PREPARED FOR:

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KERNERSVILLE, NORTH CAROLINA 27284

WATER QUALITY MONITORING PLAN

PIEDMONT LANDFILL & RECYCLING CENTER
PERMIT # 34-06

REVISED:
DECEMBER 2015

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DECEMBER 2015

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Water Quality Monitoring Certification Statement:

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

JOYCE Project # 392.1502.12, Task 02

Water Quality Monitoring Plan
Piedmont Landfill & Recycling Center
Permit # 34-06

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Water Quality Monitoring Plan
Piedmont Landfill & Recycling Center
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1.0 INTRODUCTION

This *Water Quality Monitoring Plan* (WQMP) was prepared in accordance with 15A NCAC 13B.1630-.1632 of the North Carolina Solid Waste Management Regulations (NCSWMR) and will serve as the guidance document for collecting and analyzing samples of groundwater and surface water for the Piedmont Landfill and Recycling Center (PLRC) facility. This WQMP is a supplement to the existing water quality monitoring program at the facility as defined under the *Transition Water Quality Monitoring Plan for the Piedmont Landfill and Recycling Center* (Rust, 1994b) and the *Water Quality Monitoring Plan for the Unconstructed Portion of the Piedmont Landfill and Recycling Center* (Rust,1994c). 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.

1.1 Site Description

The PLRC is a closed municipal solid waste (MSW) landfill located on approximately 108 acres in Forsyth County, North Carolina, approximately 10 miles north of the city of Kernersville. The facility is permitted under North Carolina Solid Waste Permit Number 34-06. Waste Management of Carolinas, Inc. owns the facility, which opened in June 1990. Closure construction was completed October 29, 2004, and the closure was certified by the North Carolina Department of Environment and Natural Resources (NCDENR), now called the Department of Environmental Quality (NCDEQ), on December 28, 2004. The location of the site is shown in *Figure 1* and the layout of the facility is shown in *Drawing 1*.

A composite liner system on the landfill base consisting of 18 inches compacted cohesive soil with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec overlain by a 60 mil high-density polyethylene (HDPE) geomembrane exists in Phase I, Modules 1 and 2. A double synthetic with primary and secondary leachate collection systems is incorporated in Phase I, Modules 3, 5 and 6 and Phase II, Modules 1 and 2. All liner systems meet the requirements of the NCSWMR.

1.2 Site Geology and Hydrogeology

The PLRC is located in the Piedmont physiographic province of North Carolina and is underlain by intrusive granitic rocks of Pennsylvanian to Permian age which are part of the Charlotte Belt Geologic Unit. Granitic bedrock is overlain by approximately 10-40 feet of saprolitic soil and regolith consisting of gray to brown sandy silt to silty sand, which grades downward to weathered bedrock.

The uppermost aquifer is unconfined and includes both the saprolite and uppermost fractured bedrock, which are strongly connected. The groundwater level measurements taken during the March 2015 sampling event were used to construct the groundwater surface contours shown in

Drawing 1. Historical groundwater elevations are summarized in *Table 1*. Groundwater flow at the site is generally west to northwest, which is consistent with surface topography.

Using the hydraulic gradients along the flow paths shown on *Drawing 1*, the linear flow velocity (***V***) was estimated using the modified Darcy equation: $V = i\,K/n$. The hydraulic gradients (***i***) ranged from 0.017 ft/ft to 0.027 ft/ft. An effective porosity value (***n***) of 41% (0.41) was used in the equation based on an average of six laboratory-derived porosities as reported in the April 1994 *Design Hydrogeologic Study*, prepared by RUST Environment & Infrastructure (Rust, 1994a). Hydraulic conductivities (***K***) were also taken from the *Design Hydrogeologic Study*, and were based on slug test data from piezometers located nearest the respective groundwater flow paths. The average calculated groundwater flow rate (***V***) for March 2015 was approximately 12.3 feet/year, which is consistent with previous data for this site. See *Table 2* for details of these calculations.

1.3 Site Monitoring History

The site entered into an Assessment Monitoring Program for background wells MW-01 and MW-06 and downgradient well MW-09 after volatile organic constituents were detected in MW-09 during the second semiannual event of 1996. Two organic compounds (chloroethane and 1,1-dichloroethane) were historically detected in monitoring well MW-09. Chloroethane exhibited a declining trend to the point where chloroethane was reported at less than the laboratory reporting limit during the January 1998 sampling event. The concentration of 1,1-dichloroethane in MW-09 also decreased below the laboratory reporting limit during the July 1998 sampling event. Following receipt of approval from the North Carolina Department of Environment and Natural Resources (NCDEQ), all wells at the site reverted to the Detection Monitoring Program as of the second semiannual event in 1999, as allowed by 15A NCAC 13B.1634 (b).

Monitoring well MW-09 was replaced by well MW-09R in November 1999. No chloroethane concentration above the laboratory reporting limit or Solid Waste Section Limit (SWSL) has been detected in MW-09R since the well was installed; however, 1,1-dichloroethane was detected in MW-09R at a concentration of 23 µg/L during the initial sampling event conducted in January 2000. The concentration of 1,1-dichlorothane remained relatively consistent until 2009, ranging in concentration from 7 µg/L to 28 µg/L; however, it has not been detected at quantifiable levels since September 2009. The constituent cis-1,2-dichloroethene was detected in MW-09R above the laboratory reporting limit for the first time during the July 2002 event at a concentration of 6.5 µg/L, and has been detected at concentrations ranging from 5-28 µg/L; however, it has not been detected at quantifiable levels since September 2009. The presence of organic constituents in MW-09 and MW-09R is attributed to landfill gas (LFG). The LFG extraction network was expanded in this area in January 2003, and the recent decrease in concentrations of organic constituents in this well is attributed to the control of LFG.

Due to the detection of 1,1-dichloroethane in MW-09R during the first semiannual event in 2000, the site performed Assessment Monitoring on wells MW-01, MW-06, and MW-09R through the second semiannual event of 2001. Following NCDEQ approval of an August 20, 2001 request by Waste Management, MW-01 and MW-06 again reverted to Detection Monitoring. Monitoring well MW-09R was sampled for the NC Appendix I list of constituents plus detected Appendix II

constituents during the first semiannual event each year and NC Appendix II list of constituents during the second semiannual event until the NCDEQ approved reverting back to detection monitoring in a letter dated March 15, 2012.

In the September 2007 sampling event, benzene and vinyl chloride were detected in MW-02 at concentrations in exceedance of the groundwater standards established in 15A NCAC 2L.020 (NC 2L). A resampling event confirmed the vinyl chloride, but not the benzene exceedance. An *Alternate Source Demonstration* (ASD) was submitted to NCDEQ on March 14, 2008. The ASD demonstrated that the organic constituents detected in MW-02 are related to LFG impacts. In January 2008, improvements to the active LFG recovery system at the site were initiated to help mitigate these impacts. The ASD was accepted by NCDEQ in a letter dated May 7, 2008 with the condition that if vinyl chloride and benzene concentrations in MW-02 are not sufficiently reduced by Spring 2009, MW-02 would enter Assessment Monitoring. Neither benzene nor vinyl chloride have had confirmed detections above the NC 2L standards in MW-02 since September 2008, so MW-02 remains in detection monitoring.

During the March 2010 sampling event, chromium was detected in MW-03 at a statistically significant concentration above the NC 2L groundwater standard. An ASD was submitted on July 26, 2010 for the chromium demonstrating that the chromium was naturally occurring in the soil and groundwater of the facility. NCDEQ approved the ASD for chromium at the facility in a letter dated April 28, 2011.

In September 2015, Waste Management submitted a Request to Reduce Monitoring Requirements for the PLRC. The request was approved by NCDEQ in a letter dated October 8, 2015. As a result, wells MW-6, MW-4D, MW-11D, and MW-12D were removed from the compliance monitoring network and the frequency of groundwater and surface water monitoring events was reduced from semiannual to annual.

2.0 GROUNDWATER MONITORING

2.1 Groundwater Monitoring Network

The current groundwater compliance monitoring network includes eleven monitoring wells, including one upgradient well and ten downgradient wells. The locations of the compliance monitoring wells are shown on *Drawing 1*. Construction details for the compliance wells are summarized in *Table 3* and boring/construction logs for the wells are included in *Appendix A*.

Groundwater samples will be collected from the compliance network annually and analyzed in accordance with NCSWMR §1632. Monitoring wells in Detection Monitoring (NCSWMR §1633) will be sampled for the NCSWMR Appendix I list of constituents during the annual events.

The current compliance wells are summarized below, along with their current monitoring program status.

Well ID	Location Relative to Waste	Screened Interval	Monitoring Program
MW-01	Upgradient	44.0 - 49.0 ft-bgs	Detection
MW-02	Downgradient	20.2 - 25.2 ft-bgs	Detection
MW-03	Downgradient	32.5 - 37.5 ft-bgs	Detection
MW-04	Downgradient	20.0 - 25.0 ft-bgs	Detection
MW-05	Downgradient	14.45 - 19.45 ft-bgs	Detection
MW-07	Downgradient	17.0 - 32.4 ft-bgs	Detection
MW-08	Downgradient	5.0 - 20.0 ft-bgs	Detection
MW-09R	Downgradient	32.0 - 42.5 ft-bgs	Detection
MW-10	Downgradient	20.0 - 36.99 ft-bgs	Detection
MW-11	Downgradient	19.01 - 34.22 ft-bgs	Detection
MW-12	Downgradient	3.33 - 17.22 ft-bgs	Detection

(ft-bgs = depth in feet below ground surface)

2.2 Groundwater Sampling Methodology

Groundwater samples will be collected in accordance with Solid Waste Management Rules 15A NCAC 13B .1630 through .1633 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.

2.02.01 Static Water Levels

Static water depth 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.

All compliance monitoring wells have been surveyed by North Carolina registered land surveyor to ±0.10 feet horizontal and ±0.01 feet vertical. Survey information is included in *Appendix B*. Static water table elevations will be measured from the surveyed reference point on the top of the well casing.

2.2.2 Low-flow Purging and Sampling Methodology

The Low-Flow (Minimal Drawdown) purging technique is recommended for monitoring groundwater at the PLRC. This method involves using a dedicated bladder pump to purge and sample water at a constant rate to achieve field parameter stabilization, while minimizing stress (drawdown) on the aquifer. This procedure has been well documented as a preferred methodology for collecting representative groundwater samples *(*Puls and Barcelona, USEPA, April 1996).

This procedure is accomplished by measuring field parameters at periodic intervals during purging with a flow cell or other container. The flow cell is an inline purge cell, which allows the sampler to constantly monitor the field parameters, including temperature, pH, and conductivity. Other techniques or containers can be used to collect samples for periodic measurements, provided that periodic and representative samples can be collected.

Decontamination of Equipment

Flow cells, containers, and other equipment that does not contact the samples will be used on multiple wells. Some sites also have observation wells that do not have dedicated pumps and require the use of non-dedicated equipment. All non-dedicated equipment used during the purging and sampling process, including tubing, must be decontaminated prior to each use. Any downhole equipment, such as a water level indicator, will be decontaminated between well locations.

Purge Volumes and Field Measurement Frequency

Low-flow sampling does not require the calculation of the water volume in the well, since purging is based solely on indicator parameter stabilization. Rather, the volume of the tubing, pump, and/or flow cell, if used, are necessary for making calculations needed to determine field measurement frequency and passive sampling system purge volume. Volumes of the sample equipment, such as pumps or flow cells, can be obtained by the manufacturer. Volumes of the sample tubing can be calculated using the attached formula or from a table developed for the specific tubing equipment. Examples of these tables are presented below.

Delivery Tube Volumes	
Tubing Diameter	*Volume/foot*
½ " OD	20 ml
3/8 " OD	10 ml
¼ " OD	5 ml

Pump Volumes	
Pump Model/Type	*Pump Volume*
P1101-full length	400 ml
P1150-half length	125 ml
Note: Flow Cell volumes can be obtained from the manufacturer. QED Flow Cells are typically 500 ml.	

Well casing volumes should be calculated and recorded on field forms (see *Appendix C*). Well casing volumes may be needed in cases where stabilization is not achieved after a three-volume purge (see below).

Field Measurement Frequency:

Sample equipment volumes are calculated or recorded for use in determining the frequency of field measurements. Depending on the equipment configuration, record either the known volume of the flow cell or calculate the volume of the pump and sample tubing using the methodology described above (the volumes are typically converted to liters). The frequency of field readings is based on the time required to purge either one volume of the flow cell or one volume of the pump and tubing equipment. For example, when using a flow cell, a cell with 500-ml volume, purged at a rate of 250 ml/minute will be purged in two minutes; readings should be at least two minutes apart. Similarly, if a device other than a flow cell is used, then the frequency of field measurements should be based on the time required to purge one volume of the pump and associated tubing. In either case, it is important to ensure that the field parameters are measured on independent samples.

Purging

Once the volumes are calculated and the minimum measuring frequency is determined, the purging process can begin. The objective of purging is to replace stagnant water in the monitoring well with formation water prior to sampling. Replacement by ground water from the formation results in a sample that is representative of actual aquifer conditions. The pump intake is placed within the screened interval at the zone of sampling, preferably, the center of the screen. A low flow rate (< 500 ml/min) is used to prevent exceedance of the aquifer recharge rate (lower flow rates may be required during sampling, see below). Flow rate can be monitored using a flow meter or by measuring the time it takes to fill a calibrated container. Drawdown is monitored by measuring the top of the water column with a water level indicator similar device (e.g. transducer) while pumping.

Drawdown will be stabilized during purging. Drawdown should not fall to within one (1) foot of the top of the screen during purging and sampling. Excessive drawdown may result in increased aeration or turbidity of the sample (see next section). Flow rates and drawdown are recorded on Field Information Forms.

Parameter Stabilization:

Parameter stabilization ensures that stagnant water is purged and sampled groundwater is representative. In order to determine when a well has been adequately purged, samplers should:

- Monitor the field parameters pH, specific conductance, and temperature of the purged water;
- Record turbidity or dissolved oxygen of the ground water removed during purging;
- Observe and record the drawdown; and
- Record the purge rate and volume of water removed.

A well is adequately purged when the pH and specific conductance, stabilize. Dissolved oxygen (DO) and turbidity are useful parameters for measuring stabilization. Stabilization occurs as follows:

pH:	+/- 0.2 standard units	Required
Conductance:	+/- 10.0% of reading	Required
Dissolved oxygen:	+/- 10.0% or 0.2 mg/L, whichever is greater	Optional, if using turbidity
Turbidity:	+/- 10.0% of reading	Optional, if using DO

Temperature is not a good measurement of stabilization, being insensitive to differences between formation and stagnant water; nevertheless, temperature is an important parameter that should be measured. In lieu of all four parameters, at a minimum, a subset of pH, conductance and DO or turbidity should be used for parameter stabilization.

While turbidity is not a direct measurement of water chemistry, it can be used as an indicator parameter of stabilization in place of DO. It is useful as a measure of the pumping stress on the formation and to establish the proper pumping rates. To avoid artifacts in sample analysis, turbidity should be as low as possible when samples are taken. If turbidity is not used for stabilization

measurements, it should be measured at least three times (once when purging is initiated, again after the water level in the well stabilizes, and again when the water chemistry indicator parameters being measured are stable, prior to sampling). Turbidity should also be measure again any time the pumping rate is increased or the water level in the well drops noticeably. If the initial turbidity reading is high (>25 NTU) and the second reading is not significantly lower, the pump rate should be reduced. The turbidity value measured prior to sampling should be recorded. If this value exceeds 25 NTU, procedures should be reviewed and the source of the elevated turbidity determined.

Prior to each sampling event the field probes should be calibrated in accordance with the owner's manual provided. It is important to identify the range, resolution and accuracy of the instruments used to determine if the selected stabilization criteria can be measured. If the instruments available cannot accurately measure the stabilization criteria above, consult with the regulatory program manager to determine if different criteria values would be appropriate for your sampling program.

Sampling

Wells should be sampled immediately upon completion of purging operations. Once the water level in the well is stabilized, the purge rate should remain constant during low-flow purging (generally less than 500 ml/min). The flow rate for sampling can be equal to or less than the purging rate, but should never exceed the purging rate. For VOCs, lower sampling rates (< 100 ml/min) may be required. If, after three well volumes have been removed, the chemical parameters have not stabilized according to the above criteria, it is at the discretion of the project leader whether to collect a sample or to continue purging. The conditions of sampling should be noted in the field forms.

Attempts should be made to avoid purging wells to dryness. This can be accomplished, for example, by slowing the purge rate. If a well is pumped dry, it may result in the sample being comprised partially of water contained in the sand pack, which may be reflective, at least in part, of initial, stagnant conditions. If the well goes dry repeatedly prior to sampling, then a passive sample should be considered.

Low Yield Formations/Passive Sampling:

For wells that cannot achieve a stabilized water level, even at very low pumping rates, an alternative is to use "passive" sampling techniques. Passive sampling can be used to avoid the pitfalls of well evacuation and obtain a better and more "representative" sample. Sampling the water present in the screen zone provides the greatest chance of obtaining samples with minimal alteration of the chemistry. Although the low movement rate of the ground water in the screen provides only a limited exchange, avoiding the alteration caused by the factors mentioned above is really the best alternative.

Passive sampling requires removal of the smallest possible purge volume prior to sampling, generally limited to the volume of the sampling system. The sampling system volume is minimized by using very small diameter tubing and the smallest possible pump chamber volume. Plastic tubing should have sufficient wall thickness to minimize the potential for oxygen transfer through the

tubing when pumping at very low flow rates. Samples are collected after purging 1-3 volumes of the sampling system. Since passive sampling requires the minimum possible disturbance to the water column and formation, dedicated sampling systems are required.

The pumping rates used for passive sampling are much lower than for low-flow/low-volume purging, generally 100 ml/minute or less. Drawdown is expected, since it cannot be avoided; however, it is still advisable to pump at the lowest possible rate to limit drawdown to the minimum possible. Monitoring indicator parameters for stability is not part of this approach, since the intention is not to purge until stabilization of these measurements.

Field Records

Field information must be recorded on WM Field Information Forms during purging and sampling. Waste Management requires that the field forms be submitted to the analytical laboratory along with the chain of custodies. At a minimum, the following information should be included for each groundwater well:

- Purge Information (sampling system volume and purge volumes);
- Equipment Specifications (pump type, filter if used);
- Well Data (depth to water, total depth, groundwater elevation);
- Field Measurements during purging;
- Field Measurements at the time of sample collection; and
- General weather conditions or other comments.

In some cases, it is acceptable to record the stabilization measurements using data loggers; however, final field measurements, prior to sampling must be recorded on the Field Information Forms. A sample Field Information Form is included in *Appendix C*.

2.2.3 Alternative Purging and Sampling Methodology

As an alternative to low-flow purging and sampling, monitoring wells may also be purged and sampled using bailers or portable sampling pumps. The following methodology will be followed if this alternative method is employed.

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 and pore spaces of the surrounding filter pack. 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 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).

2.2.4 Sample Collection, Bottling, and Transportation

Pre-preserved sample containers and 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, 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 form 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 C*.

2.2.5 Field and Trip Blanks

A field blank and/or equipment 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/equipment blank will be prepared in the field from lab pure water (Type II reagent grade water) supplied by the laboratory. One field/equipment blank will be prepared for each sampling event. The field/equipment blank will be generated by exposing the lab pure water to the sampling environment and sampling equipment/media in the same manner as actual field samples being collected. The lab will provide appropriate sample containers for generation of the field/equipment blank(s). The field/equipment blank will be subjected to the same analysis(es) as the groundwater samples. As with all other samples, the time(s) of the field/equipment blank collection will be recorded so that the sampling sequence is documented. The field/equipment blank monitors for contamination from the sampling equipment/media, 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 volatiles 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 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/equipment 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 or some phthalates) the concentration of that constituent detected in the field, trip, or laboratory method blanks. Contaminants present in trip blanks or field/equipment blanks at concentrations within an order of magnitude of those observed in the corresponding groundwater samples may be cause for resampling.

2.3 Groundwater Analytical Requirements

2.3.1 Analytical Requirements

Analysis of groundwater samples from the facility will be conducted by a laboratory certified by the NCDEQ. Analyses will be performed in accordance with U.S. EPA SW-846 methods. Groundwater

samples will be analyzed for the constituents listed in NCSWMR Appendix I (or if required, Appendix II). In addition, field analyses for temperature, pH, and specific conductance will be performed for each sample. *Appendix D* includes a table of all Appendix I and Appendix II constituents with their respective analytical methods, CAS numbers, NCDEQ Solid Waste Section (SWS) Reporting Limits (SWSL), 15A NCAC 2L.0202 Groundwater Standards (NC-2L), and SWS groundwater protection standards (GWPS).

2.3.2 Reporting and Record Keeping

The laboratory analytical results will be submitted to the SWS at least annually. 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, reporting or data error, missing data, etc..

2.4 Well Abandonment

Any wells or piezometers 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). No wells will be abandoned without prior approval from the NCDEQ SWS.

3.0 COMPARISON TO STANDARDS & STATISTICAL ANALYSES

3.1 Comparison to Groundwater Protection Standards (GPS)

Constituents detected in the groundwater samples collected from the compliance well network shall be compared to the appropriate GPS for that constituent in accordance with NCSWMR §.1634.g. The comparison will be performed using a value-to-value procedure. 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.

In most cases, the GPS will be equal to the Groundwater Standard established for a given constituent in 15A NCAC 2L.0202 (NC-2L Standards). For constituents without listed NC-2L Standards, the groundwater protection standards (GWPS) established by the NCDEQ SWS may be used. In the event that a site-specific statistical background value can be established for a given constituent which is higher that the NC-2L standard, GWPS, or other appropriate listed standard, the background may be used as the GPS with DENR approval.

3.2 Statistical Analyses

With the April 2011 revision to the NCSWMR, routine statistical comparison to background for all detected constituents is no longer required for landfills regulated under §.1600 of the NCSWMR; however, statistical analyses may be used to establish an alternate GPS for constituents with the approval of the DENR if desired by the facility.

If the facility elects to use statistical analyses to determine background values for a give constituent, the facility my use either interwell or intrawell statistics. If an interwell approach is taken, concentrations of detected of constituents in downgradient wells will be compared to statistically determined background values for those constituents. Background values will be based primarily on historical data from upgradient wells MW-1 and MW-6; however, background data from downgradient wells that were collected prior to waste emplacement may also be included. Background data shall be evaluated using 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.

Intrawell statistics compare new measurements to the historical data at each ground water monitoring well independently. A useful technique for intrawell comparisons is the combined Shewhart-CUSUM control chart using the DUMPStat® program. This control chart procedure will detect releases in terms of both the constituent concentration and cumulative increases. This method is also extremely sensitive to both sudden and gradual releases. Alternatively, intrawell statistical evaluation may be conducted by using historical data from the well in question, excluding the most recent 3-4 years (6-8 sampling events) as the background data. These background data can be evaluated using 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.

Statistical analyses shall be conducted in compliance with the United States Environmental Protection Agency (EPA) guidance document, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009). The background data are to be evaluated using 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.

3.2.1 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 or quantitation limit (generally, the SWSL), any data reported at less than the applicable limit will be treated as one-half the limit.

3.2.2 Assumption of Normality

Prior to conducting statistical tests that are based on the assumption of normally distributed data, normality of the background data shall be evaluated using the Shapiro-Wilk statistic (W). Normality shall be assessed at the 95% confidence level. In the event that the raw data fail to follow a normal distribution, the data shall be transformed using a base-10 logarithm. The transformed data shall then be 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 shall be applied.

3.2.3 Parametric Upper Tolerance Limit

When 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 DL for a given analyte, the downgradient values are then compared to the parametric upper tolerance limit in accordance with the procedure summarized in the EPA guidance document (USEPA, 2009).

3.2.4 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 truncated (below than the DL) for a given analyte, the mean and standard deviation are adjusted. This is done in accordance with the procedure described by Aitchison and summarized in the EPA guidance document (USEPA, 2009). 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 EPA guidance document (USEPA, 2009).

3.2.5 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 truncated (below than the DL) 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 EPA guidance document (USEPA, 2009).

3.2.6 Poisson Upper Prediction Limit

In those cases where more than 90% of the background data values are truncated (below than the DL) 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 EPA guidance document (USEPA, 2009).

4.0 SURFACE WATER MONITORING

Surface water at the facility is monitored annually in conjunction with the groundwater sampling events. Samples are collected from four surface water monitoring points, SW-2, SW-3, SW-4, and SW-5. SW-1 has been removed from the monitoring program as approved in a letter from NCDEQ dated July 15, 2010. The locations of the surface water sampling points are shown on *Drawing 2*, and are described in the table below.

Surface water samples will be collected and analyzed for the NCSWMR Appendix I list of constituents during the annual monitoring events. The results will be compared to 15A NCAC 2B (NC-2B) Surface Water Standards in a value-to-value comparison. For this facility, NC-2B Standard used for comparison shall be either the Human Health Standard or the Freshwater Aquatic Life Standard, whichever is more protective. *Appendix D* includes NC-2B Surface Water Standards for NC Appendix I and II Constituents.

Sampling Point	**Description**
SW-1 (no longer sampled)	Creek on south side of Piedmont Landfill: Upstream of the Piedmont Landfill but downstream of the old Kernersville Landfill, upstream of SW-5.
SW-2	Creek on south side of Piedmont Landfill: Downstream of the Piedmont Landfill.
SW-3	Creek on north side of Piedmont Landfill: Upstream of the Piedmont Landfill.
SW-4	Creek on north side of Piedmont Landfill: Downstream of the Piedmont Landfill.
SW-5	Creek on south side of Piedmont Landfill: Upstream of the Piedmont Landfill, downstream of SW-1.

5.0 ABILITY TO EFFECTIVELY MONITOR RELEASES

Based on review of geologic and hydrogeologic data available for this facility, no geological or hydrological conditions have been identified which will interfere with effective monitoring of the landfill. 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 the landfill, so as to be protective of public health and the environment.

6.0 REFERENCES

Aitchison, 1955. *On the Distribution of a Positive Random Variable Having Discrete Probability Mass at the Origin.* Jour. Of American Statistical Assoc. 50(272), 901-908 (1955).

Bouwer, H. and Rice, R.C., June 1976, *A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells*; Water Resources Research, American Geophysical Union, pp. 423-428.

Bouwer, H., 1989, *The Bouwer and Rice slug test-an update*; Ground Water, vol. 27, No. 3, May-June, pp. 304 - 309.

Brown, Philip M., Chief Geologist, 1985, Geologic Map of North Carolina, The North Carolina Geologic Survey, scale 1:500,000.

Butler, J. Robert, and Secor, Jr., Donald T., 1991, *The Central Piedmont*, in Horton, J. W., Jr., and Zullo, V. A., eds., The Geology of the Carolinas: The University of Tennessee Press, p. 59-78.

Halford, Keith J., and Kuniansky, Eve L., 1998. *Bower and Rice Slug Test Analysis, in: Documentation of Spreadsheets for the Analysis of Aquifer Test Data*: USGS OFR 02-197.

Harned, D.A., and Daniel, Charles C., III, 1989, *The Transition Zone Between Bedrock and Saprolite: Conduit For Contamination?*, in Ground Water in the Piedmont; Edited by Daniel, C., White, R., and Stone, P., Proceedings published by Clemson University, pp. 336-348.

Heath, R.C., 1989, *The Piedmont Ground-Water System*, in Ground Water in the Piedmont; Edited by Daniel, C.,White, R., and Stone, P., Proceedings published by Clemson University, pp. 1-13.

North Carolina Department of Environment and Natural Resources (NCDENR), 2011. North Carolina Solid Waste Management Rules. 15 NCAC 13B. Amended April 2011.

NCDENR, 1995, Sampling and Analysis Requirements, Construction and Demolition Landfills and Closed Sanitary Landfills, N.C. Solid Waste Section.

NCDENR, 1995, Draft N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities.

Parker, B.L. et al. May 1994. 1) *A conceptual understanding of contaminant migration in fractured media*, 2) *Calculations and real data: fractured media*. In: Dissolved Organic Contaminants in Groundwater Short Course [unpublished short course notes and published references contained therein]. Waterloo Centre for Groundwater Research, Univ. Of Waterloo, Ontario.

Puls, R.W. and M.J. Barcelona, 1996. *Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures*. U.S. EPA, Ground Water Issue, Publication Number EPN540/S-95/504, April1996.

RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD), 1986.

Ragland, Paul C., 1991, *Mesozoic Igneous Rocks***,** in Horton, J. W., Jr., and Zullo, V. A., eds., The Geology of the Carolinas: The University of Tennessee Press, p. 171-190.

Rust Environmental and Infrastructure, 1994a. *Design Hydrogeologic Study for the Piedmont Landfill and Recycling Center*. April 1994.

Rust Environmental and Infrastructure, 1994b. *Transition Water Quality Monitoring Plan for the Piedmont Landfill and Recycling Center*. March 1994.

Rust Environmental and Infrastructure, 1994c. *Water Quality Monitoring Plan for the Unconstructed Portion of the Piedmont Landfill and Recycling Center*. May 1994 (Revised July 1994).

United Stated Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. EPA 530/R-09-007*. March 2009.

USEPA, 1992. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance*. July 1992.

USEPA, 1989. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Interim Final Guidance*. April 1989.

7.0 ACRONYMS

ACM	Assessment of Corrective Measures (Report)
AMSL	Above Mean Sea Level
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
COC	Constituent of Concern (for corrective action)
COC	Chain of Custody (for sampling and lab reports)
DL	Detection Limit (for laboratory data)
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
GWPS	Groundwater Protection Standards (Established by NC-SWS)
JEI	Joyce Engineering, Inc.
LFG	Landfill Gas
MNA	Monitored Natural Attenuation
MSW	Municipal Solid Waste
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
NCDENR	North Carolina Department of Environment and Natural Resources (now NCDEQ)

NCDEQ	North Carolina Department of Environment Quality (formerly NCDENR)
NCGS	North Carolina Geological Survey
NCSWMR	North Carolina Solid Waste Management Regulations (15A NCAC 13B.1600)
ND	Not Detected (for laboratory data)
NES	Nature and Extent Study (Report)
O&M	Operations and Maintenance
PVC	Poly Vinyl Chloride
QL	Quantitation Limit (for laboratory data)
QRA	Quantitative Risk Assessment (Report)
RL	Reporting Limit (for laboratory data)
RQD	Rock Quality Designation
SPT	Standard Penetration Test
SWQS	Surface Water Quality Standards
SWS	Solid Waste Section (of NCDEQ-Division of Waste Management)
SWSL	North Carolina Solid Waste Section Reporting Limits
TOC	Top of Casing (of a well)
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WQMP	Water Quality Monitoring Plan (Report)
WQMR	Water Quality Monitoring Report (Report)

TABLES

TABLE 1: HISTORICAL GROUNDWATER ELEVATIONS

Well ID:	MW-01	MW-02	MW-03	MW-04	MW-04D	MW-05	MW-06	MW-07	MW-08	MW-09	MW-09R	MW-10	MW-11	MW-11D	MW-12	MW-12D
TOC Elevation:	823.93	778.04	770.08	756.92	757.33	743.17	800.82	771.57	748.95	770.62	764.95	777.20	776.80	776.36	751.48	751.53
Well Depth:	49.0	35.5	38.0	27.0	62.0	20.5	29.6	31.3	18.8	35.0	43.0	38.0	35.0	93.5	18.0	43.3
30-Jan-1998	781.82	750.71	746.26	745.46	745.46	738.49	779.84	744.32	744.30	737.47	NA	744.42	749.08	747.66	746.58	747.05
21-Jul-1998	784.78	750.06	746.76	743.92	743.78	737.14	781.04	745.07	741.20	738.96	NA	744.35	748.95	748.58	745.88	746.11
14-Jan-1999	780.98	749.16	744.91	744.27	744.16	737.60	777.86	743.57	742.68	736.62	NA	743.63	748.09	747.74	745.93	746.11
27-Jul-1999	780.48	749.08	744.86	743.26	743.28	734.04	777.52	743.92	740.53	737.12	NA	743.62	748.05	747.75	745.53	745.68
20-Jan-2000	780.30	748.51	744.83	744.77	744.43	737.82	777.27	743.87	743.18	NA	737.14	743.90	748.36	747.97	746.28	746.53
12-Jul-2001	780.10	748.73	745.30	742.88	743.06	737.08	776.81	744.25	740.40	NA	738.12	743.66	747.77	747.44	745.45	745.71
24-Jan-2001	778.93	748.91	744.43	744.69	744.73	737.72	775.84	743.40	743.41	NA	737.35	743.49	747.85	747.54	746.06	746.54
17,18-Jul-2001	779.59	748.41	744.61	742.72	742.78	736.76	776.08	743.92	739.99	NA	737.77	743.35	749.45	747.09	745.45	745.40
30,31-Jan-2002	777.29	748.14	743.08	743.09	743.49	737.37	773.72	742.57	742.17	NA	736.40	742.74	747.35	747.03	745.14	742.42
17,18-Jul-2002	776.47	747.29	742.88	741.80	741.93	736.48	772.97	742.57	738.97	NA	735.86	742.30	746.54	746.21	744.27	744.44
20,21-Jan-2003	777.12	748.14	745.45	743.87	743.96	737.40	775.08	744.06	742.51	NA	738.06	743.60	748.05	746.57	745.50	745.92
23,24-Jul-2003	782.10	749.48	748.08	743.92	743.83	738.07	778.39	745.53	742.74	NA	741.80	744.60	748.40	748.16	745.83	746.08
21,22-Jan-2004	781.75	748.89	746.57	743.77	743.84	737.36	778.02	744.37	742.30	NA	739.10	743.91	747.86	747.47	745.87	746.07
27,28-Jul-2004	780.80	748.24	745.18	742.27	742.43	736.77	776.65	743.96	739.65	NA	738.45	743.37	747.26	746.96	745.03	745.31
19,20-Jan-2005	780.38	749.11	745.43	744.35	744.37	737.97	777.46	744.56	743.35	NA	739.05	744.95	748.39	747.75	746.02	746.39
11,12,13-Jul-2005	780.55	748.59	744.82	742.81	742.87	735.22	777.51	744.96	740.87	NA	739.20	744.51	747.60	747.26	745.21	745.43
16,17,18-Jan-2006	778.76	748.58	744.75	744.03	744.13	737.77	776.53	744.19	743.40	NA	737.95	744.21	747.70	747.36	745.73	746.09
10,11,12-Jul-2006	779.27	748.17	744.47	743.69	743.58	737.39	776.09	744.08	741.90	NA	738.07	744.00	747.05	746.76	745.51	745.77
22, 23, 24-Jan-2007	781.16	749.52	745.64	744.30	744.30	738.22	778.37	745.67	743.79	NA	739.33	745.14	748.40	747.94	745.95	746.33
12,13-Sep-2007	781.71	747.84	743.58	741.65	741.58	736.57	773.75	744.06	738.53	NA	737.60	743.15	746.70	746.26	744.48	744.44
19-Mar-2008	780.19	749.02	744.26	744.04	744.04	737.91	777.94	744.85	743.34	NA	737.35	744.87	747.99	747.62	745.42	746.05
11-Sep-2008	779.78	747.53	743.05	742.03	741.98	736.92	775.93	743.93	739.86	NA	736.89	743.55	746.55	746.14	744.54	744.65
11-Mar-2009	779.55	749.34	744.67	743.91	744.14	737.96	777.02	745.84	743.52	NA	738.35	747.67	748.13	747.76	745.37	746.01
16-Sep-2009	780.08	747.87	743.28	741.69	741.56	736.64	775.82	744.64	738.49	NA	737.13	743.37	746.84	746.36	744.41	744.38
10-Mar-2010	781.45	750.17	745.87	744.22	744.21	738.17	779.04	748.14	743.24	NA	741.16	748.24	749.06	748.61	745.33	746.23
16-Sep-2010	781.85	748.47	744.64	742.51	742.53	737.22	777.86	745.57	740.03	NA	737.90	744.90	747.42	747.07	744.86	745.08
15-Mar-2011	780.68	749.36	745.05	743.89	744.35	738.29	778.17	746.17	743.74	NA	738.35	745.14	748.42	747.47	744.91	745.63
14-Sep-2011	779.51	747.58	742.58	742.01	741.95	736.34	775.42	744.48	739.28	NA	736.20	742.70	746.64	746.26	744.35	744.66
14-Mar-2012	779.74	748.97	744.85	743.92	743.91	738.05	777.61	746.82	742.95	NA	738.28	746.07	748.02	747.48	745.37	745.72
12-Sep-2012	779.25	748.01	743.26	742.42	742.35	737.39	775.87	744.70	740.40	NA	737.13	744.40	746.82	746.53	744.57	744.91
20-Mar-2013	778.80	749.52	744.09	744.22	744.15	738.26	777.37	746.86	743.31	NA	738.28	747.16	748.46	748.05	745.25	746.10
18-Sep-2013	780.36	748.53	744.23	742.68	742.60	737.61	777.12	745.97	740.20	NA	737.95	744.95	747.49	747.11	744.72	745.23
19-Mar-2014	779.73	749.82	744.80	744.73	744.65	738.97	777.92	748.47	744.45	NA	738.93	747.67	748.84	748.42	745.61	746.40
17-Sep-2014	780.05	748.14	743.93	742.40	742.31	737.67	776.56	745.44	739.57	NA	738.10	744.27	747.12	746.80	744.62	744.93
18-Mar-2015	778.22	749.23	744.35	744.19	744.13	738.49	776.65	746.59	743.36	NA	738.72	746.72	748.20	747.75	745.40	746.03

Notes: TOC = Top of PVC ca All depths in feet measured from TOC. All water level elevations are reported in feet above mean sea level.
TOC elevation for MW-02 is revised reflecting improvements were made to the well in July 2001 prior to sampling. NA = data not available.

TABLE 2:
GROUNDWATER FLOW RATE CALCULATIONS

GRADIENT CALCULATION SEGMENT	HYDRAULIC CONDUCTIVITY (***K***, cm/s)	HYDRAULIC CONDUCTIVITY (***K***, ft/s)	EFFECTIVE POROSITY (***n***, unitless)	FLOW SEGMENT LENGTH (ft)	FLOW DIRECTION	March 18, 2015		
						Elevation (ft AMSL)	**Gradient** (***i***, ft/ft)	**Velocity** (***V***, ft/yr)
i_1	2.90E-04	9.51E-06	0.41	1320	NW-N	780 745	0.027	19.4
i_2	1.70E-04	5.58E-06	0.41	1255	W-SW	780 750	0.024	10.3
i_3	1.70E-04	5.58E-06	0.41	658	N	755 740	0.023	9.8
i_4	1.70E-04	5.58E-06	0.41	881	SW	755 740	0.017	7.3
						AVERAGE:	0.022	12.3

Notes:

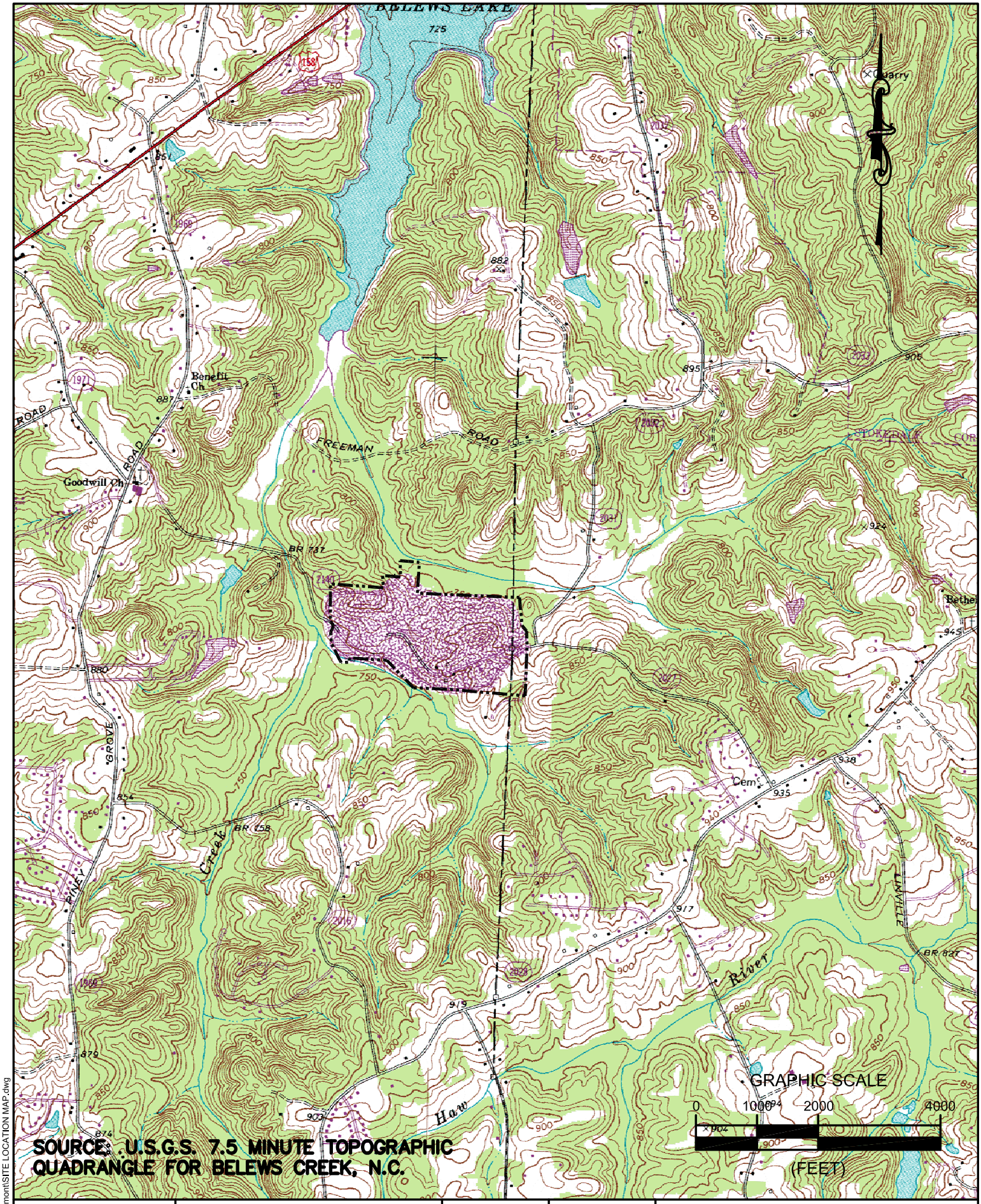
An effective porosity ("***n***") of 41% was based on average laboratory-derived porosity as reported in the April 1994 Design Hydrogeologic Study, prepared by RUST Environment & Infrastructure.
Hydraulic conductivities ("***K***") were also taken from the Design Hydrogeologic Study, and were based on slug test data from piezometers originally located nearest the respective groundwater flow paths.
Groundwater Linear Flow Velocity calculated using the modified Darcy equation: $V = i K / n$.
Gradient Calculation Segments are shown on Drawing 1.

TABLE 3:
MONITORING WELL CONSTRUCTION DATA

WELL ID	INSTAL. DATE	CASING DIAMETER (inches)	WELL ELEVATIONS (feet AMSL)		TOTAL DEPTH		TOP OF BEDROCK		SCREENED INTERVAL				GROUNDWATER *		LITHOLOGY OF SCREENED INTERVAL
			Ground Surface	TOC	Depth (feet BGS)	Elevation (feet AMSL)	Depth (feet BGS)	Elevation (feet AMSL)	Depth (feet BGS)		Elevation (feet AMSL)		Depth to Water (feet below TOC)	Water Table Elevation (feet AMSL)	
									Top	Bottom	Top	Bottom			
MW-01	07/13/89	2.00	821.40	823.93	49.00	772.40	47.00	774.40	44.00	49.00	777.4	772.40	778.22	45.71	WEATHERED GNEISS BEDROCK
MW-02	08/05/89	2.00	767.30	778.04	25.50	741.80	-	-	20.20	25.20	747.1	742.10	749.23	28.81	SILTY SAND
MW-03	08/06/89	2.00	767.30	770.08	38.00	729.30	-	-	32.50	37.50	734.8	729.80	744.35	25.73	SILTY SAND
MW-04	07/14/89	2.00	754.50	756.92	27.00	727.50	-	-	20.00	25.00	734.5	729.50	744.19	12.73	SILTY SAND
MW-04D#	02/18/94	2.00	754.30	757.33	62.00	692.30	62.00	692.30	53.25	58.25	701.05	696.05	744.13	13.20	SAPROLITE/WEATHERED BEDROCK
MW-05	08/02/89	2.00	740.40	743.17	20.50	719.90	-	-	14.45	19.45	725.95	720.95	738.49	4.68	SILTY SAND
MW-06	08/09/93	2.00	798.00	800.82	26.80	771.20	-	-	20.90	25.90	777.1	772.10	776.65	24.17	SILTY SAND
MW-07	08/25/94	2.00	768.87	771.57	33.50	735.37	-	-	17.00	32.40	751.87	736.47	746.59	24.98	SILTY SAND
MW-08	08/31/94	2.00	746.15	748.95	22.00	724.15	-	-	5.00	20.00	741.15	726.15	743.36	5.59	SILTY SAND
MW-09	08/30/94	2.00	767.82	770.62	35.00	732.82	-	-	19.81	34.81	748.01	733.01	-	-	SAND/SAPROLITE BEDROCK
MW-09R	11/09/99	2.00	762.95	764.95	41.20	721.75	28.00	734.95	32.00	42.50	730.95	720.45	738.72	26.23	BEDROCK
MW-10	10/24/94	2.00	774.20	777.20	38.00	736.20	-	-	20.00	36.99	754.2	737.21	746.72	30.48	CLAYEY SILT/SILT
MW-11	11/17/94	2.00	774.30	776.80	35.00	739.30	-	-	19.01	34.22	755.29	740.08	748.20	28.60	SILT/SANDY SILT
MW-11D	11/15/94	2.00	773.86	776.36	93.50	680.36	-	-	81.82	91.79	692.04	682.07	747.75	28.61	SANDY SILT/GRAVELY SILT
MW-12	10/21/94	2.00	748.58	751.48	18.00	730.58	-	-	3.33	17.22	745.25	731.36	745.40	6.08	SILTY CLAY/SILTY SAND/SANDY SILT
MW-12D	10/27/94	2.00	748.73	751.53	43.30	705.43	-	-	31.98	42.20	716.75	706.53	746.03	5.50	SILTY GRAVEL/

TOC = Top of PVC Well Casing BGS = Below ground surface AMSL = Above mean sea level # MW-4D originally called PZ-13 * - Groundwater data from March 18, 2015

FIGURE

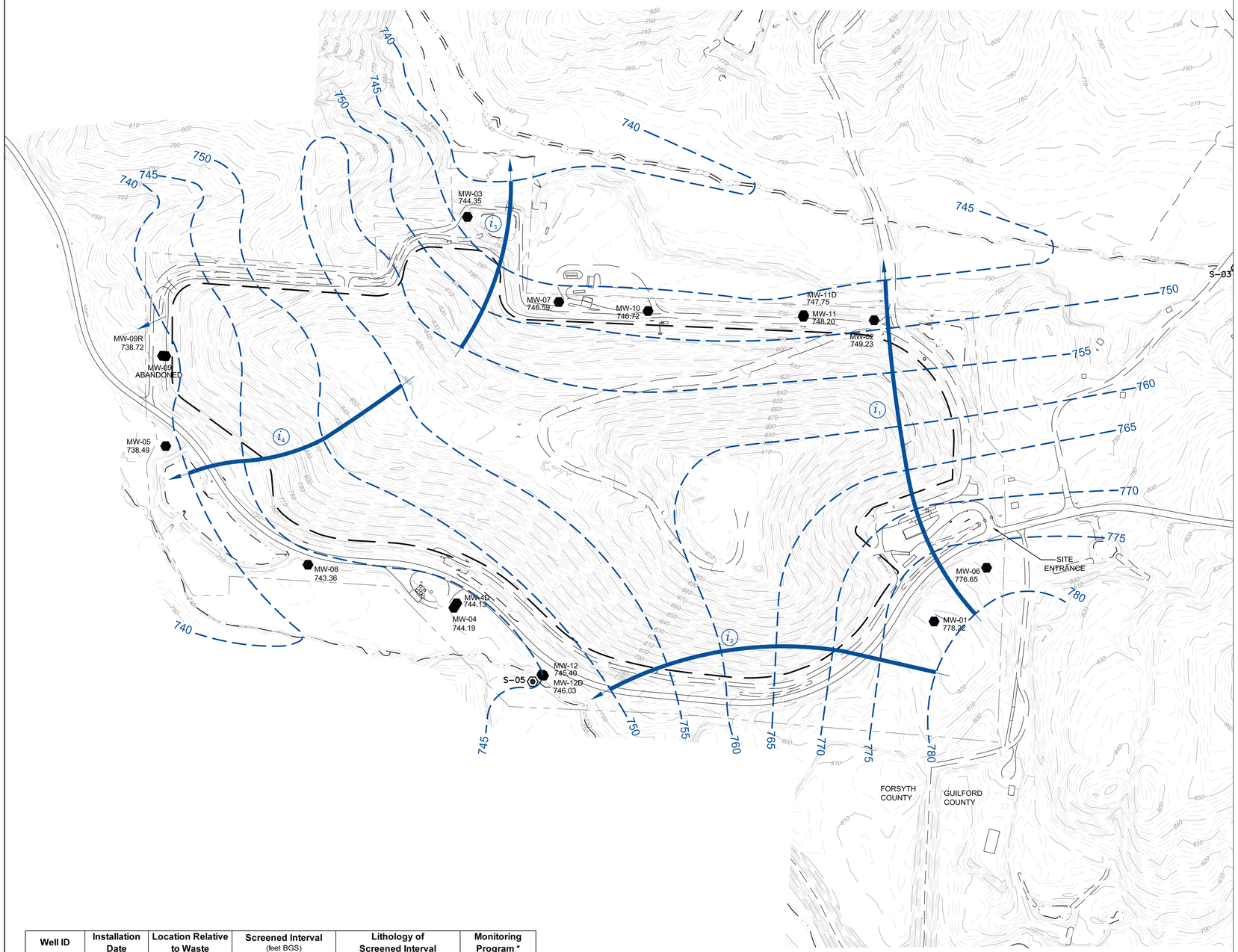


SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE FOR BELEWS CREEK, N.C.

FIGURE NO. 1	JOYCE ENGINEERING 2211 WEST MEADOWVIEW ROAD GREENSBORO, N.C. 27407 PHONE: (336) 323-0092 © 2015 Joyce Engineering, Inc. All rights reserved.	SCALE 1"=2000'	PROJECT NO. 392	PIEDMONT LANDFILL KERNERSVILLE, NORTH CAROLINA SITE LOCATION MAP

L:\WMI\dwg\Piedmont\SITE LOCATION MAP.dwg

DRAWINGS



LEGEND

- EXISTING 10' TOPOGRAPHIC CONTOUR (850)
- EXISTING 2' TOPOGRAPHIC CONTOUR
- APPROXIMATE LIMITS OF WASTE
- GROUNDWATER SURFACE CONTOUR [FEET ABOVE MEAN SEA LEVEL (AMSL)] (740)
- GROUNDWATER FLOW DIRECTION
- EXISTING ROAD
- CENTERLINE OF STREAM
- PROPERTY LINE
- GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION WITH STATIC WATER LEVEL ELEVATION (FEET AMSL) (MW-9R 738.72)
- SURFACE WATER MONITORING POINTS (S-03)
- SEGMENT USED FOR GRADIENT CALCULATIONS (i_1)

FLOW PATH LENGTH

- i_1 = 1,320 LF
- i_2 = 1,255 LF
- i_3 = 658 LF
- i_4 = 881 LF

NOTES:

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET.
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 5 FEET.
3. STATIC WATER LEVELS MEASURED ON 03/18/15.
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. TOPOGRAPHIC MAP AND SURVEYED WELL LOCATIONS PROVIDED TO JOYCE ENGINEERING, INC. BY PIEDMONT LANDFILL.
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. THE LOCATIONS OF SURFACE WATER MONITORING POINTS ARE APPROXIMATE AS SHOWN.

Well ID	Installation Date	Location Relative to Waste	Screened Interval (feet BGS)	Lithology of Screened Interval	Monitoring Program *
MW-01	07/13/89	Upgradient	44.0 - 49.0	WEATHERED GNEISS BEDROCK	Detection
MW-02	08/05/89	Downgradient	20.2 - 25.2	SILTY SAND	Detection
MW-03	08/06/89	Downgradient	32.5 - 37.5	SILTY SAND	Detection
MW-04	07/14/89	Downgradient	20.0 - 25.0	SILTY SAND	Detection
MW-04D	-	Downgradient	?? - 59	BEDROCK	Not Sampled
MW-05	08/02/89	Downgradient	14.45 - 19.45	SILTY SAND	Detection
MW-06	08/09/93	Upgradient	20.9 - 25.9	SILTY SAND	Not Sampled
MW-07	08/25/94	Downgradient	17.0 - 32.4	SILTY SAND	Detection
MW-08	08/31/94	Downgradient	5.0 - 20.0	SILTY SAND	Detection
MW-09	08/30/94	Downgradient	19.81 - 34.22	SAND/SAPROLITE BEDROCK	Abandoned
MW-09R	11/09/99	Downgradient	32.0 - 42.5	BEDROCK	Detection
MW-10	10/24/94	Downgradient	20.0 - 36.99	CLAYEY SILT/SILT	Detection
MW-11	11/17/94	Downgradient	19.01 - 34.22	SILT/SANDY SILT	Detection
MW-11D	11/15/94	Downgradient	81.82 - 91.79	SANDY SILT/GRAVELY SILT	Not Sampled
MW-12	10/21/94	Downgradient	3.33 - 17.22	SILTY CLAY/SILTY SAND/SANDY SILT	Detection
MW-12D	10/27/94	Downgradient	31.98 - 42.2	SILTY GRAVEL	Not Sampled

BGS = below ground surface.

* Monitoring Program = status as of October 2015

GRAPHIC SCALE

0 100 200 400

(FEET)

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

DESIGNED GVB
DRAWN RWH
CHECKED GVB
APPROVED GVB
DATE 10/13/15

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

PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

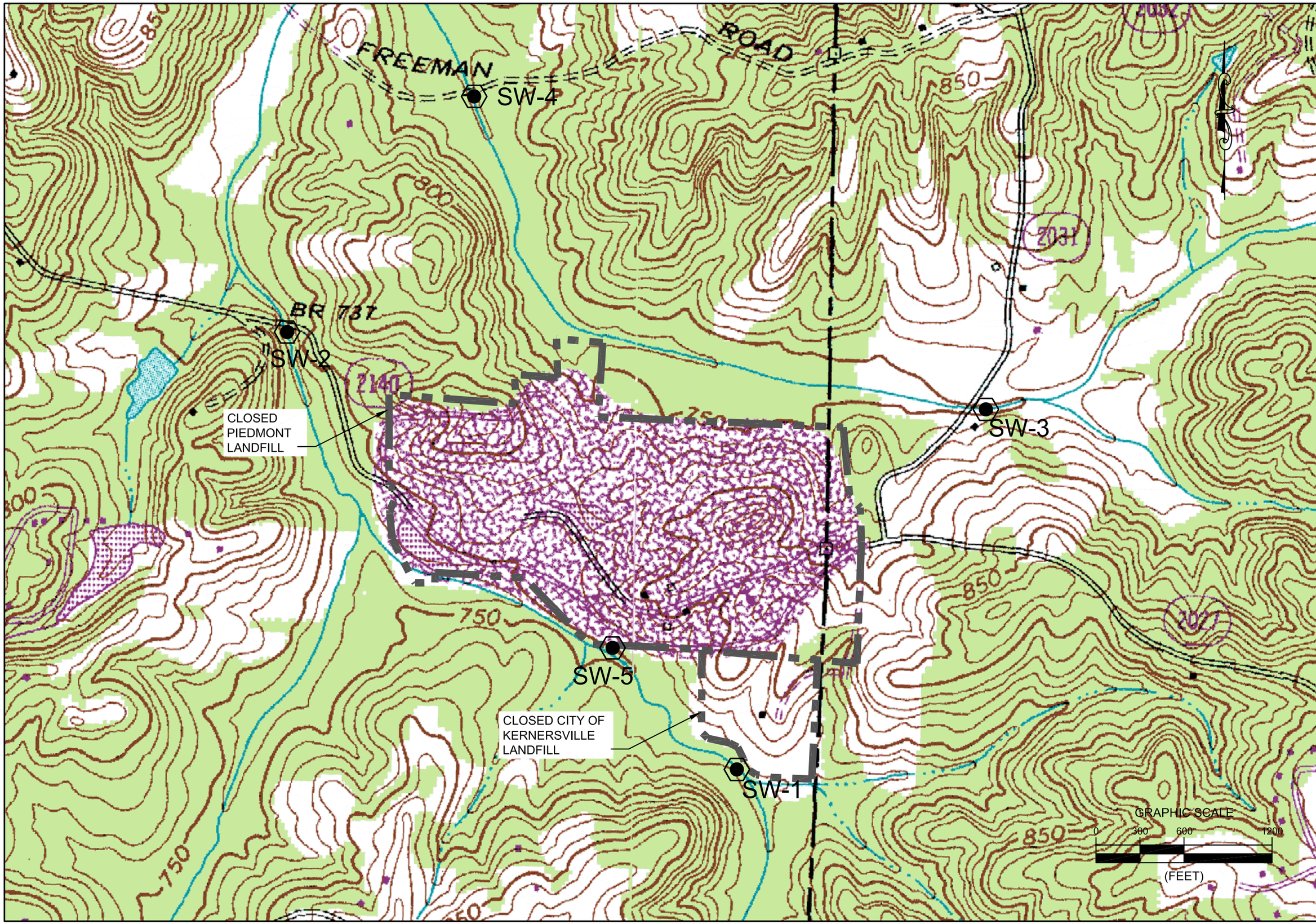
WATER QUALITY
MONITORING PLAN
PERMIT NO. 34-06

PROJECT NO.
392

SCALE
AS NOTED

DRAWING NO.
1

N:\Dwgs\Drawings-Current\WM\Piedmont\2015 WQM\WQM PLAN 2015.dwg Layout=Layout1



NO	BY	CK	APP

REVISIONS AND RECORD OF ISSUE

DATE

DESIGNED VB
DRAWN RWH
CHECKED VB
APPROVED VB
DATE 02/02/10

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

PIEDMONT LANDFILL
KERNERSVILLE, NORTH CAROLINA

SURFACE WATER MONITORING POINTS

PROJECT NO.
392.1001.12

SCALE
AS NOTED

DRAWING NO.
2

N:\Dwgs\Drawings-Current\WM\Piedmont\surface monitoring points.dwgLayout1

APPENDIX A

Boring Logs & Well Construction Records

NORTH CAROLINA DEPARTMENT OF NATURAL R RCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEM . - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919)733-3221

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-1

DRILLING CONTRACTOR Law Engineering
DRILLER REGISTRATION NUMBER 332

Sanitary Landfill
~~STATE WELL CONSTRUCTION~~
PERMIT NUMBER: 34-06

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kernersville, N. C. County: Forsyth
(Road, Community, or Subdivision and Lot No.)

2. OWNER Waste Management of Carolinas, Inc.
ADDRESS 110 Berry Shoals Road (Street or Route No.)
Duncan (City or Town) S.C. (State) 29334 (Zip Code)

3. DATE DRILLED 7/13/89 USE OF WELL Monitoring
4. TOTAL DEPTH 49 ft. CUTTINGS COLLECTED ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 2.6 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): -- METHOD OF TEST --
WATER ZONES (depth): --
9. CHLORINATION: Type -- Amount --

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	44.0	-2.6	2 in.	Sch. 40	PVC

11. GROUT:

	Depth From	Depth To	Material	Method
	37.0	3.0	Cement/bentonite	Tremie

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	49.0	44.0	2 in.	0.010 in.	PVC
			in.	in.	
			in.	in.	

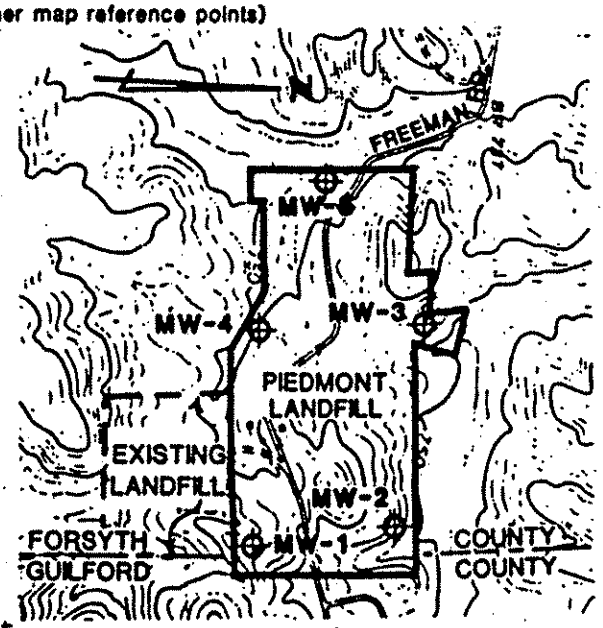
13. GRAVEL PACK:

	Depth From	Depth To	Size	Material
	49.0	40.5	20/40	sand

Depth (ft) From	To	DRILLING LOG Formation Description
0	20	Red silty clay trace sand
20	47	Red brown sand some silt
47	49	Weathered gneiss bedrock

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



REMARKS: Bentonite pellet seal from 40.5 ft. to 37.7 ft.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

GOLDER ASSOCIATES INC. [signature] October 2, 1989
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 6/88

Submit original to Division of Environmental Management and copy to well owner.

NORTH CAROLINA DEPARTMENT OF NATURAL P RCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEM . - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919)733-3221

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-2

DRILLING CONTRACTOR Law Engineering
DRILLER REGISTRATION NUMBER 332

Sanitary Landfill
~~STATE WELL CONSTRUCTION~~
PERMIT NUMBER: 34-06

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kernersville, N. C. County: Forsyth
(Road, Community, or Subdivision and Lot No.)

2. OWNER Waste Management of Carolinas, Inc.
ADDRESS 110 Berry Shoals Road (Street or Route No.)
Duncan S.C. 29334
City or Town State Zip Code

3. DATE DRILLED 8/5/89 USE OF WELL Monitoring
4. TOTAL DEPTH 25.5 ft CUTTINGS COLLECTED ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 3.0 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): -- METHOD OF TEST --
WATER ZONES (depth): --

9. CHLORINATION: Type -- Amount --

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	20.2	-3.0	2 in.	Sch. 40	PVC

11. GROUT:

	Depth From	Depth To	Material	Method
	14.0	3.0	Cement/bentonite	Tremie

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	25.2	20.2	2 in.	0.010 in.	PVC
			in.	in.	
			in.	in.	

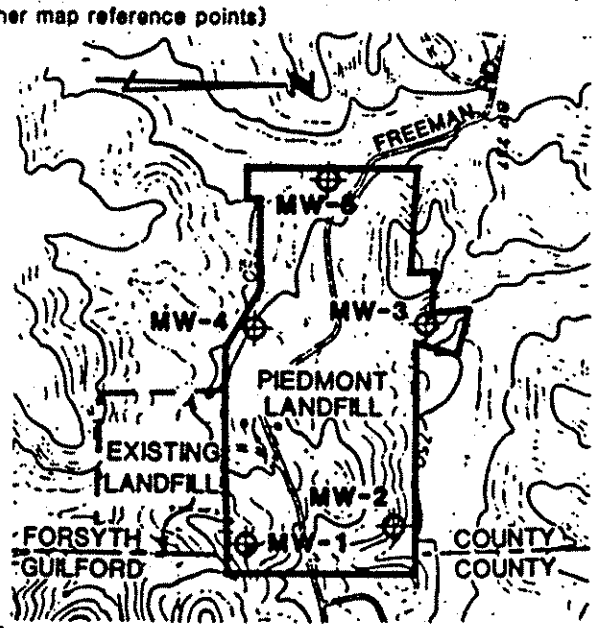
13. GRAVEL PACK:

	Depth From	Depth To	Size	Material
	25.2	17.5	20/40	sand

Depth (ft) From	To	DRILLING LOG Formation Description
0	5	Tan clayey silt some sand
5	25.5	Brown sand, some silt

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



REMARKS: Bentonite pellet seal from 17.5 ft. to 14.5 ft.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

GOLDER ASSOCIATES INC. [signature] October 2, 1989
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 6/88
Submit original to Division of Environmental Management and copy to well owner.

NORTH CAROLINA DEPARTMENT OF NATURAL RE' 'RCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEM - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919)733-3221

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-3

DRILLING CONTRACTOR: Law Engineering
DRILLER REGISTRATION NUMBER: 332

Sanitary Landfill
~~STATE WELL CONSTRUCTION~~ PERMIT NUMBER: 34-06

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kernersville, N. C. County: Forsyth
(Road, Community, or Subdivision and Lot No.)

2. OWNER: Waste Management of Carolinas, Inc.
ADDRESS: 110 Berry Shoals Road (Street or Route No.)
Duncan (City or Town) S.C. (State) 29334 (Zip Code)

3. DATE DRILLED: 8/6/89 USE OF WELL: Monitoring
4. TOTAL DEPTH: 38.0 CUTTINGS COLLECTED: ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 3.0 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): -- METHOD OF TEST: --
8. WATER ZONES (depth): --
9. CHLORINATION: Type -- Amount --

10. CASING:

From	To	Diameter	Wall Thickness or Weight/Ft.	Material
32.5	-13.0	2 in.	Sch. 40	PVC

11. GROUT:

From	To	Material	Method
26.6	3.0	Cement/bentonite	Tremie

12. SCREEN:

From	To	Diameter	Slot Size	Material
37.5	32.5	2 in.	0.010 in.	PVC

13. GRAVEL PACK:

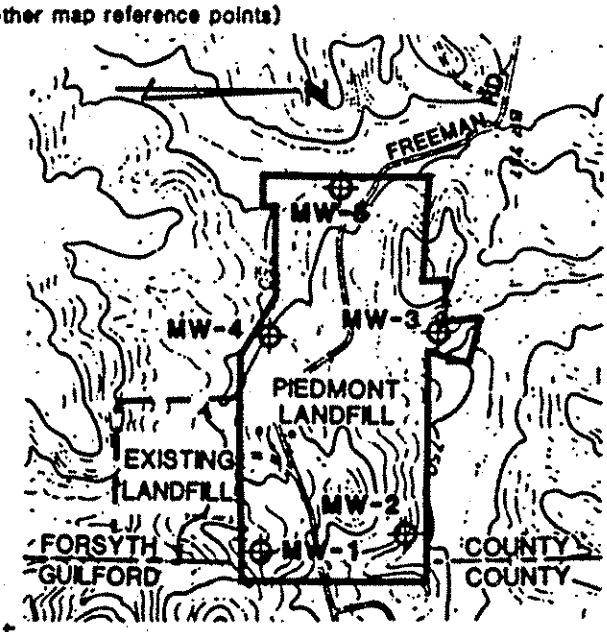
From	To	Size	Material
37.5	29.6	20/40	sand

DRILLING LOG

Depth (ft) From	To	Formation Description
0	5	Tan clayey silt some sand
5	38	Brown sand some silt

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



REMARKS: Bentonite pellet seal from 29.6 ft. to 27.0 ft.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

GOLDER ASSOCIATES INC. [signature] October 2, 1989
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 6/88

Submit original to Division of Environmental Management and copy to well owner.

NORTH CAROLINA DEPARTMENT OF NATURAL RE' 'CES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMA - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919)733-3221

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-4

DRILLING CONTRACTOR Law Engineering
DRILLER REGISTRATION NUMBER 332

Sanitary Landfill
~~STATE WELL CONSTRUCTION~~
PERMIT NUMBER: 34-06

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kernersville, N. C. County: Forsyth
(Road, Community, or Subdivision and Lot No.)

2. OWNER Waste Management of Carolinas, Inc.
ADDRESS 110 Berry Shoals Road (Street or Route No.)
Duncan (City or Town) S.C. (State) 29334 (Zip Code)

3. DATE DRILLED 7/14/89 USE OF WELL Monitoring
4. TOTAL DEPTH 27 ft. CUTTINGS COLLECTED ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 3.0 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): -- METHOD OF TEST --
WATER ZONES (depth): --
9. CHLORINATION: Type -- Amount --

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	20.0	-3.0	2 in.	Sch. 40	PVC

11. GROUT:

	Depth From	Depth To	Material	Method
	13.0	3.0	Cement/ bentonite	Tremie

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	25.0	20.0	2 in.	0.010 in.	PVC
			in.	in.	
			in.	in.	

13. GRAVEL PACK:

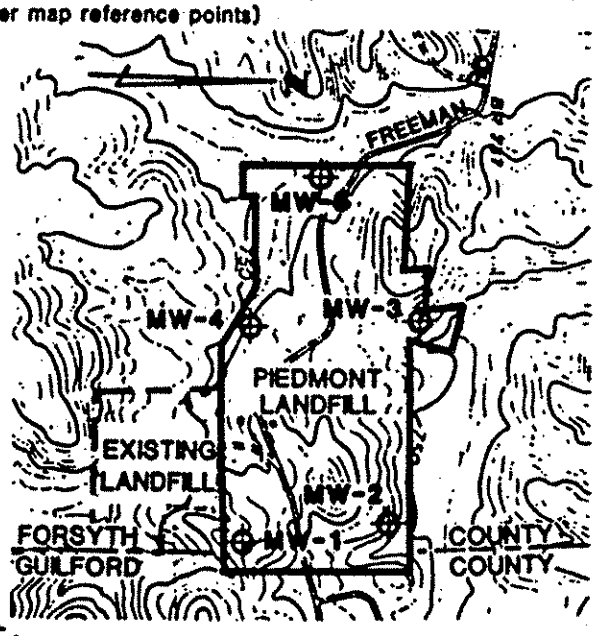
	Depth From	Depth To	Size	Material
	25.0	16.7	20/40	sand

DRILLING LOG

Depth From (ft)	Depth To (ft)	Formation Description
0	10	Tan clayey silt some sand
10	27	Brown sand some silt

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



EMARKS: Bentonite pellet seal from 16.7 ft. to 14.0 ft.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

GOLDER ASSOCIATES INC. /17 October 2, 1989
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 6/88
Submit original to Division of Environmental Management and copy to well owner.

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919)733-3221

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-5

DRILLING CONTRACTOR: Law Engineering
DRILLER REGISTRATION NUMBER: 332

Sanitary Landfill
~~STATE WELL CONSTRUCTION~~
PERMIT NUMBER: 34-06

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kernersville, N. C.
County: Forsyth
(Road, Community, or Subdivision and Lot No.)

2. OWNER: Waste Management of Carolinas, Inc.
ADDRESS: 110 Berry Shoals Road (Street or Route No.)
Duncan (City or Town) S.C. (State) 29334 (Zip Code)

3. DATE DRILLED: 8/2/89 USE OF WELL: Monitoring
4. TOTAL DEPTH: 20.5 ft. CUTTINGS COLLECTED: ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 3.0 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): -- METHOD OF TEST: --
8. WATER ZONES (depth): --
9. CHLORINATION: Type -- Amount --

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 14.45	To -3.0	Ft.	2 in.	Sdh 40	PVC
From	To	Ft.			
From	To	Ft.			

11. GROUT:

	Depth		Material	Method
From 9.0	To 3.0	Ft.	Cement/bentonite	Tremie
From	To	Ft.		

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 19.45	To 14.45	Ft.	2 in.	0.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

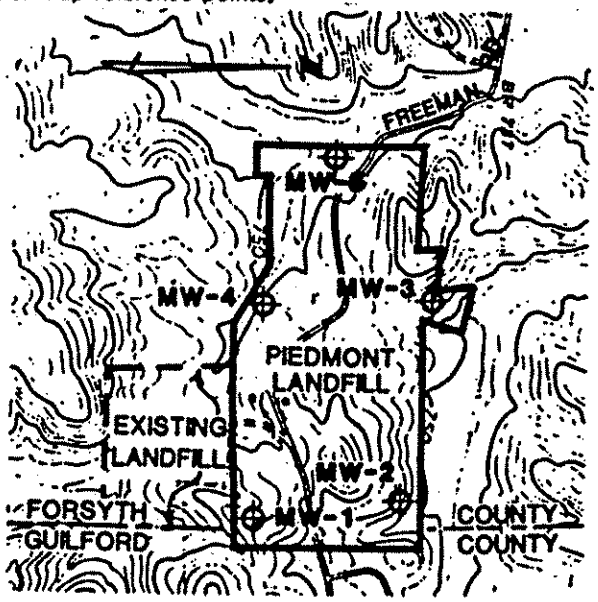
13. GRAVEL PACK:

	Depth		Size	Material
From 19.45	To 12.0	Ft.	20/40	sand
From	To	Ft.		

Depth (ft) From	To	DRILLING LOG Formation Description
0	10	Tan clayey silt some sand
10	20.5	Brown sand some silt

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

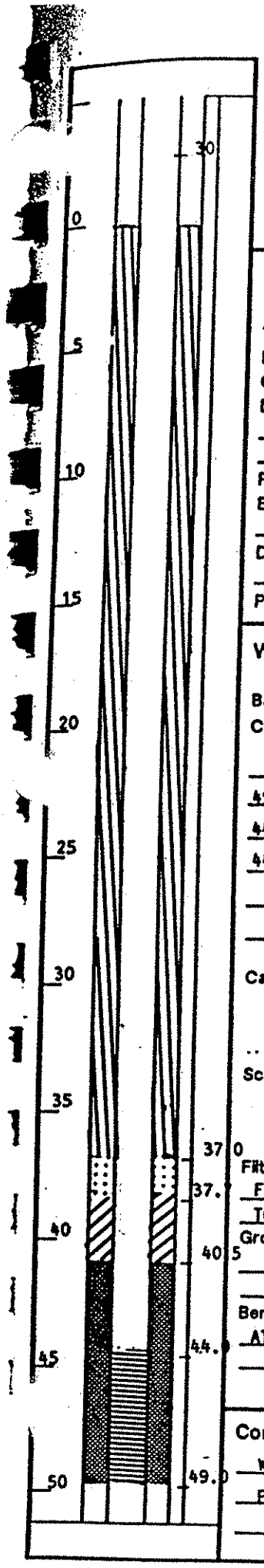


REMARKS: Bentonite pellet seal from 12.0 ft. to 9.8 ft.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

GOLDER ASSOCIATES INC. _____ October 2, 1989
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 6/88
Submit original to Division of Environmental Management and copy to well owner.



Well No. MW-1

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N: 891210.07 E: 1693821.85

Elevation Ground Level 821.4

Top of Casing 823.93

Drilling Summary:

Total Depth 49.0 FT.
Borehole Diameter 10 INCH TO 6 INCH
Casing Stick-up Height: 3.0 FT.
Driller JOHN STONE

Rig MOBILE B-53
Bit(s) 10 INCH HOLLOW STEM AUGER AND 6 INCH ROLLER CONE
Drilling Fluid NONE

Protective Casing DEPTH 2.6 TO 3.0 FT.

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	7/13/89	10:15	7/13/89	16:30
Geophys.Logging:				
Casing:	7/13/89	16:30	7/13/89	16:35
Filter Placement:	7/13/89	16:35	7/13/89	17:15
Cementing:	7/13/89	17:35	7/13/89	19:15
Development:	7/21/89	9:30	8/05/89	16:00

Well Design & Specifications

Basis: Geologic Log ____ Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
49.0 - 44.0	S1	-
44.0 - + 3.0	C1	-
44.0 -	S2	-
-		-
-		-

Casing: C1 2.0 INCH PVC RISER PIPE FLUSH THREADED
C2

Screen: S1 2.0 INCH PVC MACHINE SLOTTED (0.010) PIPE
S2 CENTRALIZER

Filter Pack: 20/40 BAGGED SAND AT A DEPTH FROM 49.0 FT. TO 40.5 FT. AND 37.7 FT. TO 37.0 FT.

Grout Seal: SEE COMMENTS

Bentonite Seal: 0.25 INCH BENTONITE PELLETS AT A DEPTH FROM 40.5 FT. TO 37.7 FT.

Well Development:

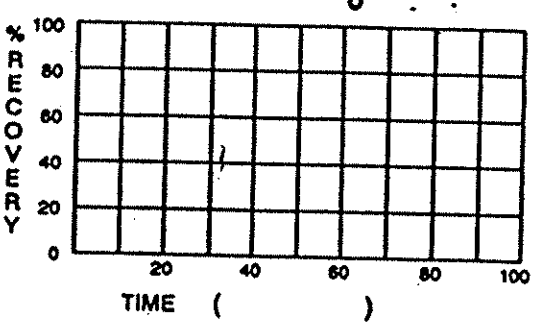
SEE WELL DEVELOPMENT FORM-TABLE 1

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
SEE pH DEVELOPMENT SHEET TABLE 1			

Recovery Data:

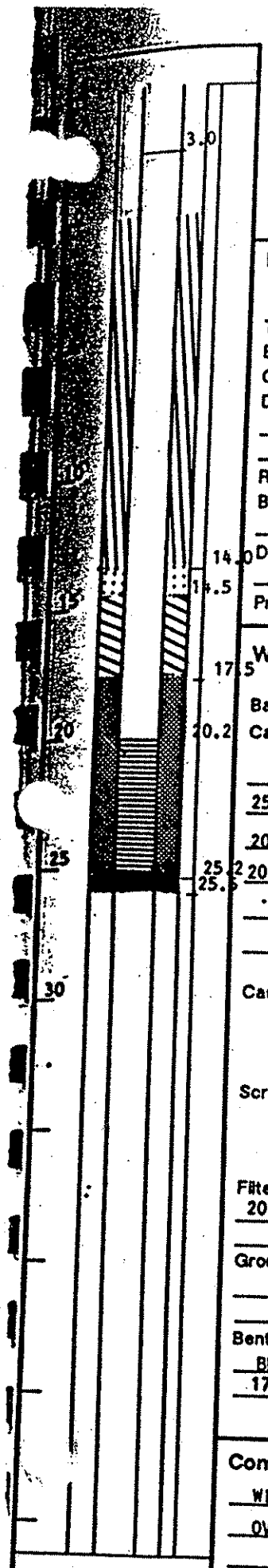
Q= S_o=



Comments: BOREHOLE BACKFILLED WITH A CEMENT/BENTONITE GROUT FROM 37.0 FT. TO WITHIN 3.0 FT. OF GROUND SURFACE. A METAL PROTECTIVE COVER CEMENTED IN PLACE OVER PVC RISER PIPE.

SITE NAME PIEDMONT LANDFILL

SUPERVISED BY FERRELL BRUNET-GOLDER ASSOCIATES/863-3407



Well No. MW-2

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N: 892336.89
E: 1693597.61

Elevation Ground Level 767.3

Top of Casing 770.16

Drilling Summary:

Total Depth 25.5 FT.
Borehole Diameter 10 INCH
Casing Stick-up Height: 3.0 FT.
Driller JOHN STONE

Rig MOBILE B-53
Bit(s) 10 INCH HOLLOW STEM AUGER

Drilling Fluid NONE

Protective Casing DEPTH 3.5 TO -3.0 FT.

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	8/05/89	15:00	8/05/89	15:35
Geophys.Logging:				
Casing:	8/05/89	15:45	8/05/89	15:47
Filter Placement:	8/05/89	15:47	8/05/89	17:10
Cementing:	8/05/89	17:55	8/05/89	18:40
Development:	8/07/89	7:40	8/07/89	14:45

Well Design & Specifications

Basis: Geologic Log ____ Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
25.2 - 20.2	S1	-
20.2 - + 3.0	C1	-
20.2 -	S2	-
-		-
-		-

Casing: C1 2.0 INCH PVC RISER PIPE FLUSH THREADED
C2

Screen: S1 2.0 INCH PVC MACHINE SLOTTED (0.010) PIPE
S2 CENTRALIZER

Filter Pack: 20/40 BAGGED SAND FROM 25.2 TO 20.2 AND FROM 14.5 TO 14.0

Grout Seal: SEE COMMENTS

Bentonite Seal: 0.25 INCH AND 0.50 INCH BENTONITE PELLETS AT A DEPTH FROM 17.5 FT. TO 14.5 FT.

Well Development:

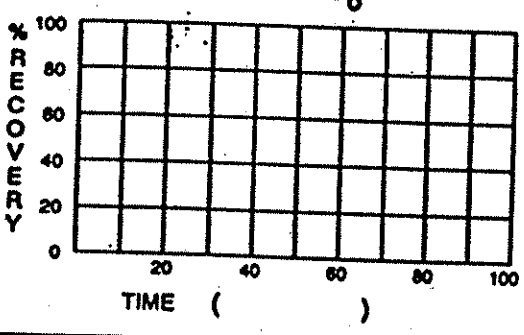
SEE WELL DEVELOPMENT FORM - TABLE 1

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
SEE pH DEVELOPMENT SHEET - TABLE 1			

Recovery Data:

Q= S_o=



Comments: BOREHOLE BACKFILLED WITH A CEMENT/BENTONITE GROUT FROM 14.0 FT. TO WITHIN 3.0 FT. OF GROUND SURFACE. A METAL PROTECTIVE COVER CEMENTED IN PLACE OVER PVC RISER PIPE.
ADDITIONAL BAGGED SAND PLACED 14.5 FT TO 14.0 FT. BELOW GROUND SURFACE.

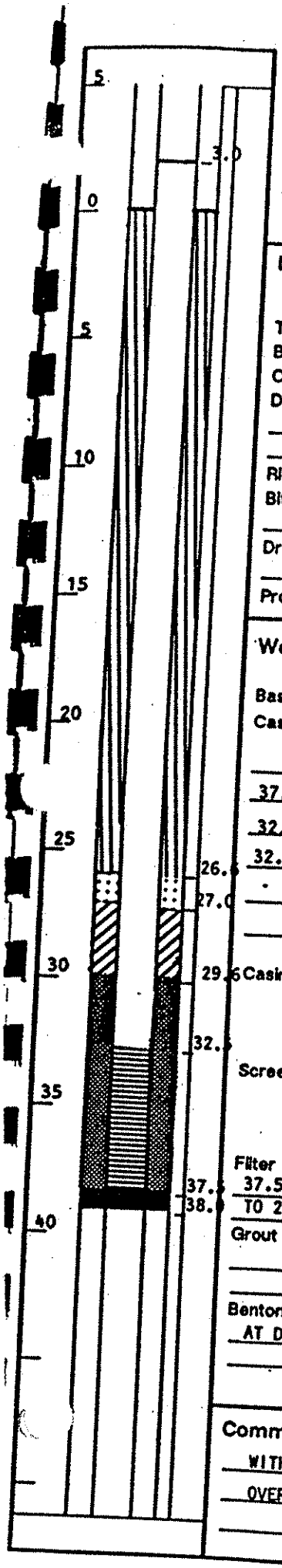
SITE NAME PIEDMONT LANDFILL

LOCATION KERNERSVILLE, NORTH CAROLINA

WC 7525

SUPERVISED BY FERRELL BRUNET-GOLDER ASSOCIATES/863-3407

DATE 8/05/89



Well No. MW-3

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N: 892723.56
E: 1692075.85

Elevation Ground Level 767.30

Top of Casing 770.08

Drilling Summary:

Total Depth 38.0 FT.
Borehole Diameter 10 INCH
Casing Stick-up Height: 3.0 FT.
Driller JOHN STONE

Rig MOBILE B-53
Bit(s) 10 INCH HOLLOW STEM AUGER

Drilling Fluid NONE

Protective Casing DEPTH 3.5 TO -3.0 FT.

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	8/06/89	11:15	8/06/89	13:15
Geophys. Logging:				
Casing:	8/06/89	13:30	8/06/89	13:40
Filter Placement:	8/06/89	13:40	8/06/89	15:50
Cementing:	8/06/89	17:10	8/06/89	18:00
Development:	8/08/89	7:30	8/08/89	11:10

Well Design & Specifications

Basis: Geologic Log ____ Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
37.5 - 32.5	S1	-
32.5 - + 3.0	C1	-
32.5 -	S2	-
-		-
-		-

Casing: C1 2.0 INCH PVC RISER PIPE FLUSH THREADED
C2

Screen: S1 2.0 INCH PVC MACHINE SLOTTED (0.010) PIPE
S2 CENTRALIZER

Filter Pack: 20/40 SAND AT A DEPTH FROM 37.5 FT. TO 29.6 FT. AND FROM 27.0 TO 26.0

Grout Seal: SEE COMMENTS

Bentonite Seal: 0.5 INCH BENTONITE PELLETS AT DEPTH FROM 29.6 FT. TO 27.0 FT.

Well Development:

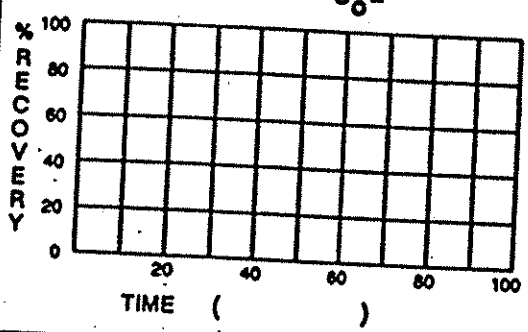
SEE WELL DEVELOPMENT FORM - TABLE 1

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
SEE pH DEVELOPMENT SHEET - TABLE 1			

Recovery Data:

Q= S_o=



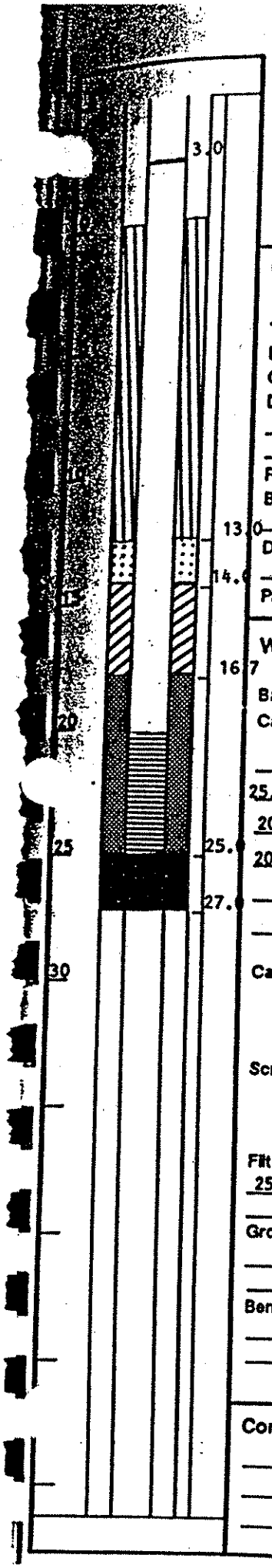
Comments: BOREHOLE BACKFILLED WITH A CEMENT/BENTONITE GROUT FROM 26.6 FT. TO WITHIN 3.0 FT. OF GROUND SURFACE. A METAL PROTECTIVE COVER CEMENTED IN PLACE OVER PVC RISER PIPE.
ADDITIONAL LAYER OF SAND AT 27.0 FT. TO 26.6 FT. BELOW GROUND SURFACE.

SITE NAME PIEDMONT LANDFILL

SUPERVISED BY FERRELL BRUNET-COLDER ASSOCIATES/863-3407

DATE 8/06/89

WC 7507



Well No. MW-4

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N: 891261.29
E: 1692025.37

Elevation Ground Level 754.5
Top of Casing 756.92

Drilling Summary:

Total Depth 27.0 FT.
Borehole Diameter 10 INCH
Casing Stick-up Height: 3.0 FT.
Driller JOHN STONE

Rig MOBILE B-53
Bit(s) 10 INCH HOLLOW STEM AUGER

Drilling Fluid NONE

Protective Casing DEPTH 3.5 TO -3.0 FT.

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	7/14/89	11:05	7/14/89	12:30
Geophys.Logging:				
Casing:	7/14/89	12:31	7/14/89	12:35
Filter Placement:	7/14/89	12:35	7/14/89	13:35
Cementing:	7/14/89	14:10	7/14/89	14:50
Development:	8/03/89	14:21	8/03/89	16:55

Well Design & Specifications

Basic: Geologic Log ____ Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
25.0 - 20.0	S1	-
20.0 - + 3.0	C1	-
20.0 -	S2	-
-		-
-		-

Casing: C1 2.0 INCH PVC RISER PIPE FLUSH THREADED
C2

Screen: S1 2.0 INCH PVC MACHINE SLOTTED (0.010) PIPE
S2 CENTRALIZER

Filter Pack: 20/40 BAGGED SAND FROM 25.0 TO 16.7 AND FROM 14.0 TO 13.0

Grout Seal: SEE COMMENTS

Bentonite Seal: 0.25 INCH AND 0.50 INCH BENTONITE PELLETS AT A DEPTH FROM 16.7 FT. TO 14.0 FT.

Well Development:

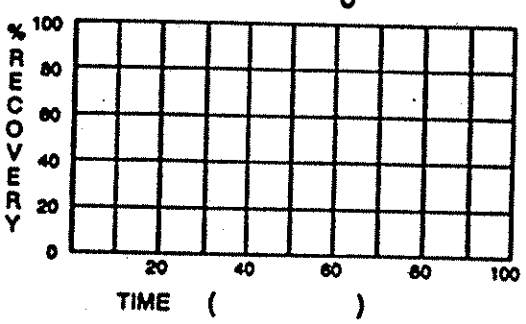
SEE WELL DEVELOPMENT FORM - TABLE 1

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
SEE pH DEVELOPMENT SHEET - TABLE 1			

Recovery Data:

Q= S_o=

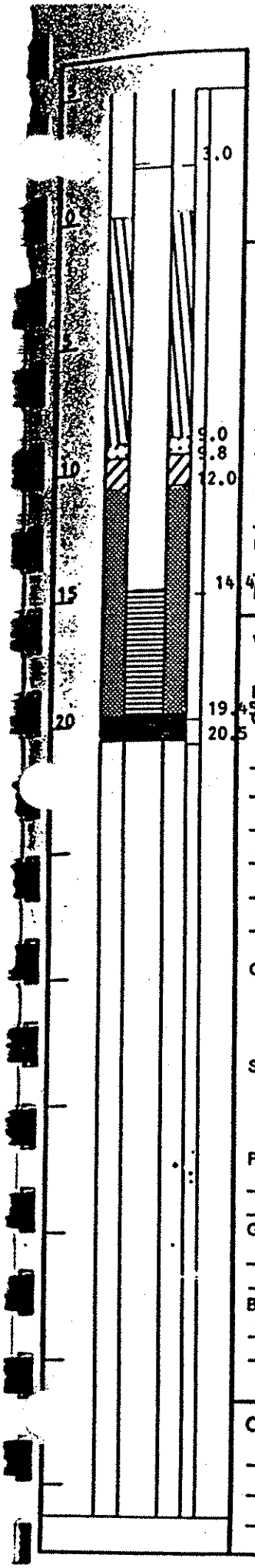


Comments: BOREHOLE BACKFILLED WITH A CEMENT/BENTONITE GROUT FROM 13.0 FT. TO WITHIN 3.0 FT. OF GROUND SURFACE. A METAL PROTECTIVE COVER CEMENTED IN PLACE OVER PVC RISER PIPE

SITE NAME PIEDMONT LANDFILL

SUPERVISED BY FERRELL BRUNET-COLDER ASSOCIATES/863-3407

DATE 7/15/89



Well No. MW-5

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N: 891866.18
E: 1690947.65

Elevation Ground Level 740.4

Top of Casing 743.17

Drilling Summary:

Total Depth 20.5 FT.
Borehole Diameter 10 INCH
Casing Stick-up Height:
Driller JOHN STONE

Rig MOBILE B-53
Bit(s) 10 INCH HOLLOW STEM AUGER

Drilling Fluid NONE

Protective Casing DEPTH 3.5 TO -3.0 FT.

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	8/02/89	17:10	8/02/89	18:05
Geophys.Logging:				
Casing: PVC	8/03/89	9:15	8/03/89	9:25
Filter Placement:	8/03/89	9:25	8/03/89	10:37
Cementing:	8/03/89	11:10	8/03/89	11:50
Development:	8/05/89	7:35	8/06/89	9:50

Well Design & Specifications

Basis: Geologic Log ____ Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
19.45 - 14.45	S1	-
14.45 - + 3.0	C1	-
11.45 -	S2	-
-		-
-		-

Casing: C1 2.0 INCH PVC RISER PIPE FLUSH THREADED
C2

Screen: S1 2.0 INCH PVC MACHINE SLOTTED (0.010) PIPE
S2 CENTRALIZER

Filter Pack: 20/40 BAGGED SAND FROM 19.45 TO 12.0 AND FROM 9.8 TO 9.0

Grout Seal: SEE COMMENTS

Bentonite Seal: 0.25 INCH BENTONITE PELLETS AT A DEPTH FROM 12.0 FT. TO 9.8 FT.

Well Development:

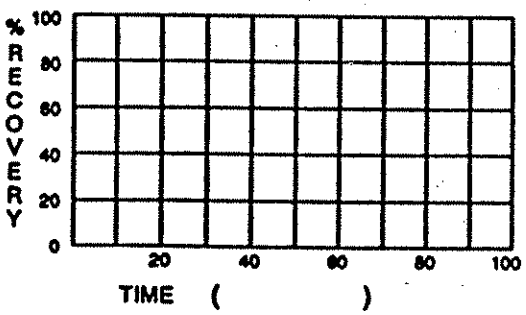
SEE WELL DEVELOPMENT FORM - TABLE 1

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
SEE pH DEVELOPMENT SHEET - TABLE 1			

Recovery Data:

Q= S_o=

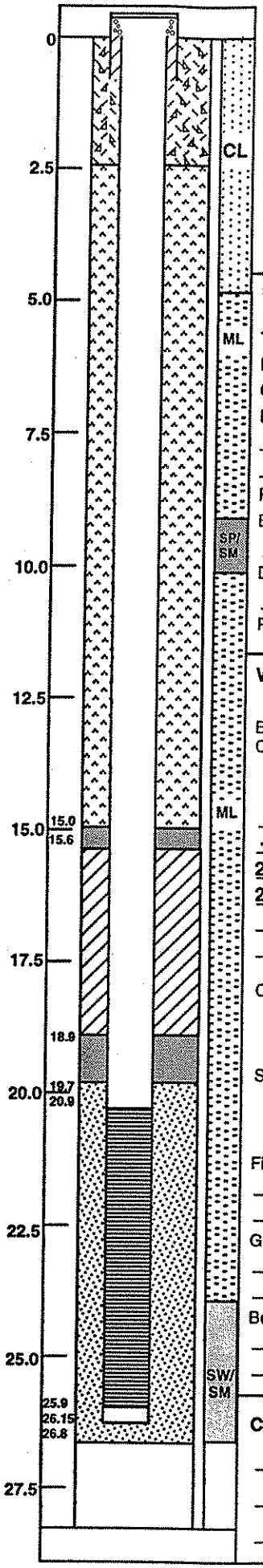


Comments: BOREHOLE BACKFILLED WITH A CEMENT/BENTONITE GROUT FROM 9.0 FT. TO WITHIN 2.0 FT. OF GROUND SURFACE. A METAL PROTECTIVE COVER CEMENTED IN PLACE OVER PVC RISER PIPE.

SITE NAME PIEDMONT LANDFILL

SUPERVISED BY FERRELL BRUNET-COLDER ASSOCIATES/863-3407

WC 7523



Well No.: MW-6

Boring No. X-Ref: MW-6

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N891410.856
E1694018.295

Elevation Ground Level: 798

Top of Casing: 800.82

Drilling Summary:

Total Depth: 26.8 ft.
Borehole Diameter: 8.0 inch
Casing Stick-up Height: 3.0 ft.
Driller: Mike Trinkle
Helper: Jim Foster
Envir. Const. Services Inc., Charlotte, NC
Rig: CME-75
Bit(s): HSA 4 1/4" Carbide Teeth

Drilling Fluid: N/A

Protective Casing: Aluminum 4"x4"x5'

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	8/3/93	12:00	8/3/93	13:00
Geophys. Logging:				
Casing:	8/3/93	14:30	8/3/93	14:40
Filter Placement:	8/3/93	14:45	8/3/93	15:15
Bentonite Seal:	8/3/93	15:20	8/3/93	16:00
Development:	8/4/93	09:30	8/4/93	12:30

Well Design & Specifications

Basis: Geologic Log: x Geophysical Log: ____
Casing String (s): C = Casing S = Screen P=Plug

Depth	String(s)	Elevation
-3.0 - 20.90	C	800.82 - 776.92
20.90 - 25.90	S	776.92 - 771.92
25.90 - 26.15	P	771.92 - 771.67

Casing: C1 2.0" Sch. 40 PVC Flush Threaded
C2

Screen: S1 2.0" Sch. 40 PVC Flush Threaded 0.010 inch slots

Filter Pack: 20/60 Filter Sand 26.8-19.7ft.; 80/100 Fine Sand 19.7 to 18.9 ft.

Grout Seal: Cement/Bentonite, 15.0-2.4 ft.

Bentonite Seal: Bentonite Chips 18.9-15.6 ft.; 80/100 Fine Sand from 15.6-15.0 ft.

Well Development:

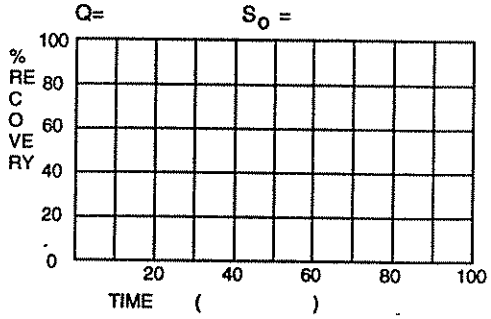
See Attched Log

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)

Recovery Data:

Q= S_o =



Comments: A 2 ft. x 2 ft. concrete pad was built on 8/3/93 & 4 3-inch ID protective abutment posts were set in concrete around the well. Bentonite chips filled up to weep hole and then 3/8 inch single size topped up inside protective casing.

SITE NAME Piedmont Landfill & Recycling Center

LOCATION Kernersville, NC

WC 11427

SUPERVISED BY: Philip E. Lish

DATE: 8/3/93

SOIL BORING LOG

SITE NAME AND LOCATION	DRILLING METHOD: 6.25-INCH I.D. HOLLOW STEM AUGER	BORING NO. MW-7
PIEDMONT LANDFILL & RECYCLING CENTER KERNERSVILLE, NC	SAMPLING METHOD: SPLIT SPOON (SPT)	SHEET 1 OF 1

					DRILLING START	DRILLING FINISH
WATER LEVEL	24.5	25.0	24.9		TIME	TIME
TIME	1600	0835	1700		1542	1705
DATE	8/29/94	9/01/94	9/07/94		DATE	DATE
CASING DEPTH					8/25/94	8/25/94

DATUM ELEVATION 769

DRILL RIG CME

SURFACE CONDITIONS Weeds approximately 1.5 feet high, some gravel.

ANGLE BEARING

SAMPLE HAMMER TORQUE FT.-LBS

DRILLING CONTR Graham & Currie

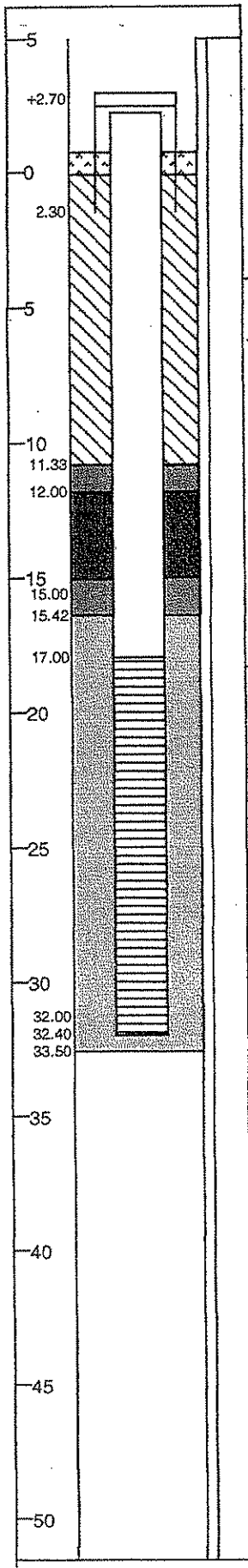
DEPTH IN FEET (ELEVATION)	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
0			**SANDY SILT (ML)** Stiff, orange brown, very fine, mostly silt, some sand.								
5	3 5 7 10 (100%)		**SILTY CLAY (ML/CL)** Stiff, red brown mottled with yellow brown, moist, mostly clay, some silt, with black intrusions.								
			8 feet								
10	1 4 4 4 (75%)		**SANDY SILT (ML)** Stiff, medium brown, mostly silt with very fine sand, with 25-30% mica.								
			14 feet								
15	3 5 4 4 (90%)		**SILTY SAND (SM)** Medium dense, speckled dark gray and white-yellow brown, mostly very fine grained sand with silt, little mica.								
20	3 4 7 6 (80%)		Similar to above, except significantly more white, trace yellow brown band.								
25	3 7 10 14 (95%)		Similar to above, except wet, trace white medium gravel, trace black material (hard, like coal).								
30	8 12 13 17 (80%) 10 12 12 16 (70%)		Saturated at 28.0 feet. Water gone at 30.0 feet. Similar to above, except striated black, yellow brown and white (like zebra stripes). 31.0 - 32.0 feet: saturated 32.0 - 33.0 feet: dry again								
35			**Boring Terminated at 33.0 feet**								

SL

LOGGED BY Heidi Baughman

DATE 8/25/94 CHK'D BY T. Yanoschak

CWM Soil Bor



Well No.: MW-7

Boring No. X-Ref: MW-7

MONITORING WELL CONSTRUCTION SUMMARY

Survey Coords: 892,405.1909 N
1,692,418.099 E

Elevation Ground Level: 768.87

Top of Casing: 771.57

Drilling Summary:

Total Depth: 33.5 ft.
Borehole Diameter: HSA - 11 inches
Casing Stick-up Height: +2.7 ft.
Driller: Graham & Currie

Rig: CME
Bit(s): 6.25-in. I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
	8/25/94	15:42	8/25/94	17:05
Geophys. Logging:	NA	NA	NA	NA
Casing:	8/26/94	10:00	8/26/94	11:00
Filter Placement:	8/26/94	11:00	8/26/94	12:00
Bentonite Seal:	8/26/94	12:00	8/26/94	12:50
Grout:	8/26/94	12:50	8/26/94	15:15
Development:	9/1/94	08:34	9/7/94	18:01

Well Design & Specifications

Basis: Geologic Log: x Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
+2.70 - 2.30	C1	771.57 - 766.57
+2.70 - 17.00	C2	771.57 - 751.87
17.00 - 32.00	S1	751.87 - 736.87
32.00 - 32.40	P1	736.87 - 736.47

Casing: C1 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum
C2 2.0 in. I.D. Schedule 40 PVC

Screen: S1 2.0 in. I.D. Schedule 40 PVC 0.010 in. slot
P1 2.0 in. I.D. PVC plug

Filter Pack: 33.50 to 15.42 ft.: medium sand. 15.42 to 15.00 ft.: fine sand. 12.00 to 11.33 ft.: fine sand

Grout Seal: 11.33 to 0.0 ft.: bentonite/cement grout

Bentonite Seal: 15.00 to 12.00 ft.: bentonite pellets

Well Development:

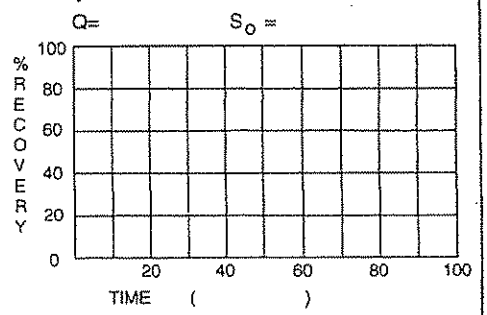
Bailer/Grundfos
Total gallons removed =100 gallons

Stabilization Test Data: * 9/1/94, v 9/7/94

Time	pH	Spec. Cond.	Temp (C)
08:34*	6.02	250	19
10:37*	5.86	100	18
15:59*	5.67	110	19
17:25v	5.87	110	20
17:56v	5.97	100	19

Recovery Data:

Q= S_o =



Comments: Surface seal = 3 ft. x 3 ft. x 3 in. concrete pad with protective post.

SITE NAME Piedmont Landfill

LOCATION Kernersville, N.C.

SUPERVISED BY: Heidi Baughman

DATE: 8/26/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Piedmont Landfill & Recycling Center	PERMIT NO.: 34-6
ADDRESS: 9900 Freeman Road, Kernersville, NC 27284	OWNER (print): Waste Management of Carolinas, Inc.
DRILLING CONTRACTOR: Graham & Currie Well Drilling Inc.	REGISTRATION NO.: MW-7

Casing Type: PVC Sch. 40 dia. 2 in.
Casing Depth: from ±2.70 to 17.00 ft. - dia. ___ in.
Screen Type: PVC Sch. 40 dia. 2 in.
Screen Depth: from 17.00 to 32.00 ft. - dia. ___ in.

Grout Depth: from 0.0 to 11.3 ft. - dia. 11'
Bentonite Seal: from 12.0 to 15.0 ft. - dia. 11'
Sand/Gravel PK: from 15.0 to 33.5 ft. - dia. 11'
Total Well Depth: from ±2.7 to 32.4 ft. - dia. 11'

Static Water Level: 27.60 feet from top of casing

Date Measured 9 / 7 /

Yield (gpm): N/A Method of Testing: N/A

Casing is 2.70 feet above land su

DRILLING LOG

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0'	14'	Stiff, orange brown to red brown sandy silt to silty clay.
14'	33'	Medium dense, gray white yellow brown silty sand with foliations.

LOCATION SKETCH

(show distance to numbered roads, or other map reference poi

See attached location plan

REMARKS:

DATE: 10/6/94 SIGNATURE:

LHS 3M2 (6/85)
H & Hazardous Waste Management Branch

SOIL BORING LOG

SITE NAME AND LOCATION	DRILLING METHOD: 6.25-INCH I.D. HOLLOW STEM AUGER	BORING NO. MW-8
PIEDMONT LANDFILL & RECYCLING CENTER KERNERSVILLE, NC	SAMPLING METHOD: SPLIT SPOON (SPT)	SHEET 1 OF 1
		DRILLING

					START	FINISH
WATER LEVEL	5.4				TIME	TIME
TIME	1045				1040	1130
DATE	9/07/94				DATE	DATE
CASING DEPTH					8/31/94	8/31/94

DATUM ELEVATION 746

DRILL RIG CME

SURFACE CONDITIONS Weeds approximately 1.5 feet high, very thick.

ANGLE BEARING

SAMPLE HAMMER TORQUE FT.-LBS

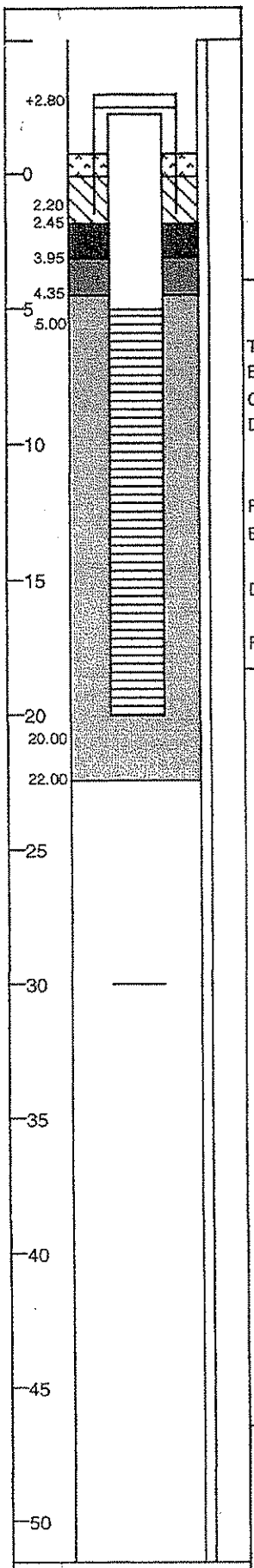
DRILLING CONTR Graham & Currie

SL

LOGGED BY Heidi Baughman

DATE 8/31/94 CHK'D BY T. Yanoschak

DEPTH IN FEET (ELEVATION)	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
0			**SILTY SAND (SM/SP)** Loose, brown-yellow brown, wet, medium fine to coarse grained silty sand. Same as above, except water at approximately 4.0 feet, turning gray.								
5	1 1 1 1 (75%)		7 feet **SANDY SILT (ML)** Stiff, light blue-gray speckled with white, moist, medium fine sandy silt, with approximately 25% mica. At 9.0 feet: color change to yellow brown speckled with white and rust (burnt orange) stripe.								
10	2 6 9 19 (100%)		13 feet **SILTY SAND (SM/SP)** Medium dense, orange brown, saturated, mostly coarse sand and coarse gravel, slightly silty.								
15	4 5 6 7 (55%)		14.5 feet **SILT (ML)** Hard, multi-colored orange brown, pink, light yellow brown, brown, moist, very fine silt.								
20	6 10 29 24		Boring Terminated at 21.0 feet								
25											
30											
35											



Well No.: MW-8

Boring No. X-Ref: MW-8

MONITORING WELL CONSTRUCTION SUMMARY

Survey Coords: 891,422.161 N
1,691,479.791 E

Elevation Ground Level: 746.15

Top of Casing: 748.95

Drilling Summary:

Total Depth: 22.0 ft.
Borehole Diameter: HSA - 11 inches
Casing Stick-up Height: +2.8 ft.
Driller: Graham & Currie

Rig: CME
Bit(s): 6.25-in. I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
	8/31/94	10:30	8/31/94	12:30
Geophys. Logging:	NA	NA	NA	NA
Casing:	8/31/94	12:30	8/31/94	12:45
Filter Placement:	8/31/94	12:45	8/31/94	13:00
Bentonite Seal:	8/31/94	13:00	8/31/94	13:45
Grout:	8/31/94	13:45	8/31/94	14:15
Development:	9/2/94	8:30	9/7/94	13:18

Well Design & Specifications

Basis: Geologic Log: x Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
+2.80 - 2.20	C1	748.95 - 743.95
+2.80 - 5.00	C2	748.95 - 741.15
5.00 - 20.00	S1	741.15 - 726.15

Casing: C1 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum
C2 2.0 in. I.D. Schedule 40 PVC

Screen: S1 2.0 in. I.D. Schedule 40 PVC
S2 0.010 in. slot

Filter Pack: 22.00 to 4.35 ft.: medium sand. 4.35 to 3.95 ft.: fine sand.

Grout Seal: 2.45 to 0.0 ft.: bentonite/cement grout

Bentonite Seal: 3.95 to 2.45 ft.: bentonite pellets

Well Development:

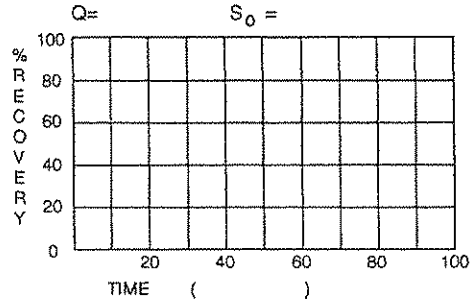
Bailer/Grundfos
Total gallons removed = 154 gallons

Stabilization Test Data: 9/7/94

Time	pH	Spec. Cond.	Temp (C)
10:50	5.86	250	21
12:09	6.12	200	20
12:46	6.18	150	20.5
13:01	6.18	140	21.5
13:18	6.18	140	21

Recovery Data:

Q= S_0 =



Comments: Surface seal = 3 ft. x 3 ft. x 3 in. concrete pad with protective post.

SITE NAME Piedmont Landfill

LOCATION Kernersville, N.C.

SUPERVISED BY: Heidi Baughman

DATE: 8/31/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Piedmont Landfill & Recycling Center	PERMIT NO.: 34-6-
ADDRESS: 9900 Freeman Road, Kernersville, NC 27284	OWNER (print): Waste Management of Carolinas, Inc.
DRILLING CONTRACTOR: Graham & Currie Well Drilling Inc.	REGISTRATION NO.: MW-8

Casing Type: PVC Sch. 40 dia. 2 in.
Casing Depth: from +2.80 to 5.00 ft. - dia. ___ in.
Screen Type: PVC Sch. 40 dia. 2 in.
Screen Depth: from 5.00 to 20.00 ft. - dia. ___ in.

Grout Depth: from 0.0 to 2.45 ft. - dia. 11"
Bentonite Seal: from 2.45 to 3.95 ft. - dia. 11"
Sand/Gravel PK: from 3.95 to 22.00 ft. - dia. 11"
Total Well Depth: from +2.80 to 20.00 ft. - dia. 11"

Static Water Level: 8.20 feet from top of casing

Date Measured 9 / 7 /

Yield (gpm): N/A Method of Testing: N/A Casing is 2.80 feet above land su

DRILLING LOG

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0'	7'	Loose brown to yellow
		brown silty sand fill.
7'	9'	Stiff light blue gray
		sandy silt alluvium.
9'	20'	Very stiff to hard
		yellow brown to orange
		brown sandy silt with
		a 1 1/2 foot sand lense.

LOCATION SKETCH

(show distance to numbered roads, or other map reference poi

See attached location plan

REMARKS:

DATE: 10/6/94 SIGNATURE:

DHS 3342 (6/85)
N.C. Hazardous Waste Management Branch

SOIL BORING LOG

SITE NAME AND LOCATION	DRILLING METHOD: 6.25-INCH I.D. HOLLOW STEM AUGER	BORING NO. MW-9
PIEDMONT LANDFILL & RECYCLING CENTER KERNERSVILLE, NC	SAMPLING METHOD: SPLIT SPOON (SPT)	SHEET 1 OF 1

					DRILLING START	DRILLING FINISH
WATER LEVEL	32.0	32.0	31.7	31.9	TIME	TIME
TIME	1600	1600	1745	1515	1230	0910
DATE	8/29/94	8/31/94	9/1/94	9/7/94	DATE 8/29/94	DATE 8/30/94
CASING DEPTH						

DATUM ELEVATION 768

DRILL RIG CME

SURFACE CONDITIONS Weeds

ANGLE BEARING

SAMPLE HAMMER TORQUE FT.-LBS

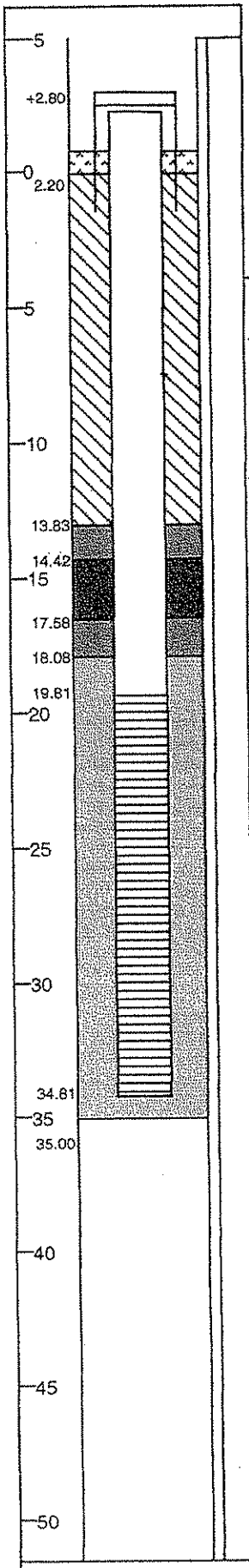
DRILLING CONTR Graham & Currie

DEPTH IN FEET (ELEVATION)	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
0			**SILTY SAND (SM)** Loose, orange brown, very fine silty sand. 3.5 feet								
5	6 6 6 15 (95%)		**SILTY SAND (SC)** Medium dense, brown, moist, coarse grained silty sand, trace clay with some blue gray coarse gravel. 7.0 feet								
10	3 4 6 11 (100%)		**SILT (ML)** Stiff, light brown to yellow brown, with black and yellow brown foliations, moist, very fine grained sandy silt, 50% mica, trace coarse grained sand.								
15	4 8 8 16 (60%)		**SANDY SILT (ML)** Very stiff, black and white speckled with little sand. 18.0 feet								
20	16 30 50/0"		**SAND (SC)** Very dense, yellow brown to brown, coarse grained sand with some quartz, trace silt.								
	50/4"		Same as above, except weathered rock.								
25											
	50/4"										
30											
	50/4"		**PARTIALLY WEATHERED ROCK** Very dense, green gray speckled with some black, saturated, very fine slightly silty sand.								
35			Boring Terminated at 35.0 feet								

LOGGED BY Heidi Baughman SL

DATE 8/29/94 CHK'D BY T. Yanoschak

CWM Soil Bor



Well No.: MW-9

Boring No. X-Ref: MW-9

MONITORING WELL CONSTRUCTION SUMMARY

Survey Coords: 892,202.753 N
1,690,947.720 E

Elevation Ground Level: 767.82

Top of Casing: 770.62

Drilling Summary:

Total Depth: 35.0 ft.
Borehole Diameter: HSA - 11 inches
Casing Stick-up Height: +2.8 ft.
Driller: Graham & Currie

Rig: CME
Bit(s): 6.25-in. I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	8/29/94	12:30	8/30/94	14:45
Geophys. Logging:	NA	NA	NA	NA
Casing:	8/30/94	15:00	8/30/94	15:15
Filter Placement:	8/30/94	15:15	8/30/94	15:45
Bentonite Seal:	8/30/94	15:45	8/30/94	16:30
Grout:	8/30/94	16:30	8/30/94	17:30
Development:	9/1/94	16:00	9/7/94	16:18

Well Design & Specifications

Basis: Geologic Log: x Geophysical Log: ___
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
+2.80 - 2.20	C1	770.62 - 765.62
+2.80 - 19.81	C2	770.62 - 748.01
19.81 - 34.81	S1	748.01 - 733.01

Casing: C1 5.0 ft. x 4.0 in. x 4.0 in. anodized aluminum
C2 2.0 in. I.D. Schedule 40 PVC

Screen: S1 2.0 in. I.D. Schedule 40 PVC
S2 0.010 in. slot

Filter Pack: 35.00 to 18.08 ft.: medium sand. 18.08 to 17.58 ft.: fine sand. 14.42 to 13.83 ft.: fine sand.

Grout Seal: 13.83 to 0.0 ft.: bentonite/cement grout

Bentonite Seal: 17.58 to 14.42 ft.: bentonite pellets

Well Development:

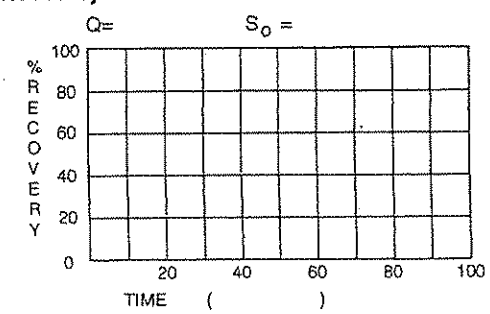
Bailer/Grundfos
Total gallons removed = 105 gallons

Stabilization Test Data: *9/1/94, v 9/7/94

Time	pH	Spec. Cond.	Temp (C)
16:08*	6.42	530	--
16:40*	6.15	290	--
17:20*	6.01	260	--
15:13v	6.10	280	21
16:18v	6.12	260	20

Recovery Data:

Q= S_o =



Comments: Surface seal = 3 ft. x 3 ft. x 3 in. concrete pad with protective post.

SITE NAME Piedmont Landfill

LOCATION Kernersville, N.C.

SUPERVISED BY: Heidi Baughman

DATE: 8/29/94

Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Piedmont Landfill & Recycling Center

PERMIT NO.: 34-6

ADDRESS: 9900 Freeman Road, Kernersville, NC 27284

OWNER (print): Waste Management of Carolinas, Inc.

DRILLING CONTRACTOR: Graham & Currie Well Drilling Inc.

REGISTRATION NO.: MW-9

Casing Type: PVC Sch. 40 dia. 2 in.
Casing Depth: from +2.80 to 19.81 ft. - dia. ___ in.
Screen Type: PVC Sch. 40 dia. 2 in.
Screen Depth: from 19.81 to 34.81 ft. - dia. ___ in.

Grout Depth: from 0.0 to 13.8 ft. - dia. 11"
Bentonite Seal: from 14.4 to 17.6 ft. - dia. 11"
Sand/Gravel PK: from 17.6 to 35.0 ft. - dia. 11"
Total Well Depth: from +2.8 to 34.8 ft. - dia. 11"

Static Water Level: 34.71 feet from top of casing

Yield (gpm): N/A Method of Testing: N/A

Date Measured 9 / 7 / 9

Casing is 2.80 feet above land sur

DRILLING LOG

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0'	7'	Loose to medium dense orange brown to brown silty sand.
7'	18'	Stiff to very stiff, brown, sandy silt.
18'	35'	Very dense, yellow brown, green gray speckled with black silty sand.

LOCATION SKETCH

(show distance to numbered roads, or other map reference poin

See attached location plan

REMARKS:

DATE: 10/6/94 SIGNATURE:

3347 (6/85)
Hazardous Waste Management Branch

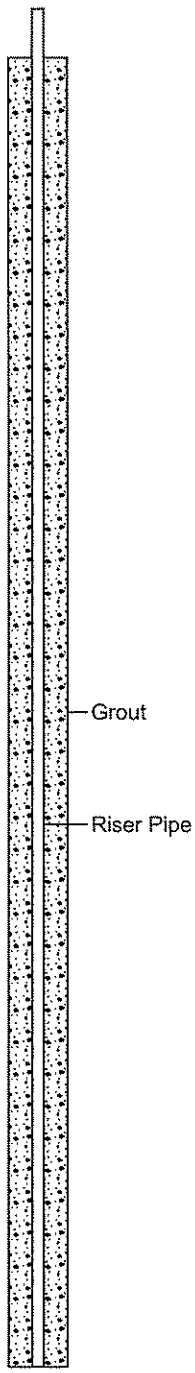
JOYCE ENGINEERING, INC.

LOG OF BORING MW-09R

Piedmont Landfill and Recycling Center Kernersville, North Carolina Permit No. 34-06	Date Started	: 11/05/99	Drilling Company : Trigon Engineering
	Date Completed	: 11/09/99	Northing Coord. : N: 892,203.9303
	Hole Diameter	: 8.25"/5.75"/5.25"	Easting Coord. : E: 1,690,935.8949
Replacement of Monitoring Well MW-09	Drilling Method	: HSA; Button Bit; CP Rock Core	Survey By : Robert E. Wilson, Inc.
JEI Project No. 392.00; Task 02	Sampling Method	: Split-Spoon; CP Rock Core	Logged By : Mathew J.Tischler

Depth in Feet	USCS	DESCRIPTION	Blow Count	Samples
0	MH	SANDY SILT,orange brown, tan, slightly micaceous with rock, hard, moist - fill	50+	
5	ML	SANDY SILT, dark brown and tan with black spotting, slightly clayey, fine-grained, stiff, moist - residual soils	6 6 7 8	
10	SM	SILTY SAND, blue gray with white, black and tan, micaceous, fine to coarse-grained, with < 5% angular quartz pebble sized rock fragments, medium dense to dense, moist - saprolite	10 12 8 16	
15	SM		12 16 16 24	
20	SM	SILTY SAND, blue gray and dark brown, tan and white, slightly micaceous, fine to coarse-grained with 10% elongated angular pebble sized rock fragments, very dense, moist - saprolite	16 36 50+	

Well: MW-09R
Elev.: T.O.C. = 764.95'



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 11/09/99
Hole Diameter(s)	: 8.25"/5.75"/5.25"
Drilling Method(s)	: Hollow Stem Augers : CP Rock Coring
Company Rep.	: Steve Williams

SURFACE CASING

Material	: NA
Diameter	: NA
Joints	: NA

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.00-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type	: DSI # 2 Sand

WELL SCREEN SEAL

Type	: 3/8" Bentonite pellets

ANNULUS SEAL

Type	: No. 1 Portland grout

PROTECTIVE CSG.

Type	: 4in. X 4in., Locking

WELL PAD

Type	: 3' X 3' X 0.5'

1. Hollow stem auger and rock core drilling performed with a CME 850 ATV drilling rig utilizing 8.25-inch hollow stem augers and a CP rock core barrell.
2. Drill to 28.2' bgs (auger refusal) with 8.25" hollow stem augers (11/05/99).
3. Wash bore boring to 31.2' bgs (wash refusal) with a 5 3/4" OD button bit (11/08/99).
4. Advance boring to 41.2' bgs with CP rock coring methods (11/08/99)
5. Set well materials (11/09/99).

JOYCE ENGINEERING, INC.

LOG OF BORING MW-09R

Piedmont Landfill and Recycling Center
Kernersville, North Carolina
Permit No. 34-06

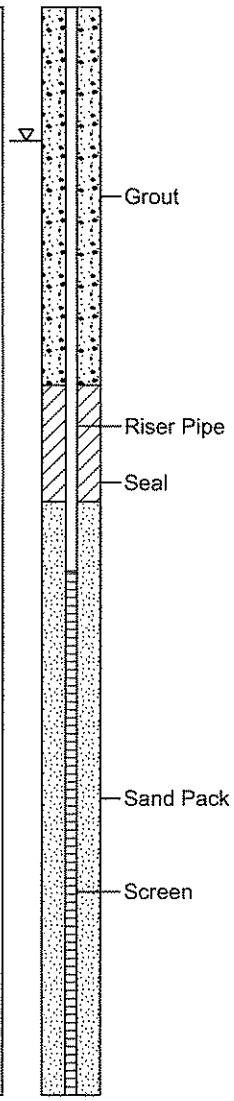
Replacement of Monitoring Well MW-09

JEI Project No. 392.00; Task 02

Date Started	: 11/05/99	Drilling Company	: Trigon Engineering
Date Completed	: 11/09/99	Northing Coord.	: N: 892,203.9303
Hole Diameter	: 8.25"/5.75"/5.25"	Easting Coord.	: E: 1,690,935.8949
Drilling Method	: HSA; Button Bit; CP Rock Core	Survey By	: Robert E. Wilson, Inc.
Sampling Method	: Split-Spoon; CP Rock Core	Logged By	: Mathew J.Tischler

Depth in Feet	USCS	DESCRIPTION	Blow Count	Samples
22.5	SM		50+	
27.5		Auger Refusal		
	PWR	PWR, greenish gray with black		
32.5	BR	ROCK, light gray and black gneiss with chlorite, minor deformed quartz and feldspar banding, minor foliation, fractures ranging from 0 to 10 degrees from the horizontal with iron staining and fine to coarse-grained sand infilling REC. = 90% RQD. = 77% PENETRATION RATE = 34 min./5'		
37.5	BR	ROCK, same as above with increased quartz and chlorite content, minor foliation, fractures ranging from 0 to 40 degrees from the horizontal with minor silt infilling REC. = 100% RQD. = 90% PENETRATION RATE = 35 min./5' Boring terminated at 41.2'		
42.5				

Well: MW-09R
Elev.: T.O.C. = 764.95'



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 11/09/99
Hole Diameter(s)	: 8.25"/5.75"/5.25"
Drilling Method(s)	: Hollow Stem Augers : CP Rock Coring
Company Rep.	: Steve Williams

SURFACE CASING

Material	: NA
Diameter	: NA
Joints	: NA

WELL CASING

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Threaded, flush-coupled
Approx. Csg. Stickup	: 2.00-feet

WELL SCREEN

Material	: Schedule 40 PVC
Diameter	: 2-inch
Joints	: Thredded, flush-coupled
Opening	: 0.010 inch, slotted

GRAVEL PACK

Type	: DSI # 2 Sand

WELL SCREEN SEAL

Type	: 3/8" Bentonite pellets

ANNULUS SEAL

Type	: No. 1 Portland grout

PROTECTIVE CSG.

Type	: 4in. X 4in., Locking

WELL PAD

Type	: 3' X 3' X 0.5'

1. Hollow stem auger and rock core drilling performed with a CME 850 ATV drilling rig utilizing 8.25-inch hollow stem augers and a CP rock core barrell.
2. Drill to 28.2' bgs (auger refusal) with 8.25" hollow stem augers (11/05/99).
3. Wash bore boring to 31.2' bgs (wash refusal) with a 5 3/4" OD button bit (11/08/99).
4. Advance boring to 41.2' bgs with CP rock coring methods (11/08/99)
5. Set well materials (11/09/99).

SOIL BOREHOLE LOG

SITE NAME AND LOCATION **PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC**	DRILLING METHOD: **6.25" I.D. HOLLOW STEM AUGER**	BORING NO. **MW-10**	
	SAMPLING METHOD: **SPLIT SPOON**	SHEET **1** OF **2**	
		DRILLING START	DRILLING FINISH
	WATER LEVEL	TIME	TIME
	TIME	09:20	14:45
	DATE	DATE	DATE
DATUM ELEVATION **774.0**	CASING DEPTH	10-24-94	10-24-94

DRILL RIG **CME-850 Track Mount** SURFACE CONDITIONS **SOIL/BOULDERS**

ANGLE **Vertical** BEARING -------

SAMPLE HAMMER TORQUE FT.-LBS

DRILLING CONTR **GRAHAM & CURRIE** DRILLER

LOGGED BY **MICHAEL TAYLOR** CHK'D BY SL

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
0.0	3 4 5 6 55%		**SILT (ML)** Stiff, brownish orange, dry, mostly silt.								
5	1 3 3 3 38%		**SILT (ML)** Similar to above, some yellow. - FILL -								
10	3 3 3 3 75%		**SILT (ML)** Similar to above, none mottled, 11 - 11 1/2 ft. light brown, white saprolite.								
15	4 5 5 4 83%		**CLAYEY SILT (ML/CH)** Stiff, brownish orange, little yellow and black mottling, moist, mostly silt, little clay, may have graded into severely weathered saprolite.								
20	3 4 5 6 100%		**CLAYEY SILT (ML/CH)** Similar to above.								
25	ST										
30	5 7 13 15 100%		**SILT (ML)** Very stiff, dark brown, orange brown, some black mottling, wet, mostly silt, few clay and fine sand, weathered gneiss/schist. - SAPROLITE -								
35.0											

Continued Next Page

SOIL BOREHOLE LOG

SITE NAME AND LOCATION **PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC**	DRILLING METHOD: **6.25" I.D. HOLLOW STEM AUGER**	BORING NO. **MW-10**
	SAMPLING METHOD: **SPLIT SPOON**	SHEET **2** OF **2**
		DRILLING START TIME **09:20** DATE **10-24-94**; FINISH TIME **14:45** DATE **10-24-94**
DATUM ELEVATION **774.0**	WATER LEVEL / TIME / DATE / CASING DEPTH	
DRILL RIG **CME-850 Track Mount**	SURFACE CONDITIONS **SOIL/BOULDERS**	
ANGLE **Vertical** BEARING ------		
SAMPLE HAMMER TORQUE FT.-LBS		

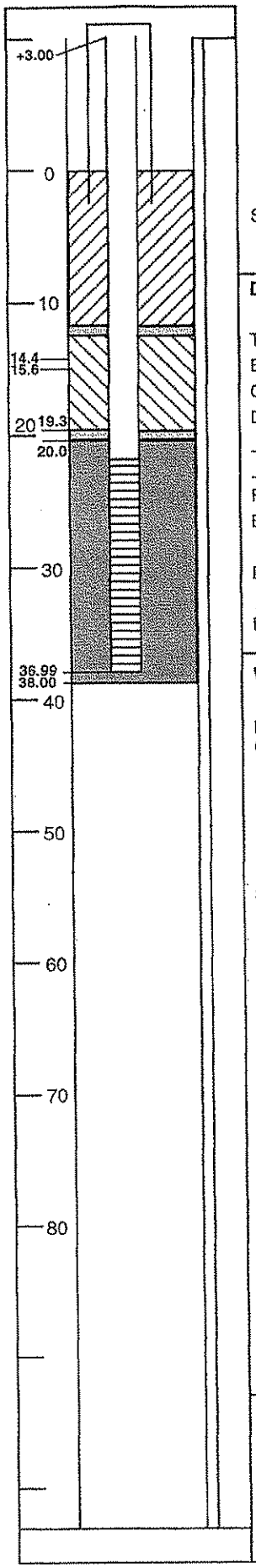
DRILLING CONTR **GRAHAM & CURRIE** DRILLER ____

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
35.0	12 24 51 5 63%		**GRAVELY SILT (MG)** Dense, white, medium brown, mottled, wet, mostly silt, some fine to medium gravel (quartz/plagioclase grains).								
			Boring Terminated at 38.0 ft.								
40											
45											
50											
55											
60											
65											
70.0											

LOGGED BY **MICHAEL TAYLOR** SL ____

CHK'D BY ____

Tracking Code: 34068, Wednesday, 12/16/94, 10:47



Well No.: MW-10

Boring No. X-Ref: MW-10

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N892,371.2
E1,692,751.8

Elevation Ground Level: 774.20
Top of Casing: 777.20

Drilling Summary:

Total Depth: 38.0 ft.
Borehole Diameter: 11 in.
Casing Stick-up Height: 3.00 ft.
Driller: Graham & Currie

Rig: CME-850
Bit(s): 6.25" I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0' x 4.0" x 4.0" Anodized Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling HSA	10/24/94	09:20	10/24/94	14:45
Geophys. Logging:				
Casing:	10/24/94	14:46	10/24/94	14:48
Filter Placement:	10/24/94	14:50	10/24/94	16:04
Bentonite Seal:	10/24/94	16:06	10/24/94	16:32
Development:	11/15/94	08:03	11/17/94	15:12

Well Design & Specifications

Basis: Geologic Log: X Geophysical Log: ___
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
-	C_1	-
22.00 - +3.00	C_2	752.20 - 777.20
36.99 - 22.00	S_1	737.21 - 752.20
37.19 - 36.99	P_1	737.01 - 737.21
-		-

Casing: C1 5' x 4" x 4" Anodized Aluminum
C2 2" I.D. Flush Threaded Sch. 40 PVC

Screen: S1 2.0" I.D. 0.010" Slot Sch. 40 PVC
P1 2.0" I.D. PVC Plug

Filter Pack: 38 - 20.8 Med. Sand
20.8 ft. 19.3 Fine Sand
15.6 - 14.4 Fine Sand

Grout Seal: 14.4 to 0.0 ft. Bentonite/ cement grout

Bentonite Seal: 19.3 ft. to 15.6 ft. Bentonite pellets

Well Development:

11/15/94 08:03 - 18:00, Displacement Pump (0.3)
11/17/94 14:42 - 15:12, Grundfos Pump (0.4)

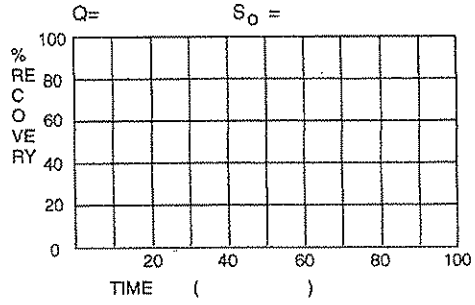
Total pumped approximately 200 gallons

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
14:45	5.64	78	14
14:50	5.64	77	15
14:55	5.53	77	15
15:00	5.52	77	15

Recovery Data: None

Q= S_0 =



Comments:

Water cleaned up after surging well during development.

SITE NAME: PIEDMONT LANDFILL
LOCATION: KERNERSVILLE, NC
WC
SUPERVISED BY: MIKE TAYLOR
DATE: 10/25/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Piedmont Landfill & Recycling Center	PERMIT NO.: 34-6
ADDRESS: 9900 Freeman Road, Kernersville, NC 27284	OWNER (print): Waste Management of Carolinas, Inc.
DRILLING CONTRACTOR: Graham & Currie Well Drilling Inc.	REGISTRATION NO.: MW-10

Casing Type:	PVC Sch. 40 dia. 2 in.	Grout Depth:	from 0.0 to 14.4 ft. - dia. 11"
Casing Depth:	from +3.00 to 22.00 ft. - dia. ___ in.	Bentonite Seal:	from 15.6 to 19.3 ft. - dia. 11"
Screen Type:	PVC Sch. 40 dia. 2 in.	Sand/Gravel PK:	from 19.3 to 38.0 ft. - dia. 11"
Screen Depth:	from 22.00 to 36.99 ft. - dia. ___ in.	Total Well Depth:	from +3.00 to 37.1 ft. - dia. 11"

Static Water Level: 32.42 feet from top of casing Date Measured 11 / 15 / 94

Yield (gpm): N/A Method of Testing: N/A Casing is +3.00 feet above land surf

DRILLING LOG

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0'	8'	Silt (ML) stiff brownish orange FILL
8'	35'	Silt (ML) stiff to very stiff brown orange, yellow, black mostly silt little clay SAPROLITE

LOCATION SKETCH

(show distance to numbered roads, or other map reference point

See attached location plan

REMARKS:

DATE: 12/16/94 SIGNATURE:

DSW 3342 (6/85)
Solid Waste Management Branch

SOIL BOREHOLE LOG

SITE NAME AND LOCATION PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC	DRILLING METHOD: 8.5" O.D. (4.25" I.D.) HOLLOW STEM AUGER	BORING NO. MW-11
	SAMPLING METHOD: SPLIT SPOON	SHEET 1 OF 3
		DRILLING START / FINISH
	WATER LEVEL / TIME / DATE / CASING DEPTH	TIME 13:06 / TIME 11:28
DATUM / ELEVATION 774.0		DATE 11-14-94 / DATE 11-15-94

DRILL RIG	CME-450	SURFACE CONDITIONS	FILL (BERM OR PHASE 3, CELL 1)
ANGLE	Vertical	BEARING	-------
SAMPLE HAMMER TORQUE		FT.-LBS	

DRILLING CONTR ECS

DRILLER

SL

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
0.0											
5	4 7 10 11 100%		**GRAVELY SANDY SILT (ML)** Very stiff, grayish brown, dry, mostly silt, little gravel and sand.								
10	1 4 6 6 83%		**SILTY SAND (SM)** Loose, olive brown, dry, mostly sand, some silt, few clay. - FILL -								
15	4 2 2 3 100%		**SILT (ML)** Soft, reddish orange, black, mottled, dry, all silt, weathered fine grained granitic gneiss.								
20	3 3 4 4 75%		**SILT (ML)** Medium stiff, white, black and orange, mottled, dry, mostly silt, few sand, weathered fine grained granitic gneiss.								
25	1 2 5 5 100%		**SANDY SILT (ML)** Medium stiff, orange brown, black and white, mottled, wet, mostly silt, little sand, weathered fine grained granitic gneiss.								
30	2 1 3 3 100%		**SANDY SILT (ML)** Similar to above. - SAPROLITE -								
35.0											

LOGGED BY MICHAEL TAYLOR

CHK'D BY

Continued Next Page

SOIL BOREHOLE LOG

SITE NAME AND LOCATION **PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC**	DRILLING METHOD: **8.5" O.D. (4.25" I.D.) HOLLOW STEM AUGER**	BORING NO. **MW-11**
	SAMPLING METHOD: **SPLIT SPOON**	SHEET **2** OF **3**
		DRILLING START TIME **13:06** DATE **11-14-94** / FINISH TIME **11:28** DATE **11-15-94**
DATUM / ELEVATION **774.0**	WATER LEVEL / TIME / DATE / CASING DEPTH	
DRILL RIG **CME-450**	SURFACE CONDITIONS **FILL (BERM OR PHASE 3, CELL 1)**	
ANGLE **Vertical** BEARING ------		
SAMPLE HAMMER TORQUE FT.-LBS		

DRILLING CONTR **ECS** DRILLER ____ SL ____

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
35.0	6 8 13 12 67%		**SANDY SILT (ML)** Very stiff, light tan-brown, wet, mostly silt, some fine sand, few clay, abundant mica in fine to medium laminations.								
40	7 7 12 10 80%		**SANDY SILT (ML)** Very stiff, top 6" and bottom 4" white and black, mottled, middle 9" orangish brown, dark gray, green, white, relict deformation, abundant mica, wet, mostly silt, little fine sand, weathered granitic gneiss, middle portion nearly schistose.								
45	11 15 13 15 100%		**SANDY CLAY (ML)** Very stiff, grayish brown, very mottled and deformed, wet, mostly clay, some fine sand, few silt. **SANDY SILT (ML)** Stiff, black and white, horizontal laminations, wet, mostly silt, some medium sand.								
50	ST										
55	10 13 14 17		**SANDY SILT (ML)** Very stiff, white, black brown, wet/moist, mostly silt, some fine sand, weathered dioritic gneiss with banding of quartz on plagioclase veins, gneiss is fine grained, iron oxidation at boundaries of quartz/plagioclase vein.								
60	*		**SANDY SILT (ML)** Similar to above. * No blows due to rods falling.								
65			- SAPROLITE -								
70.0											

LOGGED BY **MICHAEL TAYLOR** CHK'D BY ____

Continued Next Page

SOIL BOREHOLE LOG

SITE NAME AND LOCATION **PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC**	DRILLING METHOD: **8.5" O.D. (4.25" I.D.) HOLLOW STEM AUGER**	BORING NO. **MW-11**
	SAMPLING METHOD: **SPLIT SPOON**	SHEET **3** OF **3**
		DRILLING START / FINISH
	WATER LEVEL / TIME	TIME 13:06 / TIME 11:28
	DATE	DATE / DATE
DATUM / ELEVATION **774.0**	CASING DEPTH	11-14-94 / 11-15-94

DRILL RIG **CME-450**	SURFACE CONDITIONS **FILL (BERM OR PHASE 3, CELL 1)**
ANGLE **Vertical** BEARING ------	
SAMPLE HAMMER TORQUE FT.-LBS	

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER % (RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
70.0	7 9 14 26 75%		**SANDY SILT (ML)** Similar to above.								
75	11 15 25 30 65%		**SANDY SILT (ML)** Similar to above, some fine gravel in quartz/plagioclase veins. Iron stained material adjacent to veins is clay and mica.								
80	6 10 13 15 0%		No return, only material from inside augers in split spoon.								
85	7 11 23 33 55%		**GRAVELY SILT (ML)** Hard, orangish brown, white, moist, mostly silt, some fine to coarse gravel, quartz/plagioclase grains, mica in iron stained zones.								
90			**CLAYEY SILT (ML)** Hard, green, white, remenant grains, moist, mostly silt, little clay, green grains altered hornblends.								
			Boring Terminated at 93.5 ft.								
95											
100											
105.0											

DRILLING CONTR **ECS**

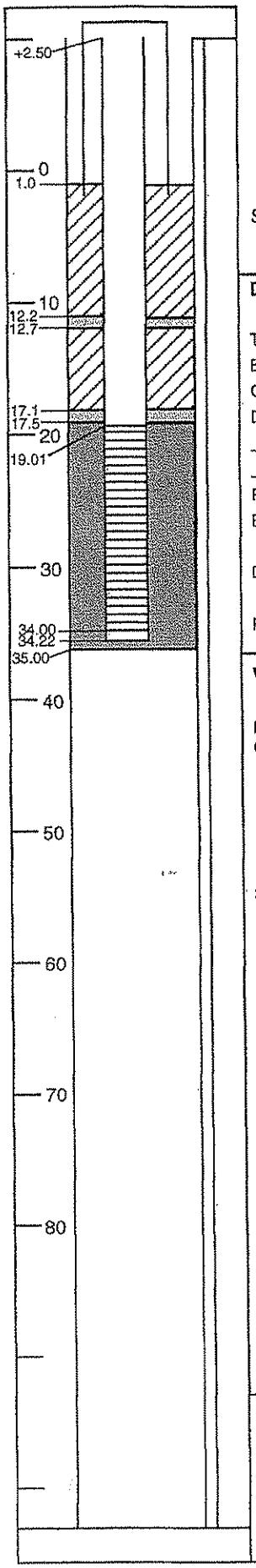
DRILLER

SL

LOGGED BY **MICHAEL TAYLOR**

CHK'D BY

Tracking Codes: J2066, Watsonk, 12/16/94, 10:43



Well No.: MW-11

Boring No. X-Ref: MW-11

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N892,349.7
E1,693,332.9

Elevation Ground Level: 774.30
Top of Casing: 776.80

Drilling Summary:

Total Depth: 35.0 ft.
Borehole Diameter: 8.5 in.
Casing Stick-up Height: 2.50 ft.
Driller: ECS

Rig: CME-45
Bit(s): 8.25" I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0' x 4.0" x 4.0" Anodized Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	11/17/94	07:55	11/17/94	09:56
Geophys. Logging:				
Casing:	11/17/94	10:05	11/17/94	10:07
Filter Placement:	11/17/94	10:12	11/17/94	11:04
Bentonite Seal:	11/17/94	11:10	11/17/94	11:20
Development:	11/18/94	14:30	11/18/94	16:32

Well Design & Specifications

Basis: Geologic Log: X Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
-	C1	-
19.01 - +2.50	C2	755.29 - 776.80
34.00 - 19.01	S1	740.30 - 755.29
34.22 - 34.00	P1	740.08 - 740.30
-		-

Casing: C1 5' x 4" x 4" Anodized Aluminum
C2 2 in. I.D. Flush Threaded Sch. 40 PVC

Screen: S1 2.0" I.D. 0.010" Slot Flush Threaded Sch. 40 PVC
P1 2.0" I.D. Flush Threaded Sch. 40 PVC

Filter Pack:
35.0 - 17.5 Med. Sand
17.5 ft. - 17.1 Fine Sand
12.7 - 12.2 Fine Sand

Grout Seal: 12.2 to 1.0 ft. Bentonite Quik gel/cement mix

Bentonite Seal: 17.1 ft. to 12.7 3/8 ft. Bentonite pellets

Well Development:

11/18/94 14:30 - 16:32, Displacement Pump (0.3)

Total pumped approximately 40 gallons

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
15:35	6.76	72	15
15:47	6.54	69	15
16:15	6.53	71	15
16:23	6.57	67	15

Recovery Data: None

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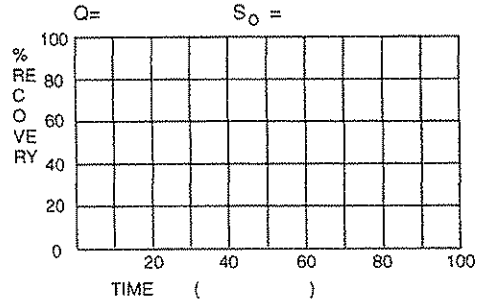


Comments:

Water cleaned up after surging well during development.

SITE NAME PIEDMONT LANDFILL
LOCATION KERNERSVILLE, NC
WC
SUPERVISED BY: MIKE TAYLOR
DATE: 11/17/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N
DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC
O. BOX 2091, RALEIGH, N.C. 27602

AME OF SITE: Piedmont Landfill & Recycling Center	PERMIT NO.: 34-6
DDRESS: 9900 Freeman Road, Kernersville, NC 27284	OWNER (print): Waste Management of Carolinas, Inc.
DRILLING CONTRACTOR: Environmental Construction Services Inc.	REGISTRATION NO.: MW-11

Casing Type: PVC Sch. 40 dia. 2 in. Grout Depth: from 0.0 to 12.2 ft. - dia. 8.5"
C ing Depth: from +2.50 to 19.01 ft. - dia. ___ in. Bentonite Seal: from 12.7 to 17.1 ft. - dia. 8.5"
S een Type: PVC Sch. 40 dia. 2 in. Sand/Gravel PK: from 17.1 to 35.0 ft. - dia. 8.5"
Screen Depth: from 19.01 to 34.00 ft. - dia. ___ in. Total Well Depth: from +2.50 to 34.2 ft. - dia. 8.5"

S tic Water Level: 27.58 feet from top of casing Date Measured 11 / 18 / 94

Yield (gpm): N/A Method of Testing: N/A Casing is +2.50 feet above land surf

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
0'	13'	Sandy silt and silty
		sand (ML/SM) stiff/loose
		olive brown dry soils
		FILL
13'	35'	Silt (ML) predominately
		stiff mottled white
		black, orange silt
		to sandy silt
		SAPROLITE

LOCATION SKETCH

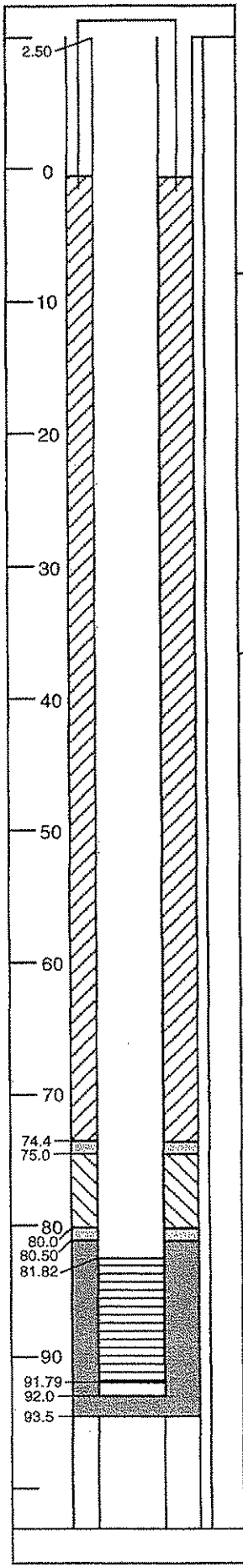
(show distance to numbered roads, or other map reference point

See attached location plan

REMARKS:

TE: 12/16/94 SIGNATURE:

DHS 3347 (6/85)
Hazardous Waste Management Branch



Well No.: MW-11D

Boring No. X-Ref: MW-11

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N892,356.00
E1,693,334.00

Elevation Ground Level: 773.86

Top of Casing: 776.36

Drilling Summary:

Total Depth: 93.5 ft.
Borehole Diameter: 8.5 in.
Casing Stick-up Height: 2.50 ft.
Driller: ECS

Rig: CME-450
Bit(s): 8.5" I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0' x 4.0" x 4.0" Anodized Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling HSA	11/14/94	13:06	11/15/94	11:28
Geophys. Logging:				
Casing:	11/15/94	13:16	11/15/94	13:20
Filter Placement:	11/15/94	17:01	11/16/94	13:53
Bentonite Seal:	11/16/94	14:06	11/16/94	14:18
Development:	11/18/94	07:26	11/18/94	13:35

Well Design & Specifications

Basis: Geologic Log: X Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
-	C1	-
81.82 - +2.50	C2	692.04 - 776.36
91.79 - 81.82	S1	682.07 - 692.04
92.00 - 91.79	P1	681.86 - 682.07
-		-

Casing: C1 5' x 4" x 4" Anodized Aluminum
C2 2" I.D. Flush Threaded Sch. 40 PVC

Screen: S1 2.0" I.D. 0.010" Slot Flush Threaded Sch. 40 PVC
P1 2.0" I.D. Flush Threaded Sch. 40 PVC

Filter Pack:
93.5 ft. - 80.5 ft. Medium Sand
80.5 ft. - 80.0 Fine Sand
75.0 - 74.4 Fine Sand

Grout Seal: 174.4 to 1.0 ft. Bentonite/cement

Bentonite Seal: 80.0 ft. to 75.0 ft. Bentonite pellets (3/8" hole plug)

Well Development:

11/18/94 07:26 - 13:35, Displacement Pump (0.1)

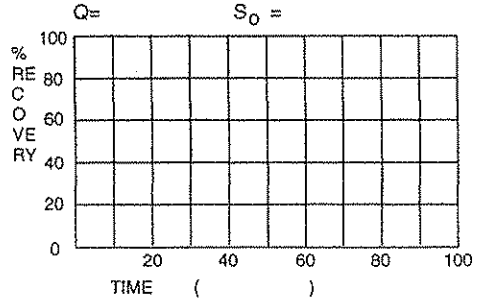
Total pumped approximately 40 gallons

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
08:00	7.08	109	18
08:25	6.85	84	15
08:37	7.07	83	16
10:30	6.93	70	16
10:54	6.94	70	16
12:13	6.98	64	16

Recovery Data: None

Q= S_0 =



Comments:

Water did not really clear up during development.

SITE NAME: PIEDMONT LANDFILL
LOCATION: KERNERSVILLE, NC
WC
SUPERVISED BY: MIKE TAYLOR
DATE: 11/15/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N
DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC
P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Piedmont Landfill & Recycling Center

PERMIT NO.: 34-6

ADDRESS: 9900 Freeman Road, Kernersville, NC 27284

OWNER (print): Waste Management of Carolinas, Inc.

DRILLING CONTRACTOR: Environmental Construction Services, Inc.

REGISTRATION NO.: MW-11D

Casing Type: PVC Sch. 40 dia. 2 in. Grout Depth: from 0.0 to 74.4 ft. - dia. 8.5"
Casing Depth: from +2.50 to 81.82 ft. - dia. ____ in. Bentonite Seal: from 75.0 to 80.0 ft. - dia. 8.5"
Screen Type: PVC Sch. 40 dia. 2 in. Sand/Gravel PK: from 80.0 to 93.5 ft. - dia. 8.5"
Screen Depth: from 81.82 to 91.79 ft. - dia. ____ in. Total Well Depth: from +2.50 to 92.0 ft. - dia. 8.5"

Static Water Level: 31.33 feet from top of casing Date Measured 11 / 18 / 94

Yield (gpm): N/A Method of Testing: N/A Casing is +2.50 feet above land surf

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
0'	13'	Sandy silt and silty sand (ML/SM) stiff/loose olive brown dry soils FILL
3'	93.5'	Silt (ML) predominately stiff to hard mottled white, black, orange silt to sandy silt with few clay lenses SAPROLITE

LOCATION SKETCH

(show distance to numbered roads, or other map reference point

See attached location plan

REMARKS:

DATE: 12/16/94 SIGNATURE:

DES 3M2 (6/85)
Solid Hazardous Waste Management Branch

SOIL BOREHOLE LOG

SITE NAME AND LOCATION PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC	DRILLING METHOD: 6.25" I.D. HOLLOW STEM AUGER	BORING NO. MW-12	
	SAMPLING METHOD: SPLIT SPOON	SHEET 1 OF 2	
		DRILLING START	DRILLING FINISH
	WATER LEVEL	TIME	TIME
	TIME	09:04	16:40
	DATE	DATE	DATE
DATUM ELEVATION 749.0	CASING DEPTH	10-21-94	10-21-94

DRILL RIG CME 850 Track Mount | SURFACE CONDITIONS GRASS/FOREST

ANGLE Vertical | BEARING ------

SAMPLE HAMMER TORQUE FT.-LBS

DRILLING CONTR GRAHAM & CURRIE | DRILLER

LOGGED BY MICHAEL TAYLOR | SL

CHK'D BY

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
0.0	3 3 4 7		**SANDY SILT (ML)** Medium stiff, brown, little oange and gray, dry, mostly silt, little fine to medium quartz sand, little mica few roots.								
5	1 1 2 3		**SILTY CLAY (CL)** Soft, gray, moist to wet, mostly clay, some silt, little fine sand, little mica, 2" fine gravel layer.								
10	1 2 1 2		**SILTY SAND (SM)** Similar to above, but wet. **SILTY SAND (SM)** Very stiff, dark gray brown, wet, fine sand with silt, some mica grading into. - SAPROLITE -								
15	22 47 50/4"		**SANDY SILT (ML)** Dense, brown with white and black, mottling, wet, mostly silt with medium to coarse sand, 6 veins of quartz and plagioclose, black appears to be weathered amphibole, relic textures, saprolite.								
20											
25	1 5 9 8		**SILTY SAND (SM)** Medium stiff, brownish black, wet, mostly fine grained sand, little medium grain sand, little silt, quartz amphibole and mica grain.								
30	50/3"		**SILTY GRAVEL (GM)** Very dense, brown, black mottled white, moist, mostly fine gravel, some silt, little sand, with few mica.								
35.0			- SAPROLITE -								

Continued Next Page

SOIL BOREHOLE LOG

SITE NAME AND LOCATION PIEDMONT LANDFILL & RECYCLING CENTER - KERNERSVILLE, NC	DRILLING METHOD: 6.25" I.D. HOLLOW STEM AUGER	BORING NO. MW-12
	SAMPLING METHOD: SPLIT SPOON	SHEET 2 OF 2
		DRILLING START TIME 09:04 DATE 10-21-94 / FINISH TIME 16:40 DATE 10-21-94
DATUM / ELEVATION 749.0	WATER LEVEL / TIME / DATE / CASING DEPTH	
DRILL RIG CME 850 Track Mount	SURFACE CONDITIONS GRASS/FOREST	
ANGLE Vertical BEARING ------		
SAMPLE HAMMER TORQUE FT.-LBS		

DRILLING CONTR GRAHAM & CURRIE

DRILLER

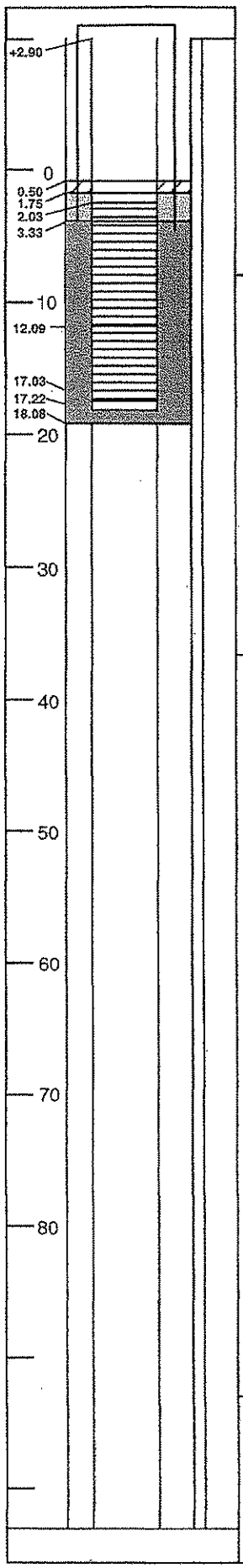
SL

LOGGED BY MICHAEL TAYLOR

CHK'D BY

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN ON SAMPLER %(RECOVERY)	SOIL GRAPH	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS: K cm/sec
35.0			**SILTY GRAVEL (GM)** Very dense, brown, black mottled white, moist, mostly fine gravel, some silt, little sand, with few mica.								
40			- SAPROLITE -								
			Boring terminated at 43.3 ft.								
45											
50											
55											
60											
65											
70.0											

acking ... 12/16/ ... 8



Well No.: MW-12

Boring No. X-Ref: MW-12

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N891,010.98
E1,692,354.73

Elevation Ground Level: 748.58
Top of Casing: 751.48

Drilling Summary:

Total Depth: 18.0 ft.
Borehole Diameter: 11.0 in.
Casing Stick-up Height: 2.90 ft.
Driller: Graham & Currie

Rig: CME-850
Bit(s): 6.25" I.D. HSA

Drilling Fluid: N/A

Protective Casing: 3.8' x 4.0" x 4.0" Anodized Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling HSA	10/21/94	09:04	10/21/94	11:08
Geophys. Logging:				
Casing:				
Filter Placement:	10/21/94	11:16	10/21/94	12:19
Bentonite Seal:	10/21/94	12:23	10/21/94	12:26
Development:	11/16/94	17:41	11/17/94	18:20

Well Design & Specifications

Basis: Geologic Log: X Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
-	C1	-
3.33 - +2.90	C2	745.25 - 751.48
17.03 - 3.33	S1	731.55 - 745.25
17.22 - 17.03	P1	731.36 - 731.55
-		-

Casing: C1 3.8' x 4" x 4" Anodized Aluminum
C2 2" I.D. Flush Threaded Sch. 40 PVC

Screen: S1 2.0" I.D. 0.010" Sch. 40 PVC
P1 2.0" I.D. PVC Plug

Filter Pack:
18.00 ft. - 3.33 ft. Medium Sand
3.33 ft. - 1.75 Fine Sand

Grout Seal: 0.50 ft. to 0.00 ft. Bentonite cement/grout

Bentonite Seal: 1.75 ft. to 0.50 ft. Bentonite pellets

Well Development:

11/16/94 17:41 - 20:09, Displacement Pump (0.8)
11/17/94 17:22 - 18:20, Displacement Pump (0.9)

Total pumped approximately 170 gallons

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
11/16/94 18:41	6.14	129	15
19:10	5.98	129	15
19:54	6.24	127	15
11/17/94			
18:11	6.15	126	15

Recovery Data: None

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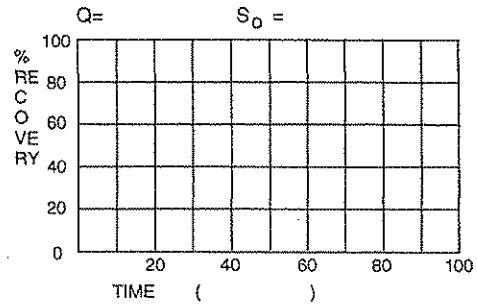


Comments:

Surface seal = 3.0 ft. x 3.0 ft. x 3 in. Concrete pad with protective post.

Water did not clear up when developing well.

SITE NAME: PIEDMONT LANDFILL
LOCATION: KERNERSVILLE, NC
WC
SUPERVISED BY: MIKE TAYLOR
DATE: 10/21/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N
DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC
P. O. BOX 2091, RALEIGH, N.C. 27602

ME OF SITE: Piedmont Landfill & Recycling Center

PERMIT NO.: 34-6

DRESS: 9900 Freeman Road, Kernersville, NC 27284

OWNER (print): Waste Management of Carolinas, Inc.

RILLING CONTRACTOR: Graham & Currie Well Drilling Inc.

REGISTRATION NO.: MW-12

sing Type:	PVC Sch. 40	dia.	2 in.	Grout Depth:	from 0.0	to 0.5	ft. - dia.	11"
g Depth:	from +2.90	to 3.33	ft. - dia. ___ in.	Bentonite Seal:	from 0.5	to 1.8	ft. - dia.	11"
n Type:	PVC Sch. 40	dia.	2 in.	Sand/Gravel PK:	from 1.8	to 18.0	ft. - dia.	11"
reen Depth:	from 3.33	to 17.03	ft. - dia. ___ in.	Total Well Depth:	from +2.90	to 17.2	ft. - dia.	11"

Water Level: 6.02 feet from top of casing Date Measured 11 / 16 / 94

eld (gpm): N/A Method of Testing: N/A Casing is +2.90 feet above land surf

DRILLING LOG

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0'	18'	Sandy silt, silty clay,
		silty sand (ML, CL, SM).
		Gradational between soil
		types and is dependent
		on weathering mottled
		brown orange white
		black
		SAPROLITE

LOCATION SKETCH

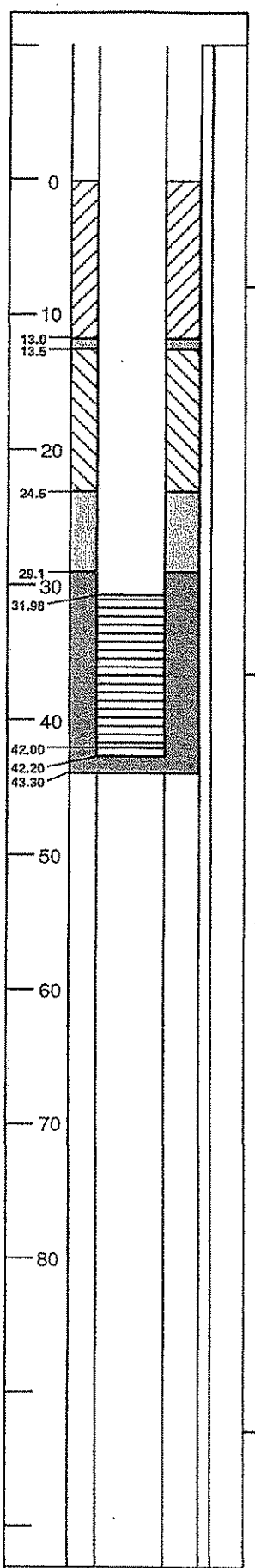
(show distance to numbered roads, or other map reference point

See attached location plan

MARKS:

: 12/16/94 SIGNATURE:

3347 (6/85)
Hazardous Waste Management Branch



Well No.: MW-12D

Boring No. X-Ref: MW-12

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N891,007.53
E1,692,360.86

Elevation Ground Level: 748.73
Top of Casing: 751.53

Drilling Summary:

Total Depth: 43.3 ft.
Borehole Diameter: 11.0 in.
Casing Stick-up Height: 2.80 ft.
Driller: Graham & Currie

Rig: CME-850
Bit(s): 6.25" I.D. HSA

Drilling Fluid: N/A

Protective Casing: 5.0' x 4.0" x 4.0" Anodized Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling 3 1/4" HSA	10/21/94	14:07	10/21/94	16:40
6 1/4" HSA	10/24/94	12:53	10/24/94	16:36
Geophys. Logging:				
Casing:	10/24/94	16:40	10/24/94	16:42
Filter Placement:	10/24/94	16:48	10/24/94	18:20
Bentonite Seal:	10/24/94	18:42	10/24/94	18:54
Development:	11/16/94	08:26	11/17/94	15:23

Well Design & Specifications

Basis: Geologic Log: X Geophysical Log: ____
Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
-	C1	-
31.98 - +2.80	C2	716.75 - 751.53
42.00 - 31.98	S1	706.73 - 716.75
42.20 - 42.00	P1	706.53 - 706.73
-		-

Casing: C1 5.0' x 4" x 4" Anodized Aluminum
C2 2" I.D. Flush Threaded Sch. 40 PVC
Screen: S1 2.0" I.D. 0.010" Sch. Slot Sch. 40 PVC
P1 2.0" I.D. PVC Plug

Filter Pack:
43.3 ft. - 29.1 ft. Medium Sand
29.1 ft. - 24.5 Fine Sand
13.5 ft. - 13.0 Fine Sand
Grout Seal: 13.0 ft. - 0.0 ft. Bentonite cement/grout
Bentonite Seal: 24.5 ft. to 13.5 ft. Bentonite pellets

Well Development:

11/16/94 08:26 - 16:30, Displacement Pump (0.15)
11/16/94 17:30 - 19:52, Grundfos Pump
11/17/94 07:49 - 15:23, Displacement Pump

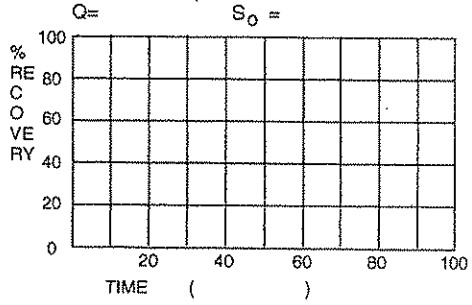
Total pumped approximately 170 gallons

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
18:27	6.03		15
18:44	6.18	194	16
19:15	6.21	192	15
19:31	6.22	191	15

Recovery Data: None

Q= S_o =



Comments:

Surface seal = 3.0 ft. x 3.0 ft. x 3 in. Concrete pad with protective posts.

Grundfos pump caused well to go dry fast at low pumping rates.

SITE NAME PIEDMONT LANDFILL

LOCATION KERNERSVILLE, NC

WC

SUPERVISED BY: MIKE TAYLOR

DATE: 10/24/94

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

OMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N
EPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC
BOX 2091, RALEIGH, N.C. 27602

E OF SITE: Piedmont Landfill & Recycling Center

PERMIT NO.: 34-6

DRESS: 9900 Freeman Road, Kernersville, NC 27284

OWNER (print): Waste Management of Carolinas, Inc.

ILLING CONTRACTOR: Graham & Currie Well Drilling Inc.

REGISTRATION NO.: MW-12D

ing Type: PVC Sch. 40 dia. 2 in.
Depth: from +2.80 to 31.98 ft. - dia. ___ in.
Type: PVC Sch. 40 dia. 2 in.
een Depth: from 31.98 to 42.00 ft. - dia. ___ in.

Grout Depth: from 0.0 to 13.0 ft. - dia. 11"
Bentonite Seal: from 13.5 to 24.5 ft. - dia. 11"
Sand/Gravel PK: from 24.5 to 43.3 ft. - dia. 11"
Total Well Depth: from +2.80 to 42.2 ft. - dia. 11"

Water Level: 5.99 feet from top of casing
Date Measured 11 / 16 / 94
a (gpm): N/A Method of Testing: N/A Casing is +2.80 feet above land surf

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
	43.3'	Sandy silt, silty clay, silty sand silty gravel (ML, CL, SM, GM) Gradational between soil types and is dependent on weathering Mottled brown orange white black SAPROLITE

LOCATION SKETCH

(show distance to numbered roads, or other map reference point

See attached location plan

MARKS:

12/16/94 SIGNATURE:

947 (6/85)
Hazardous Waste Management Branch

APPENDIX B

Survey Data for Compliance Wells

Water Quality Monitoring Plan
Appendix B

WELL SURVEY INFORMATION

MONITORING WELL ID	NC State Plane Coordinates		TOC ELEVATION (Feet AMSL)
	Northing	Easting	
MW-1	891,210.1	1,693,821.9	823.93
MW-2	892,336.9	1,693,597.6	778.04
MW-3	892,723.6	1,692,075.9	770.08
MW-4	891,261.3	1,692,025.4	756.92
MW-4D	891,278.0	1,692,036.0	757.33
MW-5	891,866.2	1,690,947.7	743.17
MW-6	891,410.9	1,694,018.3	800.82
MW-7	892,405.2	1,692,418.1	771.57
MW-8	891,422.2	1,691,479.8	748.95
MW-9	892,202.8	1,690,947.7	770.62
MW-9R	892,203.9	1,690,935.9	764.95
MW-10	892,371.2	1,692,751.8	777.20
MW-11	892,349.7	1,693,332.9	776.80
MW-11D	892,356.0	1,693,334.0	776.36
MW-12	891,011.0	1,692,354.7	751.48
MW-12D	891,007.5	1,692,360.9	751.53

TOC = Top of PVC Well Casing
AMSL = Above mean sea level

APPENDIX C

Sample Field Sampling Form and Chain-of-Custody

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name:

Site No.: | | | | Sample Point: | | | | | | | | Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: _____

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: Y or N

Filter Device: Y or N 0.45 µ or _____ µ (circle or fill in)

Purging Device ____ A- Submersible Pump B-Peristaltic Pump C-QED Bladder Pump D-Bailer E-Piston Pump F-Dipper/Bottle

Sampling Device ____

X-Other: _____

Filter Type: ____ A-In-line Disposable B-Pressure C-Vacuum X-Other _____

Sample Tube Type: ____ A-Teflon B-Stainless Steel C-PVC D-Polypropylene X-Other: _____

WELL DATA

Well Elevation (at TOC) _____ (ft/msl)

Depth to Water (DTW) (from TOC) _____ (ft)

Groundwater Elevation (site datum, from TOC) _____ (ft/msl)

Total Well Depth (from TOC) _____ (ft)

Stick Up (from ground elevation) _____ (ft)

Casing ID _____ (in)

Casing Material _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit		pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
		1st		1st					
		2nd		2nd					
		3rd		3rd					
		4th		4th					
Suggested range for 3 consec. readings or note Permit/State requirements:			+/- 0.2	+/- 3%	--	--	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: _____ Odor: _____ Color: _____ Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
___/___/___			
___/___/___			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client, PINK - Field Copy

TestAmerica
ANALYTICAL TESTING CORPORATION

Nashville Division
2960 Foster Creighton
Nashville, TN 37204

Phone: 615-726-0177
Fax: 615-726-3404

To assist us in using the proper analytical methods, is this work being conducted for regulatory purposes?
Compliance Monitoring _____

Client Name _____ Client #: _____

Address: _____

City/State/Zip Code: _____

Project Manager: _____

Telephone Number: _____ Fax: _____

Sampler Name: (Print Name) _____

Sampler Signature: _____

Project Name: _____

Project #: _____

Site/Location ID: _____ State: _____

Report To: _____

Invoice To: _____

Quote #: _____ PO#: _____

TAT
___ Standard
___ Rush (surcharges may apply)

Date Needed: _____

Fax Results: Y N

QC Deliverables
___ None
___ Level 2 *(Batch QC)*
___ Level 3
___ Level 4
Other: _____

SAMPLE ID	Date Sampled	Time Sampled	G = Grab, C = Composite	Field Filtered	Matrix: SL - Sludge DW - Drinking Water GW - Groundwater S - Soil/Solid WW - Wastewater Specify Other	Preservation & # of Containers: HNO_3	HCl	NaOH	H_2SO_4	Methanol	None	Other (Specify)	Analyze For:										REMARKS

Special Instructions:

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

LABORATORY COMMENTS:

Init Lab Temp:

Rec Lab Temp:

Custody Seals: Y N N/A
Bottles Supplied by Test America: Y N

Method of Shipment:

APPENDIX D

Analytical Requirements

Appendix I & II Constituents
Groundwater & Surface Water 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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
1	App. I	**Antimony**	metal	7440-36-0	6010	**6**	**-**	**1**	
2	App. I	**Arsenic**	metal	7440-38-2	6010	**10**	**10**	**-**	(RCRA METAL)
3	App. I	**Barium**	metal	7440-39-3	6010	**100**	**700**	**-**	(RCRA METAL)
4	App. I	**Beryllium**	metal	7440-41-7	6010	**1**	**-**	**4**	
5	App. I	**Cadmium**	metal	7440-43-9	6010	**1**	**2**	**-**	(RCRA METAL)
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**	**1,000**	**-**	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**	**1,000**	**-**	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**	**-**	**2,000**	

NC App. II - Cyanide/ Sulfide

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
1	App. II	**Cyanide**	inorganic	57-12-5	9012A	**10**	**70**	**-**	
2	App. II	**Sulfide**	inorganic	18496-25-8	9030B	**1,000**	**-**	**-**	

NC - Additional Constituents for C&D Landfills

Number	NC App. #	ANALYTE	CLASS	CAS RN	ANALYTICAL METHOD	GROUNDWATER STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
1	C&D	**Alkalinity**	inorganic	SW337	SM 2320B	**-**	**-**	**-**	
2	C&D	**Chloride**	inorganic	SW301	SM 4500-Cl-E	**-**	**250,000**	**-**	
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	**250,000**	**250,000**	**-**	
7	C&D	**Total Dissolved Solids (TDS)**	inorganic	SW311	SM 2540C	**-**	**500,000**	**-**	
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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
1	App. I	**Acetone**	volatile	67-64-1	8260B	**100**	**6,000**	**-**	
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**	**3,000**	**-**	
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**	**350**	**-**	Changed from 7 (MCL) to 350 µg/L in April 2013 (for public water supplies or drinking wells, the MCL = 7 µg/L still applies.)
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**	**4,000**	**-**	
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**	**2,000**	**-**	
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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
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**	**1,000**	**-**	
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**	semivolatile	87-68-3	8270C or 8260B	**10**	**0.4**	**0.44**	
64	App. II	**Ethyl methacrylate**	semivolatile	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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
1	App. II	**Acenaphthene**	semivolatile	83-32-9	8270C	**10**	**80**	**-**	
2	App. II	**Acenaphthylene**	semivolatile	208-96-8	8270C	**10**	**200**	**-**	
3	App. II	**Acetophenone**	semivolatile	98-86-2	8270C	**10**	**-**	**700**	
4	App. II	**2-Acetylaminofluorene**	semivolatile	53-96-3	8270C	**20**	**-**	**-**	
5	App. II	**4-Aminobiphenyl**	semivolatile	92-67-1	8270C	**20**	**-**	**-**	
6	App. II	**Anthracene**	PAH	120-12-7	8270C	**10**	**2,000**	**-**	
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 alcohol**	semivolatile	100-51-6	8270C	**20**	**-**	**700**	
13	App. II	**Bis(2-chloroethoxy)methane**	semivolatile	111-91-1	8270C	**10**	**-**	**-**	
14	App. II	**Bis(2-chloroethyl)ether**	semivolatile	111-44-4	8270C	**10**	**-**	**0.031**	
15	App. II	**Bis(2-chloro-1-methylethyl)ether**	semivolatile	108-60-1	8270C	**10**	**-**	**-**	Bis (2-chloroisopropyl) ether
16	App. II	**Bis(2-ethylhexyl)phthalate**	semivolatile	117-81-7	8270C	**15**	**3**	**-**	
17	App. II	**4-Bromophenyl phenyl ether**	semivolatile	101-55-3	8270C	**10**	**-**	**-**	
18	App. II	**Butyl benzyl phthalate**	semivolatile	85-68-7	8270C	**10**	**1,000**	**-**	
19	App. II	**p-Chloroaniline (4-Chloroaniline)**	semivolatile	106-47-8	8270C	**20**	**-**	**-**	
20	App. II	**Chlorobenzilate**	semivolatile	510-15-6	8270C	**10**	**-**	**-**	
21	App. II	**p-Chloro-m-cresol (4-chloro-3-methylphenol)**	semivolatile	59-50-7	8270C	**20**	**-**	**-**	
22	App. II	**2-Chloronaphthalene**	semivolatile	91-58-7	8270C	**10**	**-**	**-**	
23	App. II	**2-Chlorophenol**	semivolatile	95-57-8	8270C	**10**	**0.4**	**-**	
24	App. II	**4-Chlorophenyl phenyl ether**	semivolatile	7005-72-3	8270C	**10**	**-**	**-**	
25	App. II	**Chrysene**	PAH	218-01-9	8270C	**10**	**5**	**-**	
26	App. II	**m-Cresol (3-Methylphenol)**	semivolatile	108-39-4	8270C	**10**	**400**	**-**	
27	App. II	**o-Cresol**	semivolatile	95-48-7	8270C	**10**	**-**	**400**	
28	App. II	**p-Cresol (4-Methylphenol)**	semivolatile	106-44-5	8270C	**10**	**40**	**-**	
29	App. II	**Diallate**	semivolatile	2303-16-4	8270C	**10**	**-**	**-**	
30	App. II	**Dibenz[a,h]anthracene**	PAH	53-70-3	8270C	**10**	**0.005**	**-**	
31	App. II	**Dibenzofuran**	semivolatile	132-64-9	8270C	**10**	**-**	**28**	
32	App. II	**Di-n-butyl phthalate**	semivolatile	84-74-2	8270C	**10**	**700**	**-**	
33	App. II	**3,3'-Dichlorobenzidine**	semivolatile	91-94-1	8270C	**20**	**-**	**-**	
34	App. II	**2,4-Dichlorophenol**	semivolatile	120-83-2	8270C	**10**	**-**	**0.98**	
35	App. II	**2,6-Dichlorophenol**	semivolatile	87-65-0	8270C	**10**	**-**	**-**	
36	App. II	**Diethyl phthalate**	semivolatile	84-66-2	8270C	**6,000**	**6,000**	**-**	
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**	semivolatile	60-11-7	8270C	**10**	**-**	**-**	
40	App. II	**7,12-Dimethylbenz[a]anthracene**	semivolatile	57-97-6	8270C	**10**	**-**	**-**	
41	App. II	**3,3'-Dimethylbenzidine**	semivolatile	119-93-7	8270C	**10**	**-**	**-**	
42	App. II	**2,4-Dimethylphenol (M-xylenol)**	semivolatile	105-67-9	8270C	**10**	**100**	**-**	
43	App. II	**Dimethyl phthalate**	semivolatile	131-11-3	8270C	**10**	**-**	**-**	
44	App. II	**m-Dinitrobenzene**	semivolatile	99-65-0	8270C	**20**	**-**	**-**	
45	App. II	**4,6-Dinitro-o-cresol (2-methyl 4,6-dinitrolphenol)**	semivolatile	534-52-1	8270C	**50**	**-**	**-**	
46	App. II	**2,4-Dinitrophenol**	semivolatile	51-28-5	8270C	**50**	**-**	**-**	
47	App. II	**2,4-Dinitrotoluene**	semivolatile	121-14-2	8270C	**10**	**-**	**0.1**	
48	App. II	**2,6-Dinitrotoluene**	semivolatile	606-20-2	8270C	**10**	**-**	**-**	
49	App. II	**Di-n-octyl phthalate**	semivolatile	117-84-0	8270C	**10**	**100**	**-**	
50	App. II	**Diphenylamine**	semivolatile	122-39-4	8270C	**10**	**-**	**-**	
51	App. II	**Disulfoton**	OP pesticide	298-04-4	8270C	**10**	**0.3**	**-**	
52	App. II	**Ethyl methanesulfonate**	semivolatile	62-50-0	8270C	**20**	**-**	**-**	
53	App. II	**Famphur**	semivolatile	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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
56	App. II	**Hexachlorobenzene**	semivolatile	118-74-1	8270C	**10**	**0.02**	**-**	
57	App. II	**Hexachlorocylopentadiene**	semivolatile	77-47-4	8270C	**10**	**-**	**50**	
58	App. II	**Hexachloroethane**	semivolatile	67-72-1	8270C	**10**	**-**	**2.5**	
59	App. II	**Hexachloropropene**	semivolatile	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**	semivolatile	465-73-6	8270C	**20**	**-**	**-**	
62	App. II	**Isophorone**	semivolatile	78-59-1	8270C	**10**	**40**	**-**	
63	App. II	**Isosafrole**	semivolatile	120-58-1	8270C	**10**	**-**	**-**	
64	App. II	**Kepone**	pesticide	143-50-0	8270C	**20**	**-**	**-**	
65	App. II	**Methapyrilene**	semivolatile	91-80-5	8270C	**100**	**-**	**-**	
66	App. II	**3-Methylcholanthrene**	semivolatile	56-49-5	8270C	**10**	**-**	**-**	
67	App. II	**Methyl methanesulfonate**	semivolatile	66-27-3	8270C	**10**	**-**	**-**	
68	App. II	**2-Methylnaphthalene**	semivolatile	91-57-6	8270C	**10**	**30**	**-**	
69	App. II	**Methyl parathion**	semivolatile	298-00-0	8270C	**10**	**-**	**-**	
70	App. II	**1,4-Naphthoquinone**	semivolatile	130-15-4	8270C	**10**	**-**	**-**	
71	App. II	**1-Naphthylamine**	semivolatile	134-32-7	8270C	**10**	**-**	**-**	
72	App. II	**2-Naphthylamine**	semivolatile	91-59-8	8270C	**10**	**-**	**-**	
73	App. II	**o-Nitroaniline (2-Nitroaniline)**	semivolatile	88-74-4	8270C	**50**	**-**	**-**	
74	App. II	**m-Nitroaniline (3-Nitroaniline)**	semivolatile	99-09-2	8270C	**50**	**-**	**-**	
75	App. II	**p-Nitroaniline (4-Nitroaniline)**	semivolatile	100-01-6	8270C	**20**	**-**	**-**	
76	App. II	**Nitrobenzene**	semivolatile	98-95-3	8270C	**10**	**-**	**-**	
77	App. II	**5-Nitro-o-toluidine**	semivolatile	99-55-8	8270C	**10**	**-**	**-**	
78	App. II	**o-Nitrophenol (2-Nitrophenol)**	semivolatile	88-75-5	8270C	**10**	**-**	**-**	
79	App. II	**p-Nitrophenol (4-Nitrophenol)**	semivolatile	100-02-7	8270C	**50**	**-**	**-**	
80	App. II	**N-Nitrosodiethylamine**	semivolatile	55-18-5	8270C	**20**	**-**	**-**	
81	App. II	**N-Nitrosodimethylamine**	semivolatile	62-75-9	8270C	**10**	**0.0007**	**-**	
82	App. II	**N-Nitrosodi-n-butylamine**	semivolatile	924-16-3	8270C	**10**	**-**	**-**	
83	App. II	**N-Nitrosodiphenylamine**	semivolatile	86-30-6	8270C	**10**	**-**	**-**	
84	App. II	**N-Nitrosodipropylamine**	semivolatile	621-64-7	8270C	**10**	**-**	**-**	
85	App. II	**N-Nitrosomethylethylamine**	semivolatile	10595-95-6	8270C	**10**	**-**	**-**	
86	App. II	**N-Nitrosopiperidine**	semivolatile	100-75-4	8270C	**20**	**-**	**-**	
87	App. II	**N-Nitrosopyrrolidine**	semivolatile	930-55-2	8270C	**10**	**-**	**-**	
88	App. II	**Parathion**	OP pesticide	56-38-2	8270C	**10**	**-**	**-**	
89	App. II	**Pentachlorobenzene**	semivolatile	608-93-5	8270C	**10**	**-**	**-**	
90	App. II	**Pentachloronitrobenzene**	semivolatile	82-68-8	8270C	**20**	**-**	**-**	
91	App. II	**Phenacetin**	semivolatile	62-44-2	8270C	**20**	**-**	**-**	
92	App. II	**Phenanthrene**	PAH	85-01-8	8270C	**10**	**200**	**-**	
93	App. II	**Phenol**	semivolatile	108-95-2	8270C	**10**	**30**	**-**	
94	App. II	**p-Phenylenediamine**	semivolatile	106-50-3	8270C	**10**	**-**	**-**	
95	App. II	**Phorate**	OP pesticide	298-02-2	8270C	**10**	**1**	**-**	
96	App. II	**Pronamide**	semivolatile	23950-58-5	8270C	**10**	**-**	**-**	
97	App. II	**Pyrene**	PAH	129-00-0	8270C	**10**	**200**	**-**	
98	App. II	**Safrole**	semivolatile	94-59-7	8270C	**10**	**-**	**-**	
99	App. II	**1,2,4,5-Tetrachlorobenzene**	semivolatile	95-94-3	8270C	**10**	**-**	**2**	
100	App. II	**2,3,4,6-Tetrachlorophenol**	semivolatile	58-90-2	8270C	**10**	**200**	**-**	
101	App. II	**o-Toluidine**	semivolatile	95-53-4	8270C	**10**	**-**	**-**	
102	App. II	**2,4,5-Trichlorophenol**	semivolatile	95-95-4	8270C	**10**	**-**	**63**	
103	App. II	**2,4,6-Trichlorophenol**	semivolatile	88-06-2	8270C	**10**	**-**	**4**	
104	App. II	**O,O,O-Triethyl phosphorothioate**	semivolatile	126-68-1	8270C	**10**	**-**	**-**	
105	App. II	**1,3,5-Trinitrobenzene**	semivolatile	99-35-4	8270C	**10**	**-**	**-**	
106	App. II	**Hexachlorobutadiene**	semivolatile	87-68-3	8270C or 8260	**10**	**0.4**	**0.44**	
107	App. II	**Ethyl methacrylate**	semivolatile	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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
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 STANDARDS (µg/L)			NOTES
						NC SWSL	NC 2L	SWS-GWPS	
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.

All concentrations in micrograms per liter (µg/L) = parts per bilion (ppb).

NC-SWSL = NC-DENR Solid Wastre Section Reporting Limits
NC 2L = NC Groundwater Protection Standards from 15A NCAC 2l.0202.
SWS-GWPS = Groundwater Protection Standards established by the NC-DENR Solid Waste Section for constituents with no NC 2L Standard.
App. I & App. II = Solid Waste Constituent Lists incorporated into NC Solid Waste Management Rules from CFR-40 Appendix I and Appendix II.
C&D = Construction & Demolition Debris (referencing Landfills).

CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
Class: General type of compound.
OP = orthophosphate.
PAH = polynuclear aromatic hydrocarbon.
Volatile EQL of 1 µg/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).
" - " = not available/not applicable
Referenced from North Carolina Division of Waste Management website (http://www.wastenotnc.org/sw/swenvmonitoringlist.asp) as of 4/16/2015.

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Current as of 5/15/2013

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)	Human Health (HH)	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen	Data Reference Source(s)
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Acenaphthene	83-32-9	60	20	20		29			1,2-Dihydro-acenaphthylene (non-carcinogen PAH)	n	NRWQC 06/ECOTOX & RAIS 1/07
Acetaldehyde	75-07-0	970	1.4 mg/L						Acetic Aldehyde, Ethanal	y	ECOTOX 6/05 / RAIS & IRIS 2/07
Acephate	30560-19-1	70	(LD)	3.9	140					y	ECOTOX & RAIS 2/07
Acetochlor	34256-82-1	(LD)		510	1.9 mg/L					n	IRIS/RAIS 1/07 HHWSSA
Acetone	67-64-1	2.0 mg/L	300 mg/L						2-propanone	n	ECOTOX/RAIS/IRIS 1/07
Acetophenone	98-86-2	(LD)		3500	850000					n	ECOTOX/RAIS/IRIS 8/07
Acrolein	107-02-8	3	(LD)						2-Propenal	n	NRWQC 06
Acrylamide	79-06-1			0.008	0.3					y	ECOTOX/RAIS/IRIS 10/07
Acrylonitrile	107-13-1			0.051	0.25				2-Propenenitrile; ACN; AN; Acrylonitrile; Cyanoethylene; Fumigrain; Vinyl Cyanide	y	NRWQC 06/RAIS 2/07
Aldrin	309-00-2	**0.002**	**0.003**	**0.05 ng/L**	**0.05 ng/L**					y	NC/NRWQC 06/RAIS 1/07
Aliphatics										NA	
C5-C8 n-hexane as surrogate		(LD)		830	1400					NA	ECOTOX & RAIS 1/10/ MADEP tox studies
C9-C12		S		S	S					NA	NC
C9-C18 n-nonane as surrogate		S		S	S					NA	NC
C18-C32 Eicosane as surrogate		S		S	S					NA	NC
Aluminum (at pH 6.5-9.0)	7429-90-5	87		6500	8000					n	NRWQC 06/RAIS 1/09
Aluminum Sulfate	10043-01-3	12	(LD)							n	ECOTOX 2/07
2-Amino-4,6-Dinitrotoluene	35572-78-2	(LD)		6.7	150				2A-DNT	n	ECOTOX & RAIS 2/07
4-Amino-4,6-Dinitrotoluene	19406-51-0			6.7	150				4A-DNT	n	ECOTOX & RAIS 2/07
Ammonium Sulfate	7783-20-2	1.9 mg/L	(LD)							n	ECOTOX 2/07 EPIWIN
Anthracene	120-12-7	0.05			40000				(non-carcinogen PAH)	n	NRWQC 06/ ECOTOX 3/05/ RAIS 1/07
Antimony	7440-36-0			5.6	640					n	ECOTOX & RAIS 6/12/ NRWQC 06
Aromatics										NA	
C9-C32 Pyrene as surrogate				830	4.0 mg/L					n	RAIS 1/07/ surrogate from MADEP studies
Arsenic	7440-38-2	**50**	**50**	**10**	**10**					y	NC
Asbestos	1332-21-4			7,000,000 fibers/L						y	NRWQC 06
Atrazine	1912-24-9			640	8200					n	OPPT 2003 IRED; RAIS 3/09

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Current as of 5/15/2013

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)	Human Health (HH)	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen	Data Reference Source(s)
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Bacterial Indicators		*see fecal coliform and enterococcus*								NA	
Barium	7440-39-3	(LD)	(LD)	**1.0 mg/L**	200 mg/L					n	NC/ECOTOX, IRIS, AND RAIS 11/08
a-BHC	319-84-6			0.0026	0.0049				alpha-BHC; a-HCH (HCH=Hexachlorocyclohexane)	y	NRWQC 06/RAIS 1/07
b-BHC	319-85-7			0.0091	0.017				beta-BHC, b-HCH	y	NRWQC 06/RAIS 1/07
d-BHC	319-86-8	(LD)	(LD)						delta-BHC, d-HCH	n	ECOTOX & RAIS 1/07
g-BHC (also Lindane)	58-89-9	**0.01**	**0.004**						gamma-BHC, g-HCH	c	NC/PAN 3/07
Benefin	1861-40-1	(LD)		340	350					n	ECOTOX/IRIS/RAIS 1/07
Bentazon	25057-89-0	(LD)	(LD)	920	7400					n	IRIS/ RAIS/ ECOTOX 10/10
Benz(a)Anthracene **PAH**	56-55-3			**0.0028 Total PAH's**	**0.0311 Total PAH's**				(PAH)	Y	NC
Benzene	71-43-2			**1.19**	**51**					y	NC
Benzidine	92-87-5			0.086 ng/L	0.2 ng/L				4,4'-Biphenyldiamine	y	NRWQC 06
Benzo(a)Pyrene **PAH**	50-32-8			**0.0028 Total PAH's**	**0.0311 Total PAH's**				BaP/(PAH)	y	NC
Benzo(b)fluoranthene,3,4- **PAH**	205-99-2			**0.0028 Total PAH's**	**0.0311 Total PAH's**				(PAH)	y	NC
Benzo(k)Fluoranthene **PAH**	207-08-9			**0.0028 Total PAH's**	**0.0311 Total PAH's**				(PAH)	y	NC
Benzoic Acid	65-85-0	(LD)		140 mg/L	5000 mg/L				Carboxybenzene	n	ECOTOX & RAIS 1/07
Benzyl Alcohol	100-51-6	(LD)	(LD)	3.5 mg/L	290 mg/L				benzene methanol	n	ECOTOX & RAIS 6/12
Benzyl Chloride	100-44-7			0.19	2				alpha-Chlorotoluene, Chloromethyl Benzene	c	IRIS & RAIS 1/07
Beryllium	7440-41-7	**6.5**								n	NC
1,1- Biphenyl	92-52-4	18	(LD)	580	860				Diphenyl; Phenylbenzene; Bibenzene	n	ECOTOX/RAIS/IRIS 7/09
Bis (2-Chloroethyl)Ether	111-44-4			0.03	0.53				BCEE	y	NRWQC 06/RAIS 1/07
Bis(2-Chloroethoxy)methane	111-91-1			100	6.0 mg/L				dichloromethoxy ethane	n	RAIS 1/07
Bis(2-Chloroisopropyl)Ether	108-60-1			1.4 mg/L	65 mg/L					n	NRWQC 06
Bis(2-Ethylhexyl) Phthalate	117-81-7	(LD)	(LD)	1.2	2.2				DEHP	y	NRWQC 06
Bis(chloromethyl)Ether	542-88-1			0.1 ng/L	0.29 ng/L					y	NRWQC 06/RAIS 1/07
Boron	7440-42-8								no data	n	ECOTOX 11/08
Bromoform	75-25-2			4.3	140				Tribromomethane	c	NRWQC 06 & RAIS 1/07

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Current as of 5/15/2013

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)	Human Health (HH)	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen	Data Reference Source(s)
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Bromo-diphenyl Ether, p-	101-55-3	(LD)	(LD)						Bromo-diphenyl Ether, 4-	n	ECOTOX & RAIS 6/12
Butanone, 2-	78-93-3	(LD)	(LD)	20 mg/L	750 mg/L				methyl ethyl ketone; MEK	n	ECOTOX/RAIS/IRIS 7/2011
Butyl benzene, n-	104-51-8	(LD)		420	550				1-Phenylbutane	n	ECOTOX & RAIS 2/11
Butylate	2008-41-5	610		470	650				Sutan	n	ECOTOX & RAIS 1/07
Butylbenzyl Phthalate	85-68-7	19	5.1			8.2				n	NRWQC 06 & RAIS 1/07
Cadmium	7440-43-9	**2 (N)**	**5 (N)**			**0.4 (N)**				n	NC
Carbaryl (formerly Sevin)	63-25-2	0.67	(LD)						1-naphtalenol; methylcarbamate	n	ECOTOX/IRIS/RAIS 1/07
Carbazole	86-74-8			0.7	1.2					y	ECOTOX/IRIS/RAIS 8/12
Carbofuran	1563-66-2	9.7	0.46							n	ECOTOX/IRIS/RAIS 1/07
Carbon disulfide	75-15-0	(LD)	(LD)	3000	20000				Dithiocarbonic Anhydride	n	ECOTOX & RAIS 6/12
Carbon Tetrachloride	56-23-5			**0.254**	**1.6**				Benzinoform; Carbon Chloride	y	NC
Chlordane	57-74-9	**0.004**	**0.004**	**0.8 ng/L**	**0.8 ng/L**					y	NC
Chloride	16887-00-6	**230 mg/L (AL)**		**250 mg/L**						n	NC
Chlorine (TRC)	7782-50-5	**17**	7.5							n	NC/NRWQC 06
Chlorinated Benzenes				**488 Total Chlorinated Benzenes**						y	NC
Chlorinated Phenolic Compounds				**1.0 (N)**						NA	NC
Chlorobenzene	108-90-7	140	(LD)	**488 Total Chlorinated Benzenes**	1600				Phenyl Chloride; (Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 2/11
Chlorodibromomethane	124-48-1			0.4	13				Dibromochloromethane	c	NRWQC 06/RAIS 1/07
Chloroform	67-66-3			5.6	170				Trichloromethane	c	NRWQC 06/RAIS 1/07
Chloronaphthalene, 2-	91-58-7	(LD)		1.0 mg/L	1.6 mg/L					n	NRWQC 06/ECOTOX & RAIS 1/07
Chlorophyll -a, corrected		**40(N)**	**40(N)**			**15(N)**				NA	NC
Chlorothalonil	1897-45-6	1.3	1.6	7	20	0.8				c	ECOTOX/IRIS/RAIS 10/10
Chromium		**50**	**20**							NA	NC
Chrysene **PAH**	218-01-9			**0.0028 Total PAH's**	**0.0311 Total PAH's**				(PAH)	y	NC/NRWQC 06/RAIS 1/07
Cobalt	7440-48-4			3	4					n	ECOTOX/RAIS 6/09
Coliform		*see fecal coliform*								NA	
Copper	7440-50-8	**7 (AL)**	**3 (AL)**							n	NC
Cyanide	57-12-5	**5 (N)**	**1**							n	NC
Cyclohexane	110-82-7	230	120							n	ECOTOX/EPIWIN/RAIS 1/07

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Current as of 5/15/2013

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
D, 2,4-	94-75-7	60	(LD)	100	2.5 mg/L				2,4-Dichlorophenoxy acetic acid	n	NC/ECOTOX & RAIS 3/09
Dacthal	1861-32-1		(LD)	79	100					n	ECOTOX/IRIS/RAIS 7/07
DB, 2,4-	94-82-6	(LD)		270	10000					n	ECOTOX/IRIS/RAIS 8/07
DDD, 4,4'-	72-54-8			0.31 ng/L	0.31 ng/L				4,4'-Dichlorodiphenyldichloroethane	y	NRWQC 06/ECOTOX & RAIS 1/07
DDE, 4,4'-	72-55-9			0.22 ng/L	0.22 ng/L				p,p'-Dichlorodiphenyldichloroethylene	y	NRWQC 06/ECOTOX & RAIS 1/07
DDT, 4,4'-	50-29-3	0.001	0.001	0.2 ng/L	0.2 ng/L				4,4'-Dichlorodiphenyltrichloroethane	y	NC
Demeton	8065-48-3	0.1	0.1							n	NC
Diazinon	333-41-5	0.17	0.82							n	EPA final AWQC for Diazinon (12/2005)
Dibenz(a,h)Anthracene **PAH**	53-70-3			0.0028 Total PAH's	0.0311 Total PAH's				1,2:5,6-benzanthracene/ (PAH)	y	NC
Dibromo-3-chloropropane, 1,2-	96-12-8			0.033	0.13				Nemagon	c	ECOTOX/IRIS/RAIS 1/07
Dibromoethane, 1,2-	106-93-4			0.02	0.1				EDB, ethylene dibromide	y	ECOTOX/IRIS/RAIS 8/10
Dicamba	1918-00-9	200	(LD)	1.0 mg/L	38 mg/L				2,5-Dichloro-6-methoxybenzoic acid	n	ECOTOX/IRIS/RAIS 3/09
Dichloroacetic acid (DCAA)	79-43-6			0.68	25				DCAA , DCA	y	IRIS & RAIS 1/07
Dichlorobenzene, 1,2-(o)	95-50-1	470	370	488 Total Chlorinated Benzenes	1300	79			(Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 1/07
Dichlorobenzene, 1,3-(m)	541-73-1	390	390	488 Total Chlorinated Benzenes	960				(Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 1/07
Dichlorobenzene, 1,4-(p)	106-46-7	100		488 Total Chlorinated Benzenes	190	56			(Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 1/07
Dichlorobenzidine, 3,3'-	91-94-1			0.021	0.028					y	NRWQC 06/ECOTOX & RAIS 1/07
Dichlorobromomethane	75-27-4			0.55	17				Bromodichloromethane	y	NRWQC 06/RAIS 1/07
Dichloroethane, 1,1-	75-34-3	(LD)		6	100					y	Handbook of Environmental Data-Vershueren/RAIS 6/10
Dichloroethane, 1,2-	107-06-2			0.38	37				Ethylene dichloride	y	NRWQC 06/ECOTOX & RAIS 4/09
Dichloroethylene, 1,1-	75-35-4	1500	(LD)	330	7.1 mg/L				1,1 DCE ; vinylidene chloride; 1,1-Dichloroethene	n	NRWQC 06/ECOTOX & RAIS 5/10
Dichloroethylene, 1,2-trans-	156-60-5			140	10 mg/L				trans-1,2-DCE; trans-acetylene dichloride	n	NRWQC 06/ECOTOX & RAIS 1/07
Dichloroethylene, 1,2-cis-	156-59-2			60	720				cis-1,2-dichloroethene	n	IRIS & ECOTOX & RAIS 7/11
Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0			290	3200					n	ECOTOX & RAIS 8/12
Dichloropropane, 1,2-	78-87-5			0.5	15					y	NRWQC 06

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Current as of 5/15/2013

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Dichloropropene, 1,3-	542-75-6	12		0.31	21				cis and trans 1,3-Dichloropropylene	y	NRWQC 06/ECOTOX & RAIS 1/07
Dichlorvos	62-73-7	(LD)	0.12						Breakdown product of Naled	y	ECOTOX/IRIS/RAIS 1/07
Dieldrin	60-57-1	**0.002**	**0.002**	**0.05 ng/L**	**0.05 ng/L**					y	NC
Diethyl Ether	60-29-7	130 mg/L		6.8 mg/L	250 mg/L				Ethyl Ether	NA	ECOTOX/IRIS/RAIS 1/07
Diethyl Phthalate	84-66-2	1.2 mg/L	15 mg/L			600			DEP	n	ECOTOX & RAIS 1/07
Dimethoate	60-51-5	0.3	1.6						Cygon: o,o-Dimethyl s-(N-methyl)-carbamoylmethyl dithiophosphate	n	ECOTOX/IRIS/RAIS 10/10
Dimethylbenzene, 1,2-	95-47-6	*see Xylene, o-*							Xylene, o-	n	
Dimethylbenzene, 1,3-	108-38-3	*see Xylene, m-*							Xylene, m-	n	
Dimethylbenzene, 1,4-	106-42-3	*see Xylene, p-*							Xylene, p-	n	
Dimethyl Phthalate	131-11-3	3.4 mg/L	2.9 mg/L			2.8 mg/L			DMP; Benzenedicarboxylic acid; dimethyl ester	n	ECOTOX & RAIS 1/07
Dimethylformamide	68-12-2		(LD)	3.4 mg/L	130 mg/L				DMF; DMFA	n	ECOTOX & RAIS 1/07
Di-n-butyl phthalate	84-74-2	9.5	4.5						DBP	n	ECOTOX & RAIS 1/07
1,3-Dinitrobenzene	99-65-0	(LD)		3.4	140					n	ECOTOX & RAIS 1/07
Dinitrotoluene, 2,4-	121-14-2			0.11	3.4				2,4-DNT	y	NRWQC 06/ECOTOX & RAIS 2/07
Dinitrotoluene, 2,6-	606-20-2			0.048	0.71				2,6-DNT	y	ECOTOX & RAIS 2/07
Di-n-octyl phthalate	117-84-0			900	2.5 mg/L					n	RAIS 1/07
Dinoseb	88-85-7	3	12	20	65					n	IRIS/RAIS/ECOTOX 6/12
Dioxane, 1,4-	123-91-1			0.35	80				1,4- diethylene dioxide	y	ECOTOX/IRIS/RAIS 8/10
Dioxin (2,3,7,8-TCDD)	1746-01-6			**0.000005 ng/L**	**0.000005 ng/L**				2,3,7,8-Tetrachlorodibenzo-p-dioxin	y	NC
Diphenylhydrazine, 1,2-	122-66-7			0.036	0.2				1,2-DPH	y	NRWQC 06/ECOTOX & RAIS 2/07
Dissolved Gases		**110% sat (N)**	**110% sat (N)**							NA	NC
Dissolved Oxygen		**not less than 5.0 mg/L (N)**	**not less than 5.0 mg/L (N)**			**not less than 6.0 mg/L (N)**	**not less than 6.0 mg/L (E)**	**(N)**		NA	NC
Endosulfan	115-29-7	**0.05**	**0.009**						Same values apply to Endosulfan Sulfate, alpha-Endosulfan, and beta-Endosulfan	n	NC
Endothall	145-73-3	3.9 mg/L	12 mg/L	680						n	ECOTOX/IRIS/RAIS 2/07
Endrin	72-20-8	**0.002**	**0.002**							n	NC
Endrin Aldehyde	7421-93-4			0.29	0.3					n	NRWQC 06/RAIS 2/07

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Current as of 5/15/2013

Pollutant	CAS #	Freshwater Aquatic Life	Saltwater Aquatic Life	Water Supply (WS)	Human Health (HH)	Trout Waters (Tr)	High Quality Waters (HQW)	Swamp Waters (Sw)	Synonyms & Other Info	Carcinogen	Data Reference Source(s)
		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Enterococcus					**geomean of 35 organisms/100 mL (applicable to class SA, SB, and SC Saltwaters) (N)**					NA	NC
EPTC	759-94-4			580	1.7 mg/L				s-ethyl propylthiocarbamate	NA	IRIS & RAIS 4/07
Ethanol	64-17-5	(LD)	(LD)						Ethyl Alcohol	n	ECOTOX/ RAIS 12/10
Ethylbenzene	100-41-4	97	25						Phenyl Ethane	n	ECOTOX & RAIS 8/10
Ethyl Ether	60-29-7	*see Diethyl Ether*							See Diethyl Ether	n	
Fecal Coliform					**geomean of 200 organisms/100 mL in Class C Freshwaters (N); and a geomean of 14 organisms/100 mL in class SA Saltwaters (N)**					NA	NC
Fluoranthene	206-44-0	0.11	0.22						1,2-Benzacenaphthene	n	ECOTOX & RAIS 2/07
Fluorene	86-73-7	30 LD	LD	1100	5300					n	NRWQC 06; ECOTOX & RAIS 9/10
Fluoride		**1.8 mg/L**	(LD)							NA	NC; ECOTOX & KOWWIN 3/08
Fluridone	59756-60-4	90	170						Avast, Sonar	n	ECOTOX/IRIS/RAIS 4/07
Fonofos	944-22-9	0.27	17							NA	ECOTOX/IRIS/RAIS 4/07
Formaldehyde	50-00-0	1.2 mg/L	620						Formalin	n	ECOTOX/IRIS/RAIS 2/07
Guthion	86-50-0	**0.01**	**0.01**							NA	NC
Hardness, Total				**100 mg/L Calcium Carbonate**						NA	NC
Heptachlor	76-44-8	**0.004**	**0.004**	**0.08 ng/L**	**0.08 ng/L**					y	NC
Heptachlor Epoxide	1024-57-3			0.039 ng/L	0.039 ng/L					y	NRWQC 06/RAIS 1/07
Hexachlorobenzene	118-74-1			**488 Total Chlorinated Benzenes**	0.29 ng/L				(Chlorinated Benzene)	y	NC/NRWQC 06/RAIS 1/07
Hexachlorobutadiene	87-68-3			**0.44**	**18**				HCBD	y	NC
Hexachlorocyclohexane Technical	608-73-1			0.005	0.006				HCH	y	IRIS/RAIS/ECOTOX 6/12
Hexachlorocyclo-pentadiene	77-47-4	0.07		1 Organoleptic	1.1 mg/L				HCCPD; Perchlorocyclopentadiene	n	NRWQC 06/ECOTOX & RAIS 2/07
Hexachloroethane	67-72-1			1.4	3.3				HCE	y	NRWQC 06/RAIS 1/07
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	121-82-4			0.31	11				RDX	y	RAIS 2/07
Hexamine	100-97-0	2500 mg/L	2500 mg/L							n	ECOTOX & EPIWIN 2/07

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Hydrogen sulfide	7783-06-4	0.21	(LD)							n	ECOTOX & RAIS 2/07
Indeno(1,2,3-cd)Pyrene **PAH**	193-39-5			**0.0028 Total PAH's**	**0.0311 Total PAH's**				PAH	y	NC
Iron	7439-89-6	**1.0 mg/L (AL)**								n	NC/ECOTOX 1/09
Isophorone	78-59-1			35	960				1,1,3-Trimethyl-3-cyclohexene-5-one	y	NRWQC 06/RAIS 1/07
Isopropyl benzene	98-82-8	250	(LD)	2.7 mg/L	11 mg/L	135			Cumene; Cumol; (1-Methylethyl)benzene	n	ECOTOX/IRIS/RAIS 8/10
Isopropyl Ether	108-20-3	(LD)	(LD)						2,2'-Oxybispropane	n	ECOTOX & RAIS 8/10
Isopropyl toluene, p	99-87-6	(LD)	(LD)						4-Cymene	n	ECOTOX & RAIS 1/10
Lead	7439-92-1	**25 (N)**	**25 (N)**							n	NC
Lindane, g-BHC	58-89-9	*see g-BHC*							(see g-BHC)	c	
Malathion	121-75-5	0.1	0.1							n	NRWQC 06
Mancozeb	8018-01-7	(LD)		1.0 mg/L	38 mg/L				Carbamic Acid; ethylene-bis	n	ECOTOX & RAIS 2/07
Manganese	7439-96-5	(LD)		**200**						n	NC/ECOTOX & RAIS 1/09
MBAS				**500 (N)**					Methylene-blue-active substances (see note)	NA	NC
Mercury	7439-97-6	**0.012**	**0.025**							n	NC
Methanol	67-56-1			17 mg/L	630 mg/L				Methyl Alcohol	n	RAIS 12/08
Methoxychlor	72-43-5	**0.03**	**0.03**							n	NC
Methyl acetate	79-20-9	19 mg/L								n	ECOTOX & RAIS 3/08
Methyl Bromide	74-83-9	(LD)	(LD)	47	1.5 mg/L				Bromomethane	n	NRWQC 06/ECOTOX & RAIS 2/07
Methyl Chloride	74-87-3			2.6	96				Chloromethane	n	IRIS & RAIS 2/07
Methyl methacrylate	80-62-6	9600								n	IRIS/RAIS/ECOTOX 2/09
Methylene Chloride	75-09-2			4.6	590				Dichloromethane	y	NRWQC 06/RAIS 1/07
Methylnaphthalene, 1-	90-12-0			0.8	2.6					y	RAIS/ ECOTOX 4/10
Methylnaphthalene, 2-	91-57-6		(LD)	50	80					NA	IRIS/RAIS/ECOTOX 1/08
Methyl-2-pentanone, 4-	108-10-1	26 mg/L		2.8 mg/L	160 mg/L				methyl isobutyl ketone	n	ECOTOX & RAIS 2/07
Metolachlor	51218-45-2	240	(LD)			200				n	ECOTOX/IRIS/RAIS 10/10
Metribuzin	21087-64-9	(LD)		840	24 mg/L					n	ECOTOX/IRIS/RAIS 2/07
Mirex	2385-85-5	**0.001**	**0.001**							n	NC
Molybdenum	7439-98-7		(LD)	160	2.0 mg/L					n	ECOTOX 6/09 RAIS & IRIS 6/09
MTBE	1634-04-4	(LD)	(LD)	19	1500				Methyl Tertiary-Butyl Ether	NA	IRIS & RAIS & ECOTOX 1/10
Naphthalene	91-20-3	12	52						Mothballs	n	ECOTOX/IRIS/RAIS 8/10
Nickel	7440-02-0	**88 (N)**	**8.3 (N)**	**25**						n	NC
Nitrate (as N)	14797-55-8			**10.0 mg/L**					Total nitrogen may be regulated in NSW waters. See 2B .0200s for further info	n	NC
Nitrite	14797-65-0			2.7	2.7					n	IRIS & RAIS 1/07

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Current as of 5/15/2013

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Nitrobenzene	98-95-3			17	30 Organoleptic				Mirbane Oil	n	NRWQC 06 & RAIS 2/07
Nitroglycerin	55-63-0			2	67				1,2,3-Propanetriol trinitrate	y	RAIS 2/07
Nitrosamines ~~ *(N-nitrosodiethyl-amine data used)*	ID# NO4250000 (55-18-5)			0.8 ng/L	0.46				(see note)	y	NRWQC 06/IRIS & RAIS 2/07/EPA 440/5-80-064
Nitrosodibutylamine, N-	924-16-3			0.0063	0.22					y	NRWQC 06
Nitrosodiethyl-amine, N-	55-18-5			0.8 ng/L	0.46					y	NRWQC 06/IRIS & RAIS 2/07
Nitroso-di-n-Propylamine, N-	621-64-7			0.005	0.51					y	NRWQC 06/RAIS 1/07
Nitrosodimethyl-amine, N-	62-75-9			0.69 ng/L	3					y	NRWQC 06/IRIS & RAIS 2/07
Nitrosodiphenylamine, N-	86-30-6			3.3	6					y	NRWQC 06/IRIS & RAIS 2/07
Nitrosopyrrolidine, N-	930-55-2			0.016	34					y	NRWQC 06/RAIS 1/07
Nitrotoluene, 2-	88-72-2			0.14	1.5				o-Nitrotoluene	NA	RAIS 2/07
Nitrotoluene, 3-	99-08-1	(LD)		620	5.3 mg/L				m-Nitrotoluene	NA	ECOTOX & RAIS 2/07
Nitrotoluene, 4-	99-99-0			1.8	18				p-Nitrotoluene	NA	RAIS 2/07
n-Propyl Benzene	103-65-1	(LD)	(LD)	1700	3200					NA	ECOTOX & RAIS 1/10
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	2691-41-0	1.4 mg/L	1.7 mg/L		63 mg/L				HMX	n	ECOTOX & RAIS 2/07
Oil and Grease (see OG footnote)		**(N)**	**(N)**							NA	NC
Parathion	56-38-2	**0.013**	**0.178**							n	NC
PCB, total		**0.001 (N)**	**0.001 (N)**	0.064 ng/L	**0.064 ng/L (N)**				polychlorinated biphenyls / (total of all identified PCBs)	y	NC/NRWQC 06
Pentachlorobenzene	608-93-5	0.51		**488 Total Chlorinated Benzenes**	1.5				(Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 2/07
Perchlorate and Salts	14797-73-0			2.5	2.8					n	IRIS & RAIS 4/07
pH		**6.0-9.0 (N)**	**6.8-8.5 (N)**					**(N)**		NA	NC
Phenanthrene	85-01-8	0.7	0.3							n	ECOTOX & RAIS 4/10
Phenolic Compounds		300 **(N)**	300 **(N)**						(phenolic compounds: no fish flesh tainting) 300 ug/L used as a numeric translator for this narrative standard	NA	NC
Polynuclear aromatic hydrocarbons (**PAH**'s)				**0.0028 Total PAH's**	**0.0311 Total PAH's**					y	NC
Propenoic Acid	79-10-7	(LD)		17 mg/L	630 mg/L				Acrylic Acid	n	ECOTOX & IRIS & RAIS 11/09
Pyrene	129-00-0			830	4000				Benzo[def]phenanthrene/ (non-carcinogen PAH)	n	NRWQC 06/ RAIS 2/07
Pyridine	110-86-1	5000	(LD)	34	1300					NA	ECOTOX/IRIS/RAIS 8/07
Radioactive Substances		**(N)**	**(N)**		**(N)**					NA	NC
Salinity			**(N)**							NA	NC
Selenium	7782-49-2	**5**	**71**							n	NC

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Sewage		(N)	(N)	(N)						NA	NC
Silver	7440-22-4	0.06 (AL)	0.1 (AL)							n	NC
Silvex	93-72-1	(LD)	1.5 mg/L	10					2,4,5-TP; 2,4,5-Trichlorophenoxypropionoic Acid	n	NC/ECOTOX & RAIS 2/07
Solids, settleable		(N)	(N)						also includes floating solids and sludge deposits	NA	NC
Solids, total dissolved				500 mg/L						NA	NC
Solids, total suspended						HQW=10 mg/L (E)	20 mg/L(E)			NA	NC
Strontium	7440-24-6			14 mg/L	40 mg/L					n	IRIS & RAIS 2/07
Sulfates				250 mg/L						n	NC
Sulfide - Hydrogen sulfide	7783-06-4	0.21	2							n	NRWQC 06/ECOTOX & RAIS 2/07
Temperature		(N)	(N)		(N)					NA	NC
Terbacil	5902-51-2			430	9.1 mg/L					NA	IRIS & RAIS 4/07
Tetrachlorobenzene, 1,2,4,5-	95-94-3			488 Total Chlorinated Benzenes	1.1				(Chlorinated Benzene)	n	NC/NRWQC 06/RAIS 2/07
Tetrachloroethane, 1,1,2,2-	79-34-5			0.17	4				acetosol; acetylene tetrachloride	y	NC
Tetrachloroethylene (PERC)	127-18-4			0.7	3.3				PERC; PCE; perchloroethylene	y	NC
Thallium	7440-28-0			0.24	0.47					n	NRWQC 06/IRIS & RAIS 2/07
Tin	7440-31-5			770	800					NA	ECOTOX/RAIS 8/07
Toluene	108-88-3	11	370			0.36			methyl benzene; phenyl methane	n	NC/ECOTOX & RAIS 2/07
Toxaphene	8001-35-2	0.2 ng/L	0.2 ng/L							y	NC
2,4,5-T	93-76-5		1.4 mg/L	68	2.5 mg/L				2,4,5-Trichlorophenoxyacetic Acid	n	ECOTOX & RAIS 2/07
Trialkyltin		0.07	0.007							n	NC
Tributyltin (TBT)	56573-85-4	0.07	0.007							n	NC
Trichlorobenzene, 1,2,4-	120-82-1	61	27	488 Total Chlorinated Benzenes	70				(Chlorinated Benzene)	n	NC/NRWQC 06/ECOTOX & RAIS 2/07
Trichloroethane, 1,1,1-	71-55-6	2500	LD						Ethane trichloride; vinyl trichloride	n	IRIS & RAIS 4/09
Trichloroethane, 1,1,2	79-00-5			0.59	16					y	NRWQC 06/RAIS 2/07
Trichloroethylene	79-01-6			2.5	30				TCE	y	NC
Trichlorofluoromethane	75-69-4			9.1 mg/L	67 mg/L				Freon11; Frigen11; Arcton 11	n	IRIS & RAIS 2/07
1,1,2-trichloro1,2,2-trifluoroethane	76-13-1			710 mg/L	2200 mg/L				Freon 113	n	IRIS & RAIS 1/07

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				
Trichloropropane, 1,2,3-	96-18-4			0.001	0.01				1,2,3-TCP	c	ECOTOX / IRIS / RAIS 6/12
Trimethylbenzene, 1,2,4-	95-63-6	(LD)	(LD)							n	ECOTOX & RAIS 8/10
Trimethylbenzene, 1,3,5--	108-67-8	(LD)	(LD)	130	215				Mesitylene	n	ECOTOX & RAIS 8/10
Trinitrobenzene,1,3,5-	99-35-4	(LD)		1.0 mg/L	75 mg/L				TNB	n	ECOTOX & RAIS 2/07
Trinitrophenylmethylnitramine	479-45-8			140	4.3 mg/L				Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	n	ECOTOX & RAIS 2/07
Trinitrotoluene, 2,4,6-	118-96-7			1.1	39				TNT	y	ECOTOX & RAIS 2/07
Turbidity		**50/25 NTU (N)**	**25 NTU (N)**			**10 NTU (N)**				NA	NC
Vinyl Chloride	75-01-4			**0.025**	**2.4**				chloroethylene	y	NC
Xylenes, mixture	1330-20-7	670	(LD)			450				NA	ECOTOX/IRIS/RAIS 6/12
Xylene, m-	108-38-3	(LD)	(LD)			420			Dimethylbenzene, 1,3-	n	ECOTOX/IRIS/RAIS 6/12
Xylene, p-	106-42-3	(LD)	(LD)			130			Dimethylbenzene, 1,4-	n	ECOTOX/IRIS/RAIS 6/12
Xylene, o-	95-47-6	600	(LD)			400			Dimethylbenzene, 1,2-	n	ECOTOX/IRIS/RAIS 6/12
Zinc	7440-66-6	**50 (AL)**	**86 (AL)**							n	NC

References, Codes, And Additional Information

*To determine the appropriate standard, use the most stringent of all applicable columns.For Class C or SC, use the most stringent of freshwater (or, if applicable, saltwater) column and the Human Health column.

For a WS water, use the most stringent of Freshwater, WS & Human Health. Trout Waters & High Quality Waters likewise must adhere to the most stringent of all applicable standards

* All metal criteria are as total recoverable metals.

*** Values in red font are 15A NCAC 2B standards**

Unit Conversions: 1.0 mg/L = 1000.0 ug/L = 1000000.0 ng/L
1.0 ng/L = 0.001 ug/L = 0.000001 mg/L

(AL) Action Level Standard - See 2B .0211 for additional information
(E) For effluent limits only. See 2B .0224
(HH) Standards based on consumption of fish only - see 2B .0208
(HQW) High Quality Waters - see 02B .0101 and .0201
(LD) Limited data available, call for info

(N) = Narrative standard See 2B .0211 and for WS: .0212, 0214,.0215, .0216 and.0218
(NTU) Nephelometric Turbidity Units
S = Toxicity exceeds solubility, no visible sheen or free product in water or on sediment or shoreline per 2B .0211 & .0220
(Sw) Swamp Waters - as defined by 02B .0101
(Tr) Trout Waters - as defined by 02B .0101 and 0301

(WS) Water supply standards based on consumption of water and fish - see 2B .0208
-WS standards are applicable to *all* Water Supply Classifications.

DHHS: TP-SM: Dept. of Health and Human Services. 2003 Toxicological Profile for Sulfur Mustard (Update)
ECOTOX = US EPA ECOTOXicology Database System
EPA 2003 Draft Atrazine: 2003 Ambient Aquatic Life WQ Criteria for Atrazine- Revised Draft; EPA-822-R-03-023
EPA 440/5-80-064: Ambient Water Quality Criteria for Nitroamines; pg. C-66
EPIWIN = EPA's Estimation Program Interface for Windows database

HHWSSA: Herbicide Handbook of the Weed Science Society of America. 1989. Sixth edition.
IRIS = EPA's Integrated Risk Information System
MADEP tox studies: Total Petroleum Hydrocarbon Criteria Working Group of the Massachusetts Department of Environmental Protection 5/2002.
MBAS: additional narrative language is located in 02B .0212, .0214, .0215, .0216, .0218

~~ N-nitrosodiethylamine (CAS # 55-18-5) toxicological data used to calculate standards(see EPA NRWQC:2002 HHCM).

Criteria applies to N-nitrosodiethylamine and other nitrosamines (exception:N-nitrosodimethylamine, N-nitrosodibutylamine, N-nitrosopyrrolidine, N-nitrosodiphenylamine, and N-nitrosodi-n-propylamine)

NC = North Carolina 15A NCAC 2B standard (Red Book standards are bolded in **red** font)

NRWQC = EPA's National Recommended Water Quality Criteria (http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm) ; 11/02 Human Health Calculation Matrix

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		ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)	ug/l (unless noted)				

(OG)= take the lowest LC50 available for the particular type of OG you have (or similar OG) and multiply it by a safety factor of 0.01 to obtain the criteria

PAH=Applies to total PAHs present and includes the following: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene

PAN: Pesticide Database. http://www.pesticideinfo.org/Index.html

RAIS= Risk Assessment Information System; Toxicity & Chemical Specific Factors database

SePRO Corp. MSDS for 9,10-Anthraquinone

Verschueren= Handbook of Environmental Data on Chemicals, 2nd Edition; Karel Verschueren

Carcinogenicity Color Key:	
Known to cause cancer in humans (y)	**Blue**
Not known to cause cancer in humans (n)	**Green**
Carcinogenicity not assessed or does not apply (NA)	**No Color**