSYNTHETICS QUALITY ASSURANCE MANAGER PRIOR TO COMMENCEMENT OF GEOMEMBRANE INSTALLATION OVER A GIVEN AREA.

AFTER THE SURFACE HAS BEEN ACCEPTED BY THE GEOMEMBRANE INSTALLER, IT WILL BE THE GEOMEMBRANE INSTALLER'S RESPONSIBILITY TO INDICATE TO THE PROJECT MANAGER OR GEOSYNTHETICS QUALITY ASSURANCE MANAGER ANY CHANGE IN THE LOW PERMEABILITY SOIL LINER SUBGRADE CONDITIONS THAT MAY REQUIRE REPAIR WORK. IF THE GEOSYNTHETIC QUALITY ASSURANCE MANAGER CONCURS WITH THE GEOMEMBRANE INSTALLER, THEN THE GEOSYNTHETIC QUALITY ASSURANCE MANAGER WILL IDENTIFY THE NECESSARY REPAIR WORK TO BE PERFORMED BY THE CONTRACTOR.