Johnston County Landfill
Proposed C&D Landfill
Water Quality Monitoring Plan

Prepared For:
Johnston County
Department of Public Utilities
Smithfield, North Carolina

The Water Quality Monitoring Plan for this facility has been prepared by a qualified geologist who is licensed to practice in the State of North Carolina. The plan has been prepared based on knowledge of site conditions and familiarity with North Carolina solid waste rules and industry standard protocol. The Plan described herein should provide for the effective detection of a chronic release of hazardous constituents into ground and surface waters of the State, due to, or caused by past activities at the landfill.

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1.0 Introduction

1.1 Plan Background

Johnston County, North Carolina, owns and has sequentially operated four separate, unlined sanitary landfill units since1973 under Solid Waste Facility Permit #51-01, one lined municipal solid waste landfill (Phase 5) under permit 51-02, and one double-lined MSW landfill (Phase 4A) under permit 51-03. The six distinct municipal solid waste disposal units are located on a single property off State Route 210 in Johnston County.

The lined C&D landfill is proposed as a "piggy-back" landfill being constructed over a portion of the sideslope of the unlined Phase 3 MSW landfill. This lined C&D landfill "piggy-back" design is proposed as a part of the presumptive remedy for the unlined Phase 3 MSW landfill. The liner system of the C&D landfill will prevent rainwater infiltration into the soil covered sideslopes of the unlined Phase 3 MSW landfill. This design, in conjunction with the double-lined Phase 4A MSW landfill will provide significant reduction in leachate generation from the Phase 3 landfill.

The lined C&D landfill is located east of Phase 3 and north of Phases 1 & 2. These three phases of unlined landfills have impacted groundwater in this portion of the site. Therefore, this groundwater monitoring plan is more comprehensive than most for C&D landfills in order to provide for monitorability at the C&D landfill site.

C&D Landfill Monitoring Network

GNRA proposes two groundwater monitoring wells located between unlined MSW landfill Phases 1 & 2, (CDMW-1 and CDMW-2), two wells located adjacent to the diabase dikes located in the C&D area (CDMW-3 and CDMW-4), three downgradient nested pairs (CDMW-5/CDMW-5d, and CDMW-8/CDMW-8d and CDMW-9/CDMW9d), a downgradient shallow well (CDMW-6), a side gradient well (CDMW-7).

Additionally, since this is a lined C&D facility, leachate samples from the leachate collection system will be monitored semi-annually for the same Appendix I constituents that ground water is monitored for.

This Water Quality Monitoring Plan (WQMP) has been prepared to meet the field sampling and laboratory analysis requirements of the site. The WQMP details field and laboratory protocols that must be followed to meet the data objectives for the site.

1.2 Purpose & Scope

This WQMP has been designed to insure that accurate and representative field and laboratory results are obtained for all ground and surface water quality monitoring points. The WQMP addresses the following subjects:

- Ground water sample collection
- Surface water sample collection
- Sample preservation and shipment
- Laboratory analytical procedures
- Sample Chain-of-custody control
- Quality assurance/quality control programs

The methods and procedures described in the following sections are intended to facilitate the collection of true and representative samples and test data. Field procedures are presented in **Sections 3.0 through 7.0** in their general order of implementation. Equipment requirements for each field task are presented within the applicable section. Laboratory procedures, quality assurance methods and record keeping requirements are presented in **Sections 7.0 and 8.0**.

Strict adherence to these procedures stipulated in this plan is required. Any variations from these procedures should be throughly documented in the assessment report.

1.3 Sampling Program Overview

The ground water monitoring well designations, completion type, installation information and analytical requirements are included as **Table 1**. The surface water monitoring station designations, locations, sources and sampling frequency are included as **Table 2**.

2.0 Ground Water Sample Collection

This section presents details of the procedures and equipment required to perform ground water field measurements and sampling from monitoring wells during each monitoring event. A description of proposed ground water monitoring well locations and completion details are presented in **Table 1**. Ground water monitoring well locations for each Phase are shown in **Figure 1**.

2.1 Water Level Measurements

Static water level and total depth to the bottom will be measured in each well prior to any purging or sampling activities. Static water level and well depth measurements are necessary to calculate the volume of stagnant water in the well prior to purging. Additionally these measurements provide a field check on well integrity, degree of siltation, and are used to prepare potentiometric maps, calculate aquifer flow velocities and monitor changes in site hydrogeologic conditions.

Upon opening each well, new latex or nitrile surgical gloves will be donned. New gloves will be worn when taking water level measurements at each well. Appropriate measures will be taken during all measurement activities to prevent soils, decontamination supplies, precipitation, and other potential contaminants from entering the well or contacting clean equipment.

An electronic water level indicator will be used to accurately measure depth to ground water in each well and/or piezometer. Ground water depths will be measured to a vertical accuracy of 0.01 feet relative to established wellhead elevations. Each well will have a permanent, easily identified reference point on the lip of the well riser from which all water level measurements will be taken. The elevation of the reference point will be established by a Registered Land Surveyor.

The electronic water level indicator will be constructed of inert materials such as stainless steel and Teflon. Between well measurements the device will be thoroughly decontaminated by washing with non-phosphate soap and triple rinsing with deionized water to prevent cross contamination from one well to another.

The following measurements will be recorded in a dedicated field book prior to sample collection:

- Well Identification
- Depth to static water level and well bottom (to the nearest 0.01 foot)
- Height of water column in the riser (based upon known depth of well)
- Condition of wellhead protective casing, base pad and riser
- Changes in condition of well and surroundings.

2.2 Monitor Well Evacuation

Water accumulated in each well may be stagnant and unrepresentative of surrounding aquifer conditions, and therefore must be removed to insure that fresh formation water is sampled. Each well will be purged of standing water in the well casing following the measurement of the static water level.

New latex or nitrile surgical gloves will be donned for all well purging and sampling activities and whenever handling decontaminated field equipment. Appropriate measures will be taken during all measurement, purging and sampling activities to prevent surface soils, decontamination supplies, precipitation, and other potential contaminants from entering the well or contacting cleaned equipment.

The volume of standing water in the well riser and screen will be calculated immediately before well evacuation during each monitoring event. A standing water volume will be calculated for each well using measured static water level, well depth and well casing diameter according to the following equation:

$$V = (TD - SWL) \times C$$

Where: V = One well volume

TD = Total depth of the well (in feet)

SWL = Static water level (in feet)

C = Volume constant for given well diameter (gallons/foot)

C = 0.163 gal/ft for two-inch wells.

C = 0.653 gal/ft for four-inch wells.

After the volume of standing water within the casing is established, a minimum of three to five well casing volumes of water will be evacuated from each well that is not outfitted with a MicroPurge ™ system.

New, disposable bailers with either double or bottom check-valves will be used to purge each well if the MicroPurge system is not used. Disposable purge bailers will be constructed of fluorocarbon resin (Teflon) suitable for the well and ground conditions. Each bailer will be certified factory-cleaned according to approved EPA protocol and remain sealed in a plastic sleeve until use. A new Teflon-coated stainless steel, inert mono-filament line or nylon cord will be used for each well to retrieve the bailers.

Wells will be purged at a rate that will not cause recharge water to be excessively agitated or cascade through the screen. Care will also be taken to minimize disturbance to the well sidewalls and bottom which could result in the suspension of silt and fine particulate matter. The volume of water purged from each well and the relative rate of recharge will be documents in sampling field notes. Wells which are of very low recharge rates will be purged once until dry. Damaged, dry or low yielding, and high turbidity wells will noted for reconsideration before the next sampling event.

Purge water will be managed to prevent possible soil and surface water contamination. Well site management options may include temporary containment and disposal as leachate or portable activated carbon filtration.

There are several wells on-site that are outfitted with MicroPurge™ pumps. All MicroPurge™ pumps are constructed of stainless steel and teflon components and are equipped with teflon lined

tubing from the pump to the surface of the well. These pumps have been installed to maximize pump efficiency and data reliability.

Wells that are outfitted with the MicroPurge™ system T1200M pumps will be developed until the field parameters of temperature, pH and Conductivity stabilize to within 10%. The use of the MicroPurge low-flow system allows a sample to be collected from a discreet interval of the well, thus limiting the amount of purging necessary. The pumps operate at a flowrate of approximately 200 ml/min during purging. The stabilization of field parameters indicates that water from the formation is being removed. A "Flow Cell - FC4000" is used to continuously monitor the field parameters of the purge water. This cell evaluates the pH, temperature, and conductivity on a constant basis and provides an ongoing continuous readout of the parameter levels. Once three readings taken 3 to 5 minutes apart have stabilized to within 10% of each other, a sample may be immediately collected from the pump. The pumping rate during sampling shall be 100 ml/min.

Durable, non-dedicated equipment to be lowered into the well (such as water level indicators) will be thoroughly decontaminated before each use. Equipment shall be disassembled to the degree practical, washed with (non-phosphate) soapy potable tap water, and triple rinsed using de-ionized water. Detailed equipment decontamination procedures are detailed in **Section 2.6**.

2.3 Ground Water Sample Collection

After purging activities are complete, ground water samples will be collected for laboratory analysis. Additional care commensurate with the importance of this stage will be taken. All monitoring wells should be sampled in as short a time period as possible, generally within 48 hours.

Sampling will occur within 24 hours of the purging of each well and as soon after well recovery as possible. Wells which fail to recharge or produce an adequate sample volume within 24 hours of purging will be sampled and a notation as to the amount of elapsed time since purging will be placed in the "notes" section of the chain of custody sheet and in the field notes for future evaluation. If particular wells are consistently slow in recharging, a remedy should be proposed for the problem.

Field measurements of temperature, pH, specific conductivity and turbidity will be made immediately prior to sampling each monitoring point. The field test specimens will be collected with the sampling bailer and placed in a clean, non-conductive glass or plastic container for observation. The calibration of the pH, temperature, conductivity and turbidity meters will be completed according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste -Physical/Chemical Methods (SW-846). A pocket thermometer and litmus paper will be available in case of meter malfunction.

Each well outfitted with a dedicated MicroPurge™ pump will be sampled using the pump immediately upon completion of purging. Field measurements of pH, temperature and conductivity will be collected at the time of sample collection. The flowrate of pumping at the time of sampling shall be 100 ml/min or less.

Each well without a dedicated pump will be sampled using a new, factory-cleaned, disposable Teflon bailer with bottom check-valve and sample discharge mechanism. A new segment of Teflon-coated stainless steel wire, inert mono-filament line or nylon cord will be used to lower and retrieve each bailer. The bailer will be lowered into each well to the point of ground water contact, then allowed to fill as it sinks below the water table. Bottom contact will be avoided in order to avoid suspending sediment in the samples. The bailer will be retrieved and emptied in a manner which minimizes sample agitation.

Samples will be transferred directly from the Teflon bailer into a sample container that has been specifically prepared for the preservation and storage of compatible parameters. A bottom emptying device provided will be used to transfer samples from bailer to sample container. The generation air bubbles and sample agitation will be minimized during bailer discharge.

Ground water samples will be collected and contained in the order of volatilization sensitivity. Initially, only purgeable organics and total metals specimens will be collected for laboratory analysis. Subsequently, other analytical methods may required. When collected, the following order of sampling will be observed:

- Initial measurements of pH, temperature, conductivity and turbidity
- Volatile and Purgeable Organics
- Base Neutral and Acid Extractable Organics
- Total Metals
- Final measurements of pH, temperature, conductivity and turbidity

All samples will be collected and analyzed in an **unfiltered** state during all sampling events.

All reusable sampling equipment including water level probes, pH/conductivity meters, interface probes, and filtering pumps which might contact aquifer water or samples will be thoroughly decontaminated between wells by washing with non-phosphate soapy, de-ionized water and triple rinsing with deionized water. Detailed equipment decontamination procedures are detailed in Section 2.6.

2.4 Field Quality Assurance

Field and trip blanks will be prepared, handled and analyzed as ground water samples to ensure cross-contamination has not occurred. One set of trip blanks, as described later in this document, will be prepared before leaving the laboratory to ensure that the sample containers or handling processes have not affected the quality of the samples. One set of field (equipment) blanks will be created in the field at the time of sampling to ensure that the field conditions, equipment, and handling during sampling collection have not affected the quality of the samples. A duplicate ground water sample may be collected from a single well as a check of laboratory accuracy. Blanks and duplicate containers, preservatives, handling, and transport procedures for surface water samples will be identical to those noted for ground water samples.

2.5 Sample Containers

Sample containers will be provided by the laboratory for each sampling event. Containers must be either new and factory-certified analytically clean by the manufacturer, or cleaned by the laboratory prior to shipment for sampling. Laboratory cleaning methods will be based on the bottle type and analyte of interest.

2.6 Equipment Decontamination

All non-dedicated equipment (such as water level meter) that will come in contact with the well casing and water will be decontaminated. The procedure for decontaminating non-dedicated equipment is as follows:

1. Phosphate-free soap and tap water wash
2. Deionized or distilled water rinse
3. Isopropyl alcohol rinse
4. Deionized or distilled water rinse and air dry
5. Aluminum foil wrap with shiny side out

3.0 Surface Water Sample Collection

This section present details of the procedures and equipment required to perform surface water field measurements and sampling from springs, streams and ponds during each monitoring event. A description of proposed surface water monitoring station locations is presented in **Table 2**. The proposed surface water monitoring station locations are shown in **Figure 2**.

3.1 Surface Water Level Observations

Surface water quality analyses are particularly sensitive to site hydrologic conditions and recent precipitation events. Water levels may fluctuate drastically in comparison the ground water table and may result in either diluting or increasing contaminant loadings. The scheduling of sampling events and the interpretation surface water data must take into account climatic, recent weather and sampling station conditions.

Surface water level and sampling station conditions will be observed one day prior to, and during each sampling event. Surface water observations will include the flood stage in streams, seasonal base flow conditions, and confirm location and timing for meaningful surface water quality sampling. The following objective observations will be recorded in a dedicated field book prior to sample collection:

- Sample location designation
- Relative stream water level

- Surface water clarity
- Rate of flow and degree of stagnation
- Physical conditions of sampling station
- Changes in surface monitoring station conditions and surroundings.

Modifications to surface sampling station conditions may be required prior to each sampling event. These modifications may include the removal of surface and submerged debris, slightly deepening the station to allow sample container immersion, or channeling/piping to consolidate local discharge. When modifications are required, sufficient time will be allowed for settlement of suspended solids between the disturbance and sample collection. A minimum settling period of four hours prior to sampling will be observed.

3.2 Surface Water Sample Collection

Surface water samples will be obtained from areas of minimal turbulence and aeration. New latex or nitrile surgical gloves will be donned prior to sample collection. The following procedure will be implemented regarding sampling of surface waters:

1. Put on new latex or nitrile surgical gloves.
2. Hold the bottle in the bottom with one hand, and with the other, remove the cap.
3. Push the sample container slowly into the water and tilt up towards the current to fill. A water depth of six inches is generally satisfactory. Care will be taken to avoid breaching the surface or losing sample preservatives while filling the container.
4. If there is little current movement, the container should be moved slowly, in a lateral, side to side direction, with the mouth of the container pointing upstream.

Temperature, pH, specific conductivity and turbidity will be taken at the start of sampling as a measure of field conditions and check on the stability of the water samples over time. Measurements of temperature, pH, specific conductivity and turbidity will be recorded for all surface water samples. The calibration of the pH, temperature, conductivity , and turbidity meters will be completed at the beginning of each sampling event, according to the manufacturers'

specifications and consistent with Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846).

Surface water samples will be collected and contained in the order of volatilization sensitivity of the parameters as follows:

- Measurements of pH, temperature, conductivity and Turbidity
- Volatile and Purgeable Organics
- Base Neutral and Acid Extractable Organics
- Total Metals

All surface water samples will be collected in an unfiltered state.

All field meters which might contact surface water samples will be thoroughly decontaminated between stations by washing with non-phosphate soapy, de-ionized water and triple rinsing with deionized water.

One surface water samples will be collected at this site (shown on **Figure 2** and listed in **Table 2**). Samples will be collected directly from the station in the container that has been specifically prepared for the preservation and storage of compatible parameters. Samples will be collected in a manner that assures minimum agitation. Additional blanks and duplicate samples will not be taken with the surface water samples.

Sample containers shall be prepared and provided by the laboratory for each surface water sampling event. Each sample containers' preparation and preservatives shall be the same as those utilized for ground water sampling and addressed previously in Section 2.5.

4.0 Field QA/QC Program

Field Quality Assurance/Quality Control (QA/QC) requires the routine collection and analysis of trip blanks to verify that the handling process has not affected the quality of the samples. Any contaminants found in the trip blanks could be attributed to:

1) interaction between the sample and the container,
2) contaminated source water, or
3) a handling procedure that alters the sample.

The laboratory will prepare a trip blank by filling each type of sample bottle with distilled or deionized water. Trip blanks will be placed in bottles of the specific type required for the analyzed parameters and taken from a bottle pack specifically assembled by the laboratory for each ground water sampling event. Trip blanks will be taken prior to the sampling event and transported with the empty bottle packs. The blanks will be analyzed for volatile and purgeable organics only.

The concentration levels of any contaminants found in the trip blank will be reported but will not be used to correct the ground water data. In the event that elevated parameter concentrations are found in a blank, the analysis will be flagged for future evaluation and possible re-sampling.

All field instruments utilized to measure ground water characteristics will be calibrated prior to entering the field, and recalibrated in the field as required, to insure accurate measurement for each sample. The specific conductivity and pH meter shall be recalibrated utilizing two prepared solutions of known concentration in the range of anticipated values (between 4 and 10). A permanent thermometer, calibrated against a National Bureau of Standards Certified thermometer, will be used for temperature meter calibration. The turbidity meter will be calibrated using Lucite standard blocks provided by the manufacturer.

5.0 Sample Preservation and Shipment

Methods of sample preservation, shipment, and chain-of-custody procedures to be observed between sampling and laboratory analysis are presented in the following sections.

5.1 Sample Preservation

Proper storage and transport conditions must be maintained in order to preserve the integrity of samples between collection and analysis. Wet ice will be used to cool and preserve samples, as directed by the analytical laboratory. Samples will be maintained at a temperature of 4° C. Dry ice is not to be used.

Pre-measured chemical preservatives will be provided in the sample containers provided by the analytical laboratory. Hydrochloric acid will be used as a chemical stabilizer and preservative for volatile and purgeable organic specimens. Nitric acid will be used as the preservative for samples for metals analysis.

Upon collection, samples will be placed on ice in high impact polystyrene coolers and cooled to a temperature of 4°C. Samples will be packed and/or wrapped in plastic bubble wrap to inhibit breakage or accidental spills. Chain-of-Custody control documents will be placed in a waterproof pouch and sealed inside the cooler with the samples for shipping. Tape and/or custody seals shall be placed on the outside of the shipping coolers, in a manner to prevent and detect tampering with the samples.

Samples shall be delivered to the analytical laboratory within a 24-hour period in person or using an overnight delivery service to insure holding times are not exceeded. Shipment and receipt of samples will be coordinated with the laboratory.

Chain-of-Custody control will be maintained from sampling through analysis to prevent tampering with analytical specimens. Chain-of-Custody control procedures for all samples will consist of the following:

1. Chain-of-Custody will originate at the laboratory with the shipment of prepared sample bottles and a sealed trip blank. Identical container kits will be shipped by express carrier to the sampler or site or picked up at the laboratory in sealed coolers.

2. Upon receipt of the sample kit, the sampler will inventory the container kit and check its consistency with number and types of containers indicated in the Chain-of-Custody forms and required for the sampling event.

3. Labels for individual sample containers will be completed in the field, indicating the site, time of sampling, date of sampling, sample location/well number, and preservation methods used for the sample.

4. Collected specimens will be placed in the iced coolers and will remain in the continuous possession of the field technician until shipment or transferral as provided by the Chain-of-Custody form has occurred. If continuous possession can not be maintained by the field technician, the coolers will be temporarily sealed and placed in a secured area.

5. Upon delivery to the laboratory, samples will be given laboratory sample numbers and recorded into a logbook indicating client, well number, and date and time of delivery. The laboratory director or his designee will sign the Chain-of-Custody control forms and formally receive the samples. The field technician, project manager and the laboratory director will work together to insure that proper refrigeration of the samples is maintained.

6. Copies of the complete Chain-of-Custody forms will be placed in the laboratory's analytical project file and attached to the laboratory analysis report upon completion.

Chain-of-Custody forms will be used to transfer direct deliveries from the sampler to the laboratory. A coded, express delivery shipping bill shall constitute the Chain-of Custody between the sampler and laboratory for overnight courier deliveries.

6.0 Field Logbook

The field technician will keep an up-to-date logbook documenting important information pertaining to the technician's field activities. The field logbook will document the following:

- Site Name and Location
- Date and Time of Sampling
- Climatic Conditions During Sampling Event
- Sampling Point/Well Identification Number
- Well Static Water Level
- Height of Water Column in Well
- Purged Water Volume and Well Yield (High or Low)
- Presence of Immiscible Layers and Detection Method
- Observations on Purging and Sampling Event
- Time of Sample Collection
- Temperature, pH, Turbidity, and Conductivity Readings
- Signature of Field Technician.

7.0 Laboratory Analysis

The ground and surface water parameters to be analyzed will be those specified in Table 1. These will include field indicators of water quality (pH, conductivity, temperature and turbidity) and selected purgeable organic as listed in Appendix I and Appendix II of 40 CFR.258 and 15 RCRA metals constituents (total metals analysis). All analytical methods are taken from Test Methods For Evaluating Solid Waste - Physical/Chemical Methods (SW-846) or Methods For the Chemical Analysis of Water and Wastes and will be consistent with DSWM's policies regarding analytical methods and PQLs. Analysis will be performed by a laboratory certified by the North Carolina DENR for the analyzed parameters.

Formal environmental laboratory Quality Assurance/Quality Control (QA/QC) procedures are to be utilized at all times. The owner/operator of the landfill is responsible for selecting a laboratory contractor and insuring that the laboratory is utilizing proper QA/QC procedures. The laboratory must have a QA/QC program based upon specific routine procedures outlined in a written laboratory Quality Assurance/Quality Control Manual. The QA/QC procedures listed in the manual shall provide the lab with the necessary assurances and documentation that accuracy and precision goals are achieved in all analytical determinations. Internal quality control checks shall be undertaken regularly by the lab to assess the precision and accuracy of analytical procedures.

During the course of the analyses, quality control data and sample data shall be reviewed by the laboratory manager to identify questionable data and determine if the necessary QA/QC requirements are being followed. If a portion of the lab work is subcontracted, it is the responsibility of the contracted laboratory to verify that all subcontracted work is completed by certified laboratories, using identical QA/QC procedures.

8.0 Data Evaluation

Copies of all laboratory results and water quality reports for the Johnston County Landfill will be kept at the Johnston County Landfill office. Reports summarizing all ground water quality results and data evaluation will be submitted to the DSWM for each sampling event. Upon receipt of each monitoring event's data, the water quality database of analyses will be updated.

Methods to evaluate the data are taken from North Carolina Solid Waste Rules and the EPA RCRA Ground Water Monitoring Technical Guidance Documents. There is existing ground water impact at the site due to unlined MSW Phases 1 & 2 and Phase 3. Therefore, statistical analyses will be performed for this C&D landfill to determine if contaminant levels are increasing due to possible impact from the C&D landfill. As there is existing impact, intra-well statistical analyses will be performed on laboratory data from ground water samples.

The North Carolina Solid Waste Rules provide several methods for statistical analysis of ground water data. These methods are:

1. Parametric Prediction Intervals
2. Non-Parametric Prediction Intervals
3. Tolerance prediction interval
4. Control chart
5. An alternative statistical test method that meets the performance standards of 40 CFR 258.53 (h)

The choice of appropriate methods for data analysis and presentation, including statistical tests, depends on the type of monitoring, the nature of the data, and the proportion of values in the data set that are below detection limits. The statistical analysis will be conducted separately for each detected organic constituent based on the EPA's Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Interim Final Guidance Document (1989) and Addendum to the Interim Final Guidance Document (1992). Any statistical analyses will be performed in general accordance methods outlined in the North Carolina State Regulations 15A NCAC 13B.1632.

9.0 Record Keeping and Reporting

9.1 Sampling Reports

Copies of all laboratory analytical data will be forwarded to the DWM within 45 calendar days of the sample collection date. The analytical data submitted will specify the date of sample collection, the sampling point identification and include a map of sampling locations. Should a significant concentration of contaminants be detected in ground and surface water, as defined in North Carolina Solid Waste Rules, Ground Water Quality Standards, or Surface Water Quality Standards, the owner/operator of the landfill shall notify the DWM and will place a notice in the landfill records as to which constituents were detected.

9.2 Well Abandonment/Rehabilitation

Should wells become irreversibly damaged or require rehabilitation, the DWM shall be notified. If monitoring wells and/or piezometers are damaged irreversibly they shall be abandoned under the direction of the DWM. The abandonment procedure in unconsolidated materials will consist of over-drilling and/or pulling the well casing and plugging the well with an impermeable, chemically-inert sealant such as neat cement grout and/or bentonite clay. For bedrock well completions the abandonment will consist of plugging the interior well riser and screen with an impermeable neat cement grout and/or bentonite clay sealant.

9.3 Additional Well Installations

The data will be analyzed to verify the correct placement of wells and determine locations for future monitoring wells, if necessary. Any additional well installations will be carried out in accordance with DWM directives. If the potentiometric maps reveal that the depths, location, or number of wells is insufficient to monitor potential releases of solid waste constituents from the solid waste management area, new well locations and depths will be submitted to the DWM for approval.

All monitoring wells shall be installed under the supervision of a geologist or engineer who is registered in North Carolina and who will certify to the DWM that the installation complies with the North Carolina Regulations. Upon installation of future wells the documentation for the construction of each well will be submitted by the registered geologist or engineer within 30 days

after well construction. Plans to install MicroPurge™ pumps in any additional well installed on-site shall be submitted to DSWM for approval prior to pump installation.

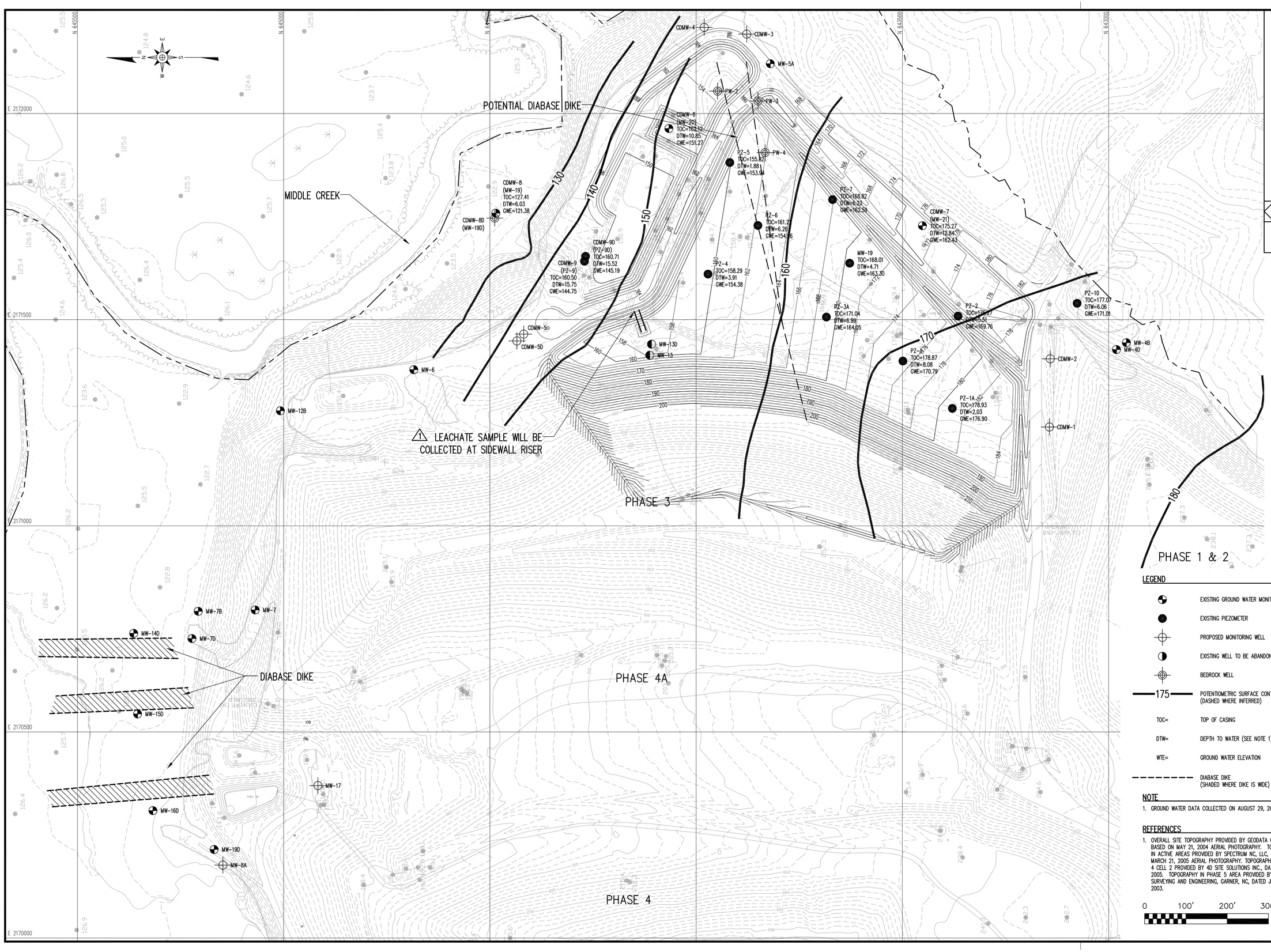
9.4 Implementation Schedule

This program is currently in place and being utilized at the site, with the exception of the addition of MW-8a, MW-14d, MW-15d, MW-16d and MW-17 and the leachate samples. These wells have also been proposed in a letter from GNRA to NCDENR dated July 18, 2001 regarding a recent geophysical evaluation of portions of the site and the proposed installation of additional wells. These well installations will be implemented upon approval from NCDENR.

Table 1
Ground Water Monitoring Well Network
Johnston County Landfill
Johnston County, North Carolina
Proposed C&D Landfill

Monitoring Well	Completion Type	Associated Wells	Screened Interval	Monitoring Program
CDMW-1	Shallow	none	TBD	Appendix I List
CDMW-2	Shallow	none	TBD	Appendix I List
CDMW-3	Shallow	none	TBD	Appendix I List
CDMW-4	Deep	none	TBD	Appendix I List
CDMW-5	Shallow	CDMW-5d	TBD	Appendix I List
CDMW-5d	Shallow	CDMW-5	TBD	Appendix I List
CDMW-6	Shallow	none	TBD	Appendix I List
CDMW-7	Deep	none	TBD	Appendix I List
CDMW-8	Shallow	CDMW-8d	TBD	Appendix I List
CDMW-8d	Deep	CDMW-8	TBD	Appendix I List
CDMW-9	Shallow	CDMW-9d	TBD	Appendix I List
CDMW-9d	Deep	CDMW-9	TBD	Appendix I List

Notes: 1.) Well locations shown on WQMP Figure 1
2.) TBD = To Be Determined



LEGEND

- EXISTING GROUND WATER MONITORING WELL
- EXISTING PIEZOMETER
- PROPOSED MONITORING WELL
- EXISTING WELL TO BE ABANDONED
- BEDROCK WELL
- 175 — POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- TOC= TOP OF CASING
- DTW= DEPTH TO WATER (SEE NOTE 1)
- WTE= GROUND WATER ELEVATION
- DIABASE DIKE (SHADED WHERE DIKE IS WIDE)

NOTE

1. GROUND WATER DATA COLLECTED ON AUGUST 29, 2005.

REFERENCES

1. OVERALL SITE TOPOGRAPHY PROVIDED BY GEODATA CORPORATION, BASED ON MAY 21, 2004 AERIAL PHOTOGRAPHY. TOPOGRAPHY IN ACTIVE AREAS PROVIDED BY SPECTRUM NC, LLC, BASED ON MARCH 21, 2005 AERIAL PHOTOGRAPHY. TOPOGRAPHY OF PHASE 4 CELL 2 PROVIDED BY 4D SITE SOLUTIONS INC., DATED JUNE 2, 2005. TOPOGRAPHY IN PHASE 5 AREA PROVIDED BY SOUTHMND SURVEYING AND ENGINEERING, GARNER, NC, DATED JUNE 16, 2003.

0 100' 200' 300'

NO.	REVISION	DATE
1	ADDED LEACHATE SAMPLE LOCAION CALLOUT	2/20/06

G. N. RICHARDSON & ASSOCIATES, INC.
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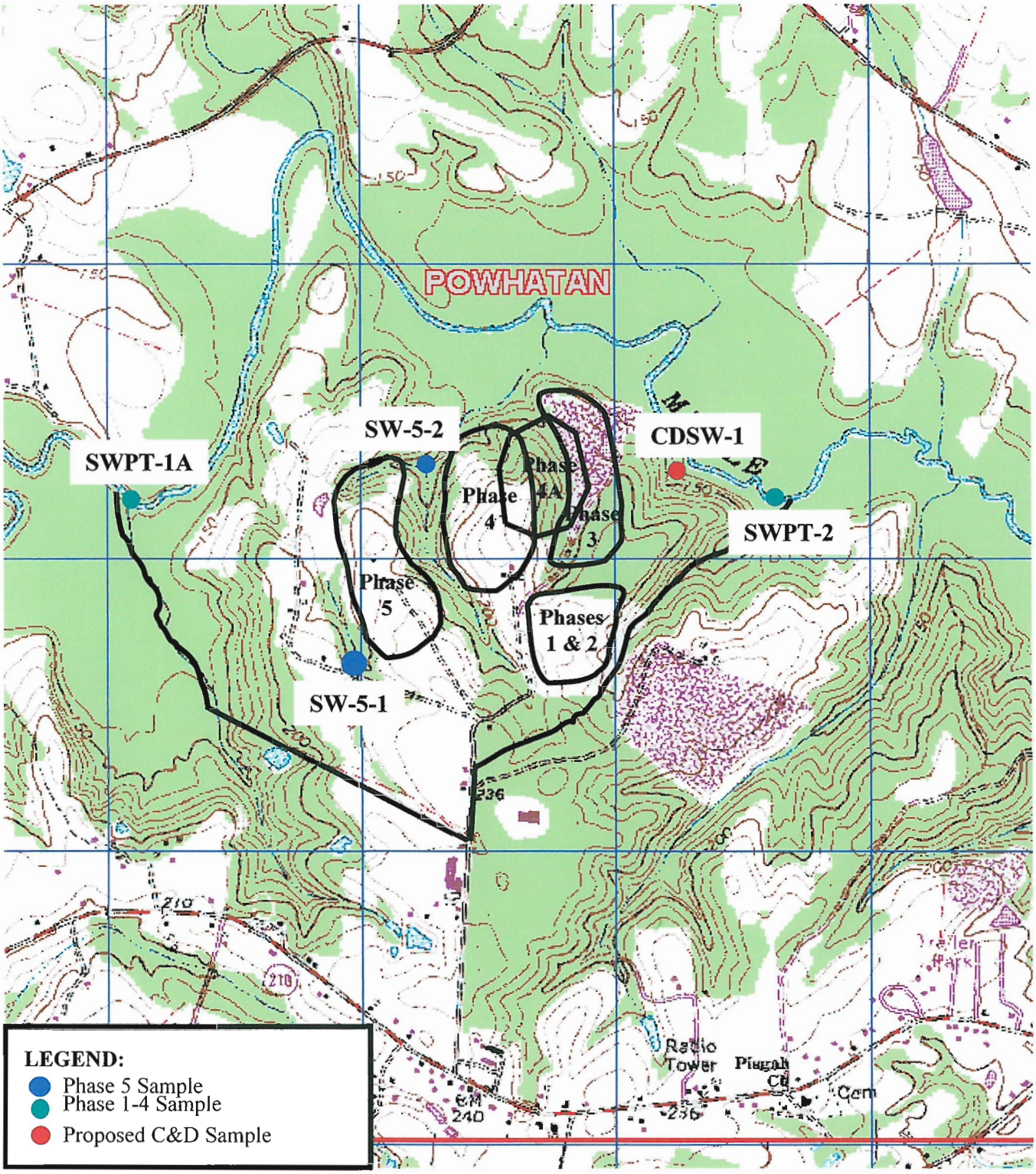
SEAL

SEAL

PROJECT TITLE:
JOHNSTON COUNTY LANDFILL
SMITHFIELD, NORTH CAROLINA

DRAWING TITLE:
POTENTIOMETRIC SURFACE MAP
AUGUST 2005 DATA
WITH PROPOSED
WELL LOCATIONS

DESIGNED BY:	DRAWN BY:
J.A.S.	C.T.J.
CHECKED BY:	PROJECT NO.:
	JOHN-23
SCALE:	DATE:
AS SHOWN	OCT. 2005
FILE NAME	
JOHN-D0385A	
SHEET NO.	DRAWING NO.
	FIG. 1



Surface Water Sampling Locations

Johnston County Landfill

Smithfield, North Carolina

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SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
NTS	CJ	JAS	11/3/05	Johnston-23	2	John sw loc.ppt