2nd Semi-Annual 2010 Groundwater Monitoring Report

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

INTRODUCTION 4

INVESTIGATION 5

INVESTIGATION RESULTS 6

Hydrogeological / Potentiometric Summary 6

Analytical Summary 9

GENERAL CONCLUSIONS AND RECOMMENDATIONS 10

APPENDICES

Appendix A: Summary of Detections by Monitoring Well
Appendix B: Dissolved Metals and TSS Detections
Appendix C: Sampling / Field Log Summary and Field Sample Logs
Appendix D: Summary of All Static Water Levels and % LEL
Appendix E: Sampling Locations and Topographic Contours
Appendix F: Potentiometric Contour Maps
Appendix G: Vertical Gradient Calculations
Appendix H: Historical Data Summary

Catawba County, North Carolina

December 2010

Newton Landfill

Permit: #18-01

EXECUTIVE SUMMARY

REI Consultants, Inc., (REIC) has performed the 2nd Semi-Annual 2010 Monitoring Program for the closed ***Newton Landfill*** operated by Catawba County, North Carolina. The procedural aspects of this monitoring program were determined after a review of historical records, site specific geology, consultations with the North Carolina Department of the Environment and Natural Resources (NCDENR) regulations, orders as formulated from ***15A NCAC 13B***, and communications from North Carolina agency officials. During those communications it was determined that Monitoring Wells MW-1, MW-3, MW-9, MW-10A, MW-10B, MW-11, MW-13, MW-14, MW-14A, MW-15, MW-16, MW-16A, MW-20, MW-21, MW-23, MW-24, MW-24D, OW-1, and OW-3 were to be evaluated twice a year for particular constituents and reported in semi-annual reports relative to North Carolina groundwater standards. In addition, wells MW-7A and MW-18 are to be sampled every 18 months. NCDENR issued a letter to Catawba County dated June 3, 2004 with approval of the above monitoring network.

In September 2010, groundwater samples were obtained by REIC's environmental field technicians, utilizing the protocols established by NCDENR. Summaries of the field sampling activities are enclosed in ***Appendix C*** of this report. No anomalies were experienced during this sampling with the exception of significant levels of suspended solids (***see Appendix B: "Summary of Dissolved Metals and TSS Analyses"***) contained in several groundwater samples.

As with previous monitoring events, water levels were recorded from all monitoring wells during the 2nd Semi-Annual Sampling Event of 2010, as well as any existing monitoring points within the ***Newton Landfill*** boundaries. This information was utilized to generate groundwater potentiometric maps for the Newton Facility. The potentiometric contour maps are included in ***Appendix F***, and a summary of the static water level data is included as ***"A Summary of Static Water Levels and %LEL"***, found in ***Appendix D***. An additional map indicating topographic contours and all wells at the facility is included in ***Appendix E***. The groundwater hydraulic gradients and velocities estimated from the current study are of the same magnitudes as in previous investigations.

Results from the 2nd Semi-Annual 2010 Sampling Event were compared to North Carolina groundwater standards. Components determined to be above North Carolina groundwater standards are as follows:

Component/Parameter	Monitoring Point
1,1-Dichloroethane	MW-1, MW-3, MW-9, MW-10A, MW-10B, MW-11, MW-13, MW-14, MW-15, MW-16, MW-16A, MW-20, OW-1
1,2-Dichloroethane	MW-9, MW-10A, MW-11, MW-14, MW-14A
1,2-Dichloropropane	MW-1, MW-9, MW-10A, MW-11, MW-14, MW-15, MW-20
1,4-Dichlorobenzene	MW-9, MW-10A, MW-14
Benzene	MW-1, MW-3, MW-9, MW-10A, MW-14, MW-15, MW-16, MW-20, OW-1
Bromochloromethane	MW-15
cis-1,2-Dichloroethene	MW-9, MW-14, MW-15, MW-20
Methylene chloride	MW-1, MW-9, MW-14, MW-15, MW-20
Nickel	MW-9
Tetrachloroethene	MW-3, MW-9, MW-10A, MW-11, MW-13, MW-14, MW-14A, MW-15, MW-16, MW-16A, MW-20, OW-1, OW-3
Trichloroethene	MW-3, MW-9, MW-10A, MW-10B, MW-13, MW-14, MW-14A, MW-15, MW-16, MW-16A, MW-20, OW-1
Vinyl chloride	MW-9, MW-10A, MW-10B, MW-13, MW-14, MW-15, MW-16, MW-16A, MW-20, OW-1

These findings are summarized specifically in ***Appendix A*** as ***"2nd Semi-Annual 2010 Summary of Detections"***.

Based upon the results of the current groundwater monitoring event, and pursuant to NCDENR policy and directives, it is recommended that the ***Newton Landfill*** continue monitoring the modified Appendix I listing, which includes Appendix I Volatiles and Chromium, Lead, and Nickel, during the 1st Semi-Annual Sampling Event of 2011.

INTRODUCTION

In July of 1998, REIC was contracted by Catawba County Solid Waste Authority to conduct a complete groundwater monitoring program for the closed landfill denoted as the "***Newton Landfill***", and registered with the NCDENR as Permit #18-01. REIC met with Mr. Larry Rose and Mr. Mark Poindexter of the NCDENR in August 1998, then again with Mr. Poindexter in March 1999, and discussed the requirements of the permit and subsequent Agency directives that have occurred during the past several years. Additionally, REIC reviewed records both from Catawba County's internal files and those stored at the NCDENR's Department of Records Facility in Raleigh, North Carolina. From these historical files REIC collated and generated a historical summary of the collected data for the monitoring points selected for monitoring consideration. Following the 2nd Semi-Annual Monitoring Event of 1998, monitoring wells MW-18, MW-19, MW-20, MW-21 and MW-22 were installed. In addition, after the 1st semi-annual 2004 event, monitoring wells MW-23, MW-24, and MW-24D were added to the program. All data from the approved monitoring network are incorporated within this report and represent what is believed to be a comprehensive collection of the groundwater quality profile for the Newton Facility.

Continuing the program in September 2010, REIC collected groundwater samples from 19 monitoring wells and two surface water sites located at the facility. The sampling was conducted to satisfy compliance with the groundwater monitoring program for the 2nd Semi-Annual 2010 Monitoring Event.

Additionally, the groundwater potentiometric surface has been modeled and is presented in the form of a static groundwater level contour map. This map identifies the general subsurface water movement and assists in determining potential, as well as identifiable, contaminant movement. As agreed, groundwater constituent levels (relative to North Carolina groundwater standards), the potentiometric surface, and groundwater flow rates are presented in this report.

INVESTIGATION

The groundwater and surface water monitoring points were sampled in accordance with State and Federal guidelines. Static water levels were measured prior to and during well purging to ascertain groundwater elevations and generate data to later produce a valid potentiometric map. The monitoring wells were purged using laboratory decontaminated Teflon™ bailers before sampling, and field analytical testing was employed to assure adequate purging. Copies of the field sampling report and summaries of these logs are in ***Appendix C***. Groundwater samples were taken as specified in REIC's Standard Operating Procedures (SOPs) that satisfy NCDENR Solid Waste regulations and guidance.

Groundwater samples were stored in pre-cleaned, preserved containers, transported in iced coolers, and delivered to the laboratory in good condition by REIC field personnel. The samples were analyzed in the laboratory referencing current EPA and NCDENR approved methodologies.

Methane measurements, as percent Lower Explosion Limit (% LEL), were recorded at each monitoring well prior to purging. Initial readings were taken at the top of casing as soon as the well caps (where installed) were removed. A second measurement was obtained after sufficient time had elapsed to allow for the equalization of any pressure differential between the well casing and the ambient surface. The methane measurements are documented in ***Appendix D: "Summary of All Static Water Levels and %LEL".***

The groundwater data are presented within this report relative to North Carolina groundwater quality standards. Per instructions of NCDENR Solid Waste Section representatives, the data have not been processed in a statistical manner to distinguish significant down-gradient elevations of constituents. However, constituents exceeding North Carolina groundwater quality standards are noted in the ***"2nd Semi-Annual 2010 Summary of Detections"*** in Appendix A.

The laboratory Quality Assurance Program included all appropriate, method specific Quality Controls. All laboratory data met the required QC criteria and were subjected to stringent REIC acceptance review prior to approval for inclusion in this report. Data have been reported to method detection limits (MDLs) as requested by NCDENR.

However, note that any values reported below Solid Waste Section Limits (SWSLs), flagged with a "J" qualifier, are only estimates, are not quantitative, and should not be used numerically in any way.

INVESTIGATION RESULTS

A. *HYDROLOGICAL POTENTIOMETRIC SUMMARY*

Models of two potentiometric surfaces have been prepared from the field data collected during the 2nd Semi-Annual 2010 Groundwater Sampling Event. One model has been created to depict the upper-most or Shallow Aquifer and another has been produced to portray a deeper or Bedrock Aquifer.

Both models were developed from groundwater elevation data calculated from the static water levels measured during the Fall 2010 Sampling Event. The groundwater depth measurements were obtained in the monitoring wells by REIC field personnel, prior to the execution of the purging and sampling procedures. Horizontal and vertical control for the field data was established from mapping based on North Carolina State Plane coordinates, as provided by J. Mike Honeycutt Surveying.

The potentiometric maps for each aquifer include the waste disposal area boundaries and streams. These features were transcribed from drawings provided by McGill Associates, P.A. An additional map that includes all wells at the facility as well as topographic contours is included in Appendix E: "***Sampling Locations and Topographic Contours***". Topographic contours were also provided by drawings from McGill Associates, P.A.

The Shallow Aquifer is the upper-most water-bearing zone of the Newton Landfill site. While some of the geologic material of the zone may be eluvial in origin, the lithology is essentially unconsolidated sediment of silt and sand sizes. It has been determined that 20 wells have screens set in this zone, although actual drill logs are not available for confirmation for a few of the wells at the site. The potentiometric map for this aquifer was modeled utilizing static water levels from wells screened in the

upper-most aquifer, as well as from stream elevation points and topographic contours. A copy of this drawing is included in ***Appendix F: "Potentiometric Contour Maps"***.

The Bedrock Aquifer is the deeper groundwater zone monitored at the landfill site. The lithology of this aquifer has typically been described as weathered, biotite gneiss. While the Shallow and Bedrock Aquifers were analyzed separately and are shown on two different potentiometric drawings, no continuous aquitard can be distinguished between the two zones in the drilling information. Groundwater elevations from 16 deeper-screened wells were utilized to create the Bedrock Aquifer model. No stream water elevations were included in this analysis. The databases for the Shallow and Bedrock Aquifers contained separate measurement points. The wells in the deeper database were shown by drill logs to have screens set in the bedrock or are of a sufficient depth to logically be screened in the referenced zone. All of the deep wells identified in the available drill logs have screens that are set fully in the weathered rock except for two partially penetrating wells that have screens with tops exposed to sediment. A copy of the resulting potentiometric map is contained in ***Appendix F: "Potentiometric Contour Maps"***.

The horizontal component of hydraulic gradient has been estimated graphically for the Shallow and Bedrock Aquifers. In each case, flow paths were chosen which traverse the central portions of the main waste disposal area of the ***Newton Landfill***. The paths were drawn on the respective potentiometric maps, following traces that are approximately normal to the hydrostatic contours, from the up-gradient western portion of the waste area to the locale of the stream along the eastern border. Other flow routes could have been chosen with varying results for the measured hydraulic gradient. The flow paths utilized in the calculation of the hydraulic gradients for the two aquifers are illustrated on drawings included in ***Appendix F: "Potentiometric Contour Maps."***

Vertical gradient calculations have been prepared for seven sets of clustered wells at the Newton Facility. These calculations generally indicate discharge conditions in the vicinity of the streams and recharge in

upland areas of the site. A copy of the vertical gradient analysis is included in ***Appendix G***.

Lateral groundwater flow velocities have been estimated for the two aquifers using a form of Darcy's Law, as follows:

Shallow Aquifer:

$$V = \frac{KI}{n} = \frac{53\ \text{ft}}{\text{yr}}$$

where:

V = Groundwater Seepage Velocity in ft/yr.
K = Average Hydraulic Conductivity = 2.8×10^{-4} cm/sec
(Averaged from data previously provided by others).
I = Hydraulic Gradient = 0.037 ft/ft.
Following a path normal to the groundwater potentiometric contours across the main waste disposal area.
n = Effective Porosity = 0.20 (unitless).
(Typical textbook value).

Bedrock Aquifer:

$$V = \frac{KI}{n} = \frac{990\ \text{ft}}{\text{yr}}$$

where:

V = Groundwater Seepage Velocity in ft/yr.
K = Average Hydraulic Conductivity = 2.5×10^{-3} cm/ sec.
(Averaged from data previously provided by others).
I = Hydraulic Gradient = 0.038 ft/ft.
Following a path normal to the groundwater potentiometric contours across the main waste disposal area.
n = Effective Porosity = 0.10 (unitless).
(Typical textbook value).

B. ANALYTICAL SUMMARY

Analytical parameters which were detected above the minimum laboratory Practical Quantitation Limits are summarized in ***Appendix A "2nd Semi-Annual 2010 Summary of Detections"***, which is included on the following pages. Values greater than the North Carolina groundwater standards are shown in red print.

All available analytical results of previous sampling events are included as a separate document under ***Appendix H: "Historical Data Summary".*** Components determined to be above North Carolina groundwater standards for the 2nd Semi-Annual 2010 groundwater sampling event are as follows:

Component/Parameter	Monitoring Point
1,1-Dichloroethane	MW-1, MW-3, MW-9, MW-10A, MW-10B, MW-11, MW-13, MW-14, MW-15, MW-16, MW-16A, MW-20, OW-1
1,2-Dichloroethane	MW-9, MW-10A, MW-11, MW-14, MW-14A
1,2-Dichloropropane	MW-1, MW-9, MW-10A, MW-11, MW-14, MW-15, MW-20
1,4-Dichlorobenzene	MW-9, MW-10A, MW-14
Benzene	MW-1, MW-3, MW-9, MW-10A, MW-14, MW-15, MW-16, MW-20, OW-1
Bromochloromethane	MW-15
cis-1,2-Dichloroethene	MW-9, MW-14, MW-15, MW-20
Methylene chloride	MW-1, MW-9, MW-14, MW-15, MW-20
Nickel	MW-9
Tetrachloroethene	MW-3, MW-9, MW-10A, MW-11, MW-13, MW-14, MW-14A, MW-15, MW-16, MW-16A, MW-20, OW-1, OW-3
Trichloroethene	MW-3, MW-9, MW-10A, MW-10B, MW-13, MW-14, MW-14A, MW-15, MW-16, MW-16A, MW-20, OW-1
Vinyl chloride	MW-9, MW-10A, MW-10B, MW-13, MW-14, MW-15, MW-16, MW-16A, MW-20, OW-1

These findings are summarized specifically in ***Appendix A*** as ***"2nd Semi-Annual 2010 Summary of Detections".***

GENERAL CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the current groundwater monitoring event, and pursuant to NCDENR policy and directives, it is recommended that the ***Newton Landfill*** continue in its current monitoring mode, with analysis of the modified Appendix I list, during the 1st Semi-Annual Sampling Event of 2011.