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Phase 2 Environmental Site Assessment Work Plan
Central Carolina Tire Monofill Landfill Phases I/II
Harnett County, North Carolina
Permit # 43-04

January 2012

Prepared by:

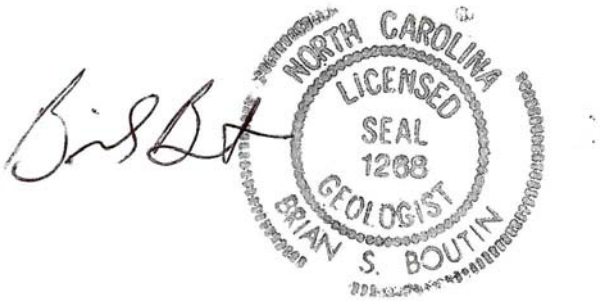

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Table of Contents

Contents

1.0 INTRODUCTION 1
2.0 BACKGROUND 2
2.1 History of Site and Operations 2
2.2 Current Conditions 2
2.2.1 Groundwater Flow 2
2.2.2 Groundwater Quality 2
3.0 GEOLOGY AND HYDROGEOLOGY 4
4.0 ASSESSMENT WORK PLAN 5
4.1 Receptor Survey 5
4.2 Proposed Groundwater Monitoring Wells 5
4.3 Groundwater Gauging 7
4.4 Groundwater Sampling and Analysis 7
4.5 Aquifer Characterization 7
4.7 Conceptual Site Model 8
5.0 ASSESSMENT REPORT 9
6.0 PROJECT SCHEDULE 10

Figures

1 Site Location Map
2 Site Map
3 Water-table Elevation Contour Map: April 2011
4 Dissolved Tetrachloroethene Isoconcentration Contour Map: November 2010
5 Proposed Groundwater Monitoring Wells

Tables

1 Field Measured Groundwater Parameters: April 2011
2 Historical Groundwater Quality Data

Appendices

A. Monitoring Well Schematics

1.0 INTRODUCTION

This document presents a work plan to conduct a Phase 2 environmental site assessment at the Central Carolina Tires Phase I/II Monofill landfill facility in Harnett County, North Carolina (**Figure 1**). Tetrachloroethene (PCE) has been detected in groundwater samples collected from monitoring well MW-8 at the Phase I/II landfill during semi-annual sampling conducted over the last several years (**Figure 2**). The concentrations of PCE have shown a generally increasing trend and are now in excess of the North Carolina 15A NCAC 2L .0202 groundwater quality standard.

The results of a preliminary environmental site assessment conducted at the site in November 2010 which involved sampling and analysis of soil and groundwater samples collected via direct-push techniques indicate that a relatively narrow, elongated plume of dissolved-phase PCE originates in the vicinity of the maintenance shelter located approximately 250 feet north of MW-8 and extends to the south-southwest toward MW-8 and the Phase I/II monofill landfill. The results indicate that the source of PCE in groundwater is likely located at or near the maintenance shelter. The maintenance shelter is used to maintain and repair equipment for the landfill, and the interior of the shelter is unpaved. Equipment maintenance and repair includes the use of parts cleaning solutions that contain PCE. Low volume incidental spills of parts cleaning solution onto the ground surface over time are likely the source of PCE in groundwater at the site. The results of the preliminary assessment are presented in the January 2011 *Preliminary Site Assessment Report*.

Based on the results of the preliminary assessment, a Phase 2 environmental site assessment will be conducted to further delineate the horizontal and vertical extent and magnitude of PCE and associated environmental breakdown products in groundwater. The site assessment will include sampling and analysis of soil and groundwater samples collected from multiple locations at the site, aquifer testing to assess the hydraulic properties of the surficial aquifer, and a potential receptor survey to identify potable wells and any other receptors within 1,500 feet of the margins of the dissolved-phase PCE plume.

2.0 BACKGROUND

2.1 History of Site and Operations

The Phase I/II of the Central Carolina Tire Monofill is operated in accordance with Solid Waste Permit 43-04. The Phase I Area of the Central Carolina Tire Monofill began operation in 1992 and the Phase II Area of the Central Carolina Tire Monofill began operation in 1997. The combined footprint of the Phase I/II Monofill is a total of 37-acres. The Phase I/II Area reached capacity in the fall of 2008. Closure activities have been completed and approved for 19.5-acres of the Phase I/II Area and a soil closure cap has been installed on the remaining areas.

2.2 Current Conditions

2.2.1 Groundwater Flow

Groundwater levels were gauged in the site groundwater monitoring wells on April 13, 2011 as part of semi-annual site monitoring. The depth to groundwater across the site relative to ground surface, as measured in the Type II groundwater-monitoring wells on April 13, 2011, generally ranged from approximately 1.2 feet below grade at MW-3 (located adjacent to a low-lying wetland area) to approximately 21.3 feet below grade at MW-9, which is consistent with the surface topography.

A water-table elevation contour map that was developed based on the April 2011 groundwater-gauging data for the Type II monitoring wells at the site is presented as **Figure 3**. The pattern of the water-table contours indicates that the horizontal component of shallow groundwater flow at the site is generally to the southeast toward unnamed streams and associated wetlands that surround the eastern and southern boundaries of the landfill, which is consistent with the surface topography and drainage features at the site. The average hydraulic gradient of the water table, based on the data depicted in **Figure 3**, ranges from approximately 0.045 ft/ft in west-southwest portion of the site to approximately 0.023 ft/ft in the east-northeast portion of the site.

2.2.2 Groundwater Quality

A preliminary environmental site assessment was conducted at the site in November 2010 which involved sampling and laboratory analysis of soil and groundwater samples collected via direct-push techniques. The results of the preliminary assessment indicate that a relatively narrow, elongated plume of dissolved-phase PCE originates in the vicinity of the maintenance shelter located approximately 250 feet north of MW-8 and extends to the south-southwest toward MW-8 and the Phase I/II monofill landfill (**Figure 4**). The results indicate that the source of PCE in groundwater is likely located at or near the maintenance shelter. The maintenance shelter is used to maintain and repair equipment for the landfill, and the interior of the shelter is unpaved. Equipment maintenance and repair includes the use of parts cleaning solutions that contain PCE.

Low volume incidental spills of parts cleaning solution onto the ground surface over time are likely the source of PCE in groundwater at the site.

Groundwater samples were collected from the site monitoring wells and surface water samples were collected from two on-site locations on April 13, 2011 for laboratory analysis to monitor the quality of groundwater and surface water at the site. The groundwater and surface water samples were collected and handled in accordance with the sampling protocols included in the site Water Quality Monitoring Plan as well as the SWS Groundwater Monitoring Guidance Document. It is noted that monitoring well MW-9 serves as the up-gradient, natural background well for the facility, and monitoring wells MW-2 through MW-7 serve as the down-gradient monitoring wells. Monitoring well MW-8 is located immediately north of the landfill. Based on its location relative to the groundwater elevation contours, MW-8 is located hydraulically cross-gradient to the northern-most area of the landfill and hydraulically up-gradient of most of the landfill area.

Prior to groundwater sampling, the monitoring wells were purged of a minimum of three well volumes of water using PVC bottom-loading bailers. During purging, measurements were made in the field of the pH, temperature, specific conductance and turbidity of the groundwater collected from the monitoring wells, in accordance with SWS requirements. The results of the field analyses of these parameters are presented in **Table 1**. The results of the field-measured water-quality parameters indicate that the values measured in groundwater collected from the site monitoring wells were generally within the applicable stabilization criteria. Groundwater at the site is acidic based on the pH values measured in the field (4.02 to 5.39). Specific conductance values ranged from 44 (MW-8) to 492 (MW-9) µS/cm in groundwater at the Type II monitoring wells. Turbidity values ranged from 2.4 (MW-5) to 9.3 (MW-6) NTUs.

All groundwater and surface water samples were analyzed at a North Carolina-certified laboratory for Appendix I volatile organic compounds (VOCs) by SW 846 Method 8260 and the 8 RCRA metals by EPA 6000/7000 series methods. Summarized historical groundwater and surface water quality data for the site are presented in **Table 2**.

The laboratory analytical results for the groundwater samples collected from the site monitoring wells on April 13, 2011 indicate that low levels of benzene and halogenated aliphatic hydrocarbons were reported in groundwater samples collected from the site. The levels of VOCs reported were generally well below the corresponding 15A NCAC 2L .0202 groundwater quality standards. Tetrachloroethene (PCE) was reported at a concentration of 5.40 µg/L in the sample from MW-8, which exceeds the 15A NCAC 2L .0202 groundwater quality standard of 0.70 µg/L. The levels of PCE reported in groundwater samples collected from MW-8 since April 2007 have shown a generally increasing trend.

3.0 GEOLOGY AND HYDROGEOLOGY

The Central Carolina Tire landfill facility is located in the Atlantic Coastal Plain physiographic province in North Carolina. The area of the site is underlain by sediments of the Late Creataceous age Middendorf Formation, which are predominantly fluvial-deltaic intercalated, lensing, thick-bedded micaceous quartz sands and clays with local concentrations of clay clast conglomerates.[1] The Middendorf Formation deposits overlie sands and clays of the Late Cretaceous age Cape Fear Formation, which in turn unconformably overlie crystalline basement rocks, the surface of which occurs at a depth of approximately 150 to 200 feet below grade near the site. Thin, discontinuous Tertiary age terrace deposits and upland sediments generally consisting of clayey sand and sand overlie the Cretaceous age deposits.

Groundwater within the surficial aquifer at the site occurs under unconfined conditions within the Middendorf Formation sediments. Clay beds within the Middendorf Formation form a confining layer separating the surficial aquifer from deeper occurrences of groundwater. As discussed in Section *2.2.1*, shallow groundwater flow at the site is generally to the southeast toward unnamed streams and associated wetlands that surround the eastern and southern boundaries of the landfill.

[1] Sohl, Norman F. and James P. Owens, 1991; Cretaceous stratigraphy of the Carolina coastal plain, in *The Geology of the Carolinas*, J. W. Horton, Jr. and V. A. Zullo, eds., The University of Tennessee Press, pp. 191-220.

4.0 ASSESSMENT WORK PLAN

4.1 Receptor Survey

The maintenance shelter and known areas of dissolved PCE at the site are located between the Phase I/II and Phase III landfills. Based on groundwater elevation data, the direction of shallow groundwater flow in the area of the maintenance shed and dissolved-phase PCE plume is to the southeast toward unnamed streams and associated wetlands that surround the eastern and southern boundaries of the Phase I/II landfill. Consequently, the spectrum of receptors that could potentially be impacted by dissolved PCE in groundwater is limited in scope. Based on the known site conditions, a receptor survey will be conducted to identify water supply wells located within 1,500 feet of the margins of the dissolved PCE plume.

4.2 Proposed Groundwater Monitoring Wells

Eight Type II and eight Type III groundwater monitoring wells are proposed for assessment of dissolved PCE in groundwater in the vicinity of the maintenance shelter and monitoring well MW-8. The proposed locations and designations of the monitoring wells are shown in **Figure 5**. The wells will be installed as shallow and deep pairs at eight locations on the site. Proposed monitoring wells GW-1S/1D are intended to serve as up-gradient wells to monitor the quality of groundwater in the shallow and deep surficial aquifer entering the area of the maintenance shelter. The remaining monitoring wells are intended to delineate the horizontal and vertical extent of dissolved PCE and associated environmental breakdown products in groundwater in the vicinity of the maintenance shelter and monitoring well MW-8.

Prior to initiating field work, monitoring well installation permit applications will be prepared and sent to DENR for approval. No wells will be installed until approved well permits are received from DENR. In addition, North Carolina 811 will be contacted to have underground utilities in the areas proposed for drilling appropriately marked. All drilling locations will also be approved by the client prior to drilling.

The proposed Type II monitoring wells will be installed using a hollow-stem auger drilling rig. All Type II wells will be installed to depths of approximately 15 to 25 feet below grade (depending on location) and will be constructed of 2-inch ID Schedule 40 PVC well casing and 10 feet of machine-slotted well screen with 0.010” slots. The wells will be finished with solid PVC risers extending approximately 2 to 3 feet above grade within steel, stickup protective casings with hinged, locking lids. The Type III wells will be constructed with a 6-inch ID Schedule 40 PVC outer casing using a hollow-stem auger drilling rig; the outer casing will be installed to a depth of approximately 20 to 30 feet below grade. The Type III wells will be installed through the outer casing to a depth of approximately 35 to 45 feet below grade and will be constructed of 2-inch ID Schedule 40 PVC well casing and 10 feet of machine-slotted well

screen with 0.010" slots. The borings for the Type III wells will be drilled using mud-rotary drilling. The Type III wells will be finished with solid PVC risers extending approximately 2 to 3 feet above grade within steel, stickup protective casings with hinged, locking lids. All wells will be installed and constructed in accordance with North Carolina Well Standards. Typical schematics of the Type II and Type III monitoring wells are presented in **Appendix A**.

Soil samples will be collected at each drilling location for lithologic descriptions using the standard penetration test (SPT) method with a 140-lb sliding hammer and steel split-spoon samplers. Samples will be collected in continuous 2-feet intervals until groundwater is encountered and every five feet thereafter to the completion depth of the boring. The soil retained in each split-spoon sampler will be logged by a geologist with respect to texture composition, color and moisture content. A representative portion of each soil sample collected above the water table will be placed in a resealable plastic bag and allowed to equilibrate with ambient conditions. After the equilibration period, a photoionization detector (PID) calibrated to an isobutylene standard will be used to measure a headspace reading of total volatile organic compounds (VOCs) in the resealable plastic bag. The soil sample from each drilling location that exhibits the highest PID response value will be retained and submitted for laboratory analysis. In the event that no PID response is elicited by any of the vadose zone samples collected from a boring, one sample will be retained for laboratory analysis based on field judgment. The retained soil samples will be analyzed at a DENR-approved laboratory for VOCs by SW 846 Method 8260. This analytical method allows for the detection of PCE and its primary environmental breakdown products. In addition, one soil sample collected from the saturated zone at each drilling location will be retained and submitted for grain size analysis at a geotechnical laboratory to allow for estimating the specific yield of the aquifer sediments.

The augers, drill pipe and drill rig will be decontaminated using a pressure washer prior to drilling at each location. Split-spoon samplers will be decontaminated prior to and following each use with a non-phosphate soap and water wash followed by multiple rinses with distilled water. An area will be set aside in the immediate vicinity of the maintenance shed for decontamination of the drilling equipment. Each well will be developed after installation using a down hole pump or bailer until the discharge water appears to be free of suspended sediments or for a maximum of one hour.

Each well will be surveyed relative to the existing site datum for horizontal position and elevation by a North Carolina licensed surveyor. At each well, elevations will be measured of the ground surface and top of the solid PVC riser. A permanent mark will be made on the top of the PVC riser at the point where the elevation measurement is made for future reference when collecting depth to water data.

4.3 Groundwater Gauging

Prior to well purging and groundwater sampling, and a minimum of one week following completion of drilling, groundwater levels will be measured in the newly installed monitoring wells, as well as existing monitoring well MW-8, using an electronic water level meter which will be thoroughly decontaminated before use at each well. The results of the groundwater gauging will be used to develop a conceptual model of groundwater flow within the surficial aquifer in the study area, including groundwater recharge and discharge zones and zones of preferential groundwater flow.

4.4 Groundwater Sampling and Analysis

Groundwater samples will be collected for laboratory analysis from monitoring wells GW-1S/1D trough GW-8S/8D and MW-8 using a low flow/low stress sampling technique. Prior to sampling, the wells will be purged of stagnant water and the pH, temperature, specific conductance, turbidity, dissolved oxygen and oxidation-reduction potential (ORP) of the purge water will be measured using a flow-through cell and a multi-parameter meter. With respect to the groundwater chemistry, an adequate purge will be considered to have been achieved when the pH, specific conductance, and temperature of the groundwater have stabilized within 10% for three consecutive readings and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTUs).

Following purging, groundwater samples will be collected from each well using the low-flow assembly directly into laboratory-prepared containers. All groundwater samples will be analyzed at a DENR-approved laboratory for VOCs by SW 846 Method 8260. This analytical method allows for the detection of PCE and its primary environmental breakdown products. In addition, the groundwater samples will be analyzed at the laboratory for dissolved organic carbon, chloride, nitrate, iron, sulfate, methane, ethene and ethane to evaluate biogeochemical conditions in the surficial aquifer and potential biotransformation of PCE via natural attenuation mechanisms.

4.5 Aquifer Characterization

Following groundwater sampling and return of groundwater levels to static conditions, rising-head permeability ("slug") tests will be conducted in the new monitoring wells and monitoring well MW-8. Static water level measurements will be made at each well prior to beginning the slug tests. The slug tests will be conducted by placing a combined data recorder-pressure transducer (In-Situ Mini Troll™) at the bottom of the well and rapidly removing a volume (slug) of water from the well using a bottom-loading bailer, submersible pump or centrifugal pump (whichever is appropriate given the depth to groundwater and yield) to lower the level of the water table below the level measured at static conditions. The data logger will be used to

measure the rate of influx of groundwater until water level equilibrium is reestablished. The measured rate of recovery of the water level is a function of the hydraulic conductivity of the aquifer material in the vicinity of the well. The slug test data will be analyzed using either the HydroSOLVE, Inc. AQTESOLV for Windows™ program according to the Bouwer-Rice procedure.

4.7 Conceptual Site Model

A conceptual site model (CSM) will be developed based on the results of the groundwater gauging, groundwater and soil quality data, information regarding the site geology and hydrogeology available from drilling logs and rising-head permeability test data, potential receptor data, as well as previous work conducted at the site by others in association with permitting the solid waste landfills. The CSM is a working hypothesis based on available site data that is a three-dimensional representation of the site hydrogeological framework. The CSM coveys what is known or suspected about contaminant sources, releases and release mechanisms, contaminant fate and transport, exposure pathways, potential receptors, and risks. The CSM is a dynamic model based on what is known about a site at any stage of assessment or remediation and is modified as more information becomes available. The CSM will be used as the basis for decisions regarding the need for additional assessment to fill data gaps and for developing corrective action strategies for the site, if deemed appropriate.

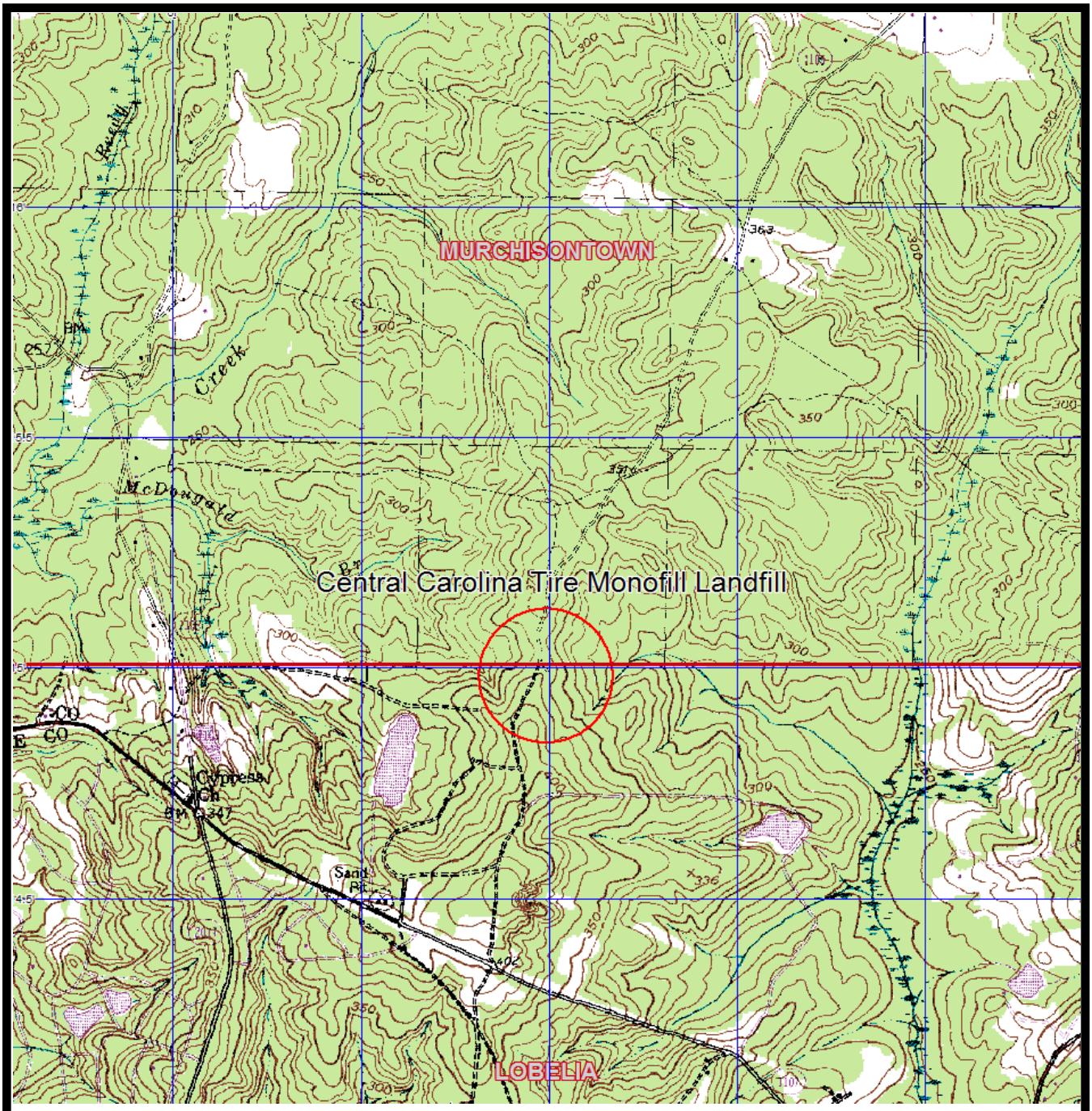
5.0 ASSESSMENT REPORT

A report of results for the Phase II site assessment will be prepared following completion of all field work and receipt of all laboratory analytical data. The report will present details of the field work performed, the results of laboratory analysis of the soil and groundwater samples, interpretations of the results and recommendations for additional work (if deemed necessary). The report will be sealed by a North Carolina Professional Geologist and/or Engineer.

6.0 PROJECT SCHEDULE

Based on the scope of the assessment work plan presented herein, it is estimated that all field work can be completed and an assessment report forwarded to DENR within 16 weeks following regulatory approval of this work plan.

FIGURES AND TABLES



Source: USGS 7.5' Topographic Quadrangle Series
Murchisontown and Lobelia, North Carolina 1981

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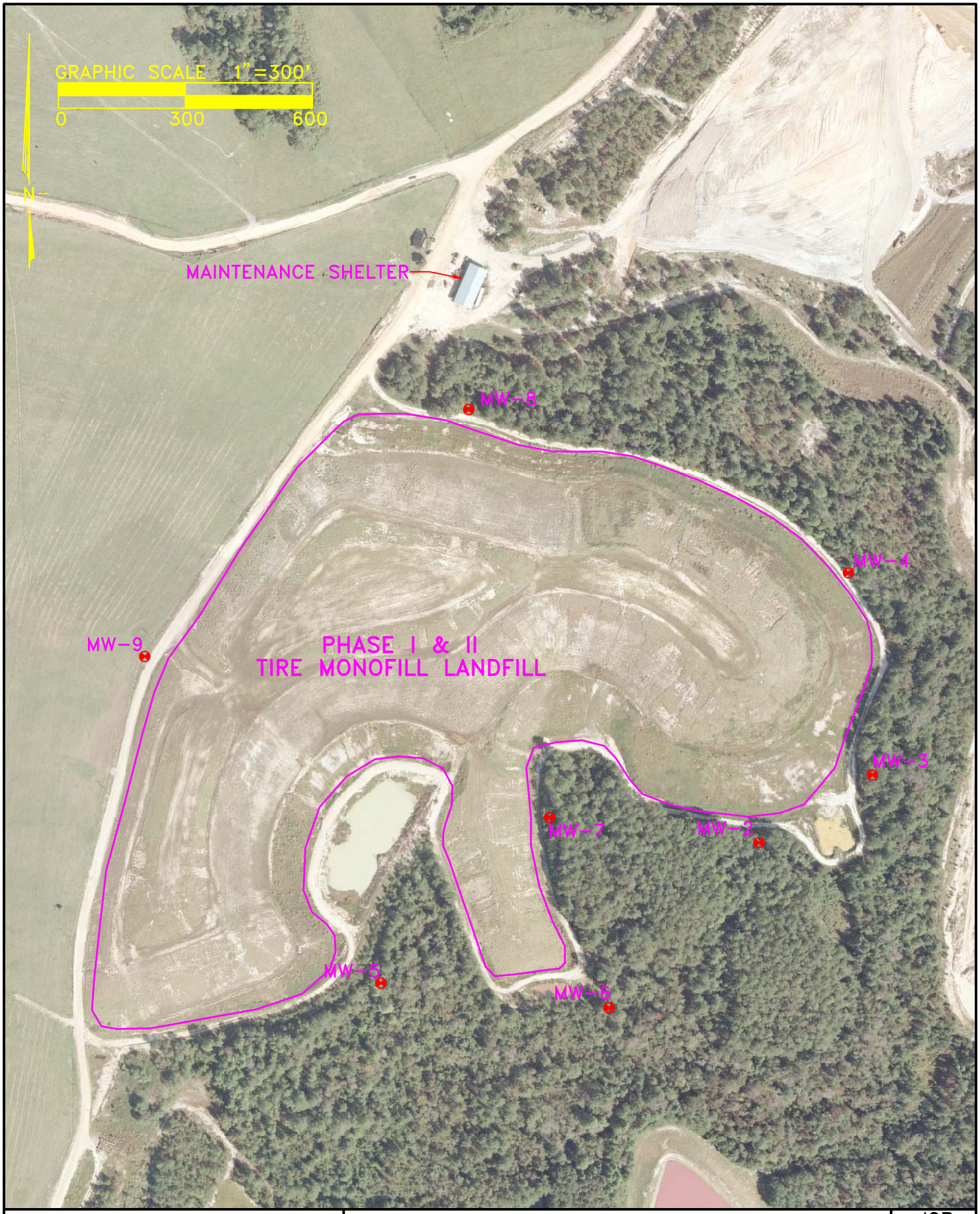
SCALE

Garrett and Moore, Inc.
Engineering Consulting Services
1428 Aversboro Rd., Suite D, Garner, NC 27529
Tel: (919) 926-7906 Fax: (866) 311-7206

SITE LOCATION MAP
Central Carolina Tire Monofill Landfill
1616 McKoy Town Road
Cameron, Harnett County, North Carolina

Drawn by:	Reviewed by:	Project #:	Drawing #: CCT0607-1	Figure No.
USGS	USGS	Scale: 1:24,000	Drawing Date: 6/20/07	1



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CENTRAL CAROLINA HOLDINGS, LLC
PHASE I/II LF GW ASSESSMENT
GW MONITORING LOCATIONS

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FIG
2

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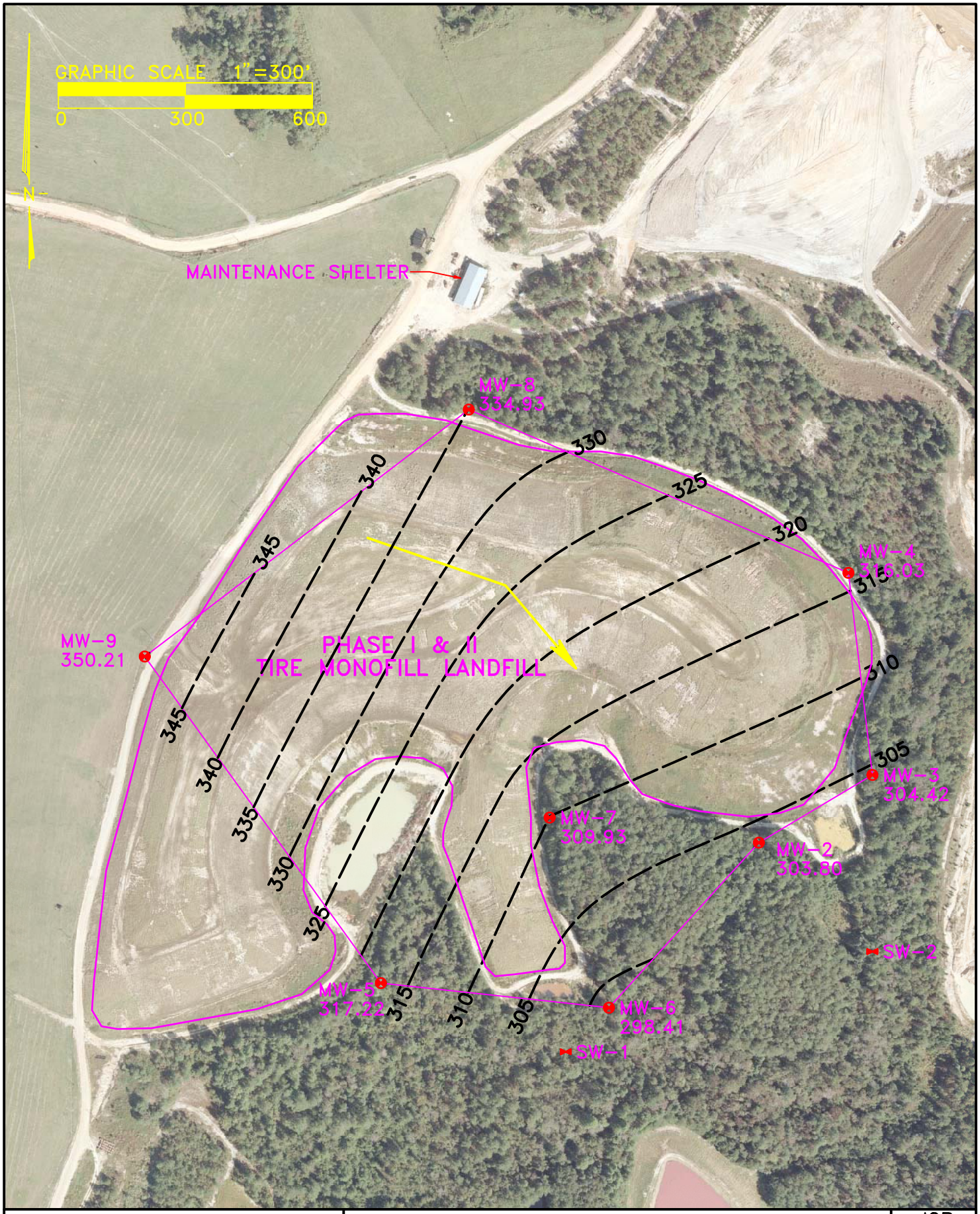

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CENTRAL CAROLINA HOLDINGS, LLC
PHASE I/II LF GW ASSESSMENT
WATER TABLE ELEVATION MAP

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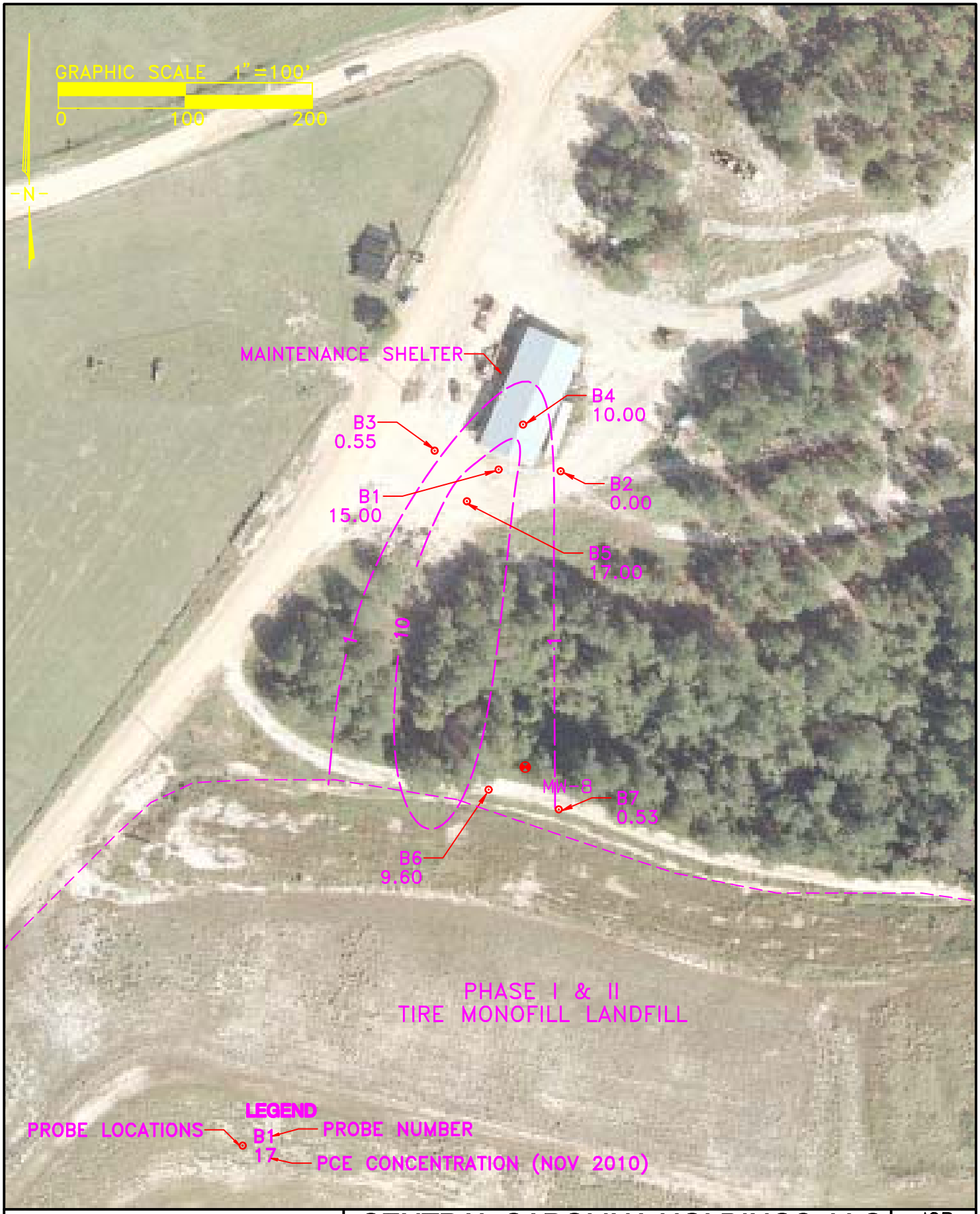
FIG
3



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CENTRAL CAROLINA HOLDINGS, LLC
PHASE I/II LF GW ASSESSMENT
DISSOLVED TETRACHLOROETHENE
ISOCONCENTRATION CONTOUR MAP

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FIG
4

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PHASE I/II LF GW ASSESSMENT
PROPOSED GROUNDWATER MONITORING WELLS

JOB

FIG
5

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Table 1
Monitoring Well and Groundwater Data
April 2011 Sampling Event
April 13, 2011
Central Carolina Tire Monofill Landfill Phase I/II
Harnett County, North Carolina
Permit # 43-04

Well Identity	Well Depth (Feet BGS)	Well Diameter (Inches)	Top of Casing Elevation (Feet MSL)	Depth to Groundwater (Feet BTOC)	Groundwater Elevation (Feet MSL)	Field Parameters			
						Temp. C^{o}	pH	S.C. umhos/cm	Turbidity (ntu)
MW-2	20.0	2.0	309.30	3.50	305.80	13.3	4.53	71	4.3
MW-3	20.0	2.0	315.20	9.02	306.18	14.4	4.58	80	6.2
MW-4	20.0	2.0	320.80	4.36	316.44	13.9	5.05	72	6.9
MW-5	20.0	2.0	322.40	4.56	317.84	16.3	5.39	90	2.4
MW-6	25.0	2.0	305.10	6.50	298.60	15.5	5.07	100	9.3
MW-7	20.0	2.0	315.80	5.50	310.30	16.9	4.42	69	9.2
MW-8	20.0	2.0	342.80	6.92	335.88	14.3	4.43	44	7.8
MW-9	30.0	2.0	378.70	24.17	354.53	14.5	4.02	492	8.8

Notes: BGS = Below Ground Surface
MSL = Mean Sea Level
BTOC = Below Top of Casing
GW = Groundwater
S.C. = Specific Conductance
ntu = Nephelometric Turbidity Units
Approximate depths to groundwater relative to ground surface were calculated by assuming a casing stickup height of 2.5 ft and subtracting from the depth to water measured below the top of the PVC casing.
Monitoring well construction data taken from October-December 2006 Sampling Event Monitoring Report prepared by Withers & Ravenel.

Table 3
Historical Summary of Constituent Detections
Central Carolina Tire Monofill Landfill Phase I/II
Harnett County, North Carolina
Permit # 43-04

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: MW-2																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	ND	2.43 JB	ND	ND	ND	ND	ND	ND	ND	ND
Barium	**700**	130	113	135	170	180	170	152	110	92.1 JB	162.0	97.5 JB	86.7 JB	115 B	73.4 JB	110.0	69.0	94.0
Cadmium	**2**	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.29 J	0.18 J	**10.00**	0.93 J
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	4.58 JB	3.11 J	2.03 JB	1.77 JB	2.91 JB	2.67 JB	ND	1.5 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	1.09 J	3.97 J	ND	ND	4.82 J	ND	1.6 J	0.68 J	ND
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	3.98 J	ND	8.75 J	ND	ND	ND	3.3 J	ND	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.36 JB	3.57 JB	1.16 JB	1.25 JB	ND	ND	ND
1,4-Dichlorobenzene	**6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.23 J	ND	ND	ND
Methylene Chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.160 JB	ND	ND	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.260 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.390 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: MW-3																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	3.3 J	3.39 JB	ND	ND	ND	ND	ND	ND	0.92 J	ND
Barium	**700**	11	17	13	ND	ND	ND	30.5	34.1	20.0 JB	38.4 J	25.5 JB	28.6 JB	29.5 JB	41.2 JB	31.0	39.0	37.0
Cadmium	**2**	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.40**	ND
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	5.06 JB	1.69 J	2.62 JB	2.62 JB	4.29 JB	2.95 JB	ND	1.5 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	1.31 J	3.60 J	ND	3.77 J	5.60 J	7.01 J	0.97 J	1.9 J	1.2 J
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	0.038 J	0.133 J	0.064 J	0.090 J	0.089 J	0.36	0.056 J	ND	0.19 J
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	5.79 J	ND	9.5 J	ND	ND	ND	ND	7.60	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.27 JB	3.74 JB	1.60 JB	ND	ND	ND	ND
Acetone	**6000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.3 J	ND	ND	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.610 J	ND	ND	0.260 J	0.55 J	ND	ND	ND
Bromomethane	**10**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
4-Methyl-2-Pentanone	**560**	ND	ND	ND	ND	ND	ND	ND	0.97 J	ND	ND	ND	ND	ND	2.8 J	0.56 J	0.89 J	ND
Vinyl Chloride	**0.03**	ND	ND	ND	ND	ND	ND	ND	**1.1**	ND	**0.490 J**	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	**6**	ND	ND	ND	ND	ND	ND	ND	ND	0.270 J	0.620 J	ND	ND	0.280 J	0.47 J	ND	ND	ND
C-1,2-Dichloroethene	**70**	ND	ND	ND	1.5	1	ND	1.5	1.7	0.760 J	2.04 J	ND	0.230 J	0.660 J	1.21 J	0.53 J	0.84	0.59
Methylene Chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.110 JB	ND	ND	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.270 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.140 J	ND	0.330 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: MW-4																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	2.9 J	4.16 JB	ND	ND	ND	ND	ND	ND	ND	ND
Barium	**700**	27	32	14	ND	ND	ND	23.7	20	20.9 JB	24.3 J	33.2 JB	29.6 JB	29.6 JB	22.2 JB	28.0	28.0	20.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16 J	ND	0.21 J	ND	0.48 J	ND
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	4.09 JB	3.11 J	2.77 JB	ND	3.40 JB	2.86 JB	ND	1.6 J	ND
Lead	**15**	ND	5	ND	ND	ND	ND	ND	ND	3.12 J	6.11 J	ND	ND	ND	ND	ND	0.96 J	ND
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	3.73 J	ND	ND	ND	ND	ND	ND	3.4 J	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.17 JB	3.90 JB	1.97 JB	1.03 JB	ND	ND	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	0.730 J	0.540 J	0.480 J	0.220 J	0.460 J	ND	0.56 J	ND	0.87
Chloroethane	**3000**	ND	ND	ND	ND	3.0	ND	4.2	1.6	3.59 J	1.99 J	2.35 J	0.820 J	2.55 J	ND	1.3 J	ND	1.2
1,1-Dichloroethane	**6**	ND	ND	ND	ND	3.0	ND	1.0	ND	0.350 J	0.560 J	0.210 J	ND	0.160 J	ND	ND	ND	ND
1,2-Dichloroethane	**0.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-Dichloroethene	**70**	ND	ND	ND	ND	ND	ND	ND	ND	0.210 J	0.560 J	ND	ND	ND	ND	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.310 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.110 J	ND	0.540 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: MW-5																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	ND	4.83 JB	1.93 J	ND	ND	ND	ND	ND	ND	ND
Barium	**700**	23	24	15	ND	ND	ND	ND	19.3	58.2 JB	32.3 J	30.8 JB	30.9 JB	33.6 JB	23.8 JB	30.0	28.0	31.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22 J	0.45 J
Chromium	**10**	7	ND	ND	ND	ND	ND	ND	ND	8.54 JB	5.67 J	1.58 JB	1.25 JB	4.10 JB	2.39 JB	0.60 J	1.7 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	14.5	6.02 J	ND	ND	ND	ND	ND	ND	ND
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	0.058 J	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	5.42 J	ND	ND	ND	ND	ND	ND	3.2 J	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.32 JB	3.74 JB	1.72 JB	ND	ND	ND	ND
Bromoform	**4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16 J	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.210 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.280 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: MW-6																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	2.8 J	2.25 JB	ND	ND	ND	3.08 J	ND	ND	0.9 J	ND
Barium	**700**	47	48	44	ND	ND	ND	37.4	29.9	30.5 JB	26.3 J	36.1 JB	34.1 JB	30.1 JB	21.3 JB	13.0	16 J	18.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26 J	ND
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	5.05 JB	1.31 J	1.88 JB	ND	ND	2.76 JB	0.60 J	1.2 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	1.62 J	4.43 J	6.14 J	3.70 J	3.50 J	ND	0.74 J	2.7 J	ND
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	4.75 J	ND	ND	ND	ND	ND	2.8 J	3.9 J	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.34 JB	3.79 JB	1.47 JB	0.78 JB	ND	ND	ND
Acetone	**6000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.74 J	3.34 J	6.0 J	3.1 J	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	**1.4**	**1.21**	**1.03**	0.780 J	0.880 J	0.990 J	0.81 J	0.56 J	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.180 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.380 J	ND	ND	ND	ND	ND

Notes:

Results in parts per billion (ppb)

ND - Not Detected above the laboratory method detection limit or practical quantitation limit (results prior to April 2007).

NA - Not analyzed for or not available

Values in boldface exceed the corresponding 15A NCAC 2L .0202 groundwater quality standards.

Results for sampling conducted prior to April 2007 as presented in previous GW reports prepared by Withers & Ravenel.

J = Estimated value above laboratory method detection limit and below SWSL or reporting limit.

B = Analyte found in associated field and/or laboratory blank.

Table 3 (Continued)
Historical Summary of Constituent Detections
Phase I/II Tire Monofill Landfill (Active)
Harnett County, North Carolina

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: **MW-7**																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	ND	3.88 JB	ND	ND	ND	ND	ND	ND	1.5 J	ND
Barium	**700**	45	119	102	ND	ND	ND	77	73.6	163 JB	64.2 J	70.7 JB	61.8 JB	63.0 JB	70.0 JB	67.0	65.0	67.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17 J	ND
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	5.47 JB	ND	1.58 JB	1.46 JB	3.01 JB	3.05 JB	ND	2.6 J	ND
Lead	**15**	ND	5.3	ND	ND	ND	ND	ND	2.1 J	10.60	6.54 J	5.69 J	4.02 JB	5.74 JB	6.97 J	3.2 J	9.20	2.7 J
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	0.043 J	0.097 J	0.062 J	ND	ND	0.117 J	0.023 J	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	3.05 J	ND	7.96 J	ND	ND	ND	ND	3.7 J	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.25 JB	3.62 JB	1.69 JB	0.94 J	ND	ND	ND
Acetone	**6000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.70	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.790 J	0.210 J	0.250 J	0.330 J	0.61 J	ND	ND	ND
1,1-Dichloroethane	**6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.150 J	ND	ND	ND	ND	ND	ND	ND
Cis 1,2-Dichloroethene	**70**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.240 J	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.23 JB	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.250 JB	0.320 J	ND	ND	ND	4.90	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.130 J	ND	0.520 J	ND	0.11 J	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: **MW-8**																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	ND	2.03 JB	ND	ND	ND	ND	ND	ND	ND	ND
Barium	**700**	112	32	24	ND	ND	ND	41.5	42.5	32.1 JB	41.4 J	43.9 JB	46.1 JB	45.0 JB	39.2 JB	38.0	33.0	40.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND	0.59 J	0.17 J
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	5.03 JB	4.54 J	2.33 JB	1.25 JB	3.20 JB	2.95 JB	0.56 J	1.3 J	ND
Lead	**15**	4	ND	ND	ND	ND	ND	ND	ND	1.04 J	7.71 J	7.42 J	ND	6.30 J	ND	1.1 J	0.72 J	1.1 J
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.28 JB	3.90 JB	1.29 JB	0.8 JB	ND	ND	ND
Ethylbenzene	**29**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.120 J	ND	ND	ND	ND	ND
Tetrachloroethene	**0.7**	ND	ND	ND	ND	ND	ND	ND	**1.8**	0.310 J	0.550 J	**0.730 J**	**0.960 J**	**2.40**	**1.74 B**	**6.30**	**1.80**	**5.40**
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.450 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.700 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: **MW-9**																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	2.6 J	2.88 JB	5.04 J	ND	ND	ND	ND	**15**	ND	**13**
Barium	**700**	188	455	308	370	270	360	242	310	462 JB	366.0	288 B	50.1 JB	210 B	311 B	680.0	230.0	**940**
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.21 J	0.23 J	0.52 J	0.31 J
Chromium	**10**	ND	5.3	ND	ND	ND	ND	ND	ND	5.71 JB	1.24 J	1.73 JB	1.35 JB	2.82 JB	5.21 JB	1.0 J	2 J	ND
Lead	**15**	ND	7.0	ND	ND	ND	ND	ND	ND	7.21 J	6.84 J	5.02 J	ND	ND	ND	10.00	3.4 J	10
Mercury	**1**	ND	0.8	ND	ND	ND	ND	ND	ND	0.83	0.077 J	ND	ND	ND	ND	0.12 J	ND	0.77
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	2.2 J	1.35 J	ND	ND	ND	ND	ND	ND	ND	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.95 JB	1.18 JB	ND	ND	ND	ND
Bromoform	**4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.28 J	ND	ND	ND
Ethylbenzene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.210 J	ND	ND	ND	ND	ND
Methylene Chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16 JB	ND	ND	ND
Toluene	**600**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.810 J	ND	ND	ND	ND	ND
Total Xylenes	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.31 J	ND	ND	ND	ND	ND

Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: **SW-1**																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	2.2 J	2.07 JB	2.86 J	ND	2.78 J	ND	ND	ND	0.61 J	ND
Barium	**700**	19	14	15	ND	100	ND	ND	17.6	18.7 JB	25.5 J	30.4 JB	384 B	36.2 JB	21.1 JB	19.00	32.00	38.00
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.370 J	0.28 J	ND	0.3 J	ND
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	5.76 JB	2.66 J	2.03 JB	2.09 JB	3.70 JB	2.49 JB	0.70 J	1.3 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.39 J	6.07 J	7.11 J	3.91 JB	ND	ND	ND	ND
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	3.7 J	1.96 J	ND	ND	ND	ND	ND	ND	3.3 J	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.46 JB	2.07 JB	1.38 JB	0.87 JB	ND	ND	ND
Acetone	**6000**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.51 JB	ND	ND	ND	ND	2.8 J	ND
Benzene	**1**	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	0.260 J	ND	ND	ND	ND	ND

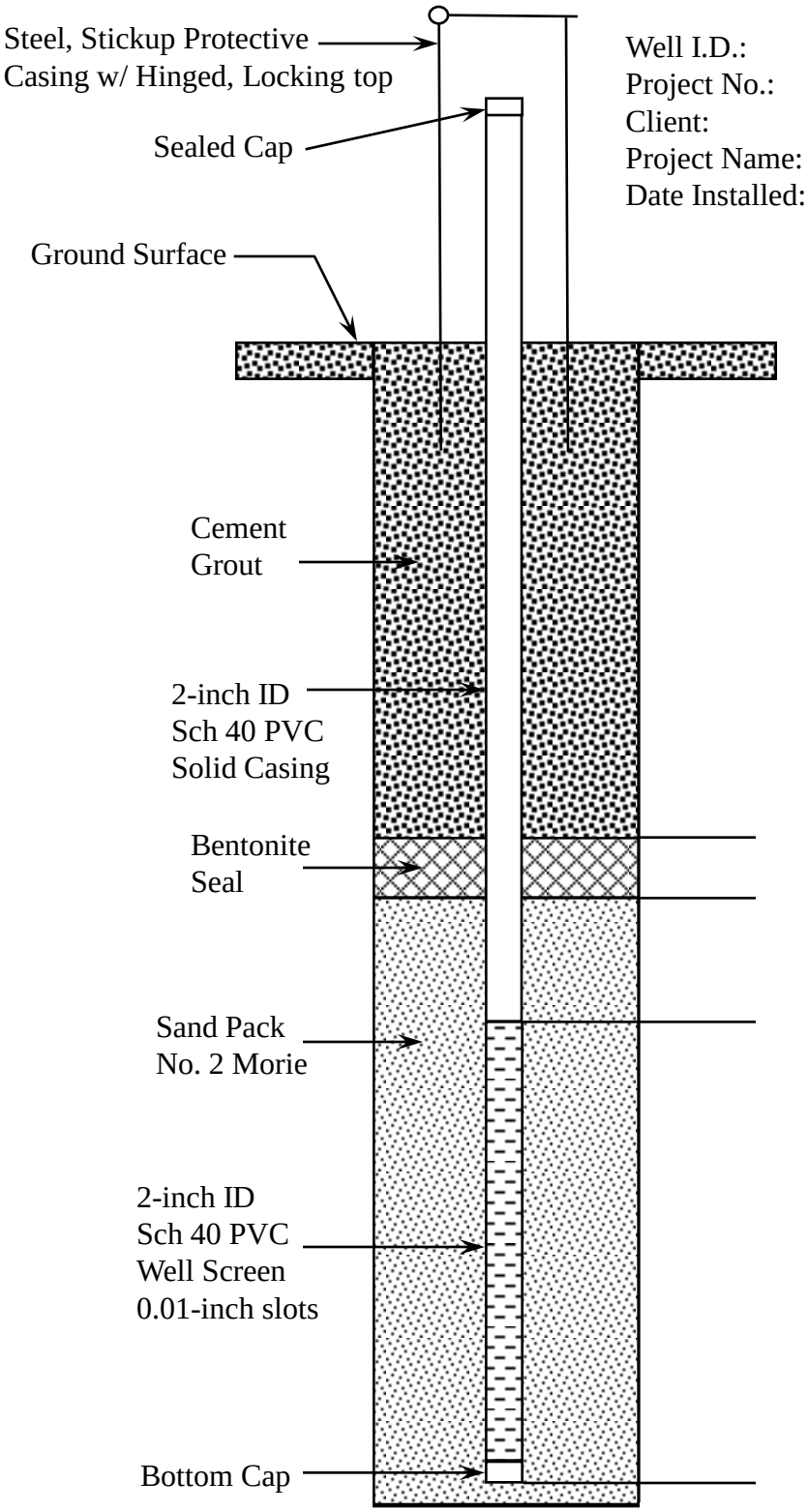
Sampling Date:	2L Standard	4/15/2003	10/23/2003	3/24/2004	11/9/2004	6/23/2005	10/26/2005	3/30/2006	10/19/2006	4/18/2007	10/24/2007	4/29/2008	10/14/2008	4/22/2009	10/14/2009	4/29/2010	10/19/2010	4/13/2011
Well No: **SW-2**																		
Arsenic	**10**	ND	ND	ND	ND	ND	ND	ND	2.9 J	1.70 JB	2.92 J	ND	ND	ND	ND	ND	ND	ND
Barium	**700**	26	12	13	ND	ND	ND	ND	21.1	31.1 JB	14.3 J	30.5 JB	55.6 JB	27.5 JB	75.1 JB	48.0	40.0	31.0
Cadmium	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J	ND	1.2	0.63 J
Chromium	**10**	ND	ND	ND	ND	ND	ND	ND	ND	6.09 JB	5.66	2.47 JB	2.82 JB	2.82 JB	11.6 B	1.1 J	1.8 J	ND
Lead	**15**	ND	ND	ND	ND	ND	ND	ND	ND	0.350 J	ND	3.79 J	6.25 J	4.42 J	21.3	ND	1.0 J	1.0 J
Mercury	**1**	ND	ND	ND	ND	ND	ND	ND	0.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2 J	ND	ND
Silver	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.24 JB	3.73 JB	1.58 JB	ND	ND	ND	ND

Notes:
Results in parts per billion (ppb)
ND - Not Detected above the laboratory method detection limit or practical quantitation limit (results prior to April 2007).
NA - Not analyzed for or not available
Values in boldface exceed the corresponding 15A NCAC 2L .0202 groundwater quality standards.
Results for sampling conducted prior to April 2007 as presented in previous GW reports prepared by Withers & Ravenel.
J = Estimated value above laboratory method detection limit and below SWSL or reporting limit.
B = Analyte found in associated field and/or laboratory blank.

APPENDIX A

Monitoring Well Schematics

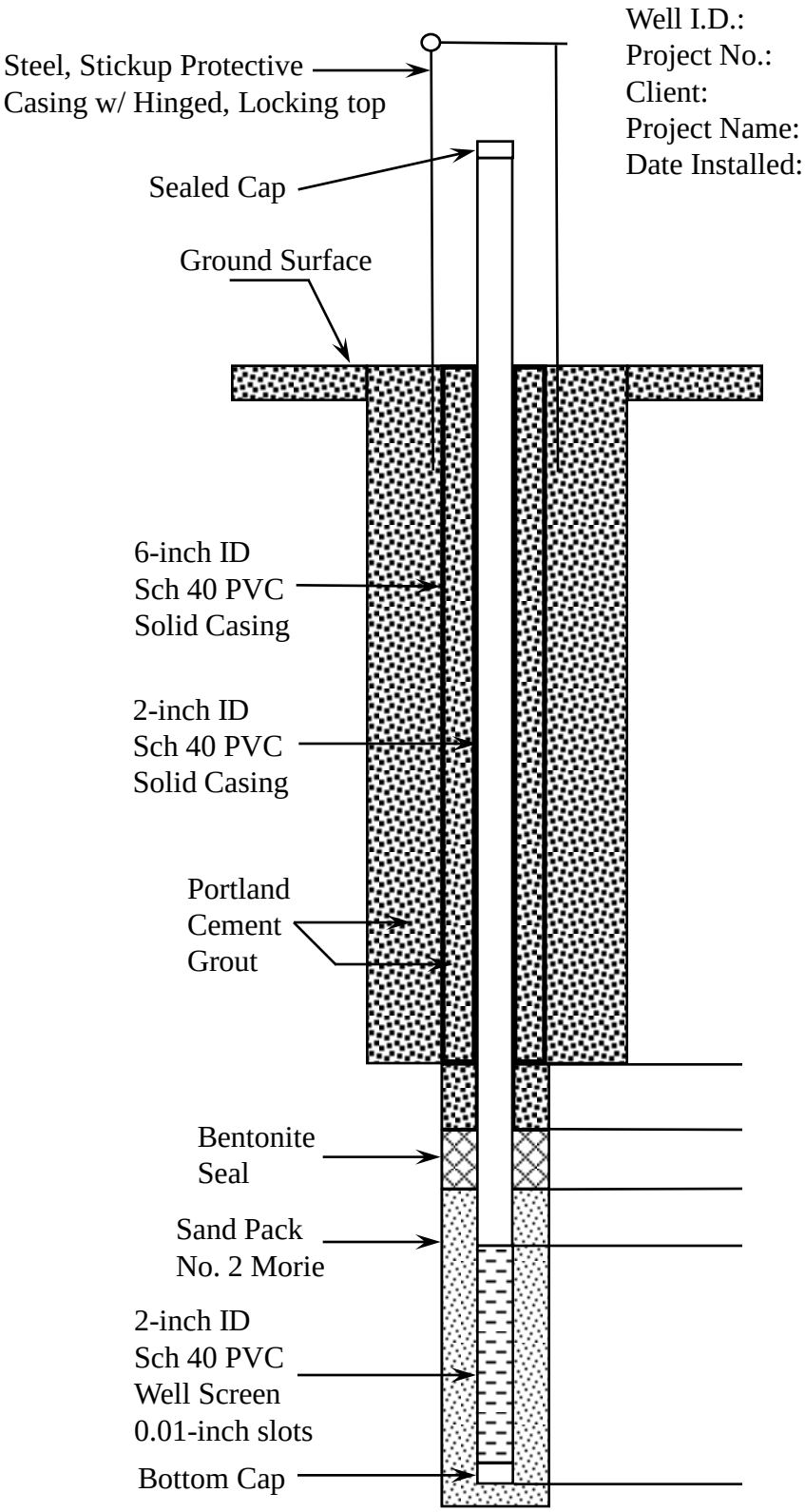
WELL CONSTRUCTION DIAGRAM
Type II Groundwater Monitoring Well



Well I.D.:
Project No.:
Client:
Project Name:
Date Installed:

NOT TO SCALE

WELL CONSTRUCTION DIAGRAM
Type III Groundwater Monitoring Well



NOT TO SCALE