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PREPARED FOR:

BOARD OF COMMISSIONERS
COUNTY OF BURKE
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JOHN'S RIVER WASTE MANAGEMENT FACILITY
BURKE COUNTY, NORTH CAROLINA
PERMIT NUMBER 12-03

C&D LANDFILL EXPANSION – PHASE 1
VOLUME 2: PERMIT TO CONSTRUCT

APPENDIX 4:
WATER QUALITY MONITORING PLAN

AUGUST 2012

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JEI PROJECT NO. 00277.1002.11.01

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THIS WATER QUALITY MONITORING PLAN WAS PREPARED IN ACCORDANCE WITH THE REQUIREMENTS NORTH CAROLINA SOLID WASTE MANAGEMENT REGULATIONS (NCSWMR) AND GENERALLY ACCEPTED STANDARDS OF GEOLOGIC PRACTICE FOR THE EXCLUSIVE USE OF AND RELIANCE UPON BY THE REFERENCED CLIENT, FOR SPECIFIC APPLICATION TO THE REFERENCED SITE. NO OTHER WARRANTY IS EITHER EXPRESSED OR IMPLIED.

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Water Quality Monitoring Plan
John's River Landfill, Permit # 12-03
Burke County, NC

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Water Quality Monitoring Plan
John's River Landfill, Permit # 12-03
Burke County, NC

1.0 INTRODUCTION

The Johns River Waste Management Facility (JRWMF) is located in the north-central portion of Burke County, north of Morganton, North Carolina. The 318-acre facility was permitted in 1987 and the existing landfill began receiving waste in 1988. The existing landfill consists of an unlined waste disposal unit covering 28 acres in the southwest corner of the landfill property. The municipal solid waste (MSW) Landfill began operation in April 1988, but was closed to comply with §.1627(c)(10)(A) of the North Carolina Solid Waste Management Rules (NCSWMR). Burke County has operated a permitted Construction and Demolition (C&D) disposal area on top of the closed portions of the MSW landfill since 1998. A MSW transfer facility is located in the eastern half of the property. An expansion of the C&D landfill located adjacent to and northeast of the existing landfill is in the process of being permitted. The expansion will include 37 acres of C&D waste disposal area to be built in eight phases. A site plan showing all the pertinent features of the facility is provided in Drawing WQMP-01.

1.01 Water Quality Monitoring

Groundwater and surface water for the existing landfill are currently monitored in accordance with the April 1994 *Transition Plan* (JEI, 1994), and in accordance with the *Corrective Action Monitoring Plan* (CAMP) submitted to North Carolina Department of Environment and Natural Resources (DENR) in June 2008 as part of a *Corrective Action Plan* (CAP), which was approved by DENR in January 2009.

This *Water Quality Monitoring Plan* (WQMP) for this facility will cover both the existing landfill and the proposed C&D expansion. It will replace the existing groundwater monitoring program at the facility as defined under the *Transition Plan* and the CAMP. This WQMP was prepared in accordance with NCSWMR 15A NCAC 13B §.0544-.0545 and §.1630-.1634 and will serve as the guidance document for collecting and analyzing samples of groundwater and surface water. The groundwater at the facility will be monitored in accordance with the requirements of the NCSWMR (under the Detection Monitoring Program and/or Assessment Monitoring Program, as appropriate) until the end of the post-closure care period.

1.02 Site Description

The 318-acre landfill property is bounded by Lower Creek to the north and east, and the Catawba River to the south. The Catawba River forms Lake Rhodhiss southeast of the facility. Lake Rhodhiss is a long, narrow lake formed by the Rhodhiss Hydroelectric Dam located approximately 12 miles downstream of the landfill property. The John's River flows into the Catawba River near the southwest corner of the landfill property.

Drawing WQMP-01 shows the existing site conditions with the existing and proposed waste units and existing and proposed facility boundaries, including the most recent topographic survey information. Properties within 2,000 feet of the landfill boundary are mostly heavily wooded or are covered by surface water. All adjoining properties and properties within 2,000 feet of the facility are undeveloped except for two private residences to the north and northwest of the landfill.

There are no water supply wells or surface water intakes within 2,000 feet of the facility boundary. All properties to the north and northwest as well as the landfill facility buildings are supplied with potable water by the Burke Caldwell Corporation. The City of Morganton and the Triple Community Water Corporation provide public water to areas south and southeast (respectively) of the facility on the other side of the Catawba River. There are three public water intakes on Lake Rhodhiss between the landfill facility and the dam. The Town of Valdese intake is located approximately 5 miles downstream of the facility boundary, and the Lenoir and Granite Falls intakes are approximately 8 and 10 miles downstream, respectively.

2.0 GROUNDWATER MONITORING

2.01 Existing Monitoring Network

Following is a summary of the wells that comprise the current compliance monitoring for the existing landfill, including the former background wells.

Well ID	Date Installed	Classification	Monitoring Program	Total Depth of Well (ft)	Lithology of Screened Interval	Constituent List*
MW-9	8-31-94	Abandoned/ Former Bkgnd.	-	-	-	-
MW-10	9-02-94	Compliance	Assessment	23.0	Saprolite	C
MW-11	9-02-94	Compliance/ Performance	Assessment/ Cor. Act.	43.0	Saprolite	C, S, & E*
MW-12	9-01-94	Compliance/ Performance	Assessment/ Cor. Act.	51.5	Bedrock	C, S, & E*
MW-13	8-31-94	Compliance	Assessment	58.0	Bedrock	C
MW-16S	3-08-99	Compliance/ Performance	Assessment/ Cor. Act.	20.0	Saprolite	C, S, & E*
MW-16D	3-10-99	Compliance	Detection	120.0	Bedrock	C
MW-17	3-08-99	Former Background	Water Levels Only	52.0	Bedrock	C, S, & E*
MW-18	4-07-09	Sentinel**	Corrective Action	12.0	Alluvial Soil	V, S, & E*
MW-19	4-07-09	Sentinel**	Corrective Action	13.0	Alluvial Soil	V, S, & E*
MW-20	5-18-95	Background	Assessment	67.0	Saprolite	C

Notes: **C =** Compliance Parameters = NCSWMR Appendix I or Appendix II organics and inorganics, as required for routine assessment or detection monitoring.
V = Appendix I Volatile Organics (Constituents of Concern)
S = Standard MNA Parameters = temperature, pH, specific conductance, oxidation reduction potential, dissolved oxygen, nitrate, sulfate, and chloride.

E = Extended MNA Parameters = dissolved hydrogen, sulfide, alkalinity, TOC, methane, ethane, ethene, volatile fatty acids, carbon dioxide, ferrous iron, and turbidity.
* After the baseline period, the DENR approved alternate frequencies for carbon dioxide, sulfide, volatile fatty acids, ethane, and ethylene. These parameters will be monitored during both semiannual events every third year.
** After the baseline period, sampling frequency for sentinel wells has changed to annual.
# MW-20 (originally named PZ-4) replaced MW-17 as the facility background well after the 1st semiannual sampling event of 2011; however, this WQMP proposes a new background well, MW-21.

The current compliance groundwater monitoring network at the facility consists of one upgradient well (MW-20) and six downgradient wells (MW-10, MW-11, MW-12 MW-13, MW-16S, and MW-16D). In March 1999, monitoring wells MW-16S and MW-16D were installed as downgradient monitoring wells and well MW-17 was installed as a replacement for upgradient background well MW-9. These wells were incorporated into the compliance monitoring network during the second semi-annual groundwater monitoring event of 2005 after receiving approval from the DENR Solid Waste Section (SWS) in a letter dated August 1, 2005. The letter also gave approval to drop MW-9 from the compliance monitoring network. MW-9 was abandoned in July 2006. Sentinel wells MW-18 and MW-19 were installed on April 7, 2009 in accordance with the facility's Corrective Action Plan.

Due to volatile organic compound (VOC) detections in MW-17, a request was submitted to the SWS in August 2010 to replace MW-17 with MW-20 as the facility background well. MW-20 (originally named PZ-4) was installed as a piezometer in 1995 for site characterization. The SWS requested that we sample both MW-17 and MW-20 for the next two sampling events (November 2010 and June 2011). Beginning in November 2011, MW-20 has been sampled as the background well and MW-17 has been used only for water level data. This WQMP proposes that MW-20 be replaced by Piezometer PZ-1, which will be renamed MW-21, as the background well after construction of Phase 1 of the C&D landfill expansion. MW-20 will continue to be sampled as a compliance well for the C&D expansion unit. The reasons for this request will be discussed further in Section 2.02.

Wells MW-10, MW-11, MW-12, MW-13, MW-16S, MW-17, and MW-20 are analyzed for the NCSWMR Appendix I list of constituents plus additional detected Appendix II constituents plus additional required C&D parameters during the first semi-annual event and for all constituents listed in NCSWMR Appendix II plus additional required C&D parameters during the second semi-annual monitoring event. Monitoring well MW-16D is analyzed for the NCSWMR Appendix I list plus additional required C&D parameters during both events. Monitoring wells MW-11, MW-12, MW-16S, and MW-17 are also sampled for MNA parameters during each sampling event.

In accordance with the CAP for the facility, MNA baseline sampling was initiated with the June 2009 sampling event and continued through the November 2010 sampling event. The baseline data were evaluated in a CAER dated May 2011. After reviewing the CAER, in a letter dated July 12, 2011, the DENR agreed to a reduced frequency for monitoring carbon dioxide, sulfide, volatile fatty acids, ethane, and ethylene. These parameters will be sampled during both semiannual sampling events every third year. The next time these parameters will be monitored will be in 2013.

The Corrective Action Monitoring Plan (CAMP) for the facility requires sentinel wells MW-18 and MW-19 to be analyzed for the facility's COC's. In their July 12, 2011 letter, the DENR updated the COC list to include the following constituents:

- Benzene;
- 1,4-Dichlorobenzene;
- Methylene chloride;
- Tetrachloroethylene (PCE);
- Trichloroethylene (TCE);
- 1,1-Dichloroethane;
- 1,2-Dichloroethane; and
- Vinyl chloride.

In addition, the DENR agreed that sentinel wells MW-18 and MW-19 need only be sampled annually. During the annual sampling, MW-18 and MW-19 will be monitored for the above COC list plus required MNA parameters.

There are (or have been) 11 other monitoring wells, 43 piezometers, and 5 temporary wells at the facility that have been used for hydrogeologic site characterization, nature and extent studies, or to supplement the data from the compliance monitoring wells. Detailed information on these wells can be found in Table 1, which summarizes construction data for all borings at the facility.

2.02 Proposed Monitoring Network for the C&D Expansion Area

Groundwater monitoring for Phase 1 of the C&D Expansion Area will be performed in accordance with NCSWMR §.0544 (Detection Monitoring Program). The proposed compliance network for Phase 1 will include one upgradient background well, two downgradient compliance wells, and one side-gradient well. Existing piezometers will be converted to monitoring wells by adding surface protective casings, well pads, and well tags.

The groundwater monitoring system well locations are shown on Drawing WQMP-01. Detailed construction parameters for the existing wells and piezometers are presented in Table 1. Construction specifications for the proposed compliance wells are presented in Appendix A.

MW-20 (former PZ-4) is currently the background well for the old, active landfill; however it is side-gradient from Phase 1; therefore, it will not be ideally located to be the background well after construction of Phase 1. The proposed background well for the C&D expansion area will be MW-21 (formerly PZ-1). We also propose making MW-21 the background for the existing landfill, after construction of Phase 1. MW-20 will continue to be sampled as a compliance well for Phase 1. The following table summarizes the proposed monitoring network for Phase 1, and for future phases.

Old ID	New ID	Date Installed	Classification	Monitoring Program	Screened Interval (Ft-BGS)	Depth to GW* (Ft-BGS)	Lithology of Screened Interval	Phases#
PZ-4	*MW-20*	Sept. 1987	Compliance	Detection	52-67'	60.83'	Saprolite	Phases 1-8
PZ-1	*MW-21*	Sept. 1987	Background	Detection	30-45'	38.14'	Saprolite	Phases 1-8
PZ-38	*MW-23*	May 2011	Compliance	Detection	40-70'!	36.49'	Saprolite	Phases 1-8
PZ-22S	*MW-22S*	May 2011	Compliance	Detection	10-25'	13.72'	Saprolite	Phase 1
PZ-22D	*MW-22D*	May 2011	Supplemental		40-45'	13.13'	PWR	Phase 1
MW-15S	*MW-15S*	June 1996	Compliance	Detection	39-54'	42.34'	Saprolite	Phases 2-8
MW-15D	*MW-15D*	June 1996	Supplemental		109-119'	41.58'	Saprolite	Phases 2-8
MW-1	*MW-1*	Sept. 1987	Compliance	Detection	18.5-28.5'	21.16'	Saprolite	Phases 2-3
MW-14	*MW-14*	June 1996	Compliance	Detection	5-20'	6.13'	Saprolite	Phases 3-8
PZ-8S	*MW-26S*	May 1995	Compliance	Detection	40-55'	44.85'	Saprolite	Phases 3-5
PZ-8D	*MW-26D*	June 1996	Supplemental		84.5-89.5'	45.42'	Saprolite	Phases 3-5
NYE	*MW-27*	*NYE*	Compliance	Detection	~20-35'	~25'	Saprolite	Phase 4
NYE	*MW-28*	*NYE*	Compliance	Detection	~15-30'	~20'	Saprolite	Phases 5-7
PZ-21	*MW-29*	June 1996	Compliance	Detection	50-65'	52.10'	Saprolite	Phase 6
NYE	*MW-30*	*NYE*	Compliance	Detection	~10-25'	~15'	Saprolite	Phases 7-8
NYE	*MW-31*	*NYE*	Compliance	Detection	~7-17'	~8'	Saprolite	Phases 7-8
PZ-5	*MW-32*	May 1995	Compliance	Detection	50-65'	56.67'	Saprolite	Phase 8

* Depth to groundwater measured on 5/16-17/2011. Ft-BGS = feet below ground surface.
PWR = partially weathered rock; *NYE* = Not yet existent;
~ = Anticipated screened intervals and depths to GW for proposed wells.
! See Table 1 for details of PZ-38 construction.

Phases = The phases of the C&D Expansion during which this well will be sampled as part of the compliance network. The wells will be installed or converted to monitoring wells prior to the first phase listed and will be abandoned prior to construction of the phase following the last phase listed. Those listed as extending through Phase 8 will also continue to be sampled through the post-closure care period.

Shaded wells listed as "supplemental" will not be a part of the compliance network; however, they will be converted to monitoring wells to be used for supplemental data in the event that there are future GPS exceedances that need to be delineated.

Groundwater samples will be collected from the Phase 1 compliance network semiannually in conjunction with the monitoring for the existing landfill. The Phase 1 compliance wells will be sampled and analyzed in accordance with NCSWMR §.0544. Groundwater samples from the monitoring wells in Detection Monitoring will be sampled for the constituents listed in Appendix I of 40 CFR Part 258 plus the C&D parameters mercury, manganese, iron, chloride, sulfate, alkalinity, total dissolved solids (TDS), pH, temperature, and specific conductance, during both semiannual events. In addition, the samples will be analyzed for tetrahydrofuran (THF) if and as long as it is required by the DENR.

2.03 Establishment of Background Data

A minimum of four independent groundwater samples will be collected from any new compliance wells prior to the start of disposal operations in the associated phase of the C&D expansion. These data will be evaluated statistically to determine background concentrations for each well.

2.04 Groundwater Sampling Methodology

Groundwater samples will be collected in accordance with NCSWMR §13B.0544. Details of well purging, sample withdrawal, and decontamination methods, as well as chain-of-custody procedures are outlined below.

Static water elevations and the total well depth will be measured to the nearest 0.01 of a foot in each well prior to the sampling of each well. An electronic water level meter will be used for the measurements. The distance from the top of the well casing to the water surface and to the bottom of the well will be measured using the tape attached to the probe. Reference elevations of the proposed wells have been obtained from a North Carolina registered land surveyor.

A low-yield well (one that is incapable of yielding three well volumes within a reasonable time) will be purged so that water is removed from the bottom of the screened interval. Low-yield wells will be evacuated to dryness once. Within 24 hours of purging, the first sample will be field tested for pH, temperature, and specific conductance. Samples will then be collected and containerized in the order of the parameters' volatilization sensitivity (i.e., volatile organics then total metals).

A high-yield well (one that is capable of yielding more than three well volumes during purging) will be purged so that water is drawn down from the uppermost part of the water column to ensure that fresh water from the formation will move upward in the screen. At no time will a well be evacuated to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen, which could cause an accelerated loss of volatiles.

A minimum of three well volumes will be evacuated from high-yield wells prior to sampling. A well volume is defined as the water contained within the well casing. The well volume will be calculated using the following formulas:

$$V_c = (d_c^2/4) \times 3.14 \times h_w \times (7.48 \text{ gallons/cubic foot})$$

$$V_c \text{ (gallons)} = 0.163 \times h_w \text{ (for a 2-inch well)}$$

where:

V_c = volume in the well casing in gallons
d_c = casing diameter in feet (d_c = 0.167 for a 2-inch well)
h_w = height of the water column in feet (i.e., well depth minus depth to water)

The purge volume will be a minimum of 3 times the calculated well volume.

Each well will be evacuated (purged) and sampled with a disposable bailer or a sampling pump. The bailer or pump will be lowered gently into the well to minimize the possibility of causing degassing of the water. If sampled with a pump, flow rates will be regulated to minimize turbidity and degassing of the water.

All equipment used for sampling will be handled in such a manner as to ensure that the equipment remains decontaminated prior to use. In between wells and following completion of

the field sampling, water level meters, sampling pumps, or any other reusable sampling equipment will be properly decontaminated. Clean disposable gloves will be worn by sampling personnel and changed between wells.

The upgradient/background well will be sampled first, followed by the downgradient wells. The order of sampling of the downgradient wells will be evaluated each sampling event to provide a sequence going from less contaminated to more contaminated, if applicable, based on the previous sampling event.

Field measurements of temperature, pH, and specific conductance will be made before sample collection. The direct reading equipment used at each well will be calibrated according to the manufacturer's specifications prior to each sampling event. Groundwater samples will be collected and containerized in the order of the volatilization sensitivity (i.e., VOCs first, followed by the metals).

Pre-preserved sample containers will be supplied by the laboratory. The VOC vials will be filled in such a manner that no headspace remains after filling. Immediately upon collection, all samples will be placed in coolers on ice where they will be stored prior to/and during transit to the laboratory.

In between wells and following completion of the field sampling, the electronic depth meter will be decontaminated using the following procedure.

1) Phosphate-free soap and distilled water wash;
2) Distilled water rinse;
3) Air dry.

Samples collected will be properly containerized, packed into pre-cooled coolers, and either hand-delivered or shipped via overnight courier to the laboratory for analysis. The chain-of-custody program will allow for tracing of possession and handling of samples from the time of field collection through laboratory analysis. The chain-of-custody program will include sample labels and seals, field logs, and chain-of-custody record, and laboratory log.

Labels sufficiently durable to remain legible when wet will contain the following information:

- Job and sample identification;
- Monitoring well number or other location;
- Date and time of collection;
- Name of collector;
- Parameter to be analyzed; and
- Preservative, if applicable.

The shipping container will be sealed to ensure that the samples have not been disturbed during transport to the laboratory. If the sample cannot be analyzed because of damage or disturbance, whenever possible, the damaged sample will be replaced during the same compliance period.

The field log will contain sheets documenting the following information:

- Identification of the well;
- Well depth;
- Static water level depth;
- Presence of immiscible layers, odors or other indications of potential contamination;
- Purge volume (given in gallons or number of bailers);
- Time well was purged;
- Date and time of collection;
- Well sampling sequence;
- Field analysis data and methods;
- Field observations on sampling event;
- Name of collector(s);
- Climatic conditions (temperature, precipitation).

The chain-of-custody record is required to establish the documentation necessary to trace sample possession from time of collection to time of receipt at destination. A chain-of-custody record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter;
- Sample identification numbers;
- Signature of collector;
- Date and time of collection;
- Sample type;
- Identification of well;
- Number of sample containers in shipping container;
- Parameters requested for analysis;
- Signature of person(s) involved in the chain of possession;
- Inclusive dates of possession; and
- Internal temperature of shipping container upon opening (noted by the laboratory).

A copy of the completed chain-of-custody sheet will accompany the shipment and will be returned to the shipper with the analytical results. The chain of custody record will also be used as the analysis request sheet.

A field blank will be collected and analyzed during each sampling event to verify that the sample collection and handling processes have not affected the integrity of the field samples. The field blank will be prepared in the field from lab pure water (Type II reagent grade water) supplied by the laboratory. One field blank will be prepared for each sampling event. The field blank will be generated by exposing the lab pure water to the sampling environment in the same manner as actual field samples being collected. The lab will provide appropriate sample containers for generation of the field blank. The field blank will be subjected to the same analyses as the groundwater samples. As with all other samples, the time(s) of the field blank collection will be recorded so that the sampling sequence is documented. The field blank monitors for

contamination from the sampling environment, or from cross-contamination that might occur between samples and sample containers as they are opened and exposed to the sampling environment.

Whenever groundwater samples are being collected for VOC analysis, a trip blank will be generated by the laboratory prior to shipment of sampling containers and coolers to the field. The same lab pure water as above shall be used. The trip blank shall be transported with the empty sampling containers to the field, but will not be opened at any time prior to analysis at the laboratory. The trip blank will accompany the groundwater samples in the cooler(s) back to the laboratory and will be analyzed by the same VOC methods as the associated field samples. The trip blank monitors for potential cross-contamination that might occur between samples or that may be a result of the shipping environment.

Detectable levels of contaminants found in the field blanks or trip blanks will not be used to correct the groundwater data, but will be noted accordingly. Contaminants present in trip blanks or field blanks at concentrations within an order of magnitude of those observed in the corresponding groundwater samples may be cause for discounting the analytical results for the groundwater or surface water samples, or for resampling.

2.05 Sample Analysis Requirements

2.05.01 Analytical Requirements

Groundwater samples from the compliance and corrective action wells associated with the existing landfill will be analyzed in accordance with the requirements of NCSWMR §.1632-.1633 and the CAMP for the facility. Groundwater samples from the compliance wells associated with the C&D expansion will be analyzed in accordance with the requirements of NCSWMR §.0544-.0545. Analysis of groundwater and surface water samples from the facility will be conducted by a laboratory certified by the DENR. Analyses will be performed in accordance with U.S. EPA SW-846 methods, where applicable.

- Wells MW-10, MW-11, MW-12, MW-13, MW-16S, MW-17, and MW-21 will be analyzed for the NCSWMR Appendix I list of constituents plus additional detected Appendix II constituents plus additional required C&D parameters during the first semi-annual event and for all constituents listed in NCSWMR Appendix II plus additional required C&D parameters during the second semi-annual monitoring event. Monitoring well MW-16D is analyzed for the NCSWMR Appendix I list plus additional required C&D parameters during both events. See section 2.02 for the list of C&D parameters.

- Monitoring wells MW-11, MW-12, MW-16S, and MW-17 are also sampled for MNA parameters during both semiannual sampling events. See Section 2.01 for details of the MNA analytical requirements.

- Sentinel wells MW-18 and MW-19 to be analyzed annually for the facility's COC's. See Section 2.01 for a list of the current COC's.

- Monitoring wells MW-20, MW-22, MW-23, MW-24, and MW-25S will be analyzed for the NCSWMR Appendix I list of constituents plus additional C&D parameters during both semiannual sampling events. See section 2.02 for the list of C&D parameters.

- Surface water samples will be analyzed for the NCSWMR Appendix I list of constituents plus additional detected Appendix II constituents during both semiannual sampling events.

- Field analyses for temperature, pH, and specific conductance will be performed for each groundwater and surface water sample.

Appendix B includes a table of all Appendix I and Appendix II constituents with their respective analytical methods, CAS numbers, DENR Solid Waste Section Limits (SWSL), 15A NCAC 2L (NC-2L) groundwater standards, and Solid Waste Section groundwater protection standards (GWPS), as well as a table of 15A NCAC 2B (NC-2B) surface water standards.

2.05.02 Reporting and Record Keeping

The laboratory analytical results will be submitted to the Solid Waste Section at least semiannually. The following measurements, analytical data, calculations, and other relevant groundwater monitoring records will be kept throughout the active life of the facility and the post-closure care period:

- Records of all groundwater quality data;

- Associated sample collection field logs and measurements, such as static water level measured in compliance wells at the time of sample collection; and

- Notices and reports of NC-2L Standard and/or GWPS exceedances, NC-2B Standard exceedances, reporting or data errors, missing data, etc..

2.06 Well Abandonment

All recently installed or pre-existing wells or piezometers at the site that are not used for permanent monitoring will be progressively abandoned as necessary to complete construction activities. The remaining piezometers may be used to supplement groundwater elevation data, if needed. Wells and piezometers that need to be abandoned will be properly abandoned in accordance with the procedures for permanent abandonment as described in 15A NCAC 2C Rule .0113(a)(2). The piezometers and wells that are within the proposed waste footprint will be overdrilled before they are grouted. Other wells that will potentially interfere with clearing and/or construction activities but are not within the waste footprint may be grouted in place without overdrilling.

3.0 COMPARISON TO GROUNDWATER PROTECTION STANDARDS

Constituents detected in the samples collected from either the compliance network or the sentinel wells shall be compared to the Groundwater Protection Standard (GPS) for that constituent as

defined in the NCSWMR § .1634 (g) and (h). Unless otherwise established by DENR, the GPS for all constituents shall be equal to their respective NC-2L Groundwater Standards, or for constituents without NC-2L standards, the GWPS established by the SWS (see Appendix B). If the NC-2L Standard or GWPS is below the SWSL, the GPS shall be equal to the SWSL. The comparison will initially be performed using a value-to-value procedure. If the GPS for a constituent as described above is less than the statistically-determined background for that constituent, the GPS shall be equal to the background value.

If an analyte is detected above the GPS in a given sampling event, confidence limits may be calculated based on the most recent four sampling events, and if the lower confidence limit is not above the GPS, the detection shall not be considered a statistically significant level compared to the GPS. If an analyte is detected below the GPS, even if it is a quantifiable concentration, compliance action will not be required unless it is demonstrated to represent a statistically significant increase over background.

If a suspect GPS exceedance is noted during the value-to-value comparison, a confirmation sample may be collected. The results from a confirmation sample will be compared to the GPS in a value-to-value comparison, or the value may be statistically compared to background.

4.0 STATISTICAL ANALYSES

The background data are to be evaluated through the use of Parametric Prediction Limits, Parametric Tolerance Intervals, Non-Parametric Prediction Limits, or Poisson Prediction Limits as appropriate. Tests for normality, outliers, Aitchison's adjustment, tolerance intervals, or prediction limits are to be included as appropriate based on the background data.

The statistical test by which downgradient data are compared to facility background data is based upon the nature of the data and the number of data values that are less than the laboratory limit of detection. All statistical tests are evaluated at the 0.05 level of significance, 95% confidence level, and are conducted as one-tailed tests. These methods and the criteria for their use are discussed below.

4.01 Treatment of Truncated Data

Truncated data are data for which the laboratory analyses did not yield a numerical result that can be used in the statistical analysis. Normally, these are "not-detected" or "not reported" results, where the analysis did not find the analyte at a concentration above its respective detection limit (DL) or reporting limit (RL). Generally, truncated background data are censored as follows: when less than or equal to 15% of the background data values are truncated, any truncated data will be treated as one-half the applicable RL.

4.02 Assumption of Normality

Prior to conducting statistical tests that are based on the assumption of normally distributed data, normality of the background data is evaluated using the Shapiro-Wilk statistic (W). Normality is

assessed at the 95% confidence level. In the event that the raw data fail to follow a normal distribution, the data are transformed using a base-10 logarithm. The transformed data are then tested for normality using the Shapiro-Wilk statistic. In the event that the log-transformed data also fail to follow a normal distribution, a non-parametric approach is applied.

4.03 Parametric Upper Tolerance Limit

In cases where the background data consist of a minimum of eight independent data values and less than or equal to 15% of the background data values for a given analyte are truncated, the downgradient values are compared to the parametric upper tolerance limit in accordance with the procedure summarized in the USEPA guidance documents, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (USEPA, 1989) and *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance* (USEPA, 1992).

4.04 Aitchison's Adjusted Parametric Upper Prediction Limit

In those cases where the background data consist of a minimum of eight independent data values and more than 15%, but less than or equal to 50%, of the background data values for a given analyte are truncated, the mean and standard deviation are adjusted. This is done in accordance with the procedure described by Aitchison (1955) and summarized in the USEPA guidance document (USEPA, 1992). After the adjustments are made, the downgradient values are compared to the Aitchison's adjusted parametric upper prediction limit in accordance with the procedures summarized in the USEPA guidance documents (USEPA, 1989 and USEPA, 1992).

4.05 Non-parametric Upper Tolerance Limit

In those cases where more than 50%, but less than or equal to 90%, of the background data for a given analyte are truncated or the background data fail to follow a normal or log-normal distribution, downgradient values are compared to the non-parametric upper tolerance limit. This procedure is done in accordance with the procedures summarized in the USEPA guidance documents (USEPA, 1989 and USEPA, 1992).

4.06 Poisson Upper Prediction Limit

In those cases where more than 90% of the background data values for a given analyte are truncated, the downgradient values are compared to the Poisson upper prediction limit. These comparisons are made in accordance with the procedure summarized in the USEPA guidance document (USEPA, 1992).

5.0 SURFACE WATER MONITORING

Surface water at the facility is currently monitored semiannually in conjunction with the groundwater sampling events for the existing landfill. Samples are currently collected from two surface water monitoring points, SMP-5 and SMP-6, as described below. After construction of Phase 1 of the C&D Expansion, we propose an additional sampling point SMP-7. SMP-7 will be

located downgradient of Phase 1 and sediment basin SB-2. This is near the head of Stream 2, so the exact sampling point may vary depending on seasonal variation in the location of the stream head. In general, the sample will be taken from the first flowing water in the stream.

Surface Point	Classification	Monitoring Program	Location
SMP-5	Compliance	Surface Water	Stream 1, west of the existing landfill, downstream of sediment basin SB-1A.
SMP-6	Compliance	Surface Water	Stream 2, east of the existing landfill and downstream of the wetland area.
SMP-7	Compliance	Surface Water	Stream 2, southeast of Phase 1 and east of sediment basin SB-2A. First flowing water.

These three monitoring points will adequately monitor the surface water that could be potentially impacted by a release from either the existing landfill or Phase 1 of the C&D expansion before the surface water flows into The Catawba River (Lake Rhodhiss). Additional surface water monitoring points may be proposed, if needed, for later phases of the C&D expansion.

Surface water samples will be analyzed for the NCSWMR Appendix I list of constituents plus detected Appendix II constituents during both semiannual events. The results will be compared to the surface water standards found in 15A NCAC 2B using a value-to-value comparison.

6.0 ABILITY TO EFFECTIVELY MONITOR RELEASES

Based on the design hydrogeologic investigations conducted to date for Phase 1 of the proposed C&D expansion area, as well as on the site suitability hydrogeologic investigations for the whole expansion area, no geological or hydrological conditions have been identified which will interfere with effective monitoring of the proposed Phase 1 C&D unit or the existing landfill.

The existing landfill is a closed, unlined MSW landfill with an active C&D landfill on top of it. The existing landfill area is under corrective action for impacts to groundwater on the down-gradient (south) side of the existing landfill. In addition, two former background wells (MW-9 and MW-17) on the upgradient (north) side of the existing landfill have had detections of VOCs believed to be due to landfill gas migration.

We do not believe that the presence of impacted groundwater beneath the existing landfill will interfere with effective monitoring of Phase 1 of the proposed C&D expansion, for the following reasons:

- Groundwater flow beneath the existing landfill is toward the south, away from the C&D expansion area, and observed groundwater flow paths will not carry impacted groundwater from the existing landfill to the C&D expansion area;
- Groundwater flow beneath Phase 1 is primarily toward the southwest, and can be monitored independently from flow beneath the existing landfill; and

- The proposed layout of the C&D expansion leaves ample space (200 feet) between the two waste units to monitor groundwater between them. Proposed monitoring well MW-23 (P-38) for Phase 1, and MW-15S&D and MW-14S&D for later phases, are located directly between the existing landfill and the C&D expansion area.

There is a significant possibility that the proposed monitoring wells between the two landfills may be impacted by landfill gas (LFG) from the existing landfill. If so, the impacts will be detected and characterized during the required background monitoring of the new wells. Since the LFG impacts will be known and characterized prior to waste being received in the new cell, these wells will still be effective in detecting a potential release from the new cell. If there are notable increases in VOCs in the monitoring wells at some point after waste is in place, there are statistical, analytical, and geochemical tools that can be used to distinguish between LFG impacts and impacts due to leachate from the new landfill cell.

This Water Quality Monitoring Plan, when implemented, will be effective in providing early detection of any release of hazardous constituents to the uppermost aquifer beneath both the existing landfill and Phase 1 of the C&D expansion so as to be protective of public health and the environment.

7.0 REFERENCES

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8.0 ACRONYMS

ACM	Assessment of Corrective Measures (Report)
AMSL	Above Mean Sea Level
AOC	Area of Concern
BGS	Below Ground Surface
C&D	Construction and Demolition Waste
CAP	Corrective Action Plan (Report)
CAER	Corrective Action Evaluation Report (Report)
CAMP	Corrective Action Monitoring Plan (Report)
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
CPVC	Chlorinated Poly Vinyl Chloride
COC	Contaminant of Concern (for corrective action)
COC	Chain of Custody (for sampling and lab reports)
DENR	North Carolina Department of Environment and Natural Resources
DL	Detection Limit (for laboratory data)
DO	Dissolved Oxygen

EPA	United States Environmental Protection Agency (or USEPA)
GPS	Groundwater Protection Standards as defined by NCSWMR §.1634 (g) & (h)
GWPS	Groundwater Protection Standards established by the DENR-SWS
JEI	Joyce Engineering, Inc.
JOYCE	Joyce Engineering, Inc.
LFG	Landfill Gas
MNA	Monitored Natural Attenuation
MSW	Municipal Solid Waste
MW	Monitoring Well
NC-2B	North Carolina Surface Water Standards found in 15A NCAC 2B
NC-2L	North Carolina Groundwater Standards found in 15A NCAC 2L
NCAC	North Carolina Administrative Code
NCGS	North Carolina Geological Survey
NCSWMR	North Carolina Solid Waste Management Regulations (15A NCAC 13B)
ND	Not Detected (for laboratory data)
NES	Nature and Extent Study (Report)
O&M	Operations and Maintenance
QL	Quantitation Limit (for laboratory data)
QRA	Quantitative Risk Assessment (Report)
RL	Reporting Limit (for laboratory data)
RQD	Rock Quality Designation
SMP	Surface Water Monitoring Point
SPT	Standard Penetration Test
SWS	Solid Waste Section, NC DENR Division of Waste Management
SWSL	Solid Waste Section Reporting Limit (for laboratory data)

TABLE

Table 1 – Construction Data for Wells and Piezometers

TABLE 1: Boring and Well/Piezometer Construction Data

ID (Former ID)	**GS Elevation** (Ft-AMSL)	**TOC Elevation** (Ft-AMSL)	**Date Installed**	**GW** (Ft.-TOC)	**GW** (Ft.-AMSL)	**AR (BR)** (Ft.-BGS)	**AR (BR)** (Ft.-AMSL)	**TD** (Ft.-BGS)	**TD** Ft.-AMSL	**Top Screen** (Ft.-BGS)	**Bottom Screen** (Ft.-BGS)	**Stick-up** (Ft.-BGS)	**Lithology of Screened Interval**	**Comments**
B-1 (P4)	1121.46	na	Jan-Feb 1986	na	na	bne	<1067	54.5	1066.96	na	na	na	na	Exploratory Boring
B-2 (P11)	1075.69	na	Jan-Feb 1986	na	na	bne	<1016	60	1015.69	na	na	na	na	Exploratory Boring
B-3 (V11)	1098.61	na	Jan-Feb 1986	na	na	40.5	1058.11	70	1028.61	na	na	na	na	Exploratory Boring
B-4 (P5)	1043.62	na	Jan-Feb 1986	na	na	bne	<995	49	994.62	na	na	na	na	Exploratory Boring
B-5 (XI)	1044.09	na	Jan-Feb 1986	na	na	bne	<987	57.5	986.59	na	na	na	na	Exploratory Boring
B-6 (P6)	1040.92	na	Jan-Feb 1986	na	na	bne	<997	44	996.92	na	na	na	na	Exploratory Boring
B-7 (IV)	1082.00	na	Jan-Feb 1986	na	na	54.5	1027.50	54.5	1027.50	na	na	na	na	Exploratory Boring
B-8 (I)	1145.75	na	Jan-Feb 1986	na	na	53.5	1092.25	53.5	1092.25	na	na	na	na	Exploratory Boring
B-9 (VI)	1121.58	na	Jan-Feb 1986	na	na	bne	<1062	59.5	1062.08	na	na	na	na	Exploratory Boring
B-10 (VIII)	1080.29	na	Jan-Feb 1986	na	na	40	1040.29	44	1036.29	na	na	na	na	Exploratory Boring
B-11 (P2)	1085.16	na	Jan-Feb 1986	na	na	33	1052.16	33	1052.16	na	na	na	na	Exploratory Boring
B-12 (P13)	1151.41	na	Jan-Feb 1986	na	na	bne	<1101	50	1101.41	na	na	na	na	Exploratory Boring
B-13 (P8)	1063.15	na	Jan-Feb 1986	na	na	25	1038.15	25	1038.15	na	na	na	na	Exploratory Boring
B-14 (P7)	1084.45	na	Jan-Feb 1986	na	na	bne	<1035	49	1035.45	na	na	na	na	Exploratory Boring
B-15 (XII)	1043.16	na	Jan-Feb 1986	na	na	49	994.16	50	993.16	na	na	na	na	Exploratory Boring
B-16 (V)	1070.90	na	Jan-Feb 1986	na	na	55.5	1015.40	55.5	1015.40	na	na	na	na	Exploratory Boring
B-17 (II/P12)	1135.00	na	Jan-Feb 1986	na	na	48.5	1086.50	48.5	1086.50	na	na	na	na	Exploratory Boring
B-18 (XIII)	1107.00	na	Jan-Feb 1986	na	na	51	1056.00	54.5	1052.50	na	na	na	na	Exploratory Boring
B-19 (IX)	1056.30	na	Jan-Feb 1986	na	na	61	995.30	65	991.30	na	na	na	na	Exploratory Boring
B-20 (P9/P9A)	1030.68	na	Jan-Feb 1986	na	na	8	1022.68	8	1022.68	na	na	na	na	Exploratory Boring
B-21 (P3)	1055.00	na	Jan-Feb 1986	na	na	bne	<1014	41	1014.00	na	na	na	na	Exploratory Boring
B-22 (III)	1107.00	na	Jan-Feb 1986	na	na	bne	<1063	44.5	1062.50	na	na	na	na	Exploratory Boring
B-23 (P14)	1058.00	na	Jan-Feb 1986	na	na	bne	<1009	49	1009.00	na	na	na	na	Exploratory Boring
B-24 (P10)	1060.58	na	Jan-Feb 1986	na	na	bne	<1001	60	1000.58	na	na	na	na	Exploratory Boring
B-25 (X)	1037.97	na	Jan-Feb 1986	na	na	60.97	977.00	60.97	977.00	na	na	na	na	Exploratory Boring
B-26 (P1)	1030.00	na	Jan-Feb 1986	na	na	56	974.00	70	960.00	na	na	na	na	Exploratory Boring
MW-1 (W-1)	1052.48	1054.98	Sept 1987	23.66	1031.32	bne	< 1012	40	1012.48	18.5	28.5	2.50	Saprolite	
MW-2 (W-5)	1012.00	1014.50	Sept 1987	15.83	998.67	bne	< 988	24.5	987.50	14.5	24.5	2.50	Saprolite	
MW-3 (W-4A)	1025.00	1027.50	Sept 1987	43.95	983.55	bne	< 966	59.5	965.50	49.5	59.5	2.50	Saprolite	
MW-4 (W-2)	1016.00	1018.00	Sept 1987	25.20	992.80	bne	< 986	30.5	985.50	18.5	30.5	2.00	Saprolite	
MW-5 (W-3)	1032.00	1034.00	Sept 1987	49.55	984.45	bne	< 979	53	979.00	43	53	2.00	Saprolite	
MW-6 (W-8)	1000.00	1002.50	Sept 1987	na	na	bne	< 983	17	983.00	7	17	2.50	Saprolite	Abandoned 10/94
MW-7 (W-7)	1050.00	1052.50	Sept 1987	35.09	1017.41	29.5	1020.5	39.5	1010.50	29.5	39.5	2.50	Bedrock	
MW-8	1070.70	1072.55	Sept 1987	32.15	1040.40	bne	< 1031	40	1030.70	27.5	37.5	1.85	Saprolite	
MW-9	1144.34	1145.97	Sept 1994	na	na	25	1119.34	73	1071.34	51	66	1.63	Bedrock	Abandoned 07/06
MW-10	1009.80	1012.23	Sept 1994	12.95	999.28	bne	< 987	23	986.80	8	23	2.43	Saprolite	Compliance Well
MW-11	1026.63	1028.58	Sept 1994	35.30	993.28	bne	< 984	43	983.63	28	43	1.95	Saprolite	Compliance Well
MW-12	1032.57	1034.22	Sept 1994	40.34	993.88	19	1013.57	51.5	981.07	37	51.5	1.65	Bedrock	Compliance Well
MW-13	1057.07	1059.40	Sept 1994	48.72	1010.68	bne	< 999	58	999.07	43	58	2.33	Saprolite	Compliance Well
MW-14	1014.76	1017.96	June 1996	9.33	1008.63	bne	< 993	21.5	993.26	5	20	3.20	Saprolite	Compliance Well
MW-15S	1066.88	1069.04	June 1996	44.50	1024.54	bne	< 1013	54	1012.88	39	54	2.16	Saprolite	Compliance Well
MW-15D	1066.67	1069.06	June 1996	43.97	1025.09	100	966.67	118.5	948.17	109	119	2.39	Bedrock	Compliance Well
MW-16S	1005.67	1007.67	June 1996	15.28	992.39	20	985.67	20	985.67	5	20	2.00	Saprolite	Compliance Well
MW-16D	1005.67	1007.87	June 1996	14.07	993.80	20	985.67	120	885.67	78	88	2.20	Bedrock	Compliance Well
MW-17	1119.73	1121.77	June 1996	41.39	1080.38	45	1074.73	52	1067.73	37	52	2.04	Transiton Zone	Background Well
MW-18	995.67	998.49	April 2009	5.45	993.04	bne	< 984	12	983.67	7	12	2.82	Aluvium	Sentinel Well
MW-19	996.99	999.95	April 2009	7.04	992.91	bne	< 984	13	983.99	8	13	2.96	Aluvium	Sentinel Well
MW-20 (PZ-4)	1114.74	1115.04	May 1995	61.13	1053.91	67	1047.74	67	1047.74	52	67	0.30	Saprolite	New Background Well
MW-21 (PZ-1)	1097.00	1099.86	May 1995	41.00	1058.86	bne	< 1052	45	1052.00	30	45	2.86	Saprolite	
PZ-2S	1152.60	1154.74	May 1995	na	na	80	1072.6	80	1072.60	65	80	2.14	Saprolite	NLE
PZ-2D	1152.40	1154.53	May 1995	na	na	77	1075.4	117	1035.40	102	117	2.13	Bedrock	NLE
PZ-3	1040.51	1043.01	May 1995	na	na	bne	< 1027	14	1026.51	4	14	2.50	Saprolite	NLE

TABLE 1: Boring and Well/Piezometer Construction Data

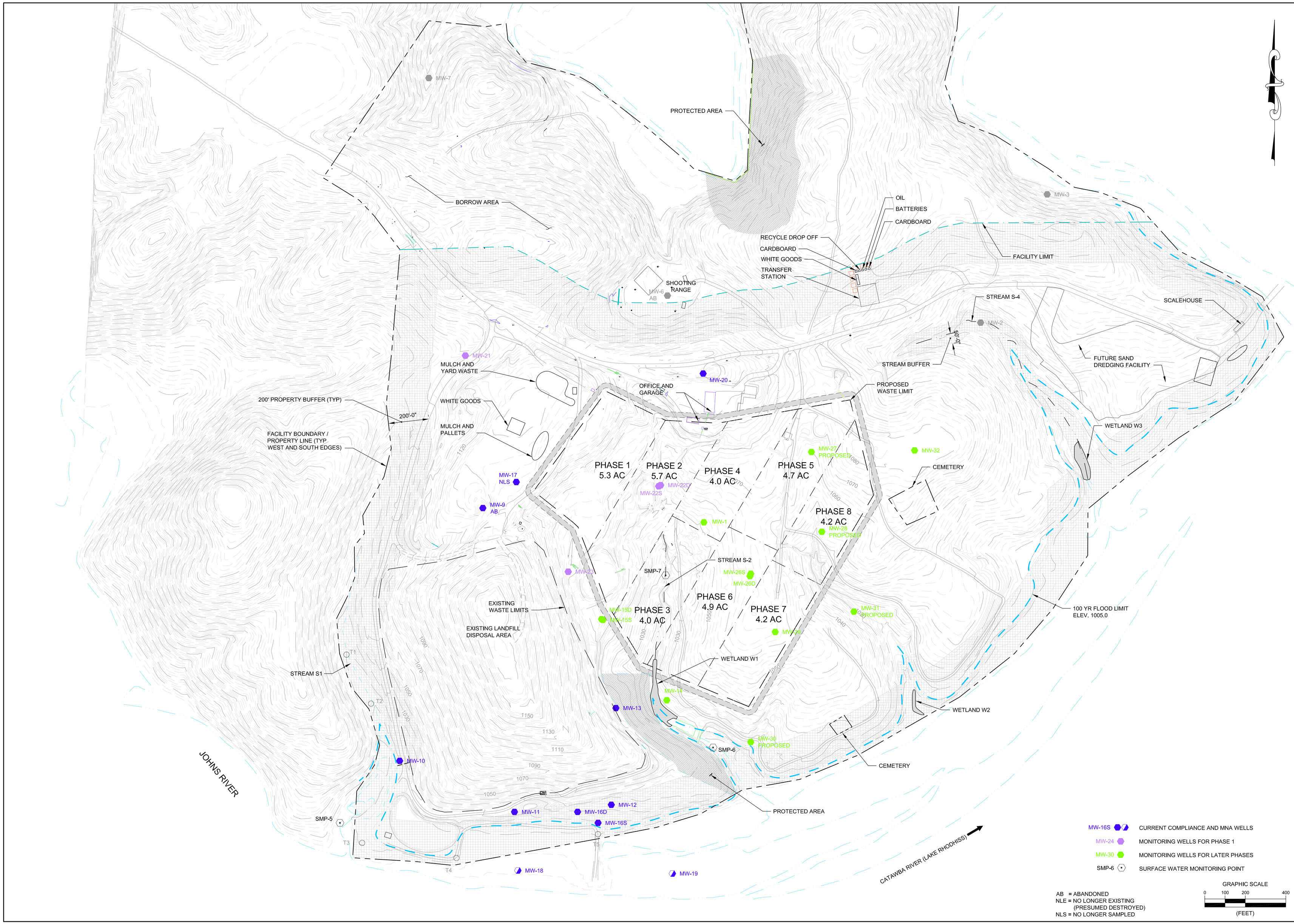
ID (Former ID)	**GS Elevation** (Ft-AMSL)	**TOC Elevation** (Ft-AMSL)	**Date Installed**	**GW** (Ft.-TOC)	**GW** (Ft.-AMSL)	**AR (BR)** (Ft.-BGS)	**AR (BR)** (Ft.-AMSL)	**TD** (Ft.-BGS)	**TD** Ft.-AMSL	**Top Screen** (Ft.-BGS)	**Bottom Screen** (Ft.-BGS)	**Stick-up** (Ft.-BGS)	**Lithology of Screened Interval**	**Comments**
MW-32 (PZ-5)	1095.10	1097.23	May 1995	58.80	1038.43	bne	< 1030	65	1030.10	50	65	2.13	Saprolite	
PZ-6	1019.90	1021.91	May 1995	na	na	bne	< 987	33	986.90	18	33	2.01	Saprolite	Damaged, but still existent.
PZ-7	1014.60	1016.48	May 1995	21.06	995.42	bne	< 987	28	986.60	13	28	1.88	Saprolite	
MW-26S (PZ-8S)	1066.60	1069.04	May 1995	47.29	1021.75	bne	< 1011	55	1011.60	40	55	2.44	Saprolite	
MW-26D (PZ-8D)	1066.13	1068.15	June 1996	47.44	1020.71	74	992.13	89.5	976.63	84.5	89.5	2.02	Bedrock	
PZ-9S	1022.66	1025.16	May 1995	17.87	1007.29	bne	< 995	28	994.66	13	28	2.50	Saprolite	
PZ-9D	1023.50	1025.96	May 1995	17.41	1008.55	47	976.5	67	956.50	52	67	2.46	Bedrock	
PZ-10	1125.30	na	May 1995	na	na	51	1074.3	51	1074.30	na	na	na	na	Boring only
PZ-11	1162.50	na	May 1995	na	na	43.5	1119	43.5	1119.00	na	na	na	na	Boring only
PZ-12	1022.55	1025.64	June 1996	7.93	1017.71	bne	< 1011	12	1010.55	5	12	3.09	Saprolite	
PZ-13	1014.49	1018.35	June 1996	7.43	1010.92	bne	< 1008	6.5	1007.99	1.5	6.5	3.86	Saprolite	
PZ-14	1018.31	1019.34	June 1996	7.69	1011.65	bne	< 1009	9.5	1008.81	2.5	9.5	1.03	Saprolite	
PZ-15	1067.45	1069.62	June 1996	na	na	bne	< 1037	30	1037.45	13	30	2.17	Saprolite	NLE
PZ-16S	1037.66	1040.23	June 1996	10.23	1030.00	bne	< 1018	20	1017.66	3	20	2.57	Saprolite	
PZ-16D	1037.77	1040.18	June 1996	4.36	1035.82	53	984.77	68	969.77	63	68	2.41	Bedrock	
PZ-17	1049.01	1050.95	June 1996	35.29	1015.66	bne	<1014	35	1014.01	20	35	1.94	Saprolite	
PZ-18	1054.11	1056.68	June 1996	na	na	bne	< 999	55	999.11	40	55	2.57	Saprolite	NLE
PZ-19	1046.67	1049.17	June 1996	27.98	1021.19	bne	< 1017	30	1016.67	15	30	2.50	Saprolite	
PZ-20	1074.59	1075.88	June 1996	na	na	bne	< 1030	45	1029.59	30	45	1.29	Saprolite	NLE
MW-29 (PZ-21)	1065.07	1067.65	June 1996	54.67	1012.98	bne	< 1000	65	1000.07	50	65	2.58	Saprolite	
MW-22S (PZ-22S)	1058.57	1061.20	June 1996	16.35	1044.85	bne	< 1034	25	1033.57	10	25	2.63	Saprolite	
MW-22D (PZ-22D)	1057.90	1060.13	June 1996	15.36	1044.77	45.5	1012.4	45	1012.90	40	45	2.23	Saprolite/PWR	
PZ-23	1057.52	1059.96	June 1996	na	na	bne	< 1013	45	1012.52	30	45	2.44	Saprolite	NLE
PZ-24	1165.53	1168.28	June 1996	90.03	1078.25	47.5	1118.03	109	1056.53	54	109	2.75	Bedrock	
PZ-25	1127.45	1130.14	June 1996	68.76	1061.38	51	1076.45	79	1048.45	64	79	2.69	Bedrock	
PZ-26	1122.00	1124.44	June 1996	74.72	1049.72	64	1058	84	1038.00	69	84	2.44	Bedrock	
PZ-27	1018.34	1020.84	Dec. 1996	8.82	1012.02	na	na	na	na	na	na	na	na	No Log or Records
PZ-30S	1085.67	1088.92	May 2011	40.91	1048.01	bne	< 1034	52	1033.67	37	52	3.25	Transition Zone	
PZ-30D	1085.73	1088.48	May 2011	41.14	1047.34	47	1038.7317	82	1003.73	67	82	2.75	Bedrock	
PZ-31	1086.69	1089.81	May 2011	28.42	1061.39	35	1051.6879	41	1045.69	25	40	3.13	Transition Zone	
PZ-32	1080.12	1083.12	May 2011	35.49	1047.63	49.5	1030.6166	65	1015.12	29	49	3.00	Saprolite	
PZ-33	1095.96	1098.96	May 2011	46.48	1052.48	52	1043.95656	62	1033.96	40	60	3.00	Transition Zone	
PZ-34	1082.46	1085.46	May 2011	35.29	1050.17	bne	< 1019	63	1019.46	27	47	3.00	Saprolite	
PZ-35	1060.64	1063.39	May 2011	21.69	1041.70	57.5	1003.13687	57.5	1003.14	15	35	2.75	Saprolite	
PZ-36	1096.52	1099.52	May 2011	31.70	1067.82	25	1071.52174	43	1053.52	28	43	3.00	Bedrock	
PZ-37	1117.93	1120.77	May 2011	57.08	1063.69	25	1092.93227	80	1037.93	60	80	2.83	Bedrock	
MW-23 (PZ-38)	1081.63	1084.76	May 2011	39.61	1045.15	30	1051.63387	71	1010.63	40-50	60-70	3.13	Bedrock	
T-1	1012.31	1014.77	March 1999	3.01	1011.76	bne	< 1009	3	1009.31	1	3	2.46	Alluvium	
T-2	1005.47	1007.85	March 1999	4.03	1003.82	bne	< 1002	3	1002.47	1	3	2.38	Alluvium	
T-3	999.93	1001.84	March 1999	9.23	992.61	bne	< 980	20	979.93	5	20	1.91	Alluvium/Saprolite	
T-4	1002.26	1004.08	March 1999	15.13	988.95	bne	< 977	25	977.26	10	25	1.82	Alluvium/Saprolite	
T-5	1001.01	1003.30	March 1999	11.45	991.85	bne	< 981	20	981.01	5	20	2.29	Alluvium	

Notes:
GS = Ground Surface.
TOC = Top of Casing.
TD = Total drilled depth of boring.
GW = Groundwater Level (Measured on 5/16-17/2011)
AR (BR) = Auger Refusal (Interpreted as Bedrock Surface).
na = Data not available, or not applicable.
Ft.-BGS = Feet below ground surface
Ft.-AMSL = Feet above mean sea level
na = not available or not applicable
bne = bedrock not encounbtered
bne = bedrock (auger refusal) not encountered above TD.
NLE = No Longer Existent. (Not found in recent investigations, presumed destroyed.)

GS Elevation estimated from topographic map.
GS Elevation determined by subtracting TOC-stickup from surveyed TOC elevation.
GS & TOC Elevations appear inconsistent with topography, data not used for maps.
Wells & piezometers outside of the proposed new facility boundary.
TOC Elevation determined by surveyor by adding measured TOC-stickup to surveyed GS elevation.

DRAWING

Drawing WQMP-01 – Water Quality Monitoring Plan on Base Map



DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

DESIGNED GVB
DRAWN RWH
CHECKED GVB
APPROVED GVB
DATE 7/25/12

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JOHNS RIVER WASTE MANAGEMENT FACILITY
BURKE COUNTY, NORTH CAROLINA

WATER QUALITY MONITORING PLAN

PROJECT NO.
277.1002.11

SCALE
AS SHOWN

DRAWING NO.
WQMP-1

L:\Burke County\JOHNS RIVER EXPANSION 2011\HYDROGEO\SHEET SET\WMQ-1 WATER QUALITY MONITORING.dwg Layout=Layout1

APPENDICES:

Appendix A: Construction Specifications for New Monitoring Wells
Appendix B: List of NCSWMR Appendix I & II Constituents

Appendix A:

Construction Specifications for New Monitoring Wells

GROUNDWATER MONITORING WELL CONSTRUCTION SPECIFICATIONS

1.0 DRILLING

1.1 Nominal Boring Diameter

In cases where the diameter of the well pipe will be 2 inches, the minimum nominal borehole diameter of borings advanced through soil materials will be 6 inches in order to help ensure that the minimum width of the annulus around the well pipe will be 2 inches.

1.2 Drilling Methods

All borings will initially be advanced by hollow stem auger drilling methods. In the event that a sufficient depth has not been reached by the point of auger refusal, borings may be advanced by air rotary.

1.3 Cuttings

Drilling will be performed in a manner that minimizes the spreading of soil cuttings. Disposition of cuttings upon project completion will be the responsibility of Owner/Operator or the Owner/Operator's designated representative, and will be in accordance with local, state, and federal regulations.

2.0 SOIL SAMPLING

2.1 Split Spoon Sampling

During hollow stem auger drilling, soil materials will be sampled for characterization of subsurface conditions using split-spoon samplers. The driller will provide one or more split spoon samplers. At a minimum, split-spoon samples will be taken at 5-foot intervals between the surface and the bottom of the boring or spoon refusal, except locations where subsurface conditions have already been adequately characterized.

2.2 Cuttings

During drilling, the driller will attempt to sample soil by the split-spoon method. In the event of spoon refusal, the driller will provide cuttings at intervals specified by the Owner/Operator or the Owner/Operator's representative. The driller will keep cuttings clear of the borehole.

2.3 Sample Disposition

Disposition of sample material upon completion of the project will be the responsibility of the Owner/Operator or the Owner/Operator's designated representative, and will be in accordance with DEQ's IDWP.

3.0 WELL CONSTRUCTION

3.1 Construction Method

In the event that the borehole stands open, the augers may be removed prior to installing the well. In the event that the borehole fails upon removal of the augers, then the well will be constructed within the augers. In the event that the hole fails and/or the auger is too small to permit tremie-pipe construction, then the boring will be re-drilled with larger augers, and the well will be constructed within those augers. Alternatively, a temporary outer casing may be installed for construction of the well within the casing.

For nested wells, each well and/or piezometer in the nest will be installed in a separate borehole. Only one well or piezometer will be installed in each borehole.

3.2 Well Pipe and Screen

Each monitoring well will be constructed of pre-cleaned, Schedule 40 PVC pipe having an inner diameter of 2 inches. Wells will be screened with a screen 10 feet in length. The screen will be factory-slotted. Slots will be 0.01 inch in width. The driller will wear clean, surgical-type gloves whenever handling PVC well pipe, and the pipe will be maintained in a clean manner. In order to provide a clean cut, a PVC pipe cutter will be used whenever it is necessary to shorten sections of the PVC well pipe; a hacksaw will not be used.

3.3 Sand Pack

Filter sand will be a clean sand of proper size in relation to the screen slots to prevent its passage into the well, with no fraction coarser than 0.25-inch nominal diameter. Filter sand will be placed in the annulus around the well riser and to a point approximately two feet above the top of the screen. A tremie-pipe will be used as feasible.

3.4 Bentonite Seal

The annulus around the well pipe will be sealed with a layer of bentonite pellets, to be placed directly above the sand filter pack. The minimum thickness of the bentonite layer will be two feet. The bentonite pellets will be allowed to hydrate prior to continuing with well construction. A tremie-pipe will be used as feasible.

3.5 Grout

Following hydration of the bentonite seal, each boring will be sealed with a Portland Type I bentonite/cement slurry, using the tremie-pipe method. Bentonite content in the slurry will be 2 to 5 percent by weight to help reduce shrinkage.

When feasible, the hollow stem auger will be used as a temporary casing while placing the filter sand and bentonite seal. Cement-bentonite backfill may be placed following removal of the hollow stem auger.

3.6 Surface Completion

The driller will be prepared for either manhole or stickup surface completions.

In the case of manhole installations, suitable surface completion will consist of capped PVC riser and steel manhole. The PVC riser will be provided with a lockable, watertight, expansion cap, with a lock. The manhole will be placed in a manner that permits surface water to runoff and drain away from the manhole cover.

In the case of stickup installations, suitable surface completion will consist of a concrete apron, capped PVC well riser, and outer protective casing. The concrete apron will have the following minimum dimensions: 3 feet x 3 feet x 6 inches, and will be centered with respect to the riser. A form will be used in constructing the apron. The upper surface of the apron will be graded to provide drainage away from the PVC riser. A spike will be set into the pad for surveying purposes.

The inner PVC riser (well pipe) will extend to an approximate height of 1.5-3.0 feet above the top of the concrete pad. A vent hole having a diameter of 0.25 inches will be drilled through the PVC riser at a point approximately 2-3 inches below its top. Shavings generated by drilling the PVC riser will be prevented from falling into the well. The PVC riser will be provided with a lockable, watertight, expansion cap. The top of casing will be marked for surveying purposes.

The outer protective casing will be constructed of steel pipe having a diameter, or diagonal, of not less than six inches. The top of the outer protective casing, when uncovered, will be placed at a point between 0.5 inch above the top of the PVC well pipe and 0.5 inch below the top of the PVC pipe. A drain hole having a diameter of 0.5 inch will be drilled through the outer protective casing near the top of the concrete apron. The outer protective casing will be lockable, and a lock will be provided.

4.0 SURVEYING

The well locations and elevations will be surveyed by a NC licensed surveyor. Survey points will include the following:

- Well location to within $\pm$ 0.1 foot in horizontal plane;
- Ground surface elevation to within $\pm$ 0.01 foot;
- Surveyor's pin elevation on concrete apron within $\pm$ 0.01 foot; and
- Top of well casing (PVC well pipe without cap) elevation to within $\pm$ 0.01 foot.

5.0 WELL DEVELOPMENT AND INSPECTION

The driller will develop each well until sediment-free water (or as close as feasible) with stabilized field constituents (temperature, pH and specific conductance) is obtained. Development will be conducted by pumping or bailing. A surge block may be used as a means

of assessing the integrity of the well screen and riser. If a pump is employed, the design of the pump will be such that groundwater having contact with air is not allowed to drain back into the well. Air surging will not be used. All well development equipment (bailers, pumps, surge blocks) and any additional equipment that contacts subsurface formations will be decontaminated prior to on-site use, between consecutive on-site uses, and/or between consecutive well installations.

6.0 ANCILLARY REQUIREMENTS

6.1 Extraneous Material

The driller will take all reasonable care to ensure that each boring is free from all materials other than those required for well construction. Materials required for well construction are here defined to include polyvinyl chloride (PVC) casing and screen, sand, bentonite, Portland cement, and natural soil materials.

All other materials accidentally or purposely placed in the hole will be removed by the driller prior to well completion.

6.2 Decontamination

All drilling equipment (drill steel, bits, casing materials) and any additional equipment that contacts subsurface formations will be decontaminated prior to on-site use, between consecutive on-site uses, and/or between consecutive well installations.

Appropriate decontamination procedures will consist of steam cleaning with potable water and biodegradable detergent (e.g. Liquinox) approved by Owner/Operator or Owner/Operator's designated representative. Steam cleaning will be conducted in a manner that minimizes over-spray and runoff.

6.4 Site Safety Plan

The driller is responsible for maintaining the personal safety of his employees while on site. The driller will keep a fire extinguisher (in good working condition) and first aid kit at the site at all times during which the site is occupied by his employees.

The driller will be responsible for providing any personal protective equipment that might be required by OSHA and other agencies, including, but not necessarily limited to, hard hats, hearing protection and steel-toed boots, for all personnel employed by the driller.

6.5 Cleanup

The driller will be responsible for removing all refuse from each well site. Such refuse typically includes, but is not limited to, PVC pipe wrappers, sand bags, bentonite bags, cement bags, beverage containers, food wrappers, and other forms of litter. Smoking on site will not be permitted.

6.6 Documentation

The driller will be responsible for providing the following information to the Owner/Operator's designated representative after well installation has been performed:

- date and time of construction;
- drilling method;
- boring diameter;
- well pipe (inner casing) specifications;
- well depth (+/-0.01 ft.);
- drilling/lithologic logs;
- specifications for other casing materials (if applicable);
- screen specifications;
- well pipe/screen joint type;
- filter pack specifications (material, size);
- filter pack volume and calculations;
- filter pack placement methods;
- bentonite seal specifications;
- bentonite seal volume;
- bentonite seal placement method;
- grout specifications;
- grout volume;
- grout placement method;
- surface completion specifications;
- decontamination procedures; and
- well development procedures.

Appendix B:

List of NCSWMR Appendix I & II Constituents

North Carolina Appendix I, II, and C and D Constituents

NC App. I & II - Total Metals

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	**Antimony**	metal	7440-36-0	6010	**6**	**-**	**1**	(RCRA METAL)
2	App. I	**Arsenic**	metal	7440-38-2	6010	**10**	**10**	**-**	(RCRA METAL)
3	App. I	**Barium**	metal	7440-39-3	6010	**100**	**700**	**-**	
4	App. I	**Beryllium**	metal	7440-41-7	6010	**1**	**-**	**4**	(RCRA METAL)
5	App. I	**Cadmium**	metal	7440-43-9	6010	**1**	**2**	**-**	
6	App. I	**Chromium**	metal	7440-47-3	6010	**10**	**10**	**-**	(RCRA METAL)
7	App. I	**Cobalt**	metal	7440-48-4	6010	**10**	**-**	**1**	
8	App. I	**Copper**	metal	7440-50-8	6010	**10**	**1000**	**-**	EPA MCL is a secondary standard.
9	App. I	**Lead**	metal	7439-92-1	6010	**10**	**15**	**-**	EPA MCL is an action level. (RCRA METAL)
10	App. I	**Nickel**	metal	7440-02-0	6010	**50**	**100**	**-**	
11	App. I	**Selenium**	metal	7782-49-2	6010	**10**	**20**	**-**	(RCRA METAL)
12	App. I	**Silver**	metal	7440-22-4	6010	**10**	**20**	**-**	EPA MCL is a secondary standard. (RCRA METAL).
13	App. I	**Thallium**	metal	7440-28-0	6010	**5.5**	**-**	**0.28**	
14	App. I	**Vanadium**	metal	7440-62-2	6010	**25**	**-**	**0.3**	
15	App. I	**Zinc**	metal	7440-66-6	6010	**10**	**1000**	**-**	EPA MCL is a secondary standard. *(AL)* = NC2B Action Level
16	App. II	**Mercury**	metal	7439-97-6	7470	**0.2**	**1**	**-**	(RCRA METAL)
17	App. II	**Tin**	metal	7440-31-5	6010	**100**	**-**	**2000**	

NC App. II - Cyanide/ Sulfide

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Cyanide**	inorganic	57-12-5	9012A	**10**	**70**	**-**	
2	App. II	**Sulfide**	inorganic	18496-25-8	9030B	**1000**	**-**	**-**	

NC - Additional Constituents for C&D Landfills

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	C&D	**Alkalinity**	inorganic	SW337	SM 2320B	**-**	**-**	**-**	
2	C&D	**Chloride**	inorganic	SW301	SM 4500-Cl-E	**-**	**250000**	**-**	
3	C&D	**Iron**	metal	7439-89-6	6010	**300**	**300**	**-**	
4	C&D	**Manganese**	metal	7439-96-5	6010	**50**	**50**	**-**	
5	C&D	**Mercury**	metal	7439-97-6	7470	**0.2**	**1**	**-**	(RCRA Metal)
6	C&D	**Sulfate**	inorganic	14808-79-8	300.0	**250000**	**250000**	**-**	
7	C&D	**Total Dissolved Solids (TDS)**	inorganic	SW311	SM 2540C	**-**	**500000**	**-**	
8	C&D	**Tetrahydrofuran**	volatile	109-99-9	8260B	**-**	**-**	**-**	

NC App. I & II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. I	**Acetone**	volatile	67-64-1	8260B	**100**	**6000**	**-**	
2	App. I	**Acrylonitrile**	volatile	107-13-1	8260B	**200**	**-**	**-**	
3	App. I	**Benzene**	volatile	71-43-2	8260B	**1**	**1**	**-**	
4	App. I	**Bromochloromethane**	volatile	74-97-5	8260B	**3**	**-**	**0.6**	
5	App. I	**Bromodichloromethane**	volatile	75-27-4	8260B	**1**	**0.6**	**-**	*MCL for total trihalomethanes
6	App. I	**Bromoform**	volatile	75-25-2	8260B	**3**	**4**	**-**	*MCL for total trihalomethanes
7	App. I	**Carbon disulfide**	volatile	75-15-0	8260B	**100**	**700**	**-**	
8	App. I	**Carbon tetrachloride**	volatile	56-23-5	8260B	**1**	**0.3**	**-**	
9	App. I	**Chlorobenzene**	volatile	108-90-7	8260B	**3**	**50**	**-**	
10	App. I	**Chloroethane**	volatile	75-00-3	8260B	**10**	**3000**	**-**	
11	App. I	**Chloroform**	volatile	67-66-3	8260B	**5**	**70**	**-**	*MCL for total trihalomethanes
12	App. I	**Dibromochloromethane**	volatile	124-48-1	8260B	**3**	**0.4**	**0.41**	*MCL for total trihalomethanes
13	App. I	**1,2-Dibromo-3-chloropropane (DBCP)**	volatile	96-12-8	8260B	**13**	**0.04**	**-**	
14	App. I	**1,2-Dibromoethane (EDB)**	volatile	106-93-4	8260B	**1**	**0.02**	**-**	
15	App. I	**o-Dichlorobenzene / 1,2-Dichlorobenzene**	volatile	95-50-1	8260B	**5**	**20**	**-**	
16	App. I	**p-Dichlorobenzene / 1,4-Dichlorobenzene**	volatile	106-46-7	8260B	**1**	**6**	**-**	
17	App. I	**trans-1,4-Dichloro-2-butene**	volatile	110-57-6	8260B	**100**	**-**	**-**	
18	App. I	**1,1-Dichloroethane**	volatile	75-34-3	8260B	**5**	**6**	**-**	
19	App. I	**1,2-Dichloroethane**	volatile	107-06-2	8260B	**1**	**0.4**	**-**	
20	App. I	**1,1-Dichloroethylene**	volatile	75-35-4	8260B	**5**	**7**	**-**	
21	App. I	**cis-1,2-Dichloroethylene**	volatile	156-59-2	8260B	**5**	**70**	**-**	
22	App. I	**trans-1,2-Dichloroethylene**	volatile	156-60-5	8260B	**5**	**100**	**-**	
23	App. I	**1,2-Dichloropropane**	volatile	78-87-5	8260B	**1**	**0.6**	**-**	
24	App. I	**cis-1,3-Dichloropropene**	volatile	10061-01-5	8260B	**1**	**0.4**	**-**	
25	App. I	**trans-1,3-Dichloropropene**	volatile	10061-02-6	8260B	**1**	**0.4**	**-**	
26	App. I	**Ethylbenzene**	volatile	100-41-4	8260B	**1**	**600**	**-**	
27	App. I	**2-Hexanone / Methyl butyl ketone (MBK)**	volatile	591-78-6	8260B	**50**	**-**	**280**	
28	App. I	**Methyl bromide / Bromomethane**	volatile	74-83-9	8260B	**10**	**-**	**10**	
29	App. I	**Methyl chloride / Chloromethane**	volatile	74-87-3	8260B	**1**	**3**	**-**	
30	App. I	**Methylene bromide / Dibromomethane**	volatile	74-95-3	8260B	**10**	**-**	**70**	
31	App. I	**Methylene chloride / Dichloromethane**	volatile	75-09-2	8260B	**1**	**5**	**-**	
32	App. I	**Methyl ethyl ketone / 2-Butanone (MEK)**	volatile	78-93-3	8260B	**100**	**4000**	**-**	
33	App. I	**Methyl iodide / Iodomethane**	volatile	74-88-4	8260B	**10**	**-**	**-**	
34	App. I	**4-Methyl-2-pentanone / Methyl isobutyl ketone**	volatile	108-10-1	8260B	**100**	**-**	**560**	
35	App. I	**Styrene**	volatile	100-42-5	8260B	**1**	**70**	**-**	
36	App. I	**1,1,1,2-Tetrachloroethane**	volatile	630-20-6	8260B	**5**	**-**	**1**	
37	App. I	**1,1,2,2-Tetrachloroethane**	volatile	79-34-5	8260B	**3**	**0.2**	**0.18**	
38	App. I	**Tetrachloroethylene (PCE)**	volatile	127-18-4	8260B	**1**	**0.7**	**-**	
39	App. I	**Toluene**	volatile	108-88-3	8260B	**1**	**600**	**-**	
40	App. I	**1,1,1-Trichloroethane**	volatile	71-55-6	8260B	**1**	**200**	**-**	
41	App. I	**1,1,2-Trichloroethane**	volatile	79-00-5	8260B	**1**	**-**	**0.6**	
42	App. I	**Trichloroethylene**	volatile	79-01-6	8260B	**1**	**3**	**-**	
43	App. I	**Trichlorofluoromethane (CFC-11)**	volatile	75-69-4	8260B	**1**	**2000**	**-**	
44	App. I	**1,2,3-Trichloropropane**	volatile	96-18-4	8260B	**1**	**0.005**	**-**	
45	App. I	**Vinyl acetate**	volatile	108-05-4	8260B	**50**	**-**	**88**	
46	App. I	**Vinyl chloride**	volatile	75-01-4	8260B	**1**	**0.03**	**-**	
47	App. I	**Xylenes (total)**	volatile	see note	8260B	**5**	**500**	**-**	Includes o-xylene, p-xylene, and unspecified xylenes [dimethyl benzenes (CAS RN 1330-20-7].

NC App. II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
48	App. II	**Acetonitrile (methyl cyanide)**	volatile	75-05-8	8260B	**55**	**-**	**42**	
49	App. II	**Acrolein**	volatile	107-02-8	8260B	**53**	**-**	**4**	
50	App. II	**Allyl chloride (3-chloroprene)**	volatile	107-05-1	8260B	**10**	**-**	**-**	
51	App. II	**Chloroprene**	volatile	126-99-8	8260B	**20**	**-**	**-**	
52	App. II	**m-Dichlorobenzene / 1,3-Dichlorobenzene**	volatile	541-73-1	8260B	**5**	**200**	**-**	
53	App. II	**Dichlorodifluoromethane**	volatile	75-71-8	8260B	**5**	**1000**	**-**	
54	App. II	**1,3-Dichloropropane**	volatile	142-28-9	8260B	**1**	**-**	**-**	
55	App. II	**2,2-Dichloropropane**	volatile	594-20-7	8260B	**15**	**-**	**-**	
56	App. II	**1,1-Dichloropropene**	volatile	563-58-6	8260B	**5**	**-**	**-**	
57	App. II	**Isobutyl alcohol**	volatile	78-83-1	8260B	**100**	**-**	**-**	
58	App. II	**Methacrylonitrile**	volatile	126-98-7	8260B	**100**	**-**	**-**	
59	App. II	**Methyl methacrylate**	volatile	80-62-6	8260B	**30**	**-**	**25**	
60	App. II	**Propionitrile**	volatile	107-12-0	8260B	**150**	**-**	**-**	
61	App. II	**1,2,4-Trichlorobenzene**	volatile	120-82-1	8260B	**10**	**70**	**70**	
62	App. II	**Naphthalene**	volatile	91-20-3	8260B or 8270C	**10**	**6**	**-**	
63	App. II	**Hexachlorobutadiene**	semi-volatile	87-68-3	8270C or 8260B	**10**	**0.4**	**0.44**	
64	App. II	**Ethyl methacrylate**	semi-volatile	97-63-2	8270C or 8260B	**10**	**-**	**-**	

North Carolina Appendix I, II, and C and D Constituents

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Acenaphthene**	semi-volatile	83-32-9	8270C	**10**	**80**	**-**	
2	App. II	**Acenaphthylene**	semi-volatile	208-96-8	8270C	**10**	**200**	**-**	
3	App. II	**Acetophenone**	semi-volatile	98-86-2	8270C	**10**	**-**	**700**	
4	App. II	**2-Acetylaminofluorene**	semi-volatile	53-96-3	8270C	**20**	**-**	**-**	
5	App. II	**4-Aminobiphenyl**	semi-volatile	92-67-1	8270C	**20**	**-**	**-**	
6	App. II	**Anthracene**	PAH	120-12-7	8270C	**10**	**2000**	**-**	
7	App. II	**Benz[a]anthracene; Benzanthracene**	PAH	56-55-3	8270C	**10**	**0.05**	**-**	
8	App. II	**Benzo[b]fluoranthene**	PAH	205-99-2	8270C	**10**	**0.05**	**-**	
9	App. II	**Benzo[k]fluoranthene**	PAH	207-08-9	8270C	**10**	**0.5**	**-**	
10	App. II	**Benzo[g,h,i]perylene**	PAH	191-24-2	8270C	**10**	**200**	**-**	
11	App. II	**Benzo[a]pyrene**	PAH	50-32-8	8270C	**10**	**0.005**	**-**	
12	App. II	**Benzyl alchohol**	semi-volatile	100-51-6	8270C	**20**	**-**	**700**	
13	App. II	**Bis(2-chloroethoxy)methane**	semi-volatile	111-91-1	8270C	**10**	**-**	**-**	
14	App. II	**Bis(2-chloroethyl)ether**	semi-volatile	111-44-4	8270C	**10**	**-**	**0.031**	
15	App. II	**Bis(2-chloro-1-methylethyl)ether**	semi-volatile	108-60-1	8270C	**10**	**-**	**-**	Bis (2-chloroisopropyl) ether
16	App. II	**Bis(2-ethylhexyl)phthalate**	semi-volatile	117-81-7	8270C	**15**	**3**	**-**	
17	App. II	**4-Bromophenyl phenyl ether**	semi-volatile	101-55-3	8270C	**10**	**-**	**-**	
18	App. II	**Butyl benzyl phthalate**	semi-volatile	85-68-7	8270C	**10**	**1000**	**-**	
19	App. II	**p-Chloroaniline (4-Chloroaniline)**	semi-volatile	106-47-8	8270C	**20**	**-**	**-**	
20	App. II	**Chlorobenzilate**	semi-volatile	510-15-6	8270C	**10**	**-**	**-**	
21	App. II	**p-Chloro-m-cresol (4-chloro-3-methylphenol)**	semi-volatile	59-50-7	8270C	**20**	**-**	**-**	
22	App. II	**2-Chloronaphthalene**	semi-volatile	91-58-7	8270C	**10**	**-**	**-**	
23	App. II	**2-Chlorophenol**	semi-volatile	95-57-8	8270C	**10**	**0.4**	**-**	
24	App. II	**4-Chlorophenyl phenyl ether**	semi-volatile	7005-72-3	8270C	**10**	**-**	**-**	
25	App. II	**Chrysene**	PAH	218-01-9	8270C	**10**	**5**	**-**	
26	App. II	**m-Cresol (3-Methylphenol)**	semi-volatile	108-39-4	8270C	**10**	**400**	**-**	
27	App. II	**o-Cresol**	semi-volatile	95-48-7	8270C	**10**	**-**	**400**	
28	App. II	**p-Cresol (4-Methylphenol)**	semi-volatile	106-44-5	8270C	**10**	**40**	**-**	
29	App. II	**Diallate**	semi-volatile	2303-16-4	8270C	**10**	**-**	**-**	
30	App. II	**Dibenz[a,h]anthracene**	PAH	53-70-3	8270C	**10**	**0.005**	**-**	
31	App. II	**Dibenzofuran**	semi-volatile	132-64-9	8270C	**10**	**-**	**28**	
32	App. II	**Di-n-butyl phthalate**	semi-volatile	84-74-2	8270C	**10**	**700**	**-**	
33	App. II	**3,3'-Dichlorobenzidine**	semi-volatile	91-94-1	8270C	**20**	**-**	**-**	
34	App. II	**2,4-Dichlorophenol**	semi-volatile	120-83-2	8270C	**10**	**-**	**0.98**	
35	App. II	**2,6-Dichlorophenol**	semi-volatile	87-65-0	8270C	**10**	**-**	**-**	
36	App. II	**Diethyl phthalate**	semi-volatile	84-66-2	8270C	**6000**	**6000**	**-**	
37	App. II	**O,O-Diethyl O-2-pyrazinyl phosphorothioate**	OP pesticide	297-97-2	8270C	**20**	**-**	**-**	Thionazine
38	App. II	**Dimethoate**	OP pesticide	60-51-5	8270C	**20**	**-**	**-**	
39	App. II	**p-(Dimethylamino)azobenzene**	semi-volatile	60-11-7	8270C	**10**	**-**	**-**	
40	App. II	**7,12-Dimethylbenz[a]anthracene**	semi-volatile	57-97-6	8270C	**10**	**-**	**-**	
41	App. II	**3,3'-Dimethylbenzidine**	semi-volatile	119-93-7	8270C	**10**	**-**	**-**	
42	App. II	**2,4-Dimethylphenol (M-xylenol)**	semi-volatile	105-67-9	8270C	**10**	**100**	**-**	
43	App. II	**Dimethyl phthalate**	semi-volatile	131-11-3	8270C	**10**	**-**	**-**	
44	App. II	**m-Dinitrobenzene**	semi-volatile	99-65-0	8270C	**20**	**-**	**-**	
45	App. II	**4,6-Dinitro-o-cresol (2-methyl 4,6-dinitrolphenol)**	semi-volatile	534-52-1	8270C	**50**	**-**	**-**	
46	App. II	**2,4-Dinitrophenol**	semi-volatile	51-28-5	8270C	**50**	**-**	**-**	
47	App. II	**2,4-Dinitrotoluene**	semi-volatile	121-14-2	8270C	**10**	**-**	**0.1**	
48	App. II	**2,6-Dinitrotoluene**	semi-volatile	606-20-2	8270C	**10**	**-**	**-**	
49	App. II	**Di-n-octyl phthalate**	semi-volatile	117-84-0	8270C	**10**	**100**	**-**	
50	App. II	**Diphenylamine**	semi-volatile	122-39-4	8270C	**10**	**-**	**-**	
51	App. II	**Disulfoton**	OP pesticide	298-04-4	8270C	**10**	**0.3**	**-**	
52	App. II	**Ethyl methanesulfonate**	semi-volatile	62-50-0	8270C	**20**	**-**	**-**	
53	App. II	**Famphur**	semi-volatile	52-85-7	8270C	**20**	**-**	**-**	
54	App. II	**Fluoranthene**	PAH	206-44-0	8270C	**10**	**300**	**-**	
55	App. II	**Fluorene**	PAH	86-73-7	8270C	**10**	**300**	**-**	

NC App. II - Method 8270

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
56	App. II	**Hexachlorobenzene**	semi-volatile	118-74-1	8270C	**10**	**0.02**	**-**	
57	App. II	**Hexachlorocylopentadiene**	semi-volatile	77-47-4	8270C	**10**	**-**	**50**	
58	App. II	**Hexachloroethane**	semi-volatile	67-72-1	8270C	**10**	**-**	**2.5**	
59	App. II	**Hexachloropropene**	semi-volatile	1888-71-7	8270C	**10**	**-**	**-**	
60	App. II	**Indeno[1,2,3-cd]pyrene**	PAH	193-39-5	8270C	**10**	**0.05**	**-**	
61	App. II	**Isodrin**	semi-volatile	465-73-6	8270C	**20**	**-**	**-**	
62	App. II	**Isophorone**	semi-volatile	78-59-1	8270C	**10**	**40**	**-**	
63	App. II	**Isosafrole**	semi-volatile	120-58-1	8270C	**10**	**-**	**-**	
64	App. II	**Kepone**	pesticide	143-50-0	8270C	**20**	**-**	**-**	
65	App. II	**Methapyrilene**	semi-volatile	91-80-5	8270C	**100**	**-**	**-**	
66	App. II	**3-Methylcholanthrene**	semi-volatile	56-49-5	8270C	**10**	**-**	**-**	
67	App. II	**Methyl methanesulfonate**	semi-volatile	66-27-3	8270C	**10**	**-**	**-**	
68	App. II	**2-Methylnaphthalene**	semi-volatile	91-57-6	8270C	**10**	**30**	**-**	
69	App. II	**Methyl parathion**	semi-volatile	298-00-0	8270C	**10**	**-**	**-**	
70	App. II	**1,4-Naphthoquinone**	semi-volatile	130-15-4	8270C	**10**	**-**	**-**	
71	App. II	**1-Naphthylamine**	semi-volatile	134-32-7	8270C	**10**	**-**	**-**	
72	App. II	**2-Naphthylamine**	semi-volatile	91-59-8	8270C	**10**	**-**	**-**	
73	App. II	**o-Nitroaniline (2-Nitroaniline)**	semi-volatile	88-74-4	8270C	**50**	**-**	**-**	
74	App. II	**m-Nitroaniline (3-Nitroaniline)**	semi-volatile	99-09-2	8270C	**50**	**-**	**-**	
75	App. II	**p-Nitroaniline (4-Nitroaniline)**	semi-volatile	100-01-6	8270C	**20**	**-**	**-**	
76	App. II	**Nitrobenzene**	semi-volatile	98-95-3	8270C	**10**	**-**	**-**	
77	App. II	**5-Nitro-o-toluidine**	semi-volatile	99-55-8	8270C	**10**	**-**	**-**	
78	App. II	**o-Nitrophenol (2-Nitrophenol)**	semi-volatile	88-75-5	8270C	**10**	**-**	**-**	
79	App. II	**p-Nitrophenol (4-Nitrophenol)**	semi-volatile	100-02-7	8270C	**50**	**-**	**-**	
80	App. II	**N-Nitrosodiethylamine**	semi-volatile	55-18-5	8270C	**20**	**-**	**-**	
81	App. II	**N-Nitrosodimethylamine**	semi-volatile	62-75-9	8270C	**10**	**0.0007**	**-**	
82	App. II	**N-Nitrosodi-n-butylamine**	semi-volatile	924-16-3	8270C	**10**	**-**	**-**	
83	App. II	**N-Nitrosodiphenylamine**	semi-volatile	86-30-6	8270C	**10**	**-**	**-**	
84	App. II	**N-Nitrosodipropylamine**	semi-volatile	621-64-7	8270C	**10**	**-**	**-**	
85	App. II	**N-Nitrosomethylethylamine**	semi-volatile	10595-95-6	8270C	**10**	**-**	**-**	
86	App. II	**N-Nitrosopiperidine**	semi-volatile	100-75-4	8270C	**20**	**-**	**-**	
87	App. II	**N-Nitrosopyrrolidine**	semi-volatile	930-55-2	8270C	**10**	**-**	**-**	
88	App. II	**Parathion**	OP pesticide	56-38-2	8270C	**10**	**-**	**-**	
89	App. II	**Pentachlorobenzene**	semi-volatile	608-93-5	8270C	**10**	**-**	**-**	
90	App. II	**Pentachloronitrobenzene**	semi-volatile	82-68-8	8270C	**20**	**-**	**-**	
91	App. II	**Phenacetin**	semi-volatile	62-44-2	8270C	**20**	**-**	**-**	
92	App. II	**Phenanthrene**	PAH	85-01-8	8270C	**10**	**200**	**-**	
93	App. II	**Phenol**	semi-volatile	108-95-2	8270C	**10**	**30**	**-**	
94	App. II	**p-Phenylenediamine**	semi-volatile	106-50-3	8270C	**10**	**-**	**-**	
95	App. II	**Phorate**	OP pesticide	298-02-2	8270C	**10**	**1**	**-**	
96	App. II	**Pronamide**	semi-volatile	23950-58-5	8270C	**10**	**-**	**-**	
97	App. II	**Pyrene**	PAH	129-00-0	8270C	**10**	**200**	**-**	
98	App. II	**Safrole**	semi-volatile	94-59-7	8270C	**10**	**-**	**-**	
99	App. II	**1,2,4,5-Tetrachlorobenzene**	semi-volatile	95-94-3	8270C	**10**	**-**	**2**	
100	App. II	**2,3,4,6-Tetrachlorophenol**	semi-volatile	58-90-2	8270C	**10**	**200**	**-**	
101	App. II	**o-Toluidine**	semi-volatile	95-53-4	8270C	**10**	**-**	**-**	
102	App. II	**2,4,5-Trichlorophenol**	semi-volatile	95-95-4	8270C	**10**	**-**	**63**	
103	App. II	**2,4,6-Trichlorophenol**	semi-volatile	88-06-2	8270C	**10**	**-**	**4**	
104	App. II	**O,O,O-Triethyl phosphorothioate**	semi-volatile	126-68-1	8270C	**10**	**-**	**-**	
105	App. II	**1,3,5-Trinitrobenzene**	semi-volatile	99-35-4	8270C	**10**	**-**	**-**	
106	App. II	**Hexachlorobutadiene**	semi-volatile	87-68-3	8270C or 8260	**10**	**0.4**	**0.44**	
107	App. II	**Ethyl methacrylate**	semi-volatile	97-63-2	8270C or 8270	**10**	**-**	**-**	
108	App. II	**Naphthalene**	volatile	91-20-3	8260B or 8270	**10**	**6**	**-**	
109	App. II	**Pentachlorophenol**	herbicide	87-86-5	8151 or 8270	**25**	**0.3**	**-**	

North Carolina Appendix I, II, and C and D Constituents

NC App. II - Pesticides Method 8081

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**Aldrin**	pesticide	309-00-2	8081A	**0.05**	**-**	**0.002**	
2	App. II	**alpha-BHC**	pesticide	319-84-6	8081A	**0.05**	**-**	**0.006**	
3	App. II	**beta-BHC**	pesticide	319-85-7	8081A	**0.05**	**-**	**0.019**	
4	App. II	**delta-BHC**	pesticide	319-86-8	8081A	**0.05**	**-**	**0.019**	
5	App. II	**gamma-BHC (Lindane)**	pesticide	58-89-9	8081A	**0.05**	**0.03**	**-**	
6	App. II	**Chlordane**	pesticide	see note	8081A	**0.5**	**0.1**	**-**	This entry includes alpha-chlordane (CAS RN 5103-71-9), beta chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 566-34-7), and constituents of chlordane (CAS RN 57-74-9 and 12672-29-6).
7	App. II	**4,4'-DDD**	pesticide	72-54-8	8081A	**0.1**	**0.1**	**-**	
8	App. II	**4,4'-DDE**	pesticide	72-55-9	8081A	**0.1**	**-**	**-**	
9	App. II	**4-4'-DDT**	pesticide	50-29-3	8081A	**0.1**	**0.1**	**-**	
10	App. II	**Dieldrin**	pesticide	60-57-1	8081A	**0.075**	**0.002**	**-**	
11	App. II	**Endosulfan I**	pesticide	959-96-8	8081A	**0.1**	**40**	**-**	
12	App. II	**Endosulfan II**	pesticide	33213-65-9	8081A	**0.1**	**42**	**-**	
13	App. II	**Endosulfan sulfate**	pesticide	1031-07-8	8081A	**0.1**	**-**	**40**	
14	App. II	**Endrin**	pesticide	72-20-8	8081A	**0.1**	**2**	**-**	
15	App. II	**Endrin aldehyde**	pesticide	7421-93-4	8081A	**0.1**	**2**	**-**	
16	App. II	**Heptachlor**	pesticide	76-44-8	8081A	**0.05**	**0.008**	**-**	
17	App. II	**Heptachlor epoxide**	pesticide	1024-57-3	8081A	**0.075**	**0.004**	**-**	
18	App. II	**Methoxychlor**	pesticide	72-43-5	8081A	**1**	**40**	**-**	
19	App. II	**Toxaphene**	pesticide	see note	8081A	**1.5**	**0.03**	**-**	Includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2) such as chlorinated camphene.

NC App. II - PCB's Method 8082

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1-6	App. II	**Polychlorinated Biphenyls (PCBs)**	PCB	see note	8082	**2**	**-**	**0.09**	This category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1)). Value given for the NC 2L Standard is the GWP for the Solid Waste Section.

NC App. II - Herbicides 8151

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER			NOTES
						NC SWSL	NC 2L	GWP STD.	
1	App. II	**2,4-Dichlorophenoxyacetic acid (2,4-D)**	herbicide	94-75-7	8151A	**2**	**70**	**-**	
2	App. II	**Dinoseb (DNBP); 2-sec-Butyl-4,6-dinitrophenol**	herbicide	86-85-7	8151A	**1**	**-**	**7**	
3	App. II	**Silvex (2,4,5-TP)**	herbicide	93-72-1	8151A	**2**	**50**	**-**	
4	App. II	**2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)**	herbicide	93-76-5	8151A	**2**	**-**	**-**	
5	App. II	**Pentachlorophenol**	herbicide	87-86-5	8151 or 8270	**25**	**0.3**	**-**	

Notes:

Color denotes NC App. I Constituents

Color denotes remaining NC App. II Constituents

Color denotes C&D Constituents

Color denotes constituents that can be analyzed by more than one method

1. CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
2. Class: General type of compound
3. OP = orthophosphate
4. PAH = polynuclear aromatic hydrocarbon.
5. Volatile EQL of 1 ug/L is based on a 25-mL purge per SW-846, Final Update III, Revision 2, December 1996, page 8260B-35 (most recent revision to method 8260 in SW-846).
6. " - " = not available/not applicable
7. Referenced from North Carolina Dvision of Waste Management website (http://www.wastenotnc.org/sw/swenvmonitoringlist.asp) as of 10/24/11.