| Fac/Perm/Co ID # | Date | Doc ID# |
|---|---|---|
| 20-02 | 8,9,10 | 11313 |

# Groundwater and Surface Water Sampling and Analysis Plan

*Prepared for*

Cherokee County Landfill, Phase 2
Marble, Cherokee County, North Carolina

RECEIVED

JUL 29 2010

SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

**MESCO Project Number: G01099.6**

This report constitutes *Appendix E* of the *Design Hydrogeologic Study-Cherokee County Landfill, Phase 2.*
**Submitted on 07/03/09**
**Revision 2 submitted on July 26, 2010**

LICENSE NUMBER: C-0281
Municipal Services Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
P.O. BOX 828 MOREHEAD CITY, N.C. 28557 (252) 726-9481

Mark Brown, SEAL PG
Senior Professional Geologist
NC License 1711

NORTH CAROLINA LICENSED SEAL 1711 GEOLOGIST STEPHEN MARK BROWN

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# 1 INTRODUCTION

## 1.1 Objective and Criteria

The objective of this *Groundwater and Surface Water Sampling and Analysis Plan* (*Plan*) is to provide clear guidelines and procedures for field and laboratory personnel when obtaining and testing groundwater and surface water samples. This *Plan* applies to Phase 1 and Phase 2 portions of the Cherokee County Subtitle D Landfill and supersedes the previous monitoring plan originally developed for the Phase 1 portion of the referenced facility. Note that groundwater and surface water monitoring points designed to monitor the Phase 2 area in particular shall be sampled at least once prior to acceptance of waste in the are to provide background water quality information. The sampling procedures outlined in this *Plan* are guidelines by which sampling will be performed. Deviation from the procedures may be warranted depending on facility conditions or unforeseen sampling variables. Alternative sampling procedures must conform to the *N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities* (Guidance Document). Copies of the NCDENR Solid Waste Section (Section) technical guidelines for sampling and monitoring are presented in the **Attachments**.

Four independent groundwater and surface water monitoring events will be performed within the first semi-annual sampling event, with at least one sampling event occurring prior to the issuance of the *Permit to Operate*. The remaining three sampling episodes will be completed within six months of the first sampling episode. The results of the sampling episodes will be used as baseline water quality information for the subsequent sampling events. All groundwater and surface water monitoring points shall be sampled semi-annually thereafter for the Appendix I list of constituents. In addition to the Appendix I list of constituents, a leachate sample collected semi-annually will be analyzed for biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrate, nitrite, sulfate, total phosphorus, and pH. The relevant point of compliance, as presented on **Plate A,** is that distance between the waste boundary and the groundwater monitoring wells.

# 2 CURRENT SAMPLING AND ANALYSIS PLAN

The current SAP, approved by the Section on November 24, 2003 as part of the *Design Hydrogeologic Study* for the Phase 2 cell, included ten groundwater monitoring wells and two surface water sampling points.

## 2.1 Existing Groundwater Monitoring Wells

Ten monitor wells comprise the groundwater monitoring phase of the current SAP. The ten sampling points include:

MW-1, MW-2, MW-3, MW-4, MW-5, [MW-6S, MW-6D (a nested pair)], MW-7, MW-8, and MW-9

MW-1, the background well for the entire monitored area, is located in the northern part of the property on the hill crest overlooking the waste area to the south. This section of the property is generally an area of groundwater recharge; hence the location of MW-1 is well suited for the placement of a background well.

MW-2, located to the southeast of the leachate lagoon near the scalehouse, is designed to intercept a potential leachate migration from the lagoon resulting from leakage. Groundwater in this immediate area typically flows southeasterly toward the Valley River.

Based on general on-site groundwater flow directions, MW-3, MW-4, MW-5, MW-6S, and MW-6D are positioned to detect, a potential plume migration originating from the eastern two thirds of the Phase 1 area. MW-3 is located to intercept groundwater flowing easterly to southeasterly from the area north of Phase 1 toward the zone of discharge. MW-4, located adjacent to a drainage feature, monitors groundwater migrating toward the feature and eventually to Valley River. MW-5 monitors groundwater in the floodplain where it typically flows easterly and southeasterly. MW-6S and MW-6D are a nested pair located south of the sump area. The deep well (MW-6D) was installed due to the occurrence of relatively shallow bedrock in this area that, during extremely dry seasons, might be reflected as a drop in the water table to below the saprolite-rock interface (contact).

Monitor wells MW-8 and MW-9, both of which are located near the base of the Phase 2 southern berm, are designed to detect leachate migration originating from Phase 2. With groundwater in Phase 2 exhibiting nearly uniform southerly to southwesterly flow, the two well should intercept groundwater migrating through Phase 2. MW-8 monitors the eastern half of the Phase 2 area while MW-9 monitors the western half.

### 2.2 Existing Surface Water Sampling Points

Two surface water sampling points (SW-2 and SW-4) located along the Valley River currently comprise the surface water monitoring portion of the approved SAP. The surface water sampling points were selected to detect an unlikely discharge of leachate from the landfill facility into the streams. SW-2 serves as the upstream monitoring point and SW-4 serves as the downstream monitoring point. There is an additional monitoring point (SW-1) located farther upstream from SW-2, which serves as the upstream point for the closed landfill facility located across the Valley River from the this facility. SW-1 is not part of the monitoring network for this facility but because SW-2 monitors surface water for both facilities, it is required that SW-1, SW-2, and SW-4 be sampled concurrently for the data to be mutually useful. Locations of sampling points are depicted in **Plate A**.

### 2.3 Leachate Lagoon

A leachate sample shall be collected at the end of the force main pipe located at eh leachate lagoon as specified in Plate A. This sampling point is to be used for both phases of the facility. The leachate sample will be analyzed for BOD, COD, phosphorus, sulfate, nitrate, pH and the Appendix I list of constituents.

### 2.4 Monitoring Plan for Closed Sanitary Landfill

This section summarizes the monitoring plan currently in place for the closed sanitary landfill facility located on the southern bank of Valley River across fro the Subtitle D Landfill facility. Although the monitoring of the closed facility is not officially a part of the monitoring plan outlined herein, its inclusion in this document was deemed appropriate, due to the fact that the new and closed facilities share the same surface water sampling points, which in turn necessitates concurrent sampling of the two facilities.

Presently, the plan consists of nine groundwater monitoring wells, four private residential wells, and two surface water sampling points. The nine monitoring wells are numbered MW-1, MW-2, MW-2R, MW-3, MW-4R, MW-5, MW-6, MW-6R, and MW-7 and the two surface water monitoring points are numbered SW-1 and SW-2. The four residential wells are designated by the residents' names (Pendergrass, Rathbone, Solesbee, and Van Buskirk, formerly know as Haney). [Note that MW-4, having been replaced by MW-4R, is no longer in the network.]

MW-2 presently serves as the background well for the closed landfill facility site. Groundwater generally moves northwesterly toward Valley River. Wells MW-1, MW-4R, MW-5, and MW-7, all of which are placed downgradient form the waste area, are designed to detect potential migration of landfill leachate before it reaches the discharge zone. MW-6 is located near the southwestern corner of the waste area and

is intended to accommodate a potential shift o f the groundwater divide which is assumed to be present in the area south of the landfill and north of Laurel Branch, a tributary to Valley River which flows westerly. Although, at the time of MW-6 installation, the divide was located outside to the south of the landfill facility, MW-6 was installed to detect unlikely southward migration of landfill leachate that may result in case of a shift in the location of the divide.

MW-2R and MW-6R are placed in response to recent detections of volatile organic compounds (VOCs) in their respective parent monitoring wells. Currently, the two wells are to be sample in conjunction with MW-2 and MW-6, but the sampling of MW-2 and MW-6 may be discontinued in future if MW-2R and MW-6R are to remain on the monitoring network on a permanent basis.

Two surface water monitoring points SW-1 and SW-2 are located along Valley River to monitor unlikely discharge of landfill leachate into the river. SW-1 is the upstream monitoring point while SW-2 is the downstream point. Since SW-2 also serves as the upstream point for the new facility, this will necessitate that sampling of all of the mentioned surface water monitoring points (SW-1, SW-2 and SW-4) be completed concurrently to avoid duplication effort.

### 2.5 Summary

In summary, the following groundwater and surface water monitoring points are to be sampled as part of this *Plan.*

- MW-1, MW-2, MW-2R, MW-3, MW-4R, MW-5, MW-6, MW-6R, and MW-7 in the closed facility
- Four residential wells (Pendergrass, Rathbone, Solesbee, and Van Buskirk) located adjacent to the facility
- MW-1, MW-2, MW-3, MW-4R, MW-5, MW-6S, MW-6D, MW-7, MW-8, and MW-8 in the Subtitle D facility
- Leachate sampling point at the end of the force main

The goal of the Plan is to obtain the desired sample while neither adding nor subtracting any constituent to or from the sample or the monitoring well. The plan details described below, when followed, are considered adequate to reduce cross-contamination or contamination from external sources of the wells sampled. These guidelines are drawn, in part, directly from, and are intended to be used in conjunction with, the NC Water Quality Monitoring Guidance Document (Guidance Document). Sampling procedures will be performed by guidelines set forth in the Water Quality Monitoring Plan.

# 3 SAMPLE PROCEDURES

## 3.1 Sampling Equipment

Groundwater purging and sampling will be performed using a submersible pump and disposable polyethylene bailers. A new bailer will be used to sample each individual well. *Under no circumstance will a disposable bailer used to sample a given well be used to sample any other or remaining well(s).* The following procedure will be used decontaminate the submersible pump:

1. Phosphate-free detergent & de-ionized or distilled water rinse.
2. De-ionized or distilled water rinse.
3. Isopropyl alcohol (isopropanol) rinse.
4. De-ionized or distilled water rinse.

At least one equipment blank will be collected during pump decontamination procedures to ensure that cross-contamination has not occurred as a result of the decontamination process. The standard equipment necessary to conduct sampling for each well consists of sample containers (including trip blanks and equipment blanks), one wide-mouth container, at least one 100-ft spool of nylon twine, at least one box of disposable latex/nitrile gloves, temperature/pH/oxygen-reduction potential/conductivity indicator, water level indicator, storage coolers, and ice. All equipment subject to damage and contamination will be transported in sealed, plastic bags or storage containers. The water level indicator will be decontaminated in accordance with Steps 2 and 3 described above prior to placement in a clean plastic bag or storage container.

## 3.2 Sampling Containers

Ground and surface water monitoring will include VOCs and inorganic (metals) analyses. Samples will be collected for the various analyses in laboratory-supplied containers.

1. Each sample container will be clearly labeled providing the following information: site name, county location, sample identification number, parameters to be analyzed, preservative added, date and time of sampling, and initials of the sampler.
2. Samples to be analyzed for VOC concentrations will be collected first in three 40-ml glass vials with Teflon septa caps. The sample vials will be completely filled to create zero headspace in the vials.
3. Samples to be analyzed for inorganic contamination will be collected second in a quart/1-liter polyethylene container.

All sample containers will be obtained from an independent laboratory in a sterilized condition and with the appropriate, method-specific preservative. Care will be taken by the field technician to prevent preservative wash out of the sample containers due to overfilling during sample collection.

# 4 SAMPLE COLLECTION

Wells will be sampled in order from upgradient to downgradient, or when previous analytical data is available, from lowest to highest contamination. This procedure is required to limit the potential of cross contamination between sampling points.

## 4.1 Preparation Set-Up

A clean sheet of plastic will be placed around the well to provide a clean surface for sampling equipment. The total well depth read from the well tag and the measured depth to water, determined using the water level indicator, will be used to compute the depth of water in the well. The total well depth will be measured and compared to the depth indicated on the well tag as a check for silt buildup or blockage at depth.

All meters used to monitor purge parameters will be calibrated immediately prior to purging and sampling, and those readings recorded in a field logbook. Entries will always include pre- and post-calibration readings as well as the model and serial number of the equipment and the date, time, and person performing the calibration(s). Two standards, which bracket the average or suspected measurements for pH and specific conductance, will be used at the site. Since natural waters (including those impacted by environmental contaminants) tend to have pH values less than 7.0, pH buffers of 4.0 and 7.0 will typically be used for instrument calibration.

The field technician will wear disposable nitrile gloves during sampling to minimize the risk of personal exposure to potentially harmful chemical substances and to minimize the risk of sample cross-contamination. Fresh pairs of nitrile gloves will be worn during each purge and sampling event. The groundwater samples will be transferred from the bailers into method-specific and appropriately preserved containers and placed into a clean cooler containing ice to chill the samples to a temperature of approximately 4$^{o}$C.

Indicator parameters such as pH, temperature and specific conductance will be measured during purging as an indication that groundwater representative of the formation surrounding a given well is being sampled. Purging is considered complete when at least three well volumes have been purged and indicator parameters have stabilized such that three successive readings vary by no more than 10%. Purging may need to be continued beyond five well volumes if indicator parameters have not stabilized. All information will be recorded on a field data sheet or in a field logbook with copies submitted to the Division of Waste Management with the analytical results.

### 4.2 Purging

Each well will be purged of approximately three (3) to five (5) volumes of standing water and allowed to settle prior to collection of groundwater samples. If the well should go dry and not recharge before the requisite well volumes are removed, the well will be allowed to recharge and a sample will be collected within 24 hours of the initial purging. The amount of standing water will be calculated by first subtracting the depth-to-water from total well depth. The amount of water in the well (in gallons) will then be determined by using the chart on **Plate C**. For example, a two-inch well that is 29 feet deep and contains 19 feet of standing water will have a well volume of ~3.3 gallons.

After determination of the amount of water to be purged from a given well, the equipment necessary for purging will be assembled at the well. The disposable bailer will be maintained in a stable, upright position while the upper portion of the plastic wrapping will be pulled away to expose only the eyelet used for securing twine to the bailer. After the twine has been secured to the bailer with gloved hands, the bailer will be suspended as the remaining plastic is removed. The bailer will be lowered slowly into the well until the bailer contacts groundwater. The bailer twine will then be cut to an adequate length and secured to prevent loss of the bailer in the well. At no time during purging will the bailer twine be allowed to touch the ground. In order to not allow the twine to touch the ground during purging, the twine will be collected when raising the bailer either by loops gathered in one hand or by alternating hand-to-hand as the bailer is pulled from the well. When purging deep wells (in excess of 40 feet), the ground and the well head may be covered with a clean plastic bag or sheet of plastic with a slit cut to allow the plastic to slide over the well head. This will be a separate sheet of plastic from the one used for the sampling equipment.

### 4.3 Groundwater Sample Collection

The bailer will be lowered slowly into the well to avoid volatilization of any dissolved-phase compounds that may be present in the groundwater. Once full, the bailer will be retrieved and containers filled by emptying the water through the hole at the bottom of the bailer. Glass 40-mL vials for VOC analyses will be filled in such a manner as to produce zero headspace in the vials. Polyethylene containers for metals analyses will be filled and sealed with the cap, leaving about ½-inch of airspace at the top. In addition to collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements. Upon completion of sampling, all groundwater samples, including equipment and trip blanks, will be placed in labeled and sealed plastic bags and stored in ice-filled coolers to chill the samples to $4^{o}$C pending transport to a NCDENR-certified analytical laboratory. Contaminated nitrile gloves and twine will be discarded.

### 4.4 Surface Water Sample Collection

Surface water sampling will be taken with given consideration to minimize turbulence and aeration. As during groundwater sampling, surface water samples will be collected by a field technician wearing disposable gloves. Containers will be dipped at sampling location points by gently dipping the sample container into surface water and allowing surface water to flow over the mouth of container so as not to displace any preservative within the sample container. If there is little current movement, the container will be moved slowly through the water laterally. During times of low water, if the water is not deep enough to allow filling of sample containers, an appropriately decontaminated sampling cup will be used to retrieve the sample. All containers will be treated in the same manner as the groundwater samples. The samples will be sealed in labeled, plastic bags, and stored in an ice-filled cooler to chill the samples to $4^{o}C$ pending transport to a NCDENR-certified analytical laboratory.

### 4.5 Leachate Sample Collection

The facility leachate will be gravity drained to the existing leachate lagoon. Leachate samples will be collected from the inflow pipe at the lagoon and will be analyzed for BOD, COD, phosphorus, sulfate, nitrate, pH and the Appendix I list of constituents.

### 4.6 Laboratory Chain of Custody

Chain-of-custody forms will be used to document the handling of all samples collected and listing all individuals who have taken possession of a given set of samples, including field personnel, laboratory couriers, and laboratory personnel. Trip blanks, equipment blanks, and sample containers will all travel and be stored together. Trip blanks will remain in the condition they are received from the laboratory and will not be opened or tampered with during the sampling. A chain-of-custody record will be completed for each day's samples, indicating the date and time, sample location, sample matrix (soil, water, etc.), and laboratory analyses to be conducted.

# 5 SAMPLE ANALYSIS

When the water samples reach the laboratory, they will be transferred to a sample custodian who will sign the chain-of-custody documentation as receipt of the samples. Internal control of the water samples in the laboratory will be in accordance with QA/QC procedures for the laboratory. Copies of QA/QC manuals for approved laboratories are on file at the Solid Waste Section.

Groundwater, surface water and leachate will be analyzed for the Appendix I list of chemical constituents; QA/QC procedures utilized during the testing will be in conformance with the laboratory QA/QC manual. Leachate samples will also be analyzed for BOD, COD, phosphate, nitrate, sulfate, and pH. In addition, practical quantitation limits (PQLs) for each of the constituents will be determined in accordance with the equipment that is used in the laboratory testing.

# 6 CONCLUSION

This SAP, included as part of the *Design Hydrogeologic Study* for the proposed Cherokee County Municipal Solid Waste Landfill - Phase 2, meets the requirements as described in Rule .1623(b)(3). The groundwater and surface water monitoring plan is designed to be effective in the early detection of any possible release of hazardous constituents to the uppermost aquifer.