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PREPARED FOR:
WILKES COUNTY DEPARTMENT OF SOLID WASTE
9219 ELKIN HIGHWAY
ROARING RIVER, NORTH CAROLINA 28669

ROARING RIVER LANDFILL
WILKES COUNTY, NORTH CAROLINA
PERMIT No. 97-04

PHASE 4 EXPANSION

GREAT STATE OF WILKES
IMPERIUM INTRA IMPERIO

VOLUME 3
HYDROGEOLOGY
SECTION VII – WATER QUALITY MONITORING PLAN

JANUARY 2011

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Water Quality Monitoring Certification Statement:

We certify that the Water Quality Monitoring Plan included in this report, when implemented, will be effective in providing early detection of any release of hazardous constituents to the upper and lower aquifers, so as to be protective of public health and the environment.

VOLUME 3, SECTION VII
WATER QUALITY MONITORING PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

This *Water Quality Monitoring Plan* (WQMP) will serve as a guidance document for collecting and analyzing groundwater samples, managing the associated analytical results, and monitoring for any potential releases to the uppermost aquifer from the Wilkes County Roaring River Landfill, which consists of the Phases 1, 2, 3, and proposed Phase 4 vertical expansion. The Plan complies with Rules .1630 through .1637 of the North Carolina Solid Waste Management Rules, Title 15A, Subchapter 13B.

1.1 Site Description

The Wilkes County Roaring River Landfill is owned and operated by Wilkes County under Permit No. 97-04. The landfill property is located near the town of Roaring River, North Carolina. The site is located on a group of knolls rising over 150 feet above the floodplain of the Yadkin River. The property boundary and disposal area are indicated on an enlarged portion of the USGS 7 ½ minute topographic map for Ronda, North Carolina (Drawing No. WQMP-T). The landfill facility boundary includes most of the area between the disposal cells and the floodplain of the Yadkin River.

The approximately 145-acre site was originally investigated for suitability as a solid waste management facility in 1989 by Westinghouse Environmental and Geotechnical Services, Inc. (Westinghouse). Additional site characterization work was performed at the site in 1990 and 1991 by Municipal Engineering Services, P.A., during preparation of the Construction Plan Application for the Phase 1 cell, in accordance with expected revisions to the North Carolina Solid Waste Management Rules (NCSWMR), in response to Subtitle D regulations. Further site characterization work was performed in 1994, as part of the Transition Plan for the facility.

Wilkes County submitted a *Design Hydrogeologic Report* in 1991 to North Carolina Department of Environment and Natural Resources (NCDENR) and the facility began accepting waste in the Subtitle D lined Phase 1 in 1993. This cell, which occupies approximately 11.7 acres of the facility, reached final capacity in 1999. A site investigation and *Design Hydrogeologic Report* for the 7.3 acre Phase 2 was completed in December 1998. The Phase 2 disposal area reached final capacity in July 2006. A *Design Hydrogeologic Report* for the 6.7 acre Phase 3 was completed in May 2004 and construction was completed January 2006. Phase 4 of the waste disposal unit will be a vertical expansion of the Phase 3 area.

1.2 Site Geology and Hydrogeology

The site is located at the boundary of the Inner Piedmont Belt and Blue Ridge Belt in the Brevard Fault Zone. In the vicinity of the site, the Brevard Zone is a five-mile wide, east-northeast trending fault zone with a complex structural and metamorphic history. Finely interlayered gneiss and schist within the zone are amphibolite facies, with peak metamorphism as high as the kyanite zone for pelitic assemblages. Typically, the more highly-strained and faulted parts of the zone have experienced retrograde metamorphism to greenschist facies. Rocks in the Brevard Zone have undergone various degrees of both ductile and brittle deformation. Espenshade and others mapped four continuous faults that either bound the zone or separate rock units consistently over long distances. These faults contain both mylonitic and cataclastic rock, and exhibit the greatest degree of retrograde metamorphism. Two of these faults cross on or near the site. Bedrock at the site and in the Brevard Zone generally is more highly fractured than rock typical of most Piedmont and Mountain sites.

The uppermost aquifer is unconfined and includes both saprolite and fractured bedrock, which are strongly connected. The groundwater level measurements taken in June 22, 2010 were used to construct the groundwater surface contours shown in Drawing No. 1. Historical static water levels are provided in Table 1. Groundwater flow is generally to the south-southwest.

Hydraulic conductivities (K) were based on slug test values from the *Design Hydrogeologic Report* submitted in April 2004. An effective porosity of 16% was used to estimate average linear groundwater flow velocities. Linear groundwater flow velocities for wells screened in saprolite were computed using the following modified Darcy equation:

$$V = Ki/n_e$$

where V = average linear velocity (feet per day), K = hydraulic conductivity (ft/day), i = horizontal hydraulic gradient, and n_e = effective porosity.

Based on calculations from the most recent sampling event, the average estimated linear groundwater flow velocity for the site is approximately 0.25 ft/day (Table 2). This falls within the range of historical estimates for groundwater flow velocities at this site. The linear velocity equation and resulting rates make the simplified assumptions of a homogeneous and isotropic aquifer. This equation can over-estimate velocities when applied to heterogeneous and/or anisotropic conditions such as are believed to exist at this site. The regolith and fractured bedrock common in Piedmont terrain are characteristically heterogeneous. Site boring logs record that regolith sampled at the site commonly exhibits relict foliation. These structures can result in locally anisotropic groundwater flow directions. Although the regolith and bedrock are hydraulically connected, the effective porosity generally decreases with depth into the underlying fractured bedrock.

2.0 GROUNDWATER MONITORING

The groundwater monitoring network was designed to monitor for potential releases to the uppermost aquifer from existing Phases 1, 2, 3, and proposed Phase 4 at the Wilkes County Roaring River Landfill. Eleven active groundwater monitoring wells comprise the monitoring network at the Roaring River Landfill. The current compliance network consists of the following monitoring wells: MW-13 (facility background well), MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12S, MW-12D, MW-17, and MW-18.

Monitoring Well	Date Installed	Classification	Monitoring Program	Total Depth from TOC (ft)	Lithology of Screened Interval
MW-2R	4/08/02	Abandoned	-	116.00	Bedrock
MW-5	8/12/93	Compliance	Detection	38.11	Saprolite
MW-6	8/13/93	Compliance	Detection	37.60	Saprolite
MW-7	8/11/93	Compliance	Detection	41.77	Saprolite
MW-8	8/11/93	Compliance	Detection	58.50	Bedrock
MW-9	8/12/93	Compliance	Detection	37.57	Saprolite
MW-10	9/02/98	Compliance	Detection	76.75	Bedrock
MW-12S	3/07/00	Compliance	Detection	104.00	Partially Weathered Rock
MW-12D	3/07/00	Compliance	Detection	134.00	Partially Weathered Rock
MW-13	2/05/01	Background	Detection	88.00	Partially Weathered Rock
MW-17	8/26/03	Compliance	Detection	24.63	Saprolite
MW-18	8/26/03	Compliance	Detection	46.85	Saprolite

Monitoring well MW-13 is the upgradient background monitoring well for the facility. This well replaced former background monitoring well MW-2R which was abandoned on September 13, 2010. Well MW-13 was installed in February 2001 to serve as the background well for the proposed C&D landfill; however, no C&D landfill has been constructed at this time. Well MW-13 was sampled for the first time on November 1, 2010 during the second semiannual event.

Monitoring wells MW-5, -6, -7, -8, -9, and -10 are monitored to detect potential releases from Cell 1. Monitoring wells MW-12S and -12D were installed in March 2000 to be incorporated into the monitoring network to effectively monitor Cell 2, while monitoring wells MW-11S and MW-11D were abandoned for Phase 2 construction. Wells MW-17 and MW-18 were installed during the Design Hydrogeologic Investigation for Phases 3 and 4 and were incorporated into the facility network after the June 2006 approval of the revised Groundwater Monitoring Plan.

3.0 INSTALLATION AND MAINTENANCE OF THE GROUNDWATER MONITORING NETWORK

The existing monitoring wells will be used and maintained in accordance with design specifications throughout the life of the monitoring program. The specifications are outlined in 15A NCAC Subchapter 2C, Section .0100. Further guidance is provided in the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities; Solid Waste Section, Division of Solid Waste Management; Department of Environment, Health and Natural Resources (March 1995).* Routine well maintenance will include inspection and correction/repair of, as necessary, identification labels, concrete apron condition, locking caps and locks, and access to the wells. Wilkes County will re-evaluate the monitoring network, and provide recommendations to the Division of Waste Management (DWM) for modifying, rehabilitating, abandoning, or installing replacement or additional monitoring wells, as appropriate.

3.1 Groundwater Sampling Methodology

Groundwater samples will be collected in accordance with Solid Waste Management Rules 15A NCAC 13B .1632 and guidance provided in the *Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities; Solid Waste Section, Division of Solid Waste Management; Department of Environment, Health and Natural Resources* (March 1995). Details of well purging, sample withdrawal, and decontamination methods, as well as chain-of-custody procedures are outlined below.

3.1.1 Static Water Levels

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 if not already known, the distance to the bottom of the well) will be measured using the tape attached to the probe. In between wells and following completion of the field sampling, the water level meter will be decontaminated using the following procedure.

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

3.1.2 Purging and Sampling Methodology

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 parameter's volatilization sensitivity (i.e., total organic 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 and pore spaces of the surrounding filter pack. The well volume will be calculated using the following formulas:

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

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

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)

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 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, specific conductance, and turbidity 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., volatile organic compounds {VOCs} first, followed by the metals).

3.1.3 Sample Collection, Bottling, and Transportation

Pre-preserved sample containers are properly prepared by the analytical laboratory scheduled to perform the analysis. No cleaning or preparation of sampling bottles by field personnel should be performed.

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.

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, chain-of-custody records, and laboratory logs.

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 or method 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);
- 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).

A sample field log sheet for groundwater is provided in Appendix VII-1.

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 sample chain-of-custody form is included in Appendix VII-2.

3.1.4 Field and Trip Blanks

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(s). The field blank will be subjected to the same analysis(es) 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 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 volatiles analysis, a trip blank will be generated by the laboratory prior to shipment of sampling containers and coolers to the field, using lab pure water as described above. 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 volatile 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. Detections of constituents in site groundwater or surface water samples may be blank-qualified if the concentration detected in the sample is less than 5 times (or 10 times, in the case of some common laboratory contaminants such as methylene chloride and some phthalates) the concentrations of that constituent detected in the field, trip, or method blanks. 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 resampling.

3.2 Sample Analysis Requirements

Analysis of groundwater samples from the facility will be conducted by a laboratory certified by the NCDENR. Analyses will be performed in accordance with U.S. Environmental Protection Agency (EPA) SW-846 methods. Groundwater samples will be analyzed for the constituents listed in NCSWMR Appendix I in accordance with 15A NCAC 13B.1633 (Detection Monitoring Program). In addition, field analyses for temperature, pH, specific conductance, and turbidity will be performed for each sample. Appendix C 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 groundwater protection standards (GWPS). All limits and standards are current as of the submittal date of the WQMP.

3.3 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 exceedences, reporting or data error, missing data, etc.

3.4 Well Abandonment

Any monitoring wells at the site which need to be abandoned due to damage, construction activities, or approved changes in the monitoring network will be properly abandoned in accordance with the procedures for permanent abandonment, as described in 15A NCAC 2C Rule .0113(a)(2) and the *NCDENR Water Quality Monitoring Guidance Document for Solid Waste Facilities*. No wells will be abandoned without prior approval from the SWS.

4.0 COMPARISONS TO THE NC 2L AND GWPS

Constituents detected in the groundwater samples collected from the compliance network shall be compared to the NC 2L Standards established by 15A NCAC 2L.0202. For constituents without NC 2L Standards, the groundwater samples shall be compared to the GWPS established by the SWS. Unless otherwise established by DENR, the standards for all constituents shall be equal to their respective NC 2L or GWPS (see Appendix VII-3), unless the NC 2L or GWPS is below the SWSL, in which case the standard shall be equal to the SWSL. If a statistically-determined background concentration for a constituent is greater than the applicable NC 2L or GWPS, the background may be considered the standard for comparison. The initial comparison will be performed using a value-to-value procedure.

If an analyte is detected above the NC 2L or GWPS 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 NC 2L or GWPS, the detection shall not be considered a statistically significant level compared to the NC 2L or GWPS. If an analyte is detected below the NC 2L or GWPS, 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 NC 2L or GWPS 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 NC 2L or GWPS in a value-to-value comparison, or the value may be statistically compared to background.

5.0 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.

5.1 Treatment of Censored Data

Generally, background data are censored as follows. When less than or equal to 15% of the background data values are less than the applicable reporting limit (SWSL), any data reported less than the SWSL will be treated as one-half the SWSL.

5.2 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.

5.3 Parametric Upper Tolerance Limit

In some cases the background data consist of a minimum of eight independent data values and less than or equal to 15% of the background data values are less than the RL for a given analyte. The downgradient values are then 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).

5.4 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 are less than the RL for a given analyte, 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).

5.5 Non-parametric Upper Tolerance Limit

In those cases where more than 50%, but less than or equal to 90%, of the background data values are less than the RL for a given analyte 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).

5.6 Poisson Upper Prediction Limit

In those cases where more than 90% of the background data values are less than the RL for a given analyte, 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).

6.0 SURFACE WATER MONITORING (RULE .0602)

Surface water monitoring has not been conducted in the past and none is proposed in this plan.

7.0 ABILITY TO EFFECTIVELY MONITOR RELEASES

There are no known conditions, physical or hydrogeologic, which will interfere with the effective monitoring of Phases 1, 2, and 3, including the proposed Phase 4 vertical expansion. Depths to groundwater and bedrock are well defined in and around the site, especially in the area of Phase 3/4. This condition presents a significant environmental advantage for the long term monitoring of this unit by retarding the downward migration of any potential releases of solid waste constituents.

The proposed Water Quality Monitoring Plan, when implemented, will be effective in providing early detection of any release of hazardous constituents to the surficial aquifer beneath the Roaring River Landfill, so as to be protective of public health and the environment.

8.0 REFERENCES

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TABLES

TABLE 1

SUMMARY OF HISTORICAL GROUNDWATER ELEVATIONS

Location	Background		Downgradient									
	MW-2	MW-2R	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-12S	MW-12D	MW-17	MW-18
TOC Elevation	1115.00	1118.10	996.15	981.01	984.08	984.46	971.89	1024.10	1052.79	1052.89	986.68	1026.49
Well Depth	81.50	116.00	38.11	37.60	41.77	58.50	37.57	76.75	104.00	134.00	24.63	46.85
Oct-94	1042.13	NI	966.74	949.27	947.37	948.60	943.17	NI	NI	NI	NI	NI
Apr-95	1042.19	NI	966.73	949.01	946.65	948.07	943.08	NI	NI	NI	NI	NI
Oct-95	1041.70	NI	967.05	948.73	946.67	947.85	943.24	NI	NI	NI	NI	NI
Apr-96	1043.10	NI	968.15	950.20	947.21	948.46	943.34	NI	NI	NI	NI	NI
Nov-96	1040.56	NI	967.40	949.28	946.75	947.96	943.36	NI	NI	NI	NI	NI
Mar-97	1041.55	NI	968.14	951.06	947.61	948.99	944.23	NI	NI	NI	NI	NI
Sep-97	1039.38	NI	966.55	948.88	947.07	951.62	943.81	NI	NI	NI	NI	NI
Mar-98	1037.72	NI	969.55	949.61	946.98	948.34	944.19	NI	NI	NI	NI	NI
Sep-98	1042.12	NI	967.92	950.09	947.36	948.57	943.43	956.95	NI	NI	NI	NI
Oct-98	1040.53	NI	967.13	948.76	946.77	947.98	943.37	956.08	NI	NI	NI	NI
Nov-98	1039.10	NI	966.53	947.76	946.33	947.68	943.64	955.13	NI	NI	NI	NI
Dec-98	1038.41	NI	966.20	947.24	946.08	947.35	942.29	954.56	NI	NI	NI	NI
Feb-99	1036.80	NI	968.43	947.79	946.31	947.61	943.77	953.18	NI	NI	NI	NI
Apr-99	Dry	NI	967.89	948.44	946.36	947.61	943.34	952.93	NI	NI	NI	NI
Sep-99	Dry	NI	965.54	946.43	945.33	946.50	942.86	NA	NI	NI	NI	NI
Apr-00	Dry	NI	965.71	945.72	945.34	947.85	943.31	951.29	958.39	958.38	NI	NI
Sep-00	Dry	NI	964.15	945.49	945.20	946.52	943.43	949.79	956.37	956.58	NI	NI
Mar-01	Dry	NI	964.30	944.87	944.86	946.21	943.49	948.39	954.38	954.56	NI	NI
Oct-01	Dry	NI	960.32	944.79	944.15	945.46	943.49	947.56	954.05	953.23	NI	NI
Apr-02	Dry	1018.99	961.64	946.59	944.28	945.71	943.38	947.40	952.78	949.37	NI	NI
Nov-02	AB	1032.21	961.81	946.92	943.07	946.25	943.90	947.40	949.98	946.52	NI	NI
May-03	AB	1037.34	964.50	951.47	946.87	948.19	944.07	947.43	951.89	944.49	NI	NI
Nov-03	AB	1041.84	962.60	950.27	946.77	948.05	943.42	948.66	955.89	954.78	NS	NS
Apr-04	AB	1041.41	963.52	948.59	946.70	947.51	943.88	948.54	954.92	954.11	967.57	995.90
Oct-04	AB	1041.53	962.11	947.33	945.43	945.76	943.68	950.62	954.06	954.41	967.30	995.49
May-05	AB	1041.82	963.19	949.53	946.57	946.85	943.96	948.89	954.14	954.73	967.46	987.81
Oct-05	AB	1042.35	960.87	945.83	945.05	945.27	943.51	948.62	954.36	953.60	967.19	993.87
29-Jun-06	AB	1030.65	958.18	943.61	944.08	944.52	946.31	948.21	952.45	952.55	963.04	991.49
07-Dec-06	AB	1039.79	959.85	Dry	944.43	944.76	943.76	Dry	951.34	951.34	Dry	992.24
28-Jun-07	AB	1040.52	959.61	Dry	944.40	944.82	942.93	947.61	951.35	951.38	966.53	979.73
19-Dec-07	AB	1038.71	958.68	Dry	942.46	942.74	941.34	947.61	949.72	930.89	966.68	979.73
28-Apr-08	AB	1067.25	959.42	Dry	942.67	943.02	941.66	947.42	949.95	949.97	966.79	993.45
30-Dec-08	AB	1037.69	958.27	Dry	942.39	NS	942.20	947.41	950.11	944.41	967.03	990.66
24-Jun-09	AB	1038.56	958.47	946.16	944.79	NS	944.39	947.57	951.65	943.56	962.69	994.60
16-Dec-09	AB	1041.43	960.52	950.67	952.89	NS	944.70	947.37	952.90	940.66	967.30	996.27
22-Jun-10	AB	1045.29	959.14	950.08	946.27	NS	944.20	947.61	955.62	936.47	966.86	995.72

Notes:

1. Dry = Monitoring well was considered to be dry and no water level measured.
2. AB = Monitoring well was abandoned.
3. NI = Monitoring well was not installed.
4. NS = Monitoring well was not sampled.
5. NA = Not available.

TABLE 2

ESTIMATED HYDRAULIC GRADIENTS AND AVERAGE LINEAR VELOCITIES

GRADIENT CALCULATION SEGMENT	FLOW LINE LENGTH (feet)	FLOW DIRECTION	June 2010				
			GROUNDWATER ELEVATION (feet)	HORIZONTAL GRADIENT i (ft/ft)	HYDRAULIC CONDUCTIVITY K (ft/day)	EFFECTIVE POROSITY n	LINEAR VELOCITY V (ft/day)
i_1	858	W-SW	1030 970	0.070	5.5E-01	0.16	0.24
i_2	1365	S-SW	1030 950	0.059	5.5E-01	0.16	0.20
i_3	1039	S-SE	1040 950	0.087	5.5E-01	0.16	0.30
			Average	0.072		Average	0.25

Notes:

1. Linear flow velocities in plain type = Ki/n_e.
2. Effective porosity is based on average specific yields calculated using the Johnson (1967) textural classification triangle from the Design Hydrogeologic Report and Groundwater Monitoring Plan prepared by Joyce Engineering, Inc. in April 2004.
3. Hydraulic conductivity is based on a geomean of individual well slug tests performed for wells at the site.
4. Gradient calculation segments were obtained from Drawing No. 1.

DRAWINGS

LEGEND

- 1070 — EXISTING 10' TOPOGRAPHIC CONTOUR
- EXISTING 2' TOPOGRAPHIC CONTOUR
- 970 — GROUNDWATER SURFACE CONTOUR [FEET ABOVE MEAN SEA LEVEL (AMSL)]
- PROPERTY LINE
- EXISTING ROAD
- APPROXIMATE LIMITS OF WASTE
- CENTERLINE OF STREAM
- TREELINE
- MW-9 944.20 — GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION WITH STATIC WATER LEVEL ELEVATION (FEET AMSL)
- GROUNDWATER FLOW DIRECTION WITH GRADIENT CALCULATION SEGMENT
- i_1 — SEGMENT USED FOR GRADIENT CALCULATIONS

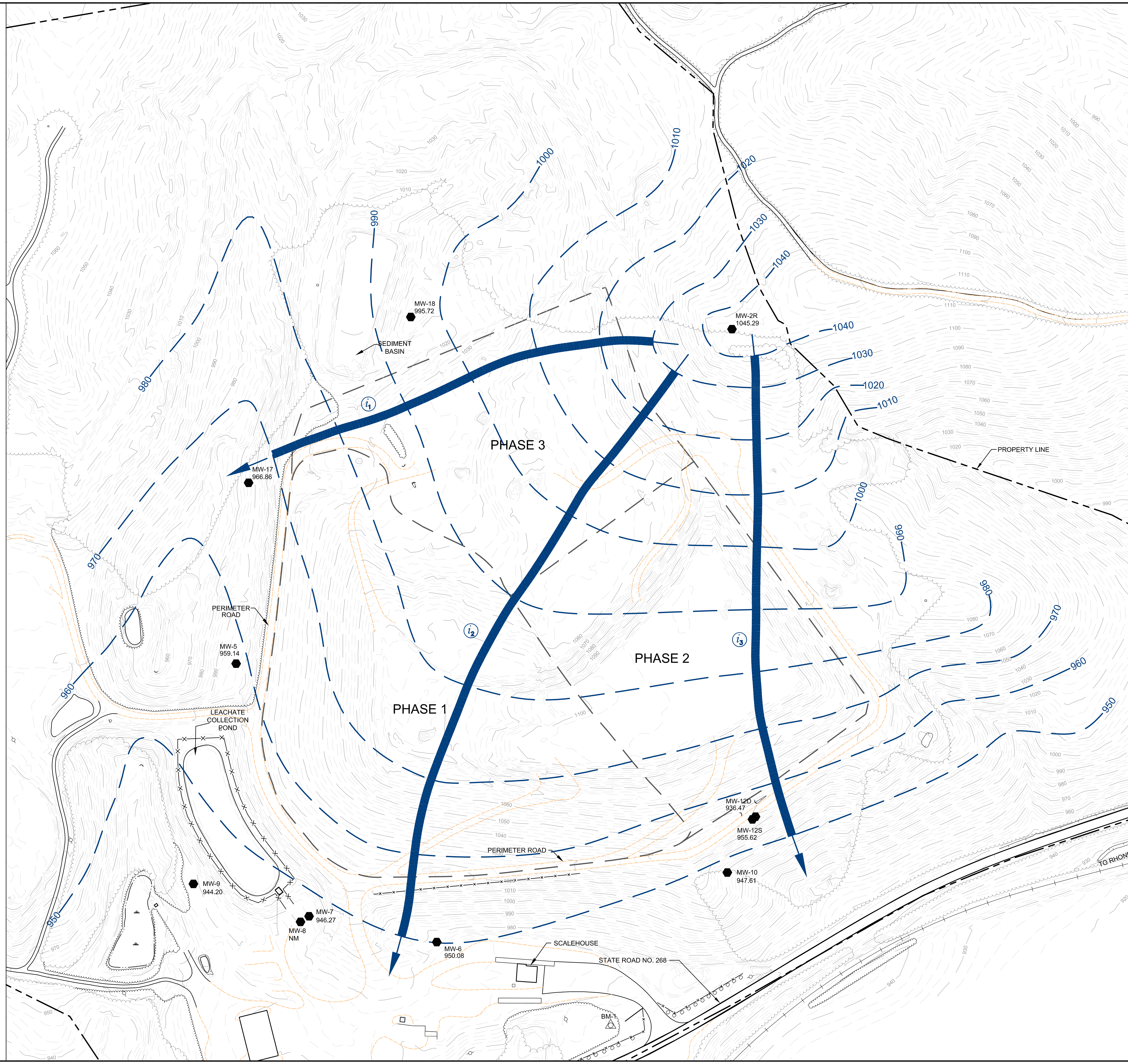
NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 10 FEET.
3. STATIC WATER LEVELS MEASURED ON 06/22/10.
4. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL GROUNDWATER CONDITIONS.
5. DIGITAL MAPPING PROVIDED BY SPATIAL DATA CONSULTANTS, INC. FLYOVER DATE: MARCH 11, 2003. GROUND CONTROL AND PROPERTY LINE TIE-IN TO NC GRID COORDINATE SYSTEM SET BY SUTTLES SURVEYING, INC.
6. GROUNDWATER CONTOUR LINES SHOW THE WATER TABLE SHAPE AND ELEVATION. THESE CONTOURS ARE INFERRED LINES FOLLOWING THE GROUNDWATER SURFACE AT A CONSTANT ELEVATION ABOVE SEA LEVEL. THE GROUNDWATER FLOW DIRECTION IS GENERALLY PERPENDICULAR TO THE GROUNDWATER SURFACE CONTOURS, SIMILAR TO THE RELATIONSHIP BETWEEN SURFACE WATER FLOW AND TOPOGRAPHIC CONTOURS.
7. MW-12D WATER ELEVATIONS ARE NOT INCLUDED IN REGARDS TO MAPPING THE GROUNDWATER SURFACE CONTOURS.

GRAPHIC SCALE

0 50 100 200

(FEET)



DESIGNED	ACE
DRAWN	ACE/JJK
CHECKED	JJK
APPROVED	JJK
DATE	09/02/10

JOYCE ENGINEERING, INC.
2211 W. MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: (336) 323-0092

ROARING RIVER LANDFILL
WILKES COUNTY, NORTH CAROLINA

GROUNDWATER SURFACE CONTOUR MAP
JUNE 22, 2010
PERMIT NO. 97-04

PROJECT NO. 356.1002.11

SCALE AS NOTED

DRAWING NO. WQMP-01

NO	BY	CK	APP	REVISIONS AND RECORD OF ISSUE	DATE

P:\Wilkes\Roaring River\Permitting NC\2010 MSW Permit Amendment\Task 03 - Construction Plan Application\VII - Monitoring Plans\GW Map 2010.dwg Layout=Layout1

APPENDIX VII-1

FIELD LOG DATA SHEET

DATE:____________

GROUND WATER SAMPLING LOG

Project Name: ______________________ **Project No./Task No.:** ______________

Well ID: ______________ **Sampler(s):**__________________________________

Well Location:____

Well Diameter: ____________inches

Initial Depth to Water (DTW): ____________feet

Depth to Bottom (DTB): ____________feet

Water Column Thickness (WCT): ____________feet [DTB-DTW]

Calculation for One Well Volume (WV):

For 2" Well: WCT X 0.163 = ____________gallons

For 4" Well: WCT X 0.653 = ____________gallons

For THREE Well Volumes: WV X 3 = ____________gallons

Actual Amount Purged/Bailed : ____________gallons

Purged with: ____

Sampled with: ____

Depth to Water before Sampling : ____________feet

Gallons	Time	Temp(°C)	pH	Cond. (µS)	Turb.(ntu)	Initials
Before Sampling						

Comments (weather conditions, odor, color, silt, etc.): ________________________

____

____

____

Signature: ______________________________ **Date:** ____________________

QA/QC Sign Off: __________________________ **Date:** ____________________

APPENDIX VII-2
SAMPLE CHAIN OF CUSTODY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : Of

Section A
Required Client Information:

Company:	
Address:	
Email To:	
Phone:	Fax:
Requested Due Date/TAT:	

Section B
Required Project Information:

Report To:
Copy To:
Purchase Order No.
Client Project ID:
Container Order Number:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Quote Reference:
Project Manager:
Profile #:

Regulatory Agency
State / Location

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM#	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Requested Analysis Filtered (Y/N)	Residual Chlorine (Y/N)	
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:	
SIGNATURE of SAMPLER:	DATE Signed:

APPENDIX VII-3
GROUNDWATER LIMITS AND STANDARDS

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 NC SWSL	GROUNDWATER NC 2L	GROUNDWATER GWP STD.	NOTES
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	-	0.2	
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 NC SWSL	GROUNDWATER NC 2L	GROUNDWATER GWP STD.	NOTES
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 NC SWSL	GROUNDWATER NC 2L	GROUNDWATER GWP STD.	NOTES
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	-	

NC App. I & II - Method 8260

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER NC SWSL	GROUNDWATER NC 2L	GROUNDWATER GWP STD.	NOTES
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	-	*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	-	
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 NC SWSL	GROUNDWATER NC 2L	GROUNDWATER GWP STD.	NOTES
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	-	-	

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	-	35	
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	-	-	
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	Hexachlorocyclopentadiene	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	400	-	
106	App. II	Hexachlorobutadiene	semi-volatile	87-68-3	8270C or 8260	10	0.4	-	
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, , 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	0.002	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	-	-	
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)