SHIELD ENGINEERING, INC.

March 26, 2013

Mr. Ervin Lane
Solid Waste Section
Division of Waste Management
NCDENR
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Subject: **Semi-Annual Groundwater Monitoring Report**
City of Albemarle Landfill
DSWM Permit No. 84-01
Shield Project 1110192

Dear Mr. Lane:

On behalf of City of Albemarle, Shield Engineering (Shield) has completed the first 2013 Semi-Annual Sampling and Analysis event at the City of Albemarle Active C&D and closed Municipal Solid Waste Landfill (MSWLF) and the Subtitle D Lined MSWLF. The results are contained in the attached report.

Please contact the undersigned at (704) 394-6913 if you have any questions or comments about this report or other landfill-related issues.

Sincerely,
SHIELD ENGINEERING, INC.

NORTH CAROLINA PROFESSIONAL SEAL 20055 ENGINEER J. DAVID WALLACE

J. David Wallace, P.E.
Senior Engineer

Keith A. Anthony, P.E.
Principal Engineer

Attachments

cc: Mr. Mike Lambert, Director of Public Works (City of Albemarle)

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Charlotte, NC 28208

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DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- In accordance with NC General Statutes Chapter 89C and 89E and NC Solid Waste Management Rules 15A NCAC 13B, be sure to affix a seal to the bottom of this page, when applicable.
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

SHIELD ENGINEERING, INC.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: J. David Wallace, P.E. Phone: (704)-971-4149

E-mail: dwallace@shieldengineering.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
CITY OF ALBEMARLE LANDFILL	40592-B STONY GAP ROAD ALBEMARLE NORTH CAROLINA, 28001	84-01	.1600	JANUARY 14-17, 2013

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify)
☐ Other(specify)

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

J. David Wallace, P.E.	SENIOR ENGINEER	(704)-971-4149
Facility Representative Name (Print)	Title	(Area Code) Telephone Number

J. David Wallace 3/26/13

Signature Date

Affix NC Licensed/ Professional Geologist/Engineer Seal here:

NORTH CAROLINA PROFESSIONAL SEAL 20055 ENGINEER J. DAVID WALLACE

Revised 01/2007

REPORT OF
SEMI-ANNUAL SAMPLING AND ANALYSIS
JANUARY 2013
CITY OF ALBEMARLE LANDFILL

ACTIVE C&D AND CLOSED MSWLF
SUBTITLE D LINED MSWLF
DSWM PERMIT NO. 84-01

Prepared for:

City of Albemarle – Public Works Department
Stanly County, North Carolina

March 26, 2013
Shield Project 1110192

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ENGINEERING, INC.

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ENGINEERING, INC.

TABLE OF CONTENTS

Page

1.0 BACKGROUND INFORMATION 1-1

1.1 ACTIVE C&D AND CLOSED MSWLF 1-2

1.2 SUBTITLE D LINED MSWLF 1-3

1.3 SAMPLING PLAN 1-4

2.0 ACTIVE C&D AND CLOSED MSWLF 2-1

2.1 SAMPLING AND CHEMICAL ANALYSES 2-1

2.2 GROUNDWATER AND SURFACE WATER SAMPLING 2-1

2.2.1 Groundwater Flow Characteristics 2-1

2.2.2 Indicator Parameters 2-1

2.3 RESULTS OF CHEMICAL ANALYSES 2-2

3.0 SUBTITLE D LINED MSWLF 3-1

3.1 SAMPLING AND CHEMICAL ANALYSES 3-1

3.2 GROUNDWATER AND SURFACE WATER SAMPLING 3-1

3.2.1 Groundwater Flow Characteristics 3-1

3.2.2 Indicator Parameters 3-2

3.3 RESULTS OF CHEMICAL ANALYSES 3-2

4.0 SUMMARY AND CONCLUSIONS 4-1

FIGURES

Figure 1 Site Vicinity Map
Figure 2 Groundwater Contour Map – City of Albemarle Landfill

TABLES

Table 1 Summary of Groundwater Data
Table 2 Groundwater Flow Characteristics – Active C&D and Closed MSWLF
Table 3 Field-Tested Parameters – Active C&D and Closed MSWLF
Table 4 Analytical Inorganic Parameters for Groundwater Samples – January 2013
Table 5 Analytical Organic Parameters for Groundwater Samples – January 2013
Table 6 Monitored Natural Attenuation Parameters for Groundwater Samples – January 2013
Table 7 Analytical Inorganic Parameters for Surface Water Samples – January 2013
Table 8 Groundwater Flow Characteristics – Subtitle D Lined MSWLF
Table 9 Field-Tested Parameters – Subtitle D Lined MSWLF

APPENDICES

Appendix A: Laboratory Report

1.0 BACKGROUND INFORMATION

The City of Albemarle Landfill (DSWM [Division of Solid Waste Management] Permit #84-01) is located on Stony Gap Road (SR 1720), in Stanly County, North Carolina (see Figure 1). Prior to operating as a C&D Landfill, the site formerly operated as an unlined Municipal Solid Waste Landfill (MSWLF) that consisted of two units. The first unit (Unit #1) was closed prior to October 1991 with a 24-inch final soil cover. The second unit (Unit #2) was closed with an 18-inch thick cohesive soil cap with a permeability of 10^{-5} centimeters per second (cm/sec) and an 18-inch thick soil erosive layer prior to June 1999 in accordance with the *Transition Plan*. The C&D Landfill is constructed and operating on top of the Unit #1 MSWLF.

Adjacent to the C&D Landfill, across the unnamed tributary of Jacobs Creek, on the same contiguous property is the active Subtitle D lined MSWLF. The lined MSWLF is comprised of two contiguous phases (Phase 1 and 2) which are combined and treated as a single unit for continuity of the reporting to the SWS. This active MSWLF also operates under DSWM Permit #84-01 and is also reported herein.

As specified within Solid Waste Management Rules as per Title 15A, Subchapter 13B, Rules .1630 - .1637 of the North Carolina Administrative Code (15A NCAC 13B.1630 - .1637) this report contains sampling procedures, field measurements, laboratory analytical results, characterization of the groundwater and surface water, and findings from this sampling event. Tables of the hydrogeologic properties of the underlying groundwater, field parameters, summary of the analytical results with detections of those constituents exceeding the North Carolina Groundwater Standards (i.e., 15A NCAC 2L.0202) (NC 2L Groundwater Standards), potentiometric map, and quality assurance/quality control data, are presented. Additionally the laboratory analytical reports with chains-of-custody (CoC) are included in Appendix A.

The sampling programs for these two areas (i.e., Active C&D and closed MSWLF; and, the Subtitle D lined MSWLF) are described in Sections 1.1 and 1.2, respectively. The sampling procedures are described in Section 1.3.

1.1 ACTIVE C&D AND CLOSED MSWLF

A groundwater monitoring system for the Active C&D and the closed MSWLF landfill has been installed in accordance with Solid Waste Management Rules 15A NCAC 13B.1630 - .1637.

The site-specific Sampling and Analysis Plan (SAP) contains a combination of detection, assessment and corrective action monitoring. Detection monitoring was performed on six monitoring wells (MW-4R, MW-5R, MW-8D, MW-11, MW-24, and MW-25); one surface water sampling location (SW-7); and, background monitoring well (MW-1). Corrective action monitoring was performed on six monitoring wells (MW-2, MW-3, MW-6, MW-7, MW-9, and MW-10). An area downgradient of the Phase 1 Subtitle D lined MSWLF; and, between the unnamed tributary of Jacobs Creek and the Active C&D and closed MSWLF around the Leachate Lagoon has been under assessment since July 2009. At a meeting with SWS on July 14, 2009 a subset of monitoring wells were selected for assessment monitoring in this area. Therefore, assessment monitoring was performed on Monitoring Wells MW-12, MW-13 and MW-23 around the Leachate Lagoon. These monitoring well locations are shown on Figure 2.

Three surface water sampling locations monitor the unnamed tributary of Jacobs Creek (i.e., SW-1, SW-6, and SW-7); with SW-1 upstream, SW-6 downstream, and SW-7 is located between these two locations (i.e., SW-1 and SW-6). Since the unnamed tributary of Jacobs Creek passes between the closed MSWLF and the Subtitle D lined MSWLF, these three surface water sampling locations are also included for the SAP for the Subtitle D lined MSWLF (see Section 1.2). A fourth surface water sampling location (SW-5) monitors surface water runoff from the closed MSWLF before the runoff enters into the unnamed tributary of Jacobs Creek. These four surface water monitoring locations are shown on Figure 2.

Groundwater and surface water samples have been collected at this site on a semi-annual basis since 1994, in accordance with Solid Waste Management Rule 15A NCAC 13B.1633(b). As a condition of the water quality monitoring program, semi-annual reports are required to be submitted to the North Carolina Solid Waste Section (SWS). Shield Engineering, Inc. (Shield) of Charlotte, North Carolina performed this sampling event on January 14 through 15, 2013 in accordance with the *Sampling and Analysis Plan* (SAP) contained in the *CAER* dated July 1, 2011 for this site; and, the SWS *Guidelines for Groundwater, Soil, and Surface Water Sampling* dated April 2008.

SWS Rule 15A NCAC 13B.1634(d)(2) requires that an Appendix I detection exceeding the NC 2L Groundwater Standards within the groundwater at any of the monitoring wells be followed by re-

sampling of "all wells of the approved detection monitoring system for the unit for all constituents listed in the Appendix I and for those constituents in Appendix II that have been detected". In the vicinity of the leachate lagoon Appendix II sampling has been previously performed at Monitoring Wells MW-12, MW-13, and MW-23. Hence, for this sampling event Appendix II sampling was again completed in these three monitoring wells and reported to the SWS herein. Appendix I sampling was completed for the remaining monitoring wells at this site.

1.2 SUBTITLE D LINED MSWLF

A groundwater monitoring system for the Subtitle D lined MSWLF landfill has been installed in accordance with Solid Waste Management Rules as per Rules .1630 - .1637 of the North Carolina Administrative Code (15A NCAC 13B.1630 - .1637).

Based on both the site-specific SAP and interaction with the SWS the water quality monitoring program for this site consists of detection monitoring. Detection monitoring was performed on nine monitoring wells (MW-14, MW-15, MW-16S, MW-16D, MW-17, MW-18, MW-22, MW-26, and MW-27); four surface water sampling locations (SW-1, SW-2, SW-6, and SW-7); background monitoring well (MW-19); and, a leachate sample (LEACHATE) from the collection lagoon.

The three surface water sampling locations that monitor the unnamed tributary of Jacobs Creek (i.e., SW-1, SW-6, and SW-7) are located between the closed MSWLF (see Section 1.1) and the Subtitle D lined MSWLF. Hence, these three surface water sampling locations are also included for the SAP for the Subtitle D lined MSWLF. A fourth surface water sampling location (SW-2) monitors surface water runoff in a drainage feature south from the Subtitle D lined MSWLF before the runoff enters into the unnamed tributary of Jacobs Creek. These four surface water monitoring locations are shown on Figure 2.

Groundwater and surface water samples have been collected at this site on a semi-annual basis since this MSWLF commenced operations in 1999. The groundwater and surface water sampling has been conducted in accordance with Solid Waste Management Rule .1633(b) [15A NCAC 13B.1633(b)]. As a condition of the water quality monitoring program, semi-annual reports are required to be submitted to the North Carolina Solid Waste Section (SWS). Shield Engineering, Inc. (Shield) of Charlotte, North Carolina performed this sampling event on January 16 through 17, 2013 in accordance with the *Sampling and Analysis Plan* dated March 2, 2009 for this site; and, the SWS *Guidelines for Groundwater, Soil, and*

Surface Water Sampling dated April 2008.

1.3 SAMPLING PLAN

Prior to the initiation of the data collection during this sampling event the function and integrity of each of the monitoring locations was visually evaluated and inspected. Subsequently, the depth-to-groundwater measurements were collected using an electronic water level meter at each of the monitoring wells prior to the purging of the groundwater from the monitoring wells. Additionally, the dissolved oxygen (DO) was measured in the monitoring well prior to the initiation of the well purging. The purging of each of the monitoring wells was carried out using bailing with clean Teflon bailers. The well purging was completed for a minimum of three well volumes or until the well was dry. During the well purging field parameters of pH, specific conductivity, temperature, and oxidation-reduction potential (ORP) were recorded for each monitoring well.

Shield personnel performed this sampling event utilizing portable monitoring methodology. Monitoring locations were designated in the approved SAPs for both sites. Groundwater sampling and analysis were performed at each of the two City of Albemarle sites in general accordance with the respective SAPs for these sites, and other appropriate documents and agreements. The first 2013 semi-annual sampling event for these two sites was performed in January 2013. The results of this sampling event are reported herein.

The samples were placed into laboratory prepared pre-preserved containers using a Teflon bailer. Samples were collected based on likelihood of potential cross-contamination, kept on ice, and transported to a North Carolina certified laboratory using proper Chain-of-Custody protocol within the specified hold times for each of the required analyses.

The sampling was attempted at the Active C&D and closed MSWLF for the following:

- Appendix I list constituents and turbidity for Monitoring Wells MW-1, MW-2, MW-3, MW-4R, MW-5R, MW-6, MW-7, MW-8D, MW-9, MW-10, MW-11, MW-24, and MW-25; and Surface Water monitoring stations SW-1, SW-2, SW-5, and SW-7.
- Appendix II list constituents and turbidity for Monitoring Wells MW-12, MW-13, and MW-23 and Surface Water monitoring station SW-6.
- Monitored natural attenuation parameters for Monitoring Wells MW-1, MW-2, MW-3, MW-6, MW-7, MW-9, and MW-10.

The sampling was attempted at the Subtitle D lined MSWLF for the following:

- Appendix I list constituents for Monitoring Wells MW-14, MW-15, MW-16S, MW-16D, MW-17, MW-18, MW-19, MW-22, MW-26, and MW-27; and, Surface Water monitoring stations SW-1, SW-2, SW-6 and SW-7.

The sampling includes the collection of a leachate sample from the leachate lagoon for the Subtitle D lined MSWLF for the following:

- Leachate for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nitrate, sulfate, phosphate, pH, Total Suspended Solids, and Appendix I metals and volatile constituents.

Quality control measures implemented during this sampling event included submittal and subsequent blank quantification, equipment blank (EB), field blank (FB), and trip blank (TB).

2.0 ACTIVE C&D AND CLOSED MSWLF

2.1 SAMPLING AND CHEMICAL ANALYSES

The function and integrity of each of the monitoring locations was visually evaluated and inspected prior to the purging/sampling at the monitoring location. Subsequently, the depths to groundwater were measured at the site monitoring wells prior to well purging and sampling and are presented in Section 2.2. The sixteen wells identified in Section 1.1 were purged on the date listed below. Samples of groundwater were collected from monitoring locations described in Section 1.1 and samples of surface water were collected from the four surface water sampling locations (i.e., SW-1, SW-5, SW-6, and SW-7). Water samples were collected in laboratory cleaned and laboratory furnished containers, preserved as appropriate for the test method, and delivered to Environmental Conservation Laboratories (ENCO) in Cary, North Carolina. Chain-of-custody protocol was followed.

The chemical analyses (i.e., Appendix I or Appendix II) performed on the samples of groundwater were identified in Section 1.3 and the results of these analyses are presented in Section 2.3.

2.2 GROUNDWATER DEPTHS AND FIELD MEASUREMENTS

2.2.1 Groundwater Flow Characteristics

Depths to groundwater were measured at the site monitoring wells prior to well purging and sampling. Groundwater elevations at the wells are listed in the attached Table 1, and were determined by subtracting the depths to groundwater measured on January 14 through 16, 2013 from the surveyed (reference) top-of-casing elevations.

A potentiometric map for the contiguous property, which includes both sites, is included in Figure 2. The groundwater flow characteristics based on both the potentiometric map and the aquifer characteristics for the monitoring system in January 2013, are presented in Table 2. The estimated groundwater flow velocities for this site range from 0.3 (MW-8D) up to 120 (MW-10) feet per year (ft/yr), with an average groundwater flow velocity of about 36 ft/yr.

2.2.2 Indicator Parameters

The field parameters pH, temperature, DO, ORP, and specific conductivity were measured with calibrated electronic meters. Field tested parameters are shown in Table 3. Specific conductivity values of the groundwater samples for the monitoring wells ranged from 208 (MW-6) to 2504 (MW-10) micromhos per centimeter (µmhos/cm). Values of groundwater pH for the monitoring wells ranged from 5.31 (MW-2) to 7.02 (MW-10). The concentrations of dissolved oxygen ranged from 0.02 (MW-12) to 5.67 (MW-5R) milligrams per liter (mg/L). Values of oxidation reduction potential (ORP) for the monitoring wells ranged from 37.0 (MW-13 and MW-23) to 144.0 (MW-3) millivolts (mV).

Specific conductivity values for the surface water samples from the four sampling locations (i.e., SW-1, SW-5 through SW-7) ranged from 134.5 (SW-1) to 356.4 (SW-5) micromhos per centimeter (µmhos/cm). Values for the surface water pH for the four sampling locations ranged from 6.76 (SW-5) to 7.38 (SW-7). Values of oxidation reduction potential (ORP) for the four surface water sampling locations ranged from 77.0 (SW-1) to 111.0 (SW-5) millivolts (mV).

2.3 RESULTS OF CHEMICAL ANALYSES

Results of analyses for inorganics in groundwater are listed in Table 4 and the organics in groundwater are listed in Table 5. The results of the analyses for the partial list of monitored natural attenuation parameters for the six (seven were attempted, however MW-1 was dry) selected corrective action monitoring wells (i.e., MW-2, MW-3, MW-6, MW-7, MW-9, and MW-10) are shown in Table 6. Results of analyses for inorganics in surface water are listed in Table 7. No organic constituents were detected in the four surface water samples (see Appendix A).

Several inorganics exceeded the NC 2L Groundwater Standards (i.e., arsenic [MW-3, and MW-25], cadmium [MW-7], chromium [MW-2, MW-11, MW-24, and MW-25], lead [MW-2 and MW-25], and nickel [MW-2]). The Interim Maximum Allowable Concentration (IMAC) for cobalt was exceeded in all of the sampled monitoring wells except Monitoring Well MW-9. The IMAC for vanadium was exceeded in about half of the Monitoring Wells (i.e., MW-2, MW-3, MW-7, MW-9, MW-11, MW-12, MW-24, and MW-25). Additionally, the IMAC for beryllium was exceeded in Monitoring Well MW-2.

Only those organic constituents that were detected in any one of the monitoring wells or in the leachate sample were included in Table 5. Organic constituents were detected in eight of the 15 monitoring wells sampled in January 2013. The remaining seven monitoring wells did not exhibit any organic constituents

(i.e., MW-2, MW-4R, MW-5R, MW-10, MW-13, MW-24 and MW-25: - see Table 5). However, only five of these monitoring wells (i.e., MW-7, MW-8D, MW-9, MW-11, and MW-23) had organic constituent concentrations exceeding the NC 2L Groundwater Standards.

Tetrachloroethene was detected above the NC 2L Groundwater Standard of 0.7 mg/L in Monitoring Wells MW-8D, and MW-9 at estimated concentrations of 0.97J and 0.98J µg/L, respectively. Vinyl chloride was detected above the NC 2L Groundwater Standard of 0.03 µg/L in Monitoring Wells MW-11 and MW-23 at concentrations of 2.2 and 1.8 µg/L, respectively. Two other organic constituent (1,1-dichloroethane and benzene) were detected above the NC 2L Groundwater Standard, with one in each of Monitoring Wells MW-11 and MW-7 (see Table 5), respectively.

Monitoring Wells MW-2, MW-6 and MW-7 are located along the western property boundary in an area where the groundwater has been labeled as the West Plume due to the previous occurrence of organic constituents at these wells. Similar to previous sampling events one VOC (benzene at 2.4 µg/L) exceeded the NC 2L Groundwater Standard (1 µg/L) in Monitoring Well MW-7. Recently the City of Albemarle purchased the adjacent 104-acre property beyond the western property boundary as a buffer for the active C&D and closed MSWLF area of the site. This additional buffer is located beyond these monitoring wells. Additionally, Monitoring Well MW-24 which is located immediately downgradient from Monitoring Well MW-7, continued to exhibit no detections of organic constituents during this sampling event. Hence, with the increased buffer zone in this area Monitoring Well MW-7 will no longer be a compliance well in this area.

Also within the West Plume, no VOCs were detected at either Monitoring Well MW-2 or the downgradient well (MW-25) during the January 2013 sampling event. Six VOCs (1,1-dichloroethane, chlorobenzene, methylene chloride, tetrachloroethene, tetrahydrofuran, and trichlorofluormethane) were detected in Monitoring Well MW-6, but without any exceedances of the NC 2L Groundwater Standards. The two monitoring wells (MW-24 and 25) immediately downgradient from Monitoring Wells MW-2 and MW-7, did not exhibit any VOCs during this sampling event.

Monitoring Wells MW-3, MW-9, and MW-11 are located on the east side of the closed MSWLF area of the site. Together these wells make up the East Plume due to previous occurrence of organic constituents in these three monitoring wells. During this sampling event no exceedances of the NC 2L Groundwater Standards were identified in the area of the East Plume at Monitoring Wells MW-3 or MW-10. One

VOCs (tetrachloroethene) was measured above the NC 2L Groundwater Standard in Monitoring Well MW-9. The monitoring wells in this area (i.e., MW-3, MW-9, and MW-10) will continue to be monitored during subsequent sampling events.

Monitoring Well MW-8D is located upgradient from the active C&D and closed MSWLF area. This well exhibited tetrachloroethene at an estimated concentration of 0.97 µg/L, above the NC 2L Groundwater Standard of 0.7 µg/L. Estimated concentrations of tetrachloroethene have been reported at this well in several previous sampling events.

In the area of the Leachate Lagoon Monitoring Well MW-12, which is located upgradient from the lagoon (see Figure 2), exhibited one VOC (acetone), but no exceedances of the NC 2L Groundwater Standards. Two monitoring wells are located on the downgradient side of the Leachate Lagoon (i.e., MW-13 and MW-23; which are both located between the lagoon and the unnamed tributary of Jacobs Creek). Monitoring Well MW-13 did not exhibit any VOCs. Monitoring Well MW-23 exhibited five VOCs, with only one VOC above the NC 2L Groundwater Standards (i.e., vinyl chloride at 1.8 µg/L).

Due to the rains this winter the unnamed tributary of Jacobs Creek that passes through the property has been flowing. Therefore surface water samples were collected during the January 2013 sampling event. Only three inorganics (copper, nickel, and zinc) exceeded the 15A NCAC 2B.0202 surface water standards (NC 2B surface water standards) (see Table 7). Each of these three inorganics exceeded the surface water standards at Surface water Sampling Location SW-5 (see Figure 2). Five inorganics were identified in the surface water sample collected at the upstream sampling location (SW-1) (see Table 7). A comparison between the three surface water sampling locations located on the unnamed tributary of Jacobs Creek (i.e., SW-1 [upstream], SW-7 [middle of the onsite stream reach] and SW-6 [downstream]) does indicate that for some inorganics, concentrations increase as the surface water flows through the site, and then for several other inorganics the higher concentrations were found at the middle surface water sampling station and then the downstream sample exhibited lower concentrations (barium, chromium, and vanadium). The three inorganics (antimony, chromium, and copper) that were not found in the upstream surface water sample, did exhibit traces in the other two downstream surface water samples (i.e., SW-7 and SW-6) collected from the unnamed tributary of Jacobs Creek (see Table 7).

Selected monitored natural attenuation (MNA) parameters were measured in the laboratory for selected monitoring wells (i.e., MW-2, MW-3, MW-6, MW-7, MW-9 and MW-10). The results of the laboratory

analyses for the MNA parameters are shown in Table 6. However, these particular MNA parameters are a partial set of the complete suite of typical MNA parameters and as a result it is not possible to provide an assessment of overall biodegradation for these wells. A comparison of these results to previous MNA data sets does indicate ongoing degradation. In their letter dated July 11, 2011 the SWS has provided the City of Albemarle a sequencing schedule for collecting the MNA parameters over the coming years. The primary conclusion from these data is that natural degradation is continuing to breakdown the VOCs within the subsurface.

The laboratory reports for these analyses are included in Appendix A.

3.0 SUBTITLE D LINED MSWLF

3.1 SAMPLING AND CHEMICAL ANALYSES

The function and integrity of each of the monitoring locations was visually evaluated and inspected prior to the purging/sampling at the monitoring location. Subsequently, the depths to groundwater were measured at the site monitoring wells prior to well purging and sampling and are presented in Section 3.2. The ten monitoring wells identified in Section 1.2 were purged on the date listed below. Samples of groundwater were collected from monitoring locations described in Section 1.2 and samples of surface water were collected from the four surface water sampling locations (i.e., SW-1, SW-2, SW-6, and SW-7). Water samples were collected in laboratory cleaned and laboratory furnished containers, preserved as appropriate for the test method, and delivered to Environmental Conservation Laboratories (ENCO) in Cary, North Carolina. Chain-of-custody protocol was followed.

The chemical analyses (i.e., Appendix I) performed on the samples of groundwater were identified in Section 1.3 and the results of these analyses are presented in Section 3.3.

3.2 GROUNDWATER DEPTHS AND FIELD MEASUREMENTS

3.2.1 Groundwater Flow Characteristics

Depths to groundwater were measured at the site monitoring wells prior to well purging and sampling. Groundwater elevations at the wells are listed in the attached Table 1, and were determined by subtracting the depths to groundwater measured on January 14 through 16, 2013 from the surveyed (reference) top-of-casing elevations.

A potentiometric map for the contiguous property, which includes both sites, is included in Figure 2. The groundwater flow characteristics based on both the potentiometric map and the aquifer characteristics for the detection monitoring system in January 2013, are presented in Table 8. The estimated groundwater flow velocities for this site range from 1 (MW-16S) up to 700 (MW-15) feet per year (ft/year), with an average groundwater flow velocity of about 138 ft/year.

3.2.2 Indicator Parameters

The field parameters pH, temperature, DO, ORP, and specific conductivity were measured with calibrated electronic meters. Field tested parameters are shown in Table 9. Specific conductivity values of the groundwater samples for the detection monitoring system wells ranged from 117.3 (MW-18) to 768 (MW-19) µmhos/cm. Values of groundwater pH for the detection wells ranged from 5.35 (MW-22) to 6.66 (MW-26). The concentrations of dissolved oxygen ranged from 0.16 (MW-16D) to 6.25 (MW-26) mg/L. Values of ORP for the detection wells ranged from 13.0 (MW-15) to 182.0 (MW-26) mV.

Specific conductivity values for the surface water samples from the four sampling locations (i.e., SW-1, SW-2, SW-6, and SW-7) ranged from 127.1 (SW-2) to 173.7 (SW-6) micromhos per centimeter (µmhos/cm). Values for the surface water pH for the four sampling locations ranged from 7.05 (SW-1) to 7.40 (SW-2). Values of oxidation reduction potential (ORP) for the four surface water sampling locations ranged from 77.0 (SW-1) to 110.0 (SW-7) millivolts (mV).

3.3 RESULTS OF CHEMICAL ANALYSES

Results of analyses for the inorganics in groundwater are listed in Table 4 and the organics in groundwater are listed in Table 5.

None of the 15 Appendix I total metals analyzed were detected above the NC 2L Groundwater Standard. Two metals (cobalt and vanadium) were detected above the North Carolina IMACs. Cobalt was found above the IMAC (i.e., 0.001 mg/L) in nine of the ten monitoring wells around the Subtitle D lined MSWLF with concentrations ranging from 0.00172J (MW-15) up to 0.0508 (MW-16D) mg/L. Vanadium was detected above the IMAC in Monitoring Wells MW-14, MW-18, MW-22, MW-26, and MW-27 with estimated concentrations ranging from 0.0016J (MW-22) up to 0.00804J (MW-26) mg/L.

No organic constituents were detected at the Subtitle D lined MSWLF site. All the ten monitoring wells around the Subtitle D lined MSWLF did not exhibit any traces of organic constituents.

Due to the rains this winter the unnamed tributary of Jacobs Creek that passes through the property has been flowing. The three surface water samples collected along the unnamed tributary of Jacobs Creek were discussed in Section 2.3. The only other surface water sampling location in the vicinity of the Subtitle D lined MSWLF site is SW-2. This surface water sampling location is located on a drainage

feature south of the Subtitle D lined MSWLF that discharges to the unnamed tributary of Jacobs Creek that flows through the site (see Figure 2). The surface water samples were collected during the January 2013 sampling event. Only one inorganic (copper) exceeded any of the respective NC 2B surface water standards and traces of eight other inorganics were also identified at the surface water sampling location SW-2. A comparison between the three surface water sampling locations located on the unnamed tributary of Jacobs Creek (i.e., SW-1, SW-7, and SW-6) and SW-2 indicates that the same seven inorganics that were identified along the unnamed tributary of Jacobs Creek were also present at SW-2. In addition to these seven inorganics at SW-2, arsenic was also identified at SW-2.

4.0 SUMMARY AND CONCLUSIONS

The sampling event reported herein includes the monitoring wells for each of the two landfill sites (except for MW-1, which was dry) presented in Sections 1.1 and 1.2, and the leachate sample collected from the leachate lagoon that receives flow from the Subtitle D lined MSWLF. Surface water samples were collected from all of the five surface water sampling locations during the January 2013 sampling event.

The inorganic constituents identified at the two landfill sites that exceed either the NC 2L Groundwater Standards or the IMACs are as follows:

Active C&D and closed MSWLF:

- Arsenic: MW-3, and MW-25
- Beryillium: MW-2
- Cadmium: MW-7
- Chromium: MW-2, MW-11, MW-24, and MW-25
- Cobalt: All thirteen monitoring wells (except MW-9)
- Lead: MW-2 and MW-25
- Nickel: MW-2
- Vanadium: MW-2, MW-3, MW-7, MW-9, MW-11, MW-12, MW-24, and MW-25

Subtitle D lined MSWLF:

- Cobalt: Nine of the ten monitoring wells, including background Monitoring Well MW-19
- Vanadium: MW-14, MW-18, MW-22, MW-26, and MW-27

One of the wells listed above is the background monitoring well (MW-19) for the Subtitle D lined MSWLF. Additionally, another monitoring well listed once above (cobalt - MW-8D; see Figure 2) is located upgradient from the Active C&D and closed MSWLF, and is not a compliance well.

The organic constituents identified at the landfill sites that exceed either the NC 2L Groundwater Standards or the IMACs are as follows:

Active C&D and closed MSWLF:

The only organic constituents identified at the Active C&D and closed MSWLF Site that exceed the NC 2L Groundwater Standards are as follows:

- 1,1-Dichloroethane in Monitoring Well MW-11;
- Benzene in Monitoring Well MW-7;
- Tetrachloroethene in Monitoring Wells MW-8D, and MW-9;
- Vinyl chloride in Monitoring Wells MW-11, and MW-23.

Organic constituents continue to be present within Monitoring Wells MW-6, and MW-7 in the West Plume and generally lower than previous sampling events, and no organics were identified in Monitoring Well MW-2 during the January 2013 sampling event. Better than previous sampling events, only one VOC exceeding the NC 2L Groundwater Standards was identified in Monitoring Well MW-7. The monitoring wells in this area (i.e., MW-2, MW-6, and MW-7) will continue to be monitored during subsequent sampling events. The two monitoring wells (MW-24 and 25) immediately downgradient from Monitoring Wells MW-2 and MW-7, did not exhibit any VOCs during this sampling event.

No exceedances of the NC 2L Groundwater Standards were identified in the area of the East Plume at Monitoring Wells MW-3 or MW-10. Whereas, tetrachloroethene exceeded the NC 2L Groundwater Standard in Monitoring Well MW-9. The monitoring wells in this area (i.e., MW-3, MW-9, and MW-10) will continue to be monitored during subsequent sampling events.

Subtitle D lined MSWLF:

No organic constituents were detected at the Subtitle D lined MSWLF site as all the ten monitoring wells around this site did not exhibit any traces of organic constituents.

The leachate sample collected from the leachate lagoon exhibited five organic constituents (see Table 5). Seven inorganic constituents were also identified in the leachate sample (see Table 4).

The monitoring networks currently sampled around each of the two landfill sites owned and operated by City of Albemarle are capable of detecting the migration of constituents for the landfill cells.