RECEIVED
30
SOLID WASTE SECTION

WHITE STREET LANDFILL
PHASE II CORRECTIVE ACTION PLAN
GREENSBORO, NORTH CAROLINA

S&ME Project No. 1584-98-081

Prepared For:

The City of Greensboro

Prepared By:

S&ME, Inc.
3718 Old Battleground Road
Greensboro, North Carolina 27410

June 2008

JUN 30 2008
SOLID WASTE SECTION

WHITE STREET LANDFILL
PHASE II CORRECTIVE ACTION PLAN
GREENSBORO, NORTH CAROLINA

S&ME Project No. 1584-98-081

Prepared For:

The City of Greensboro

Prepared By:

S&ME, Inc.
3718 Old Battleground Road
Greensboro, North Carolina 27410

June 2008

S&ME

Celebrating 35 Years
1973 • 2008

I hereby certify this 9th day of June, 2008, that this report was prepared by me or under my direct supervision.

NORTH CAROLINA LICENSED SEAL 1216 GEOLOGIST EDMUND Q.B. HENRIQUES

Edmund Q.B. Henriques, P.G.
Environmental Department Manager

Report preparation performed by:

Connel D. Ware
Senior Project Manager

SR: WHW

TABLE OF CONTENTS

Page No.

Executive Summary **1**
1.0 Introduction **1**
1.1 Site Background 1
1.2 Regional Geology 3
1.3 Site Geology 3
1.4 Site Soil Classification 3
1.5 Aquifer Characteristics 3
1.5.1 Darcy's Velocity 4
1.5.2 Seepage Velocity 4
1.6 Contaminant Transport Conceptual Model 5
1.6.1 Surface Water Model 5
1.6.2 Groundwater Model 5
1.7 Regulatory Status 6
2.0 Contaminant Characterization **6**
2.1 Constituents of Concern 6
2.2 Contaminant Distribution 7
2.3 Contaminant Source Confirmation 9
2.4 Source Control Measures 9
2.5 Groundwater End Use 9
2.6 Sensitive Receptor and Exposure Pathway Risks 10
2.7 Exceedances of Groundwater Quality Standards 10
2.8 Exceedances of Surface Water Quality Standards 11
2.9 Media of Concern 11
3.0 Selected Remedy **12**
3.1 Remedy Description 12
3.1.1 Phytoremediation 12
3.1.2 Monitored Natural Attenuation 14
3.2 Justification of Selected Remedy 18
3.3 Technical Approach, Design, and Specifications 20
4.0 Groundwater And Surface Water Monitoring **23**
4.1 Revised Water Quality Monitoring Plan 23
4.2 CAMP Monitoring Well Network 23
4.2.1 Revised Compliance Monitoring Network Description 23
4.2.2 Sentinel Monitoring Network Description 24
4.3 CAMP Monitoring Constituent List 24
4.4 Surface Water Sampling 25
5.0 Evaluation of Effectiveness of Remedial Actions **25**
5.1 Performance Evaluations 25
5.2 Corrective Action Site Evaluation Reporting 26
6.0 Contingency Plan **28**
7.0 Corrective Action Plan Implementation Schedule **29**
7.1 Corrective Action Plan Completion 29
7.2 CAP Implementation Bid Process and Proposal Preparation 29
7.3 Phytoremediation System Installation, CAP Implementation 29
7.4 MNA Indicator Background Sampling Events 30

TABLE OF CONTENTS (CONT.)

Page No.

8.0 Financial Assurance Requirements 30
9.0 Completion of Corrective Action 30
10.0 References 31
Tables I
Figures II
Appendix I III
Appendix II IV
Appendix III V
Appendix IV VI
Appendix V VII
Appendix VI VIII
Appendix VII IX
Appendix VIII X

EXECUTIVE SUMMARY

As per 15A NCAC 13B.1635 of the North Carolina Department of Environment and Natural Resources, Division of Waste Management (NCDENR-DWM) whenever it is demonstrated that one or more constituents listed in Appendix II has been detected at a statistically significant level exceeding the 15A NCAC 2L Groundwater Quality Standards (2L standards) and/or NCDENR GPS, the owner or operator shall initiate Assessment of Corrective Action Measures. Under the Assessment Groundwater Monitoring Program, a statistically significant level is determined by a point comparison of the compliance data directly to the 2L standard or NCDENR GPS.

Several organic compounds including the volatile organic compounds benzene, trichloroethene, tetrachloroethene, vinyl chloride, and 1,4-dichlorobenzene as well as the inorganic constituent thallium have exceeded the 2L standards and/or the North Carolina Department of Environment and Natural Resources (NCDENR) Groundwater Protection Standards (GPS) within the Phase II portion of the White Street Landfill compliance monitoring well network.

These exceedances above the 2L Standard at Phase II of the White Street Landfill Facility triggered the Assessment of Corrective Action Measures. This process requires Facilities to characterize the nature and extent of the plume as well as assess possible remedies to restore groundwater quality at the Facility to levels below the 2L standards, and ultimately prepare a Corrective Action Plan (CAP) to implement the appropriate remedy(s) to achieve compliance with the standards.

Based on the results of a Nature and Extent Study and Assessment of Corrective Measures Report completed by S&ME, Inc. on behalf of the City of Greensboro (City), the City has selected Phytoremediation coupled with Monitored Natural Attenuation (MNA) to restore groundwater quality to the 2L standards in the Phase II portion of the White Street Landfill.

In accordance with 15A NCAC 13B .1636 S&ME, Inc. has prepared this Corrective Action Plan on behalf of the City of Greensboro to implement the City's selected combined remedies of Monitored Natural Attenuation (MNA) coupled with Phytoremediation at Phase II of the White Street Landfill (Facility).

1.0 INTRODUCTION

1.1 Site Background

The White Street Landfill is located at the end of White Street in the City of Greensboro, North Carolina (reference **Figure 1**). The subject landfill contains three distinct phases, I, II, and III, which operated under Permit Nos. 41-03 (Phase I & II) and 41-12 (Phase III). Phase II of the landfill is an active construction, demolition, and debris landfill on top of a closed municipal solid waste (MSW) cell. The Phase II portion of the landfill was included under Permit No. 41-03. A detailed site map is included as **Figure 2**. The NCAC 2L Groundwater Quality Standards (2L standards) for several target constituents have been exceeded in Phase II of the facility at points along the north-northwestern

property boundary. The nearest downgradient receptor north-northwest of the facility is North Buffalo Creek.

A Nature and Extent Study Report has been completed by S&ME describing the nature of the primary constituents of concern within Phase II exceeding their respective 2L standards, where the exceedances occurred within the compliance network, and to what extent the 2L standards were exceeded. The results of the Nature and Extent Study indicated that organic constituents tetrachloroethene (PCE), trichloroethene, benzene, 1,4 dichlorobenzene, and vinyl chloride, as well as inorganic constituents thallium and vanadium, exceeded the 2L standards and/or NCDENR GPS values within the Nature and Extent Study (NES) wells at the north-northwestern property boundary near North Buffalo Creek.

Subsequent to the completion of the Nature and Extent Study, S&ME completed an Assessment of Corrective Measures Report (ACM) which documented the potential corrective measure options and recommended, with public input, measures that are appropriate for the facility based on the magnitude of the constituents of concern. The ACM evaluated "The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination; the time required to begin and complete the remedy; the costs of remedy implementation; and the institutional requirements such as State and Local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s)," as per 15A NCAC 13B.1635 of the NCDENR DWM.

In order to incorporate comments from the general public regarding the selection of the remedy for the Phase II portion of the White Street Landfill, the City of Greensboro held a public meeting on December 20, 2007 at 6:30PM at the Peeler Recreational Facility in Greensboro. An announcement of the public meeting was run in the local newspaper for two consecutive weeks prior to holding the public meeting. The above mentioned NES and ACM Reports were displayed for public review at two local libraries. Both of these Reports were approved by NCDENR.

Subsequent to the original submittal of the NES and ACM Reports, it was decided between S&ME and the City of Greensboro to include Phytoremediation as an integral part of the Facility's selected remedies to restore groundwater quality and attain the approved Groundwater Protection Standards (GPS). In order to recommend Phytoremediation as part of the selected remedy the Facility's ACM had to be amended to include Phytoremediation as a possible remedy. The ACM was amended to include Phytoremediation, and in order to satisfy the requirements of 15A NCAC 13B.1635 (d), the amended ACM was made available for public review at two public libraries for a 30-day public comment period followed by a subsequent public meeting with interested and affected parties. The second public meeting was held on June 19, 2008 at the Peeler Recreational Facility in Greensboro.

The final step in the Assessment of Corrective Measures process is to prepare a Corrective Action Plan to implement the selected remedy(s) outlined in the ACM Report. In accordance with the guidelines set forth in 15A NCAC 13B.1636, S&ME has prepared

this Corrective Action Plan (CAP) for the White Street Landfill Facility. This CAP will be protective of human health and the environment, outline the necessary course of actions to implement the selected remedies of MNA and Phytoremediation at the Facility, describe the required revisions to the Facility's Water Quality Monitoring Plan (WQMP), discuss the implementation schedule, and include an estimated projected schedule to meet the requirements of 15A NCAC 13B.1636 (b) (2) to "attain the approved Groundwater Protection Standards (GPS)".

1.2 Regional Geology

The Greensboro area of North Carolina lies in the center of the Piedmont Physiographic province of the Appalachian Highlands. The Piedmont is comprised of five northeast southwest trending rock belts of various metamorphic grades. Greensboro lies within the Carolina Slate Belt, a group of low rank meta sedimentary rocks that were originally deposited in an off-shore island arc system. Various volcanic rocks including tuffs, basalts, argillites, and others were deposited in a shallow marine environment. The age of these rocks are believed to be Pre-Cambrian to Paleozoic.

Numerous tectonic events have greatly deformed these rocks and a general metamorphic imprint has taken place. Additionally, several intrusive events have occurred which have resulted in the emplacement of granitic plutons of Paleozoic age throughout the belt.

1.3 Site Geology

Locally, the landfill area is underlain by granitic plutonic rocks. The depth of these rocks varies with topography, but is generally less than 30 feet. As the rocks weather, the individual mineral grains tend to disintegrate into small rocks and pebbles within a sandy matrix. This soil is commonly referred to as "sandrock" in reference to its weathering characteristics.

1.4 Site Soil Classification

According to the Soil Survey of Guilford County, the soil in the landfill area has been classified as Pits (Pt). Pits are miscellaneous land types made up of areas where the original soil has been removed or altered beyond recognition. In landfill areas the original soil has been removed and solid waste material has been placed in alternating layers with original soils and other materials.

The soils around the landfill include Wehadkee silt loams (Wh), Chewacla sandy loams (Ch), Wilkes sandy loams (Wke), Madison sandy loams (MaE and MaD), Enon fine sandy loams (EnC and EnB), Mecklenburg sandy clay loam (McC2), Mecklenburg-Urban land complex (MuB), and Cecil-Urban land complex (CfB).

1.5 Aquifer Characteristics

The uppermost aquifer was characterized during a subsurface exploration program executed by BPA Environmental and Engineering Inc. (BPA). This program was initiated during installation of the initial groundwater monitoring network during February, 1996. In situ hydraulic conductivity tests were performed by BPA on wells I-5, II-1, II-2, II-3, II-4, II-5, and MW-13. The data from these tests yielded hydraulic conductivity values ranging from 0.042 feet/day in II-5 to 0.380 feet/day in II-3. A

complete discussion of the test methods and calculations is presented in BPA's February 1996 report "In-situ Hydraulic conductivity Testing, White Street Landfill, Greensboro, North Carolina". In-situ hydraulic conductivity tests were performed by HDR Engineering, Inc. on monitoring wells II-6, II-7, II-8, and MW-14 in the fall of 1995. The hydraulic conductivities determined by HDR ranged from 0.221 feet/day in II-6 to 2.353 feet/day in II-8. These data were used to calculate groundwater flow velocities across the site.

The static water levels in the Phase II monitoring wells were measured on September 27, 2007. The depth to the water table ranged from 9.50 feet to 29.38 feet below the top of well casing on these dates. A groundwater contour map constructed using the data collected during September 2007 is presented as **Figure 3**. The groundwater gradient at each well was calculated assuming a constant groundwater gradient along the flow line between adjacent groundwater elevation contours or between the well and the nearest contour. Groundwater flow lines were drawn through each well based upon the groundwater elevation data collected during this monitoring event. The groundwater elevation data collected during this monitoring event indicates that the groundwater beneath Phase II generally flows toward the northwest, toward North Buffalo Creek.

Calculated hydraulic conductivity and gradient values and estimated effective porosity values for each well were used in the velocity calculations. The 20 percent effective porosity value is based on porosity and specific yield versus grain size distribution relationships presented in Fetter (1988), and is typical of the types of soils (predominantly silts and sandy silts with some clays) comprising the regolith at the landfill. The calculated groundwater velocities ranged from 0.007 feet/day to 0.136 feet/day.

The September 2007 groundwater velocity calculations can be found in **Appendix I** of this report. The potentiometric map on which the gradient calculations were based is Figure 3 of this report. Calculation methodology is described in the following sections.

1.5.1 Darcy's Velocity

In 1856, Darcy first characterized flow through a porous media. Darcy's Law states that;
$Q = kiA$
where;
Q = Rate of flow, [cm3/sec]
k = Hydraulic Conductivity, [cm/sec]
I = Hydraulic gradient = dh/dl
A = Cross sectional area, perpendicular to direction of flow [cm2]

Therefore, flow is equal to the velocity of the fluid multiplied by the cross-sectional area where flow is occurring. This yields Darcy's velocity.

1.5.2 Seepage Velocity

The seepage velocity (vs) of a fluid flowing through a porous media is derived from Darcy's velocity. Darcy's velocity does not, however, literally describe the movement of fluid through the porous media. It is simply a statistically convenient product. This is due to one of Darcy's original assumptions that flow occurs over the entire cross-

sectional area, thus ignoring the soil particles themselves. To determine the actual speed a fluid flows through a porous media, such as soil, a more accurate representation of the area of flow must be realized. Soil mechanics commonly makes use of a void space to soil solids space ratio. Porosity is defined as the volume of voids per volume of total space;

$n = Vv / Vt$

Therefore, the seepage velocity of a fluid moving through soil may be expressed as;

$vs = vd / n$

1.6 Contaminant Transport Conceptual Model

1.6.1 Surface Water Model

The natural topography surrounding the waste management units at the Facility is best characterized as gradual to moderately sloping with small drains and small hollows truncating the slopes and feeding the unnamed tributaries of North Buffalo Creek. Surface runoff in the undisturbed areas of the landfill will generally mimic the slope gradients and follow the drains and small hollows to the creek. Infiltration and percolation into the upper soil horizon is expected to be moderate due to the sandy loam content within this stratum. Percolation within the waste management units is expected to be minimal since the landfill has been capped with a compacted low permeability clay layer. However, in areas where weathering and erosion have thinned or removed the upper soil horizon such that it is exposed at the surface, vertical percolation rates will be higher as this soil horizon has a greater sand and gravel content. The nearest surface water body to the waste management units is North Buffalo Creek. The shortest distance between any of the waste management units and North Buffalo Creek is between the stream and the northeast corner of the Phase II disposal area located adjacent to the stream at the northeast property boundary. The distance from the stream to the northern edge of the waste management units of the landfill varies along the waste boundary. This stream will be the primary receptor of surface water runoff from the landfill

1.6.2 Groundwater Model

The uppermost pervasive aquifer at the site is the soil to bedrock interface. The aquifer is contained within the weathered and metamorphosed granitic gneiss. The principal flow vectors within the bedrock aquifer will be along current or relic fracture planes and joints and as porous media flow in saprolitic intervals.

In the Piedmont region, groundwater generally occurs in two hydraulically interconnected zones. The upper zone, or regolith, consists of an unconsolidated or semi-consolidated mixture of clay fragmental material ranging in size from silt to sand boulders. The porosity of the regolith is generally on the order of 20 to 30 percent (Heath, 1984). Because of its high porosity, the regolith functions as a reservoir which slowly feeds water downward into the bedrock. Water is introduced to the regolith by precipitation and stream flow. Once in the regolith, groundwater moves between intergranular pore spaces.

This “water table” zone is controlled by climactic factors. Groundwater levels vary seasonally, declining during the summer when atmospheric conditions favor evaporation

and plants transpire large amounts of water, and rising during the winter when plants are dormant. Annual groundwater storage in the vicinity of the Landfill Facility is thought to be relatively stable.

Groundwater also occurs below the regolith, in the bedrock zone where it moves through sheet like openings formed along fractures. Fractures in bedrock are of two types: joints, which are fractures along which there has been no differential movement, and faults, which are fractures along which the adjacent rocks have undergone measurable differential movement. Groundwater in the bedrock zone is fairly stable and not easily influenced by climactic conditions. The regolith and bedrock zones are connected hydraulically.

Reference Figure 1 for the White Street Landfill Overall Base Map.

1.7 Regulatory Status

Groundwater exceedances above the 2L Standard in Phase II of the White Street Landfill triggered the Assessment of Corrective Measures process. This process requires Facilities to characterize the nature and extent of the release as well as assess possible remedies to restore groundwater quality at the Facility to levels below the 2L standards, and ultimately prepare a Corrective Action Plan (CAP) to implement the appropriate remedy(s) to achieve compliance with the standards.

A Nature and Extent Study and Assessment of Corrective Measures Report were completed by S&ME, Inc. on behalf of the City of Greensboro (City) for the White Street Landfill. The Facility is currently in the final stage of the Corrective Measures process, which is to prepare and ultimately implement a CAP to restore groundwater quality at the Facility. This CAP has been prepared in accordance with 15A NCAC 13B .1636 to implement the City's selected combined remedies of Monitored Natural Attenuation (MNA) coupled with Phytoremediation to restore groundwater quality at Phase II of the White Street Landfill (Facility).

2.0 CONTAMINANT CHARACTERIZATION

2.1 Constituents of Concern

After entering the Assessment Monitoring Program in 1997, several target constituent concentrations exceeded the approved 15A NCAC 2L groundwater quality standards (2L standard) and/or the North Carolina Groundwater Protection Standards (GPS) (for constituents without a 2L standard) in several downgradient compliance groundwater monitoring wells. However, since 1997, most of these constituents have shown decreasing trends in reported concentrations during subsequent monitoring events, and many have not exceeded their respective 2L or GPS standards for several years. The Nature and Extent Study Report prepared by S&ME for the Facility addressed the constituents which had been detected above the respective 2L or GPS throughout the monitoring history of the Facility. For the purpose of determining the constituents of concern which require remedial action under this Corrective Action Plan, constituents which have not been detected at concentrations above their respective 2L or GPS for two consecutive years (four monitoring events) or more are no longer considered constituents

of concern (COCs). Constituents not listed as a concern under this CAP have not exceeded the 2L or GPS within the last two years. Many of the historically detected constituents which triggered Assessment Monitoring at the Facility have either not been detected or have not exceeded the 2L or GPS within the last seven years.

Additionally, S&ME completed an Alternate Source Demonstration (ASD) for metals (White Street Landfill Phase II – Alternate Source Demonstration Amendment, S&ME Inc., August 2007). The purpose of the ASD was to determine if the presence of naturally-occurring metals in the onsite in-situ soils were affecting groundwater quality through vertical percolation into the uppermost pervasive aquifer beneath the White Street Landfill. The results of the ASD successfully demonstrated that the metals cadmium, chromium, and vanadium which have historically, as well as currently (in the cases of cadmium and vanadium) exceeded their respective 2L standard or GPS value are naturally-occurring in the in-situ soils at the Facility. The ASD also successfully demonstrated that the concentrations of the naturally-occurring metals cadmium, chromium, and vanadium within the in-situ soil at the Facility are sufficient to influence the concentrations of these metals in groundwater samples collected from the downgradient groundwater monitoring wells and the exceedance of cadmium, chromium, and vanadium above their respective 2L Standards is not due to a release by the Facility, but instead may be the result of the natural occurrence of these metals in the native, residual soil. Based on the results of the ASD, the metals cadmium, chromium, and vanadium are not considered COCs.

Therefore, the constituents considered the primary constituents of concern for which remedial action is required include the volatile organic compounds benzene, trichloroethene, tetrachloroethene, vinyl chloride, and 1,4 dichlorobenzene, as well as the inorganic constituent thallium. The historical groundwater quality monitoring results for all of these COCs are included in **Table 1** thru **Table 9**.

2.2 Contaminant Distribution

The Nature and Extent Report submitted to the NCDENR in August of 2007 documented the exceedance of the 2L standards and/or NCDENR GPS at Phase II of the White Street Landfill.

As a result of several network compliance monitoring wells containing target constituent concentrations exceeding the established NCAC 2L groundwater standard and/or NCDENR GPS, Phase II of the White Street Landfill as defined under NCDENR Permit #41-03 installed seven non-network shallow monitoring wells, with one deep monitor well. The wells are designated II-2B, II-7B (deep monitor well), II-9, II-10, II-11, II-12, and II-13.

The nature of impacts to the hydrogeologic regime at the White Street Landfill Facility is primarily from low level organic constituents. However, the metal thallium also exceeds the recently promulgated NCDENR GPS of 0.28 μg/L set by NCDENR for thallium.

The lateral extent of contaminant migration away from the landfill is limited by North Buffalo Creek, which truncates the primary component of groundwater flow in the uppermost prevalent aquifer along the northern Facility boundary. This creek also

represents the primary receptor of impact from constituents migrating away from the landfill and is expected to be the primary local discharge point for the uppermost prevalent aquifer. The vertical extent of contaminant migration has been observed to be limited to periodic low level impacts from tetrachloroethene at a concentration close to the NCAC 2L standard in NES well II-7B.

For the last two years the occurrences of the organic constituents of concern are limited to monitoring wells II-1, II-2, II-2B, II-7, II-7B, and II-9. The organic constituents of concern detected in monitoring well II-1 include vinyl chloride and 1,4 dichlorobenzene. The organic constituents benzene, trichloroethene, tetrachloroethene, and vinyl chloride have all been detected at monitoring well II-2 with tetrachloroethene and vinyl chloride also being detected at monitoring well II-2B. Monitoring well II-7 has shown recent detections of vinyl chloride above its respective 2L standard, and groundwater samples from both wells II-7 and II-7B(deep well) have shown detections of tetrachloroethene above its respective 2L standard. Finally, vinyl chloride has been detected in monitoring well II-9 at reported concentrations above its respective 2L standard.

The occurrences of these organic constituents of concern are defined by the location and vicinity of the above listed monitoring wells as illustrated on **Figure 4**. For illustrative purposes the lateral extent of these organic constituents of concern shown on Figure 4 was interpreted to extend half the distance between the monitoring well in which volatile organic compounds (VOCs) have occurred above the 2L standard or GPS and the next neighboring monitoring well in which no VOCs were detected at concentrations above the applicable standard. The downgradient extent of the organic constituents of concern is limited by North Buffalo Creek, which is the primary receptor of groundwater influenced by the landfill.

The occurrences of the metal thallium are limited to monitoring wells II-1, II-2, II-6, NES Well II-11, and II-12 and is also defined by the location and vicinity of these wells as illustrated on **Figure 5**. As with the VOCs, the lateral extent of the metal thallium shown on Figure 5 was approximated to half the distance between the monitoring well in which thallium occurred above its GPS and the next neighboring monitoring well in which thallium was not detected. The downgradient extent of thallium is defined by North Buffalo Creek which is the primary receptor of groundwater influenced by the landfill. It is important to note that thallium has not been detected above its respective GPS of 0.28μg/L in any compliance monitoring well for three consecutive groundwater monitoring events. If thallium is not detected above its GPS in the compliance monitoring wells during subsequent groundwater monitoring events, the need to address thallium through the corrective measures later discussed in this report may be modified (e.g. only detected in one or more wells) or nullified (e.g. non-detect in all compliance monitoring wells).

It is S&ME's opinion that the presences and distribution of trichloroethene (TCE) and vinyl chloride (VC) are likely related to anaerobic degradation of tetrachloroethene in the decomposing waste. As such, TCE and VC in certain downgradient compliance wells, likely represents the leading edge of the chlorinated solvent plume within this hydrogeologic regime.

2.3 Contaminant Source Confirmation

The source of the constituents of concern which have affected groundwater quality in the downgradient region of the White Street Landfill Facility is the Phase II waste management unit.

With the exception of benzene, the organic constituents of concern at the White Street Landfill are classified as chlorinated hydrocarbons. The hydrocarbon benzene has been detected sporadically in the monitoring history of the landfill primarily in compliance monitoring well II-7 but more recently in compliance well II-2. This compound had not been detected in compliance monitoring wells since the October 1998 monitoring event until it was detected in monitoring well II-2 during the April 2007 groundwater monitoring event. Specifically tetrachloroethene (PCE) and trichloroethene (TCE) and their degradation products are the most commonly detected chlorinated hydrocarbons in groundwater samples from the site. The most frequently detected degradation products include TCE and vinyl chloride. These daughter compounds may be present at the site solely due to biodegradation of PCE, or they may be present due to direct transport from a source within the Phase II waste management unit.

The metal thallium enters the environment primarily from coal-burning and smelting, in which it is a trace contaminant of the raw materials. It stays in the air, water, and soil for a long time and is not broken down. Some thallium compounds are removed from the atmosphere in rain and snow. It's absorbed by plants and enters the food chain. It builds up in fish and shellfish. The occurrences of thallium at the Facility are at low concentrations close to the NCDENR DWM groundwater protection standard for thallium and have been limited to monitoring wells II-1, II-2, II-6, II-11, and II-12 at the White Street Landfill.

2.4 Source Control Measures

In order to control and reduce the release of the constituents of concern from the Phase II waste management unit at the Facility, a low permeability clay cap was added to the top of the waste management unit in 1998. Low permeability caps reduce landfill mass by reducing vertical percolation of rain water into the waste mass through leaching.

In addition to the low permeability clay cap, the Facility installed an active decomposition methane gas extraction system in 1998. Decomposition gases can directly affect groundwater quality through interaction of the decomposition gas with the upper most prevalent aquifer. Contaminants contained within the decomposition gas can transfer to the monitored aquifer via phase transfer during interaction of gases and liquids. It appears that controlling decomposition gas levels at the Facility has reduced reported concentrations of the COCs in groundwater monitoring events post installation and activation of the active gas extraction system.

2.5 Groundwater End Use

Based on static water level measurements taken during each groundwater monitoring event at the Facility, the groundwater beneath Phase II generally flows toward the northwest, toward North Buffalo Creek which is predicted to be the primary discharge point for groundwater which has interacted with the Phase II portion of the White Street

Landfill. There are no uses of the groundwater which has been influenced by the Facility before it discharges to North Buffalo Creek.

2.6 Sensitive Receptor and Exposure Pathway Risks

As part of the previously submitted Nature and Extent Study, S&ME completed a drinking water receptor survey to visually look for evidence of drinking water wells within a quarter mile radius of the compliance monitoring wells in which groundwater impact has been detected. This visual survey was completed from a vehicle traveling along public roads and right-of-ways within the quarter mile radius.

The results of our survey show that there are five (5) drinking water wells within a quarter mile radius of the impacted compliance monitoring wells II-2 and II-7. The drinking water wells were identified on the opposite side of North Buffalo Creek from the landfill and are at a topographically higher elevation than the landfill. North Buffalo Creek is a local hydraulic divide for the uppermost prevalent aquifer

Based on these findings and the distance of the wells from the compliance wells showing impacts, the risk to these drinking water wells from the constituents of concern from the landfill is expected to be low. A map showing the locations of the identified drinking water wells within a quarter mile radius of compliance wells II-2 and II-7 is included as **Figure 6** of this Report.

North Buffalo Creek is the primary receptor of groundwater influenced by the Facility. North Buffalo Creek is classified as a Class C stream by NC DENR. There are no known public water outtakes from North Buffalo Creek within a 1 mile radius of the White Street Landfill. There is, however, as waste water treatment plant located immediately upstream of the Facility.

While a formal benthic study of the section of North Buffalo Creek influenced by the White Street Landfill has not been completed, the risk, if any, associated with the release of the primary constituents of concern (COCs) from the Facility will be to the aquatic life in North Buffalo Creek. However, as will be discussed in Section 2.8 below, the Facility has historically, and currently does, monitored surface water quality upstream as well as downstream of the landfill. Based upon the surface water quality monitoring results, there have been no exceedances of the 15A NCAC 2B surface water standards for any of the COCs in the portion of North Buffalo Creek influenced by the Facility. Therefore, the risk to aquatic life in North Buffalo Creek from discharging groundwater influenced by the Facility is expected to be low.

Additionally, the risks to onsite workers during installation and future maintenance of the selected remedies of phytoremediation coupled with monitored natural attenuation for the Facility will be low since it is unlikely that an exposure pathway will exist for workers to come in direct contact with groundwater containing the COCs.

2.7 Exceedances of Groundwater Quality Standards

The constituents considered the primary constituents of concern (COCs) which have exceeded the 15A NCAC 2L groundwater quality standards for which remedial action is required include volatile organic compounds benzene, trichloroethene, tetrachloroethene,

vinyl chloride, and 1,4 dichlorobenzene as well as the inorganic constituent thallium. The criteria for selecting this list of constituents as the COCs was discussed above in Section 2.1.

2.8 Exceedances of Surface Water Quality Standards

As part of the routine semi-annual sampling events conducted at the Facility each year, the surface water quality in the vicinity of the landfill has also been monitored. Five stream samples (SW-1, SW-2, SW-3, SW-4, and SW-5) have historically been collected. The locations of the stream samples are shown in **Figure 1** and **Figure 3** of this Report.

SW-1 was historically collected upstream from the landfill near the US Highway 29 bridge. SW-2 was collected from a southern tributary of North Buffalo Creek just before it joins the main creek west of the landfill entrance. SW-3 was collected downstream of the North Buffalo Wastewater Treatment Plant outfall and upstream of the landfill. SW-4 was collected downstream of the landfill at a USGS gauging station located on North Buffalo Creek about three-quarters of a mile north of the landfill. SW-5 was collected from North Buffalo Creek immediately downstream of the Phase II landfill disposal area. Due to past detections of select parameters exceeding the NCAC 2L groundwater quality standards at compliance well II-7, three stream samples were collected from North Buffalo Creek in the vicinity of compliance well II-7 (SWII-7, SWII-7up, and SWII-7down). SW-7 was collected from North Buffalo Creek immediately downstream of compliance well II-7. SW-7-up was collected from North Buffalo Creek approximately 100 feet upstream of sample SW-7. SW-7-down was collected from North Buffalo Creek approximately 100 feet downstream of sample SW-7.

Based upon the surface water quality monitoring results, there have been no exceedances of the 15A NCAC 2B surface water standards for any of the COCs in the portion of North Buffalo Creek influenced by the Facility.

2.9 Media of Concern

The active decomposition gas extraction system is in place to prevent migration of methane gas beyond the Facility boundary and to prevent methane gas from presenting an explosion hazard. It is expected that vapors being released by the COCs in groundwater will also be collected in the regions where active gas extraction wells are present. For vapors not collected by the active gas extraction system, the threat of vapor intrusion from the COCs is not expected to be a concern because the levels of the COCs are considered low and are close to their respective 2L standard and/or GPS value, and because there are no enclosed structures in the downgradient region of the Phase II portion of the landfill.

Contamination of the onsite soils is also not expected to be a concern because of the nature of the leachate's movement within the subsurface. Leachate from the waste management unit will percolate at a steep to near vertical angle until it reaches the uppermost prevalent aquifer. Once the COCs have entered the uppermost aquifer, the characteristics of their further migration toward North Buffalo Creek will be governed by the flow paths of groundwater within the aquifer. The only additional contact with onsite soils will be along the vadose zone or capillary fringe which should only change with seasonal fluctuations in static water level.

The media of concern is groundwater, which has been influenced by the Facility.

3.0 SELECTED REMEDY

3.1 Remedy Description

The City of Greensboro, North Carolina has chosen phytoremediation coupled with monitored natural attenuation (MNA) to restore groundwater quality at the White Street Landfill.

3.1.1 Phytoremediation

Method Description

Phytoremediation uses plants to cleanup contaminated soil and groundwater, taking advantage of plants' natural abilities to take up, accumulate, and for select constituents, even degrade soil and groundwater contaminants. Research indicates that phytoremediation is applicable to a broad range of contaminants including numerous metals, radionuclides, volatile organic compounds (such as chlorinated solvents), BTEX, PCBs, PAHs, pesticides/insecticides, explosives, nutrients, and surfactants. According to the information reviewed, general site conditions best suited for potential use of phytoremediation include large areas with moderate levels of contaminants in shallow soil or large volumes of water with low level contamination subject to low treatment standards. Depth to groundwater for in-situ treatment is generally limited to about 20 feet, but ex-situ treatment in constructed troughs or wetlands has also been investigated.

Research suggest that there are five basic types of phytoremediation techniques: 1) rhizofiltration, a water remediation technique involving the uptake of contaminants by plant roots; 2) phytoextraction, a soil technique involving uptake from soil, 3) phytotransformation, applicable to both soil and groundwater, involving the degradation of contaminants through plant metabolism, 4) phyto-stimulation or plant-assisted bioremediation, also used for both soil and water, which involves the stimulation of microbial biodegradation through the activities of plants in the root zone, and 5) phytostabilization, using plants to reduce the mobility and migration potential of contaminants in soil.

Major advantages reported for phytoremediation as compared to traditional remediation technologies include the possibility of generating less secondary wastes, minimal associated environmental disturbance, and the ability to leave soils in place and in a usable condition following treatment. Cited disadvantages include the long lengths of time required (usually several growing seasons), depth limitations, and seasonal effectiveness.

Performance and Reliability

Phytoremediation is an emerging technology that has the potential to treat a wide range of contaminants for a lower cost than traditional technologies. Phytoremediation techniques are almost by definition innovative. Several have been proven to be effective if appropriate site conditions exist. However, many have not been applied very often. In spite of the large body of information concerning applications of phytoremediation to

contaminated soils, groundwater, and surface waters, there is still a need to determine the specific plant(s) and treatment procedures for cleanup at a specific site that will work to remediate the contaminant(s) in the soil or water at the specific site. Many factors will influence the success of phytoremediation at a given site, including contaminant concentration, availability of nutrients, daily maximum and minimum temperature, rainfall or possibility of irrigation, grade on site, aesthetic considerations, daily illumination level, relative humidity, wind patterns, and/or the presence of growth-suppressing contaminants. The desired level of cleanup and the desired rate of decontamination also need to be considered. All of these factors need to be evaluated prior to a substantial expenditure of time and money on a large-scale phytoremediation effort.

Treatability studies could also provide information relating to disposal of contaminated biomass. Such disposal is a major consideration in the cleanup of metal-containing soils. Depending on regulations and plant concentrations of metals, plants may need to be landfilled, or the metals reclaimed through smelting, pyrolysis of biomass, or extraction.

In a discussion of the reclamation of metal-contaminated plant tissue by smelters, Dibakar (1997) stated that plant tissue with a dry-weight concentration of over one percent metal was amenable to reclamation. Ongoing progress of phytoremediation can be measured post implementation of this remedy. Tree sap flow rates can be monitored in order to determine the pumping rates of the trees. A noninvasive technique can be used to measure sap flow on certain trees during the various sampling seasons. Groundwater monitoring data from some successful projects indicate that the trees are capable of pumping large amounts of groundwater to the point that the water table has been lowered by tenths of feet in the planting area at the end of the growing season, indicating possible groundwater withdrawal by the trees for containment of the contaminated groundwater in future growing seasons. Some studies show that trees are utilizing the groundwater at rates of 2 to 10 gallon per day/tree.

Phytoremediation using trees to clean up groundwater contaminated with volatile organic compounds and metals may be an ideal choice for this site and others due to the lower cost, lower maintenance, and lower impact associated with the technology, especially if this technology is applied in conjunction with other technoligies.

Remediation Timeframe

Remediation time frames for phytoremediation can vary widely as with other technologies due to site specific conditions and varying end point remedial goals. Many case studies utilizing phytoremediation technology are on-going. Many of these cases are predicting multiple years until targeted remediation end points will be achieved. However, over time phytoremediation, under proper site conditions, can be effective at remediating volatile organic compounds and metals from groundwater.

Implementation Requirements

Specific methodologies for the application of phytoremediation to contaminated sites have been standardized, and general principals have been established. The general steps followed in the design and implementation of a phytoremediation project, for any of the

specific techniques under this technology discussed in the *Method Description* above include:

- Site characterization, including determination of soil and water chemistry/conditions, climate, and contaminate distribution;
- Treatability studies to determine rates of remediation and appropriate plant species, density of planting, location, etc.;
- Preliminary field testing at the site to monitor results and refine design parameters;
- Full-scale remediation;
- Disposition of resulting affected plant material

Institutional Controls and Requirements

The operating permit for the landfill would require modification by the NCDENR DWM to adopt and accept the revised Groundwater and Surface Water Monitoring Plan outlined in this CAP in Section 4.0 once it has received the approval of the NCDENR DWM.

3.1.2 Monitored Natural Attenuation

Method Description

Natural Attenuation is the reduction in mass or concentration of a chemical in groundwater over time or distance from the source of contamination due to naturally occurring physical, chemical, and biological processes. These naturally occurring physical, chemical, and biological processes include: dispersion, dilution, sorption, volatilization, biodegradation/biotransformation, and abiotic degredation/transformation. There are two types of mechanisms of natural attenuation; non-destructive and destructive mechanisms. Non-destructive mechanisms result in reduction in groundwater concentrations with no mass loss of contaminants from the system. Non-destructive mechanisms include dispersion, dilution from recharge, sorption, and volatilization. In the sorption process contaminant mass is transferred to aquifer solids. During volatilization contaminant mass is transferred to the surrounding atmosphere. Destructive mechanisms of natural attenuation results in mass loss of contaminants from the system. Destructive mechanisms include aerobic biodegradation, anaerobic biodegradation, cometabolism, abiotic oxidation/reduction reactions, and hydrolysis. The affects of the natural attenuation process can be seen over increased distance from a continuous contaminant source in a tapered linear relationship when compared with source concentrations. With increasing distance from a slug release contaminant source, the relationship between attenuation and contaminant concentrations will be represented by a bell curve plot of groundwater quality data over time throughout the natural attenuation process. For the White Street Landfill Phase II, it appears that the contaminant plume is at least stable, if not shrinking based on the decreasing trends of the primary constituents of concern observed at well II-7. Monitoring well II-7 was formerly the most impacted downgradient monitoring well within the Phase II compliance monitoring network at the Facility. Additional plume behavior at the Facility will be determined during the MNA process.

Monitored Natural Attenuation is considered as an appropriated remedy for corrective measures at a Facility if the site meets the following criteria:

1. The groundwater flow is not in a direction of a public or private drinking water supply
2. The groundwater flow velocity, based on monitoring well conductivity tests, does not suggest the contaminated groundwater flow as quickly leaving the property boundary, as further suggested by:
   a) The site has a relatively high clay content and low sand content.
   b) The site does not have a steep upgradient hydraulic head.
   c) The site has well drained soil, without many preferred groundwater flow pathways.
   d) The constituents exceeding 2L standard do not dramatically change over short periods of time.

Biodegradation is often the primary reduction process of landfill mass during the natural attenuation process. Biodegradation involves biologically mediated oxidation/reduction reactions and is fundamentally an electron transfer process. Electrons are transferred from more reduced compounds to more oxidized compounds. Energy released is used by microbes to sustain metabolism and growth. Redox chemistry is a good analogy of this process in that electron donors are what microbes "eat" and electron acceptors are what microbes "breath" (Barden & Wiedemeier 1997). Electron donors include natural organic carbon, fuel hydrocarbons, and most importantly for this case, landfill leachate constituents.

The constituents of concern at the Phase II Landfill include the organic parameters benzene, Tetrachloroethene, Trichloroethene, 1,4 dichlorobenzene, and Vinyl Chloride as well as the hydrocarbon benzene. Research has shown that chlorinated solvents which include Tetrachloroethene and Trichloroethene, all biodegrade via halorespiration (Barden & Wiedemeier 1997). Tetrachloroethene and Trichloroethene have also been shown to degrade through cometabolism. Benzene and 1,4-dichlorobenzene will biodegrade via aerobic microbial consortium. Finally, Vinyl Chloride, an anthropogenic Cl-ethene, will biodegrade through aerobic respiration and iron (III) reduction. Based on the years of groundwater monitoring analytical data coupled with the various studies throughout the groundwater monitoring history of the Facility including the previously discussed Nature and Extent Study, the primary substrate at the Facility should contain a sufficient quantity of anthropogenic organic carbon to support biodegradation of the chlorinated solvents of concern. In addition, there is likely native organic carbon in trace amounts which will further enhance biodegradation rates of these constituents. However, exact analysis of existing native organic carbon has not been studied to date. The dominant thermal electron-accepting process through which biodegradation takes place is:

Aerobic Respiration	Dentrification	Iron (III) Reduction	Sulfate Reduction	Methanogenesis

Time ----------►

◄---------- Distance From Source

(After: Bouwer and McCarty, 1984)

The geochemical content of the uppermost monitored aquifer will evolve over time due to the biodegradation process. Based on the above equation, with increased time, a decrease in electron acceptors such as dissolved oxygen, nitrate, FE(III), SO^{2-}_4 and CO_2 will occur close to the source as a result of the metabolic processes intrinsic to the hydrogeologic regime at the site. Conversely there will be an increase in degradation/transformation products including dissolved iron, methane, ethane, ethane, and chloride. If additional lines of evidence for natural attenuation are needed, microbiological indicators can be analyzed and included in the study if warranted. The effectiveness and magnitude of the natural attenuation process can be demonstrated through inclusion of these constituents during the routine groundwater sampling and subsequent analytical analysis. Monitoring these indicators as well as noting reductions in the concentrations of the landfill constituents of concern over time will be essential for mapping and gauging a successful natural attenuation process over time.

MNA can result in complete mineralization of contaminants to innocuous products. Although considered a "passive" technique, it allows for continuing use of infrastructure and can be very cost effective.

An evaluation of the risks posed to human health and the environment at the landfill is included in this report. Based on the risk evaluation it may be concluded that MNA would be an appropriate remedial measure for the landfill coupled with phytoremediation.

This process would involve sampling the appropriate property boundary groundwater monitoring wells for the constituents found over the 2L standard. After an appropriate amount of samples have been taken, assumptions may be drawn concerning the constituent magnitude concentration trend (increasing, decreasing, or static) in order to reevaluate the Dispersion and Natural Attenuation process effectiveness. The objectives for a monitored natural attenuation groundwater remediation program include the following:

- Demonstrate that natural attenuation is occurring
- Be protective of human health and the environment
- Monitor natural attenuation and environmental impact; and
- Restore COC concentrations in groundwater at the compliance boundary to below the 2L standard and GPS

Performance and Reliability

MNA is a proven remedial alternative and can successfully restore groundwater quality and return monitored constituents to within 2L standard levels. MNA has been used at many different types of sites to treat both impacted groundwater and soils. MNA is an adequate stand alone remedy in cases where there is no identified risk to human health or the environment, and/or when proactive remediation is not likely to be more effective than MNA at restoring groundwater quality.

MNA performance differs at every site and is dependant on the individual site conditions. Therefore, performance of MNA is typically determined by long term monitoring for the monitored contaminant parameters, daughter products if any, and other indicators of

attenuation such as electron acceptors (oxygen, sulfate, nitrate, and ferrous iron) and waste products (ethane, ethane, methane, chloride, carbon dioxide, etc.).

Associated Receptor Impacts

There are no major remediation-related impacts associated with MNA, since MNA results in the reduction in mass of COCs. Minor impacts would include the generation of contaminated purge water, which would have to be disposed of in accordance with applicable regulations.

Remediation Timeframe

The timeframe for achieving objectives should be reasonable compared to other alternatives. The existing and historical data can be used as a predictor of future results. Based on the historical groundwater data, it is reasonable to believe that the GPS can reasonably be obtained in 15+ years based on case study literature. It is believed that MNA has already been occurring and is evidenced by the daughter products such as vinyl chloride already present in the compliance and NES groundwater monitoring wells.

Implementation Requirements

In order to implement MNA at the Facility a performance monitoring PM program designed to address the higher level of uncertainty regarding the mass contaminants and predictive analyses will be required. Per the EPA Office of Solid Waste and Emergency Response (OSWER) Directive (1999), performance monitoring to evaluate the remedy effectiveness and to ensure protection of human health and the environment is a critical element of all response actions. The monitoring program will have to be designed to incorporate the following:

Demonstrate that natural attenuation is occurring according to expectations;

- Detect changes in environmental conditions that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding
- Verify no unacceptable impact to downgradient receptors
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

Institutional Requirements

The NCDENR-DWM will require modification to the operating permit for the landfill.

3.2 Justification of Selected Remedy

Phytoremediation

Prior to final selection, S&ME researched phytoremediation as a possible remedy to reduce the concentrations of the COCs at the White Street Landfill to levels within the acceptable compliance limits. S&ME's research included case studies completed by others involving either similar site characteristics and/or similar COCs compared to the White Street Landfill, as well as testimonials by, and research from, outside professionals considered as experts in phytoremediation by their peers and the environmental industry itself. Consideration was also given to the existing site characteristics in the areas where the proposed phytoremediation beds will be installed such as; depth to groundwater, topography, availablility of acreage for installation of the phytoremediation system, and soil type. The following findings provide justification for the selection of Phytoremediation.

Phytoremediation has been successfully employed as the principal remedy to restore groundwater quality at similar sites to the White Street Landfill, including other landfills in North Carolina. The results of the selected case studies which S&ME examined showed favorable results including the reduction in reportable concentrations of similar constituents of concern.

According to information obtained by S&ME through interviews with Phytoremediation experts, the optimal depth to the uppermost aquifer for favorable results from a phytoremediation system should be approximately 20 to 25 feet below ground surface. The maximum depth to water observed in any Phase II downgradient compliance monitoring well during the September 2007 groundwater monitoring event was 21.77 feet in monitoring well II-2. The average depth to groundwater was 15.6 feet below ground surface. Additionally, these static water elevations were taken during the drought of 2007. Water levels under normal conditions are expected to be more shallow.

Additionally, the proposed phytoremediation planting zone is located in or along the alluvial deposit of North Buffalo Creek. Alluvial deposits, according to the experts interviewed by S&ME, are typically favorable to hybrid poplar tree growth. Also, the alluvial bench where the phytoremediation beds will be installed is relatively flat topographically, which is also favorable to phytoremediation success. A summary of selected research documents and interviews with phytoremediation experts is included in **Appendix II** of this Report.

Monitored Natural Attenuation (MNA)

As described in Section 3.1.2 above, monitored natural attenuation (MNA) is widely accepted as a long term "passive" remedy to remediate volatile organic compounds in groundwater. If the proper geochemical conditions exist in the subsurface environment at the facility, MNA is a proven remedial alternative and can successfully restore groundwater quality and return monitored constituents to within 2L standard levels. MNA has been used at many different types of sites to treat both impacted groundwater and soils. MNA has been shown to be an adequate stand alone remedy in cases where

there is no identified risk to human health or the environment as in the case of the White Street Landfill.

As illustrated in Figure 4 of this report, the volatile organic plume in the downgradient region of Phase II is naturally divided into 3 distinct zones. The first zone includes compliance monitoring well II-1, the second zone includes compliance monitoring wells II-7, II-7B, and NES well II-9, and the third zone contains compliance well II-2 and NES well II-2B. In order to evaluate the degradation potential of the chlorinated solvents, 1,4-dichlorobenzene and benzene within the subsurface geochemical environment in each of these zones, S&ME collected groundwater samples from each of these wells and had them analyzed for parameters indicative of a suitable environment for anaerobic biodegradation processes. This screening process is designed to recognize geochemical environments where anerobic biodegradation is plausible. The select list of parameters includes: oxygen, nitrate, Iron (Fe+2), sulfate, sulfide, methane, oxidation reduction potential, pH, total organic carbon, temperature, chloride, BTEX, trichloroethene, dichloroethene, vinyl chloride, 1,1,1 trichloroethane, and chloroethane. The parameter values obtained from field and laboratory analyses of the groundwater samples are compared to criteria indicative of a suitable geochemical environment for anaerobic biodegradation processes. Each result is assigned a point value which is based on a comparison of the obtained result to a range of predetermined values indicative of a suitable environment for anaerobic biodegradation. The points are totaled and if the score for an individual sampling location is 15 or more points, it is likely that anaerobic biodegradation (i.e. reductive dechlorination) is occurring at that location. The interpretations given in the following table are from the NCDENR DWM Guidance on Developing a Monitored Natural Attenuation Remedial Proposal for Chlorinated Organics in Groundwater, Hazardous Waste Section, October 2000:

Total Points	**Interpretation**
0 to 5 points	Inadequate evidence for anaerobic biodegradation of chlorinated organics.
6 to 14 points	Limited evidence for anaerobic biodegradation of chlorinated organics.
15 to 20 points	Adequate evidence for anaerobic biodegradation of chlorinated organics.
>20 points	Strong evidence for anaerobic biodegradation of chlorinated organics.

On May 5, 2008, S&ME collected groundwater samples from compliance monitoring wells II-1, II-2, II-7, and NES wells II-2B, II-7B, and II-9 for the purpose of screening the samples for evidence of a suitable geochemical environment for the anaerobic biodegradation processes. The analytical results from each well along with the point value assigned to each result is illustrated in **Table 10** of this Report. The full laboratory report of the analytical results is included in **Appendix III**. The results indicate that the geochemical environment within the zone including compliance well II-1 as well as the zone containing compliance well II-2 and NES well II-2B is adequate for anaerobic biodegradation of chlorinated organics. However, the zone of the VOC plume containing compliance well II-7 and NES wells II-7B and II-9 shows limited evidence for anerobic biodegradation of chlorinated organics. The historical analytical results from compliance

well II-7 show a decreasing trend in the concentrations of PCE and TCE. Additionally, vinyl chloride, a daughter isotope of PCE, was first detected in well II-7 during the September 27, 2007 groundwater monitoring event. These trends are indicative of reductive dechlorination at or upgradient of well II-7. It is possible that adequate anaerobic biodegradation conditions exist upgradiant of well II-7 and they are responsible for the observed trend of decreasing PCE and TCE concentrations. Additionally, phytoremediation beds will be planted in the VOC plume zone containing compliance well II-7 and NES wells II-7B, and II-9 as illustrated on **Figure 7** to combine with the anaerobic biodegradation process to restore groundwater quality below the 2L standards.

In order to fulfill the requirements set forth in 15A NCAC 13B.1635, the City of Greensboro held a public meeting on Monday, June 19, 2008 for the purpose of inviting comments and input from the general public, especially those living near the landfill, regarding phytoremediation as the Facility's selected remedy. A copy of the ACM Amendment was made available to the public by posting it at the City's public library. Overall the general public was accepting of, and generally agreed with, implementing phytoremediation as the Facility's selected remedy to restore groundwater quality at the Facility. Comments received during the public meeting and questions asked from the public meeting are included in **Appendix IV** of this Report.

In summary, our research supports the theory that phytoremediation coupled with MNA is likely to be a viable option to remediate the COCs from the uppermost aquifer at the White Street Landfill.

As part of this CAP, the City of Greensboro requests the right to delay the implementation of Phytoremediation in the vicinity of compliance wells II-6 and II-12 since the historic detections of Thallium is the sole reason for their inclusion in this CAP. As noted in Table 6, Thallium has not been detected at these compliance wells during the last three monitoring events. It is S&ME's opinion that if the current trend on non-detection of thallium in these wells continues, it would not be practical or reasonable to implement Phytoremediation in the vicinity of these wells, given the current lack of repeated exceedances of the groundwater protection standard, the trigger for corrective measures at these wells.

3.3 Technical Approach, Design, and Specifications

According to S&ME's research, hybrid poplar trees and willows are the desired species for phytoremediation systems targeting chlorinated solvents and metals which make up the COCs at the White Street Landfill. The trees are planted in beds either directly above the impacted groundwater plume or downgradient of the source area. The beds are planted perpendicular to the primary direction of groundwater flow. For this CAP, S&ME has chosen a technical approach that is based on and consistent with the work of Dr. Licht.

According to Dr. Licht, the phytoremediation bed acts as a bioreactor. The target is 8 days storage/interaction time in the root system "bioreactor" to successfully remediate the COCs. Based on research and field trials completed by Ecolotree®, trees planted in 4 rows with 11 feet of spacing between each row such that the minimum span of the phytoremediation bed is 33 feet wide typically achieves this targeted 8 day

storage/interaction time within the root system. The average groundwater velocity in the downgradient region of the Phase II portion of the White Street Landfill was 0.061 feet per day based on the September 2007 gradient calculations (reference Appendix I). Based on this average groundwater velocity, groundwater storage/interaction time in the root system "bioreactor" will be approximately 541 days, easily surpassing the minimum 8 day requirement. As a result, the phytoremediation beds installed at the facility may only require 2 rows of poplar trees. The actual number will be determined in the design phase of the phytoremediation system.

Prior to planting the hybrid poplar tress, each row is excavated to a depth of up to 6 feet to enhance entrapment of rain water to naturally irrigate the trees. According to Dr. Licht the phytoremediation beds may need additional irrigation. The hybrid poplar trees are planted along each row and are spaced a distance of 7 feet apart. The distance between the hybrid poplar trees along each row can be changed. Spacing of the trees is usually determined by the number of years projected until they are harvested. The shorter the cutting cycle/time to harvest, the closer the spacing of the trees. For poplars a cutting cycle of one to three years can have spacing as short as 2 to 4 feet. For a harvest time of 15 to 20 years spacing can be much wider, sometimes as much as 15 feet between trees. Closely spaced, genetically identical trees, such as hybrid poplars, are prone to insect infestations and fungal diseases. Additionally, trees that are too widely spaced apart may take longer to root to the water table. According to Dr. Licht, the spacing of 7 feet between trees is usually ideal for overlap of the subsurface zone of influence between the poplar tree root balls, and also for timing the harvest and subsequent replanting of the hybrid poplar trees. A successful tree spacing design in phytoremediation achieves a balance where tree spacing promotes deep rooting without fostering conditions that encourage plant pathology problems. A proposed phytoremediation bed design is illustrated in **Figure 8**.

Trenches can be excavated by conventional methods, but often a specialized trenching machine works best. Trenches installed for in-situ phytoremediation work best on flat terrain, however, phytoremediation beds can be effective installed on up to 3:1 slopes. Some systems have been installed on 4:1 slopes, but 3:1 is the maximum recommended slope.

S&ME completed a walk through of the entire area in the downgradient region of the Phase II waste management unit where the proposed phytoremediation beds will be installed. Much of the targeted areas are mostly flat alluvial depositions of North Buffalo Creek and should be ideal for planting phytoremediation beds. Photos of the proposed planting areas are included in **Appendix V** of this Report. At the time of our reconnaissance, this area was covered in lush grasses with a mixture of immature and mature hardwoods. The existing species observed through out this area included immature cedar, sweet gum, and cucumber trees. The only area containing existing yellow poplar trees was southwest of II-1. Consequently, the areas where the phytoremediation beds are to be installed at the White Street Landfill will have to be cleared before planting the hybrid poplar trees.

The proposed areas to install phytoremediation beds at the White Street Landfill were chosen based on the distribution of the COCs which are illustrated on Figures 4 and 5 of

this Report. We are proposing to install a continuous phytoremediation bed beginning at the mid-point between monitoring wells II-2B and II-13 and continuing west and south to the midpoint between compliance wells II-7B and II-10 as illustrated on Figure 7 of this Report. Additionally, we are proposing to install a second continuous phytoremediation bed beginning just northeast of compliance well II-1 and continuing to a point southwest of compliance well II-12 as illustrated on Figure 7. As illustrated on Figure 7, these beds will be installed between the affected compliance wells and North Buffalo Creek with the exception of compliance wells II-7B and II-1. The available space between each of these wells and the creek is insufficiently wide to accommodate the typical 33 feet wide phytoremediation beds. Therefore, in these locations, the phytoremediation bed will be installed between these wells and the Phase II waste management unit as illustrated on Figure 7.

In a telephone conversation between Ms. Jackie Drummond of the NCDENR DWM and Connel Ware of S&ME, Inc. on May 15, 2008, S&ME understands that the NCDENR-DWM would permit the City of Greensboro to move the compliance boundary from it's present location within 250 feet of the Phase II waste management unit, as illustrated on Figure 7, to the edge of North Buffalo Creek. It is the City's desire to officially shift the compliance boundary to the edge of North Buffalo Creek as illustrated on Figure 7. This shift in the official compliance boundary will be included in the permit amendment to implement this Corrective Action Plan as well as the revise the Water Quality Monitoring Plan for the Facility. According to the NCDENR DWM, shifting the official facility compliance boundary to the edge of North Buffalo Creek will not require additional permit amendment fees beyond the fee incurred to implement this Corrective Action Plan. Additionally, according to NCDENR DWM, the phytoremediation beds can be planted within the 50 foot buffer offset from the Facility property boundary which is the center line of North Buffalo Creek.

It is possible to plant hybrid poplar cuttings by hand or by machine. The best time to plant cuttings is when soil temperature reaches 50 degrees Fahrenheit. In the Central United States, planting usually occurs between mid April and early June. Proper soil moisture and control of weeds are critical for a successful first year. The soil should be moist and the cuttings kept wet and protected from the sun while planting. The fatal flaw characteristics for a site to impede the success of a phytoremediation system include; wildlife, salinity, over hydration, lack of management, and agronomy (weed control). According to S&ME's research, phytoremediation beds, particularly in the seedling stage, must be protected from beavers and deer which cut or browse on these plants. If onsite soils are too saline or overly hydrated, hybrid poplars will not survive. It is critical to maintain proper moisture while avoiding over hydration of the tree beds. Since the proposed planting area for the phytoremediation beds at the Facility is an alluvial deposit S&ME considered the potential impacts of clay layers between the sand layers of the alluvium. According to Dr. Licht, clay layers can actually enhance the performance or an in-situ phytoremediation bed by keeping vertical percolation rates from being too rapid. Once planted, the phytoremediation beds must be maintained and weeds kept mowed in order to prevent weeds and other vegetation from overtaking and choking out the hybrid poplar seedlings.

Static water elevations were collected during late April of 2008 in each of the downgradient compliance monitoring wells of the Phase II portion of the White Street Landfill. The depths to groundwater ranged from a maximum depth of 21.77 feet below ground surface (bgs) in compliance well II-2 to a minimum depth of 10.66 feet bgs in II-12. At this range, the depth to groundwater is shallow enough for hybrid poplar trees to effectively uptake the COCs through rhizofiltration. According to Dr. Licht, we should assume an average of 12 gallons of uptake per 7 to 8 linear feet of row, or 12 gallons/day per tree. However, mature hybrid poplar trees that have reached canopy height (40 feet and up) can uptake 30 to 40 gallons per day.

While there is no design involved with MNA, there is evidence that MNA is already occurring at the Facility and the progress of MNA will be monitored as described below in Section 4.0.

4.0 GROUNDWATER AND SURFACE WATER MONITORING

4.1 Revised Water Quality Monitoring Plan

This portion of the Corrective Action Plan is a summary of the monitoring system, frequency, and analytical parameter list the Facility will use to monitor groundwater quality under the corrective action phase of monitoring in the Phase II portion of the White Street Landfill. The Facility's current Phase II Water Quality Monitoring Plan (WQMP) will be revised to reflect the changes to the groundwater monitoring system at the Facility under this Corrective Action Plan. The revised Water Quality Monitoring Plan will be titled the Corrective Action Monitoring Program (CAMP). The CAMP will be a complete, stand alone document which will be completed and submitted under a separate cover after receiving NCDENR approval of this Corrective Action Plan. The CAMP will be inserted in the Facility's permit prior to the actual initiation of the remedial actions discussed in this report as outlined under 15A NCAC 13B .1636. A copy of the final NCDENR approved CAMP will be inserted into the Facility's permit amendment as an attachment.

4.2 CAMP Monitoring Well Network

4.2.1 Revised Compliance Monitoring Network Description

The Facility's new compliance monitoring network under the CAMP will consist of eleven monitoring wells: II-2, II-3, II-4, II-5, II-6, II-8, II-9, II-11, II-12, MW-13, and MW-14. Monitoring wells MW-13 and MW-14 serve as the Facility's upgradient monitoring wells. Former NES wells II-9 and II-11 were added to the list of compliance monitoring wells due to the previous detections of select COCs within groundwater samples collected from these wells.

This suite of compliance monitoring wells will continue to monitor constituent concentrations migrating hydraulically downgradient of the Phase II waste management unit.

4.2.2 Sentinel Monitoring Network Description

The purpose of a sentinel monitoring network is to monitor groundwater quality post interaction with a Facility's remediation system and to ensure that the plume does not adversely threaten receptors. For the White Street Landfill a network of sentinel monitoring wells will be installed downgradient of the phytoremediation beds between the remediation system and North Buffalo Creek. The locations of the proposed sentinel monitoring wells are illustrated on **Figure 9**. These wells will serve to monitor groundwater quality after interaction with the phytoremediation beds and prior to discharging to North Buffalo Creek.

One new sentinel monitoring well will be installed downgradient of each of the compliance or former NES monitoring wells in which COCs have been detected at concentrations exceeding the 2L standard. These wells include compliance wells II-2, II-6, former NES wells II-9, II-11, and compliance well II-12. These sentinel wells will be installed on the downgradient side of the phytoremediation beds downgradient from the above listed impacted monitoring wells. The new sentinel wells will be labeled with the prefix "SMW" for "Sentinel Monitoring Well" and will be labeled SMW-1, SMW-2, SMW-3, SMW-4, and SMW-5 as illustrated on Figure 8. The proposed new sentinel wells will monitor the same portion of the uppermost aquifer as the affected compliance or NES wells upgradient of their location.

Due to space constraints the proposed phytoremediation beds will be installed upgradient of former compliance monitoring wells II-1, II-7, and former NES well II-7B. Therefore, as illustrated on Figure 7, the phytoremediation beds will be installed between these wells and the Phase II waste management unit. As a result, these wells will become sentinel monitoring wells and will be included in the sentinel monitoring network. They will also monitor groundwater quality after interaction with the phytoremediation beds and prior to discharging to North Buffalo Creek. Additionally, former compliance well II-10 will also be added to the sentinel monitoring network. This well is being added for the purpose of monitoring groundwater quality in the zone between the two phytoremediation systems where no trees will be planted. Monitoring groundwater quality at this well will help ensure that impacted groundwater does not pass undetected between the phytoremediation systems, should a future release from the Phase II waste management unit occur.

4.3 CAMP Monitoring Constituent List

Under the CAMP, groundwater samples collected from the compliance monitoring network, which will include monitoring wells: II-2, II-3, II-4, II-5, II-6, II-8, II-9, II-11, II-12, MW-13, and MW-14, will continue to be analyzed on a semi-annual basis. One sampling event will be for all Appendix II constituents, and one sampling event will be for Appendix I constituents plus previously detected Appendix II constituents. A report of each sampling event will continue to be developed and submitted to the Division for placement into the operating record. Additionally, wells II-1, II-2, II-2B, II-7, II-7B, and II-9 will be analyzed for the MNA indicator parameters listed in Table 7 on a quarterly basis for the first monitoring year following NCDENR approval of this CAP and annually thereafter. The basis for sampling on a quarterly frequency for the first year

following CAP approval by NCDENR is for the purpose of establishing background concentrations of these parameters for future comparative purposes.

Under the CAMP, groundwater samples collected from the sentinel monitoring network, which includes former compliance monitoring wells II-1, II-7, II-10, and former NES well II-7B, along with the proposed new sentinel wells SMW-1 thru SMW-5, will be analyzed semi-annually for the COCs listed in Section 2.1 of this report. These wells will be sampled and analyzed during the routine semi-annual compliance monitoring events. Should additional constituents be detected above the 2L groundwater quality standard in the compliance monitoring well network during future groundwater monitoring events, these constituents will be added to the sentinel monitoring well constituent list.

4.4 Surface Water Sampling

The purpose of collecting surface water samples is to verify that the migration of constituents from the landfill will not result in a violation of surface water quality standards. Under the CAMP the Facility will continue monitoring surface water quality at the already established surface water sampling points including: SW-2, SW-3, SW-4, and SW-5. Surface water samples will be collected from these sampling points on a semi-annual basis during the routine semi-annual groundwater monitoring events. The collected surface water samples will be analyzed for the North Carolina Appendix I constituents plus the COCs listed in Section 2.1 of this report. The COC list will be amended to include any new constituents which become COCs by exceeding the 2L groundwater standard in either the compliance and/or sentinel monitoring network should this occur in the future. The surface water sampling locations are illustrated on Figure 1 of this report.

5.0 EVALUATION OF EFFECTIVENESS OF REMEDIAL ACTIONS

5.1 Performance Evaluations

The Facility will demonstrate that the phytoremediation system coupled with MNA is performing according to design and meeting the requirements set forth in this Plan through scheduled performance evaluations. These scheduled performance evaluations will contain technical information outlined below and will be prepared in accordance with 15A NCAC 13.B1637 of the NCDENR DWM.

- Groundwater quality data will be collected from the compliance and sentinel monitoring networks in order to monitor the phytoremediation system and monitored natural attenuation processes ability to achieve clean-up standards at the compliance and sentinel monitoring points. The effectiveness of the system will be determined through evaluation of the analytical data. The evaluations will include analysis of physical and chemical changes in the aquifer conditions as well as physical and chemical changes in the plume characteristics. Details of the evaluations will be discussed in Section 5.2 below.

  This data will be collected on a quarterly basis for the first monitoring year following NCDENR approval of this CAP and annually thereafter. The basis for sampling on a quarterly frequency for the first year following CAP approval by

NCDENR is for the purpose of establishing background concentrations of the MNA indicator parameters for future comparative purposes.

- The Facility will maintain annual phytoremediation assessment logs for the phytoremediation system. Each annual phytoremediation assessment log will contain entries for observed site conditions including general site conditions, annual rainfall to date, phytoremediation bed inspections, tree health observations, tree growth observations, phytoremediation bed maintenance, and general information. An example phytoremediation assessment log is included in **Appendix VI** of this Report. The annual phytoremediation assessment logs will be included in an annual Corrective Action Site Evaluation (CASE) Report which will be discussed in detail in Section 5.2 below.
- In conjunction with the annual phytoremediation assessment logs, the Facility will also perform an annual tree growth survival audit. Under this audit, each tree within the phytoremediation system will be visually inspected to determine if it is: dead or dying, shows limited growth, is established, or shows good growth and appears healthy. This audit will ensure the phytoremediation beds remain healthy to promote effective remediation of groundwater quality. The results of this annual audit will be summarized in a spreadsheet and included in the annual CASE Report discussed in Section 5.2 below.
- The groundwater analytical results will be reviewed each year to assure that the remedial actions proposed in this CAP remain on schedule with the proposed schedule outlined in Section 7 of this Plan.
- The continuous groundwater and surface water monitoring activities and subsequent laboratory analytical data will be monitored to assure that the remedial actions outlined in this Plan are protecting human health and the environment.
- All groundwater monitoring personnel will be OSHA trained and certified and will comply with OSHA standards to assure safety of site personnel. No other personnel will be in contact with groundwater influenced by the Phase II waste management unit.
- Installation and operational budgets will be set to ensure that the remedial actions proposed in this CAP meet the anticipated start-up and annual O&M costs as defined in the Facility's ACM.

It is anticipated that it will require several years for the phytoremediation system to become established. Water quality improvements due to phytoremediation are not expected to be observed in this interim timeframe.

It is not anticipated that the phytoremediation system coupled with monitored natural attenuation will have negative impacts to other media. Additionally, given the relatively low concentrations of the listed COC's as well as the theory that VOCs will be transpired through the surface biomass of the hybrid poplar trees, we do not anticipate that there will be "residuals" generated from the phytoremediation system or MNA processes.

5.2 Corrective Action Site Evaluation Reporting

The Facility will prepare and submit Corrective Action Site Evaluation (CASE) reports annually to NCDENR which will provide an analysis of the progress and effectiveness of

the phytoremediation system as well as MNA processes at restoring groundwater quality at the Facility. The Facility will also maintain copies of the CASE Reports on file for its records. The CASE Reports will each include a summary of the following:

- An analysis of the statistical trends in the MNA indicator parameters analytical results from the groundwater monitoring year for which the CASE Report is being prepared. The concentration trends in the analytical data from the sentinel monitoring wells will reviewed in order to determine the effectiveness of the selected remedies at restoring groundwater quality at the Facility. The evaluation may include a direct point comparison to historical concentrations or may include a statistical evaluation using one of the five NCDENR approved statistical evaluation methods for MSWLF Facilities. This evaluation will also include trend graphs.
- The most recent groundwater elevation data with respect to the revised compliance and sentinel monitoring network functionality. A potentiometric map will be constructed and included from the groundwater elevation data collected throughout the specific groundwater monitoring year.
- Contaminant and daughter product isoconcentration maps will be prepared from the analytical data collected for the specific monitoring year. These maps will be prepared for the COC's detected in the monitoring well network. These maps will graphically illustrate the interpretation of data on the distribution and relative transport and degradation rates of contaminants in the subsurface, and will be utilized to monitor and illustrate the effectiveness of the phytoremediation system.
- Contour maps will also be prepared for electron acceptors and metabolic by-products. These contour maps will also be prepared and submitted in each CASE report to graphically illustrate the effectiveness of the MNA process at the Facility. Contours will be generated for electron acceptors consumed (decrease in the concentration of dissolved oxygen (DO), nitrate, and sulfate) and metabolic by-products produced (increase in the concentration of iron (Fe+2), chloride, and methane) during biodegradation. Under anaerobic conditions, the concentrations of nitrate and sulfate will be seen to decrease to levels below background over time, and the concentrations of iron (Fe+2), chloride, and methane will increase to levels above background of time. Dissolved oxygen concentrations will decrease when biodegradation occurs under aerobic conditions.
- Contour maps will also be prepared for total organic carbon, total alkalinity (as calcium carbonate), and oxidation-reduction potential (ORP). Respiration of dissolved oxygen, nitrate, iron (Fe+2), and sulfate tends to increase the total alkalinity of groundwater. Oxidation-reduction potential potential in groundwater will be monitored because some biological processes operate only within a prescribed range of ORP conditions.
- Each CASE Report will include the annual phytoremediation assessment logs as well as the annual tree growth survival audits. The CASE report will include recommendations for tree replacement or additional tree plantings if site conditions and/or analytical assessments warrant it. Additionally, recommendations for specific maintenance or upkeep steps may be recommended in a CASE report if it is deemed necessary.

- Each CASE Report will include a conclusions and recommendations section which will include an evaluation of the effectiveness of the corrective action process, and recommendations for upkeep and/or system modifications if warranted.

The CASE Reports will be signed and sealed by a North Carolina Licensed Geologist or North Carolina Registered Engineer and submitted to NCDENR within 90 days after completing the second semi-annual groundwater monitoring event at the Facility each year unless an alternate schedule is established in the Facility's permit.

6.0 CONTINGENCY PLAN

If, prior to CAP approval by NCDENR and subsequent implementation, an unforeseen condition should develop or other such site conditions exist which require additional or alternative immediate action by the Facility in order to protect human health or the environment, appropriate action will be taken to address the issue(s). If alternate corrective measures are implemented, a minor permit amendment will be sought by the City to implement the alternative measures. Any additional corrective action measures will be submitted to NCDENR for approval as an addendum to the CAP prior to implementing the measures.

If a significant portion of the trees in the phytoremediation program die, or the overall health of the trees is considered to be inadequate for effective remediation, an assessment will be prepared to determine if the program should be modified by adding different types of trees and/or revising the locations of the trees.

If the CASE Reports show that, over the time period outlined and discussed in Section 7 of this report, the phytoremediation system coupled with monitored natural attenuation is not effectively restoring groundwater quality to concentrations at or below the 2L standards, the Facility will evaluate adding additional rows of hybrid poplar trees to the phytoremediation beds. If modifying the phytoremediation system remains unsuccessful over a reasonable period of time at restoring groundwater quality to levels at or below the 2L standards, the Facility will implement additional remedial action. The alternative remedial action selected will be chosen from the list of possible remedies presented in the ACM previously completed and submitted by S&ME on behalf of the Facility. The most likely alternative remedial option the Facility would consider under these conditions would be the installation of a groundwater extraction system with the collected groundwater being discharged to the local POTW.

If, during the Corrective Action Monitoring Period, the surface water samples collected from North Buffalo Creek immediately adjacent or downgradient of the Facility indicate levels of the COCs in excess of the 15A NCAC 2B surface water standards, and it is determined through analysis that the exceedance has been caused by the Facility, then the Facility will select, design, submit to NCDENR for approval, and implement corrective measures adequate to reduce the contaminates to levels below the surface water standards. The selected corrective measures will be selected from the possible remedies presented in the Facility's ACM and will be adequate to prevent adverse impact to the environmental receptor's aquatic regime.

The selection of an alternative remedy will be made only if, at a point in time in the future, it is deemed necessary to implement an alternative corrective measure based on the above criteria. The alternate remedy selection will be based on specific data obtained throughout the corrective action phase of monitoring as well as site conditions exhibited at the time the alternate remedy is selected.

7.0 CORRECTIVE ACTION PLAN IMPLEMENTATION SCHEDULE

For the following discussions, please refer to the Proposed Timeline for Corrective Action Plan Implementation included in **Appendix VII** of this Report. This schedule is subject to change if NCDENR approval of this CAP takes longer than projected.

7.1 Corrective Action Plan Completion

- The completed Corrective Action Plan will be submitted to NCDENR by July 1, 2008 for review and comments.
- Per the North Carolina Solid Waste Management Act, NCDENR has 90 days to complete their review of the submitted CAP and provide their comments. Therefore, it is anticipated that review comments from NCDENR will be received by the second week of October 2008.
- If required, the Corrective Action Plan will be revised per NCDENR review comments and resubmitted for NCDENR final review and approval on a schedule yet to be determined.
- The NCDENR approval letter of the final Cap submission is anticipated by mid December 2008, however, this date is subject to change.

7.2 CAP Implementation Bid Process and Proposal Preparation

- The City of Greensboro will issue an invitation for Bids/Proposals for a detailed Phytoremediation System Design within 30 days of receiving the CAP approval letter from NCDENR DWM.
- The contract for Phytoremediation System Design will be awarded within 60 days of receiving the CAP approval letter from NCDENR DWM.
- It is anticipated that the Phytoremediation System design will be completed within 30 days of awarding the Phytoremediation System Design contract.

7.3 Phytoremediation System Installation, CAP Implementation

- The City of Greensboro will issue an invitation for Bids to install the Phytoremediation System within approximately 3.5 months of receiving the CAP approval letter from NCDENR DWM.
- It is anticipated that the contract for installing the Phytoremediation System will be awarded within approximately 60 days of issuing the invitation for bids.
- Site clearing and grading in preparation to install the system will begin within approximately 90 days of issuing the invitation for bids.

- Installation of the sentinel groundwater monitoring network will begin approximately 90 days from awarding the contract to install the phytoremediation system.
- Installation of the Phytoremediation System is anticipated to begin by December 2009 and is anticipated to be completed by the end of February 2010. This delay in the schedule to plant the hybrid poplar trees is being proposed in order to avoid planting during the hot, potentially dry season which may necessitate the need for supplemental irrigation. Additionally, in order to optimize the tree survival rate, it is best to plant seedlings during their dormant season which is usually from December to the end of March.
- A report documenting the installation of the Phytoremediation System will be submitted approximately 30 days after installation of the phytoremediation system is completed.

7.4 MNA Indicator Background Sampling Events

- The first MNA Quarterly Background Sampling Event will be conducted in mid February 2009.
- The second MNA Quarterly Background Sampling Event will be conducted in mid May 2009.
- The third MNA Quarterly Background Sampling Event will be conducted in mid August 2009.
- The fourth and final MNA Quarterly Background Sampling Event will be conducted in mid-November 2009.
- The MNA Indicator Parameter Background Sampling Report will be prepared and submitted by the end of December 2009.

Based on the project schedule discussed above, the first CASE Report for the White Street Landfill will be submitted after completion of the 2010 groundwater monitoring year.

8.0 FINANCIAL ASSURANCE REQUIREMENTS

Per 15A NCAC 13B.0547, the City of Greensboro North Carolina has completed the local government test for financial assurance to implement this Corrective Action Plan. The supporting documentation for financial assurance is included in **Appendix VIII** of this Report.

9.0 COMPLETION OF CORRECTIVE ACTION

The remedies for groundwater quality restoration will be considered complete as per 15A NCAC 13B.1637 when the following occurs:

- The Facility complies with the 15A NCAC 2L groundwater quality standards, or NCDENR DWM groundwater protection standards for constituents for which a 2L groundwater quality standard has not been promulgated, at all monitoring points within the plume of contamination.

- Compliance with the 15A NCAC 2L groundwater quality standards, or NCDENR DWM groundwater protection standards (GPS) has been achieved by demonstration that all concentrations of all NCDENR DWM Appendix I and Appendix II constituents have not exceeded the 2L standard or GPS and is at or below background values for a period of three consecutive years using the NCDENR appropriate statistical procedures and performance standards.
- All actions outlined in the Plan required to complete the selected remedies have been satisfied, including actions required under this CAP and providing the certifications required under 15A NCAC 13B.1637.

Upon completion of the remedies outlined in this CAP, the Facility will notify NCDENR within 14 days by submitting a certification that the remedies have been completed in compliance with the requirements discussed above. The certification will be signed by the facility's designated representative and by a licensed Geologist or Registered Engineer.

When, upon completion of the certification, NCDENR determines that the corrective action remedies have been completed in accordance with the requirements described above, the Facility will be released from the requirements for financial assurance for corrective action under 15A NCAC 13B.0547.

10.0 REFERENCES

North Carolina Department of Environment, Health, and Natural Resources, North Carolina Official Administrative Code, 15A NCAC 13B.1636, and 15A NCAC 13B.1637, 1998.

North Carolina Division of Waste Management, Hazardous Waste Section, Guidance on Developing a Monitored Natural Attenuation Remedial Proposal for Chlorinated Organics in Groundwater, October 4, 2000.

Earth Tech, Inc., Corrective Action Plan for the Needmore Road Landfill Facility in Salisbury North Carolina, November 2007.

Frazar, Chris ,The Bioremediation and Phytoremediation of Pesticide-contaminated Sites, National Network of Environmental Studies (NNEMS) Fellow, August 2000.

Miller, Ralinda R., Phytoremediation, with the Ground-Water Remediation Technologies Analysis Center, October 1996.

Anderson, S.W. and Yerraguntla, K.M., Remedial Alternatives for Agricultural Contamination, Black and Yeatch Corporation, 2002

Licht, Dr. Louis A., Ecolotree®, 2006 Year-End Report Summary for the Watertower Paint and Repair Facility in Clear Lake Iowa, January 2007

Widdowson, Mark A., Sandra Shearer, Rikke G. Andersen, and John, T. Novak, Remediation of Polycyclic Aromatic Hydrocarbon Compounds in Groundwater Using Poplar Trees, The Charles E. Vai Jr. Department of Civil and

Environmental Engineering, Virginia Polytechnic Institute and State University, February, 2005.

Pitterle, Mark t., Rikke G. Andersen, John T. Novak, and Mark A. Widdowson, Push-Pull Tests to Quantify In-Situ Degradation Rates at a Phytoremediation Site, Department of Civil and Environmental Engineering, Virginia Polytechnic Institute and State University, October 2005.

Brenoel, M. and R.A. Brown. 1985. Remediation of a Leaking Underground Storage Tank with Enhanced Bioreclamation. In: Proc. Fifth Nat. Symp on Aquifer Restoration and Ground Water Monitoring, National Water Well Association, Dublin, OH, pp. 527.

Ehrenfield, J. and J. Bass. 1984. Evaluation of Remedial Action Unit Operations of Hazardous Waste Disposal Sites. Pollution Technology Review No. 110, Noyes Publications, Park Ridge, NJ.

EPA Seminar Publication, 'Site Characterization for Subsurface Remediation', United States Environmental Protection Agency Technology Transfer, Nov. 1991, Office of Research and Development, Washington, DC 20460

Jones-Lee, A. and Lee, G. F., 'Groundwater Pollution by Municipal Landfills: Leachate Composition, Detection and Water Quality Significance,' Proc. Sardinia '93 IV International Landfill Symposium, Sardinia, Italy, pp. 1093-1103, October (1993). [47k]"

Tchobanoglous, G., H. Theisen, S. Vigil, 1993. INTEGRAWTED SOLID WASTE MANAGEMENT, Engineering Principles and Management Issues, McGraw-Hill pp 452 - 455.

Thomas, J.M. and C.H. Ward. 1989. In Situ Biorestoration of Organic Contaminants in the Subsurface. Environ. Sci. Technol. 23:760-766.

Thomas, J.M., M.D. Lee, P.B. Bedient, R.C. Borden, L.W. Canter, and C.H. Ward. 1987. Leaking Underground Canter, and C.H. Ward. 1987. Leaking Underground Storage Tank Remediation with Emphasis on In Situ Biorestoration. EPA/600/2-87/108 (NTIS PB87-168084/REB).

U.S. Environmental Protection Agency (EPA). 1985. Remedial Action at Waste Disposal Sites. EPA/625/6-85/O06 (NTIS PB87-201O34).

U.S. Environmental Protection Agency (EPA). 1990. Basics of Pump-and-Treat Ground-Water Remediation Technology. EPA/600113-90/003.

TABLES

TABLE 1
BENZENE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location											PQL	NCAC 2L
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	MW-13	MW-14		std.
3/25/1994	BQL	**5.4**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
7/6/1994	BQL	**6.5**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/9/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
3/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
7/11/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**7**	BQL	BQL	BQL	5	1
11/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**7**	BQL	BQL	BQL	5	1
1/5/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**6.7**	BQL	BQL	BQL	5	1
9/25/1996	BQL	BQL	BQL	BQL	BQL	BQL	**5.2**	**14**	BQL	BQL	BQL	5	1
3/26/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/17/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**6**	BQL	BQL	BQL	5	1
5/5/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
10/16/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**11**	BQL	BQL	BQL	5	1
3/26/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
3/24/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
9/22/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
2/17/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
5/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
10/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
4/24/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
10/19/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1
4/12/2007	BQL	BQL	**1.4**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	1	1
9/27/2007	BQL	0.77 J	**1.5**	BQL	BQL	BQL	dry	BQL	BQL	BQL	BQL	1	1

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 2
1,4-DICHLOROBENZENE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location											PQL	NCAC 2L
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	MW-13	MW-14		std.
3/17/1995	**5.2**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
7/11/1995	**79**	**6**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
11/17/1995	**6.7**	**6.7**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
1/5/1996	**6.2**	**5.9**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/25/1996	**5**	BQL	BQL	BQL	BQL	BQL	**6**	BQL	BQL	BQL	BQL	5	1.4
3/26/1997	BQL	**9**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/17/1997	BQL	**6.7**	BQL	BQL	BQL	BQL	**6.9**	BQL	BQL	BQL	BQL	5	1.4
5/5/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
10/16/1998	BQL	**6.6**	BQL	BQL	BQL	BQL	**9**	**6.6**	BQL	BQL	BQL	5	1.4
3/26/1999	BQL	BQL	BQL	BQL	BQL	BQL	**6.4**	BQL	BQL	BQL	BQL	5	1.4
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
3/24/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
9/22/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
2/17/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
5/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	**5**	BQL	BQL	BQL	BQL	5	1.4
10/11/2005	BQL	**6**	BQL	BQL	BQL	BQL	**7**	BQL	BQL	BQL	BQL	5	1.4
4/24/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
10/19/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	1.4
4/12/2007	**2.9**	BQL	BQL	BQL	BQL	BQL	**3.3**	BQL	0.89	BQL	BQL	5	1.4
9/27/2007	**1.8**	**5**	BQL	BQL	BQL	BQL	dry	BQL	BQL	BQL	BQL	5	1.4

PQL = Methods Practical Quantitation Limits

BQL = Analytical results is less than the corresponding PQL

NCAC 2L std.. = 15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 3
TRICHLOROETHENE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location												PQL	NCAC 2L
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-7B	II-8	MW-13	MW-14		std.
3/25/1994	BQL	1.9	BQL	BQL	BQL	BQL	BQL	NA	NI	BQL	BQL	BQL	5	2.8
7/6/1994	BQL	BQL	BQL	BQL	BQL	0.9	BQL	NA	NI	BQL	BQL	BQL	5	2.8
9/9/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	NI	BQL	BQL	BQL	5	2.8
3/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**56.2**	NI	BQL	BQL	BQL	5	2.8
7/11/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**93**	NI	BQL	BQL	BQL	5	2.8
11/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**73**	NI	BQL	BQL	BQL	5	2.8
1/5/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**82**	NI	BQL	BQL	BQL	5	2.8
9/25/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**100**	NI	BQL	BQL	BQL	5	2.8
3/26/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**63**	NI	BQL	BQL	BQL	5	2.8
9/17/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**90**	NI	BQL	BQL	BQL	5	2.8
5/5/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**10**	NI	BQL	BQL	BQL	5	2.8
10/16/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**180**	NI	BQL	BQL	BQL	5	2.8
3/26/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	5	2.8
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	5	2.8
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	5	2.8
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	5	2.8
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	5	2.8
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**20**	BQL	BQL	BQL	BQL	5	2.8
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
3/24/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
9/22/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
2/17/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
5/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
10/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
4/24/2006	BQL	BQL	**5.5**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
10/19/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	2.8
4/12/2007	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	1	2.8
9/27/2007	BQL	BQL	**3.7**	BQL	BQL	BQL	dry	1.2	BQL	BQL	BQL	BQL	1	2.8

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

ns = ***no corresponding NCAC 2L groundwater quality standard***

NI = ***The well was not installed at the time of the earlier sampling event***

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 4
TETRACHLOROETHENE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location												PQL	NCAC 2L
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-7B	II-8	MW-13	MW-14		std.
3/25/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	NI	BQL	BQL	BQL	5	0.7
7/6/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	NI	BQL	BQL	BQL	5	0.7
9/9/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	NI	BQL	BQL	BQL	5	0.7
3/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**95.4**	NI	BQL	BQL	BQL	5	0.7
7/11/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**160**	NI	BQL	BQL	BQL	5	0.7
11/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**66**	NI	BQL	BQL	BQL	5	0.7
1/5/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**77**	NI	BQL	BQL	BQL	5	0.7
9/25/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**52**	NI	BQL	BQL	BQL	5	0.7
3/26/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**87**	NI	BQL	BQL	BQL	5	0.7
9/17/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**150**	NI	BQL	BQL	BQL	5	0.7
5/5/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**15**	NI	BQL	BQL	BQL	5	0.7
10/16/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**190**	NI	BQL	BQL	BQL	5	0.7
3/26/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**12**	NI	BQL	BQL	BQL	5	0.7
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**12**	NI	BQL	BQL	BQL	5	0.7
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**9**	NI	BQL	BQL	BQL	5	0.7
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**12**	NI	BQL	BQL	BQL	5	0.7
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**9.6**	NI	BQL	BQL	BQL	5	0.7
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**20**	BQL	BQL	BQL	BQL	5	0.7
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**7**	BQL	BQL	BQL	BQL	5	0.7
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**8.7**	BQL	BQL	BQL	BQL	5	0.7
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
3/24/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**6.7**	BQL	BQL	BQL	BQL	5	0.7
9/22/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
2/17/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	**5**	BQL	BQL	BQL	BQL	5	0.7
5/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
10/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
4/24/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
10/19/2006	BQL	BQL	**5.2**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5	0.7
4/12/2007	BQL	BQL	**5.1**	BQL	BQL	BQL	BQL	**3.6**	**1.8**	BQL	BQL	BQL	1	0.7
9/27/2007	BQL	BQL	**3.2**	BQL	BQL	BQL	dry	**1.6**	**0.49 J**	BQL	BQL	BQL	1	0.7

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

ns = ***no corresponding NCAC 2L groundwater quality standard***

NI = ***The well was not installed at the time of the earlier sampling event***

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 5
VINYL CHLORIDE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location												PQL	NCAC 2L
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-7B	II-8	MW-13	MW-14		std.
3/25/1994	BQL	**93**	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
7/6/1994	BQL	**9**	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/9/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
3/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
7/11/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
11/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
1/5/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/25/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
3/26/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/17/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
5/5/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
10/16/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
3/26/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NI	BQL	BQL	BQL	10	0.015
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
3/24/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
9/22/2004	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
2/17/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
5/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
10/11/2005	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
4/24/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
10/19/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	0.015
4/12/2007	BQL	BQL	**3.2**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	1	0.015
9/27/2007	BQL	**0.70 J**	**4.3**	BQL	BQL	BQL	dry	**0.44 J**	BQL	BQL	BQL	BQL	1	0.015

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

NI = ***The well was not installed at the time of the earlier sampling event***

NA = ***Not analyzed***

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 6
THALLIUM
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location											PQL	NCAC 2L	NC DENR
	I-5	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	MW-13	MW-14		std.	GPS (µg/L)
3/25/1994	NA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	NA	10	ns	0.28
7/6/1994	NA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	10	ns	0.28
9/9/1994	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	NA	10	ns	0.28
3/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
7/11/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
11/17/1995	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
1/5/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
9/25/1996	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/26/1997	**14**	**14**	BQL	BQL	BQL	BQL	**26**	BQL	BQL	BQL	BQL	10	ns	0.28
9/17/1997	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
5/5/1998	**18**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
10/16/1998	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/26/1999	**15**	BQL	BQL	BQL	BQL	**14**	**29**	BQL	BQL	BQL	BQL	10	ns	0.28
9/22/1999	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/27/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
9/13/2000	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/12/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
9/13/2001	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/7/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
9/18/2002	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
4/15/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
10/16/2003	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
3/24/2004	BQL	BQL	BQL	**13**	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
9/22/2004	**14**	BQL	BQL	BQL	BQL	**10**	BQL	BQL	BQL	**10**	BQL	10	ns	0.28
2/17/2005	NA	BQL	BQL	BQL	BQL	NA	NA	BQL	BQL	NA	NA	10	ns	0.28
5/11/2005	**24**	**16**	**11**	BQL	BQL	BQL	**16**	BQL	BQL	BQL	BQL	10	ns	0.28
10/11/2005	**14**	**23**	BQL	BQL	BQL	BQL	**25**	BQL	BQL	BQL	BQL	10	ns	0.28
4/24/2006	**20.5**	**23.7**	BQL	BQL	BQL	BQL	**18.2**	BQL	BQL	BQL	BQL	10	ns	0.28
10/19/2006	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10	ns	0.28
4/12/2007	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	5.5	ns	0.28
9/27/2007	0.043 J	0.045 J	0.040 J	0.051 J	0.182.J	0.047 J	dry	0.047 J	BQL	0.041J	0.045J	5.5	ns	0.28

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

ns = ***no corresponding NCAC 2L groundwater quality standard***

NA = ***Not analyzed***

= Orange cells indicate the reported concentration exceeds the NCDENR GPS groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 7
NES WELL DETECTS - TETRACHLOROETHENE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location							PQL	NCAC 2L
	II-7B	II-9	II-10	II-11	II-12	II-2B	II-13		std.
9/13/2001	BQL	NI	NI	NI	NI	NI	NI	5	0.7
3/7/2002	BQL	NI	NI	NI	NI	NI	NI	5	0.7
9/18/2002	BQL	NI	NI	NI	NI	NI	NI	5	0.7
4/15/2003	BQL	NI	NI	NI	NI	NI	NI	5	0.7
10/16/2003	BQL	NI	NI	NI	NI	NI	NI	5	0.7
3/24/2004	BQL	NI	NI	NI	NI	NI	NI	5	0.7
9/22/2004	BQL	NI	NI	NI	NI	NI	NI	5	0.7
2/17/2005	BQL	NI	NI	NI	NI	NI	NI	5	0.7
5/11/2005	BQL	BQL	BQL	BQL	BQL	NI	NI	5	0.7
10/11/2005	BQL	NA	NA	NA	NA	NI	NI	5	0.7
4/24/2006	BQL	BQL	BQL	BQL	BQL	NI	NI	5	0.7
10/19/2006	BQL	NA	NA	NA	NA	NI	NI	5	0.7
4/12/2007	**1.8**	NA	NA	NA	NA	NI	NI	1	0.7
7/11/2007	NA	NA	NA	NA	NA	**2.3**	BQL	1	0.7
9/27/2007	0.49 J	NA	NA	NA	NA	NA	NA	1	0.7

PQL = Methods Practical Quantitation Limits

BQL = Analytical results is less than the corresponding PQL

NCAC 2L std.. = 15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 8
NES WELL DETECTS - VINYL CHLORIDE
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location							PQL	NCAC 2L std.
	II-7B	II-9	II-10	II-11	II-12	II-2B	II-13		
9/13/2001	BQL	NI	NI	NI	NI	NI	NI	10	0.015
3/7/2002	BQL	NI	NI	NI	NI	NI	NI	10	0.015
9/18/2002	BQL	NI	NI	NI	NI	NI	NI	10	0.015
4/15/2003	BQL	NI	NI	NI	NI	NI	NI	10	0.015
10/16/2003	BQL	NI	NI	NI	NI	NI	NI	10	0.015
3/24/2004	BQL	NI	NI	NI	NI	NI	NI	10	0.015
9/22/2004	BQL	NI	NI	NI	NI	NI	NI	10	0.015
2/17/2005	BQL	NI	NI	NI	NI	NI	NI	10	0.015
5/11/2005	BQL	**12**	BQL	BQL	BQL	NI	NI	10	0.015
4/24/2006	BQL	BQL	BQL	BQL	BQL	NI	NI	10	0.015
4/12/2007	BQL	NA	NA	NA	NA	NI	NI	1	0.015
7/11/2007	NA	NA	NA	NA	NA	**3.2**	BQL	1	0.015
9/27/2007	BQL	NA	NA	NA	NA	NA	NA	1	0.015

PQL = Methods Practical Quantitation Limits

BQL = Analytical results is less than the corresponding PQL

NCAC 2L std.. = 15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater

= Orange cells indicate the reported concentration exceeds the NCAC 2L groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 9
NES WELL DETECTS - THALLIUM
DETECTION ABOVE 2L SUMMARY TABLE
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Sampling Date	Sample Location							PQL	NCAC 2L	NC DENR
	II-7B	II-9	II-10	II-11	II-12	II-2B	II-13		std.	GPS (µg/L)
9/13/2001	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
3/7/2002	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
9/18/2002	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
4/15/2003	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
10/16/2003	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
3/24/2004	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
9/22/2004	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
2/17/2005	BQL	NI	NI	NI	NI	NI	NI	10	ns	0.28
5/11/2005	BQL	BQL	BQL	**12**	BQL	NI	NI	10	ns	0.28
4/24/2006	BQL	BQL	BQL	BQL	**25.3**	NI	NI	10	ns	0.28
4/12/2007	BQL	NA	NA	NA	NA	NI	NI	10	ns	0.28
7/11/2007	NA	NA	NA	NA	NA	NA	NA	5.5	ns	0.28
9/27/2007	0.037 J	NA	NA	NA	NA	NA	NA	5.5	ns	0.28

PQL = ***Methods Practical Quantitation Limits***

BQL = ***Analytical results is less than the corresponding PQL***

NCAC 2L std.. = ***15A North Carolina Administrative Code 2L .0200, Groundwater Quality Standards for Class GA groundwater***

NI = ***The well was not installed at the time of the earlier sampling event***

NA = ***Not analyzed***

= Orange cells indicate the reported concentration exceeds the NCDENR GPS groundwater standard.

All concentrations are reported in micrograms per liter (µ/L).

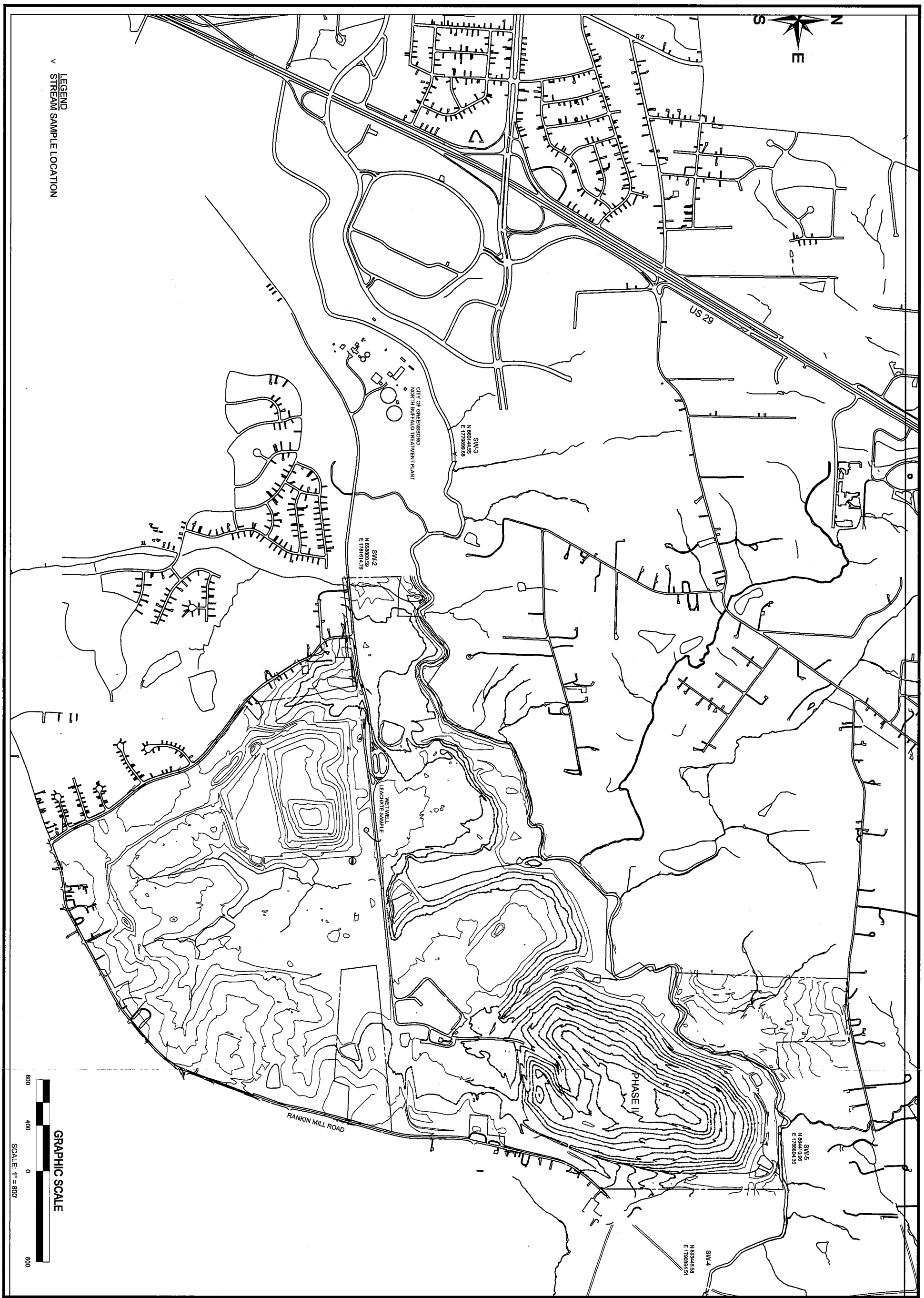
NCDENR DWM changed from PQL to Solid Waste Section Limit (SWSL) in 2007

TABLE 10
GROUNDWATER ANALYTICAL RESULTS for PRELIMINARY SCREENING OF ANAEROBIC BOIDEGRADATION PROCESSES
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Parameters	Well ID II-1	Point Value	Well ID II-2	Point Value	Well ID II-2B	Point Value	Well ID II-7	Point Value	Well ID II-7B	Point Value	Well ID II-9	Point Value
Oxygen	0.47	3	0.78	2	0.16	3	0.96	2	0.92	2	0.19	3
Nitrate	0.015	2	0.013	2	0.01	2	2.2	0	0.023	2	0.41	2
Iron, Ferrous	0.042	0	0.042	0	1.7	3	0.042	0	0.042	0	0.042	0
Sulfate	25	0	25	0	25	0	4.7	2	0.1	2	40	0
Sulfide	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0
Methane	0.135	0	3.49	3	2.33	3	0.009	0	0.003	0	0.002	0
ORP	-316	2	-302	2	-373	2	-268	2	-282	2	-319	2
pH	6.33	0	6.86	0	6.32	0	5.42	0	10.43	-2	5.51	0
Total Organic Carbon	15	0	2.2	0	3.3	0	1.3	0	3.1	0	9.2	0
Temperature (^{o}C)	13.36	0	17.86	0	19.22	0	14.27	0	15.14	0	15.37	0
Chloride	450	2	12	2	11	2	4.3	2	4.8	2	6	2
BTEX	1.27*	0	2.87	2	BQL**	0	1.27*	0	1.27*	0	BQL**	0
Trichloroethene	0.25*	2	3.6	2	BQL**	0	0.25*	0	0.25*	0	BQL**	0
Dichloroethene	0.46*	0	0.46*	0	BQL**	0	0.46*	0	0.46*	0	BQL**	0
Vinyl Chloride	0.3	2	3.6	2	BQL**	0	0.3*	0	0.3*	0	BQL**	0
1,1,1 Trichloroethane	0.27	0	0.27	0	BQL**	0	0.27*	0	0.27*	0	BQL**	0
Chloroethene	0.3	2	0.3	2	BQL**	0	0.3*	0	0.3*	0	BQL**	0
Total Point Value Score	--	**15**	--	**19**	--	**15**	--	8	--	8	--	9

If the Point Total for an individual sampling location equals 15 or more points, it is likely that anaerobic biodegradation (i.e. reductive dechlorination) is occuring at that location
Results in mg/L
Point value system based on mg/L
* = Consituents Not Detected and reported limits are below laboratory method detection limits
** = Results are from wells sampled April 2007
BQL = Below Quanitation Limits

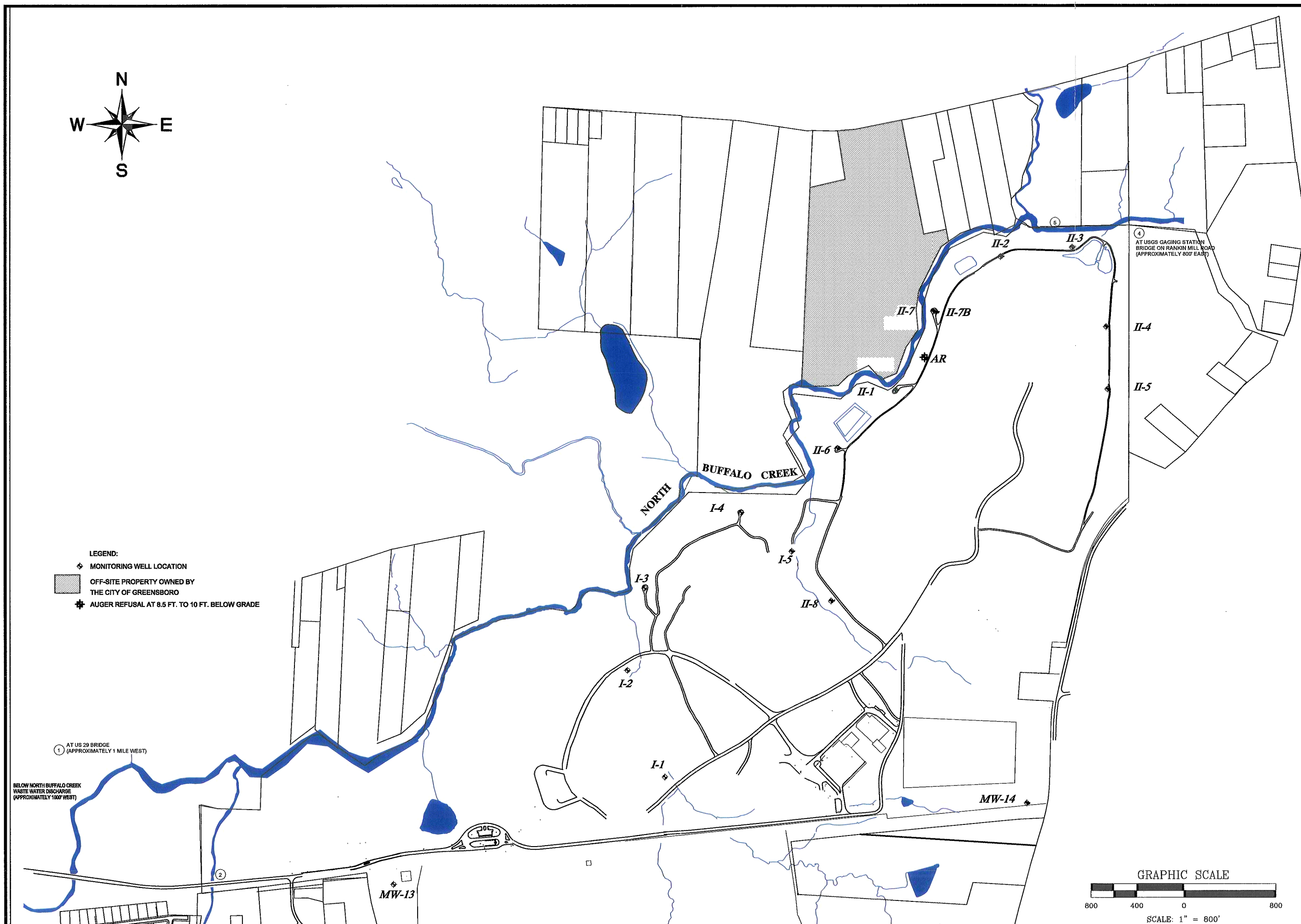
FIGURES



S&ME
ENVIRONMENTAL SERVICES
ENGINEERING · TESTING

SITE BASE MAP
PHASE II
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: DSB/RDM	CHECKED BY: LE
JOB NO. 1584-98-081	DATE: NOVEMBER 2007	FIGURE NO. 1



DETAILED SITE BASE MAP
PHASE II
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

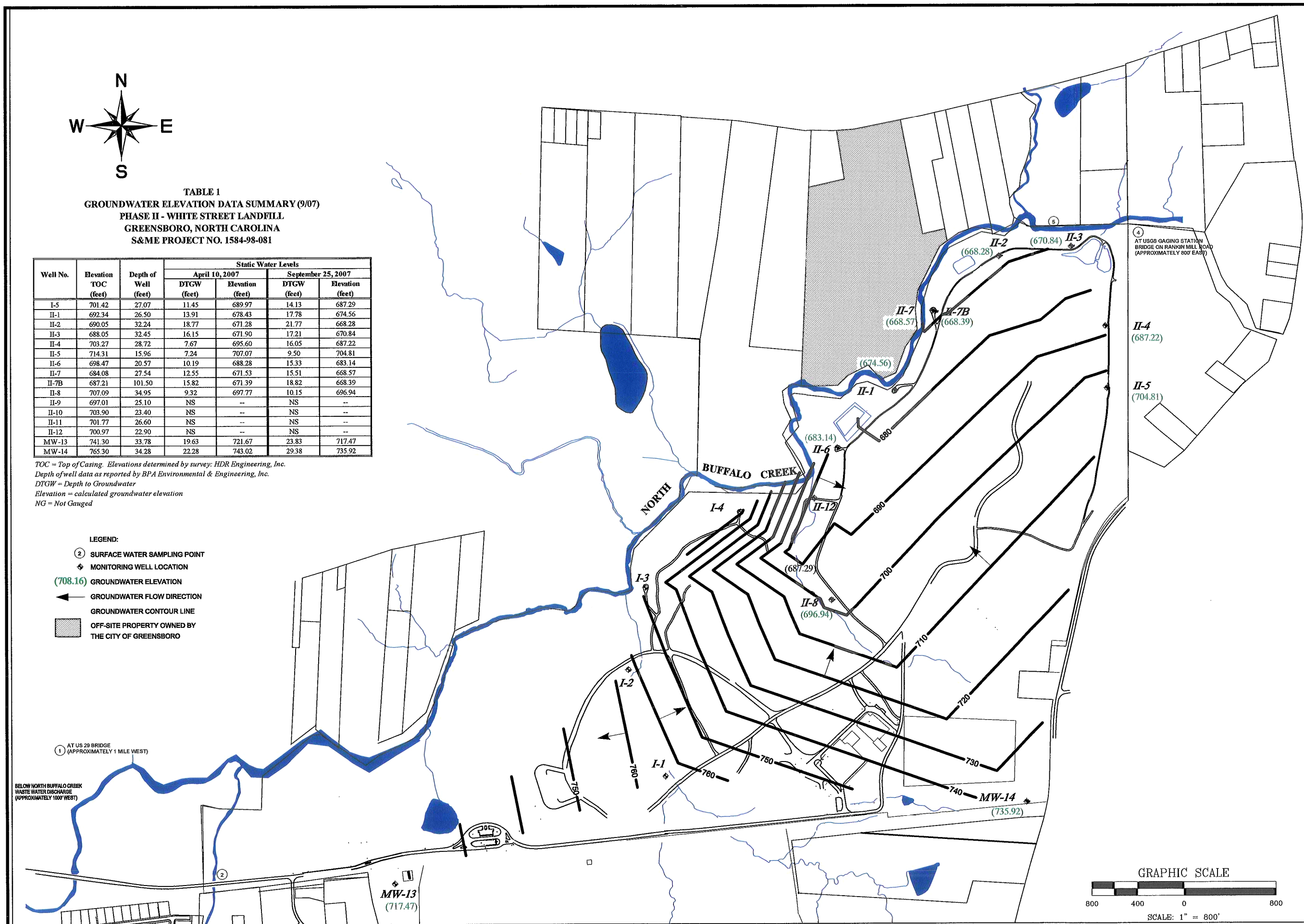
SCALE: AS SHOWN	DRAWN BY: DSB/RDM	CHECKED BY: CDW	
JOB NO. 1584-98-081	DATE: JUNE 2008	FIGURE NO. 2	

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING · TESTING

TABLE 1
GROUNDWATER ELEVATION DATA SUMMARY (9/07)
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Well No.	Elevation TOC (feet)	Depth of Well (feet)	Static Water Levels			
			April 10, 2007		September 25, 2007	
			DTGW (feet)	Elevation (feet)	DTGW (feet)	Elevation (feet)
I-5	701.42	27.07	11.45	689.97	14.13	687.29
II-1	692.34	26.50	13.91	678.43	17.78	674.56
II-2	690.05	32.24	18.77	671.28	21.77	668.28
II-3	688.05	32.45	16.15	671.90	17.21	670.84
II-4	703.27	28.72	7.67	695.60	16.05	687.22
II-5	714.31	15.96	7.24	707.07	9.50	704.81
II-6	698.47	20.57	10.19	688.28	15.33	683.14
II-7	684.08	27.54	12.55	671.53	15.51	668.57
II-7B	687.21	101.50	15.82	671.39	18.82	668.39
II-8	707.09	34.95	9.32	697.77	10.15	696.94
II-9	697.01	25.10	NS	--	NS	--
II-10	703.90	23.40	NS	--	NS	--
II-11	701.77	26.60	NS	--	NS	--
II-12	700.97	22.90	NS	--	NS	--
MW-13	741.30	33.78	19.63	721.67	23.83	717.47
MW-14	765.30	34.28	22.28	743.02	29.38	735.92

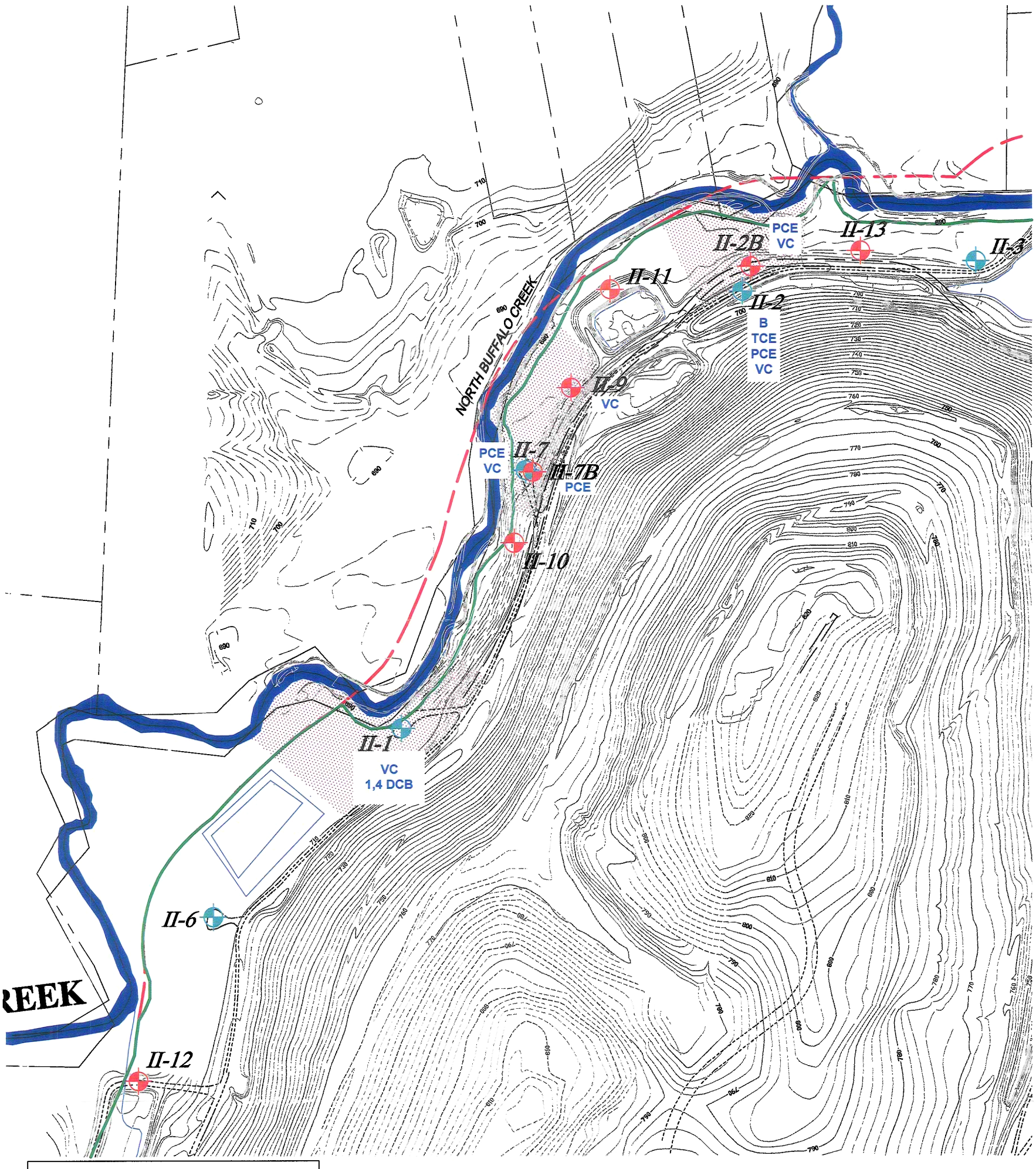
TOC = Top of Casing. Elevations determined by survey: HDR Engineering, Inc.
Depth of well data as reported by BPA Environmental & Engineering, Inc.
DTGW = Depth to Groundwater
Elevation = calculated groundwater elevation
NG = Not Gauged



GROUNDWATER FLOW MAP
PHASE II
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN
DRAWN BY: DSB/RDM
CHECKED BY: LE
JOB NO. 1584-98-081B
DATE: NOVEMBER 2007
FIGURE NO. 3

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING · TESTING



CONSTITUENT ACRONYMS LIST	
ACRONYM	CONSTITUENT
B	BENZENE
TCE	TRICHLOROETHENE
PCE	TETRACHLOROETHENE
VC	VINYL CHLORIDE
1,4 DCB	1,4 DICHLOROBENZENE

LEGEND
- APPROXIMATED EXTENT OF VOLATILE ORGANIC COMPOUND PLUME
- GROUNDWATER MONITORING WELL
- PCE VC - CONSTITUENTS DETECTED IN THE DESIGNATED MONITORING WELL
- FORMER COMPLIANCE BOUNDARY

GRAPHIC SCALE

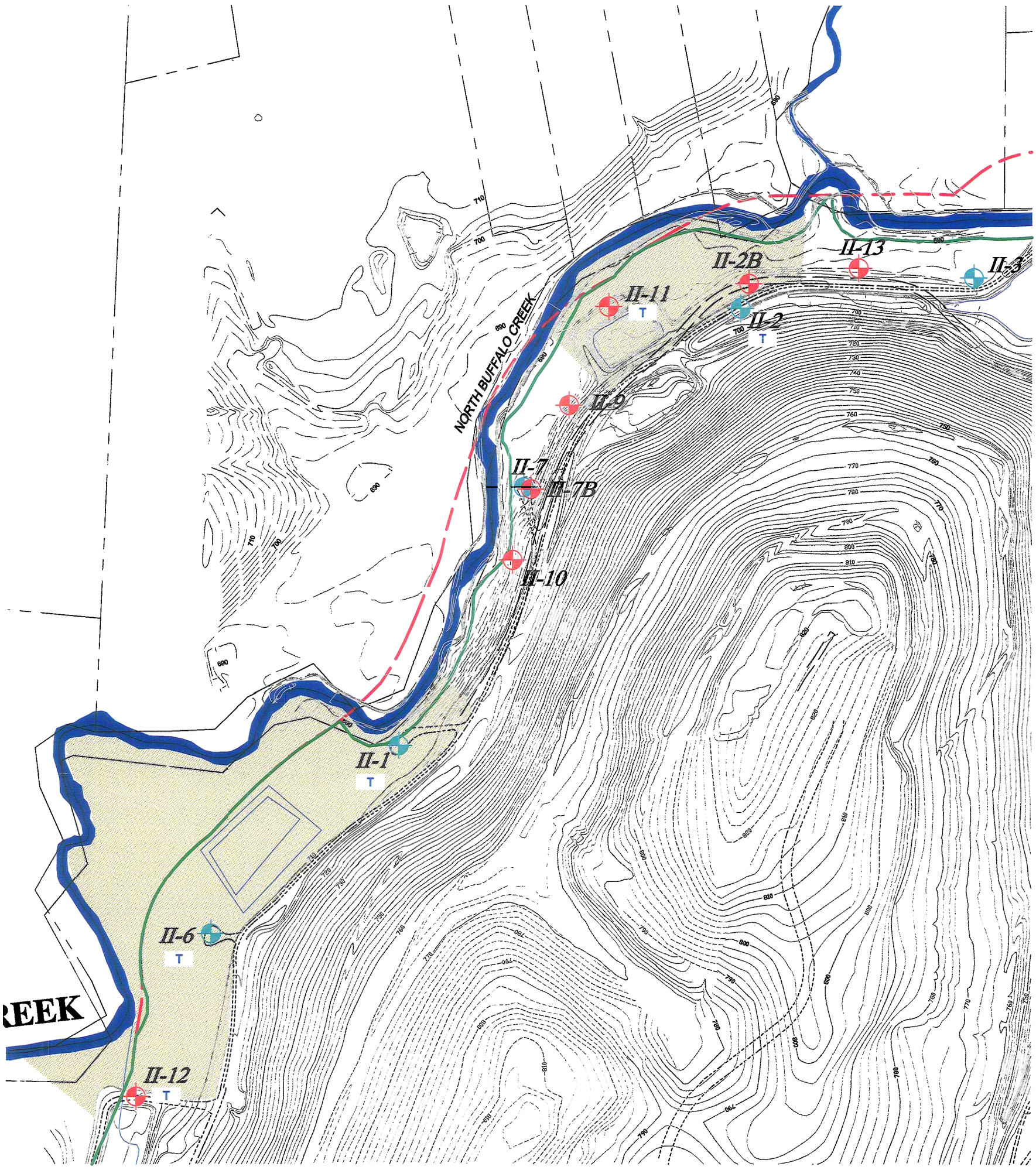
300 150 0 300

SCALE: 1" = 300'

S&ME

CONTAMINANT DISTRIBUTION - VOLATILE ORGANIC COMPOUNDS
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: RDM	CHECKED BY: CDW
JOB NO. 1584-98-081	DATE: JUNE 2008	FIGURE NO. 4



CONSTITUENT ACRONYMS LIST	
T	THALLIUM

LEGEND
- APPROXIMATED EXTENT OF METALS PLUME
- GROUNDWATER MONITORING WELL
- CONSTITUENT DETECTED IN THE DESIGNATED MONITORING WELL
- FORMER COMPLIANCE BOUNDARY

GRAPHIC SCALE

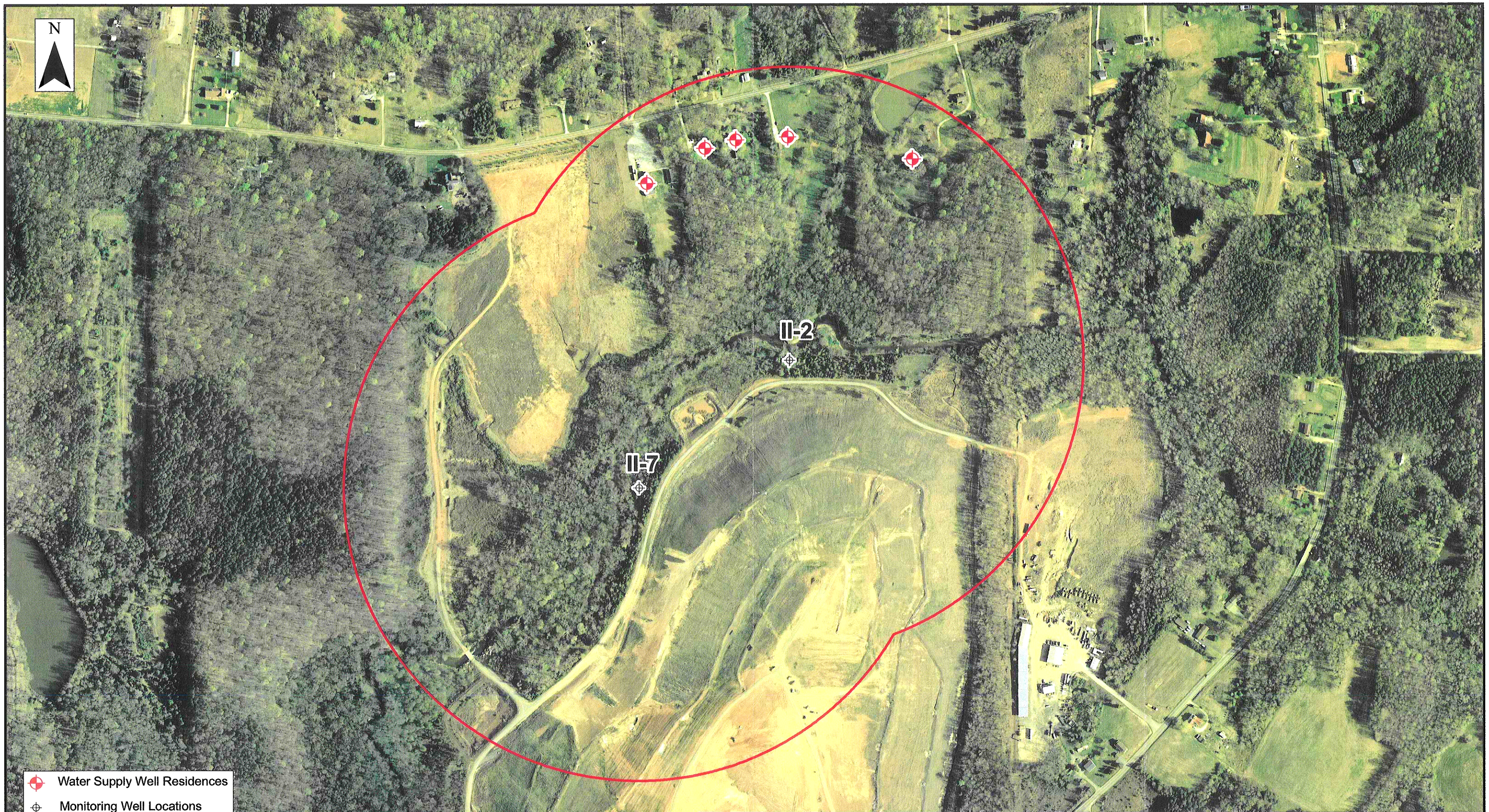
300 150 0 300

SCALE: 1" = 300'

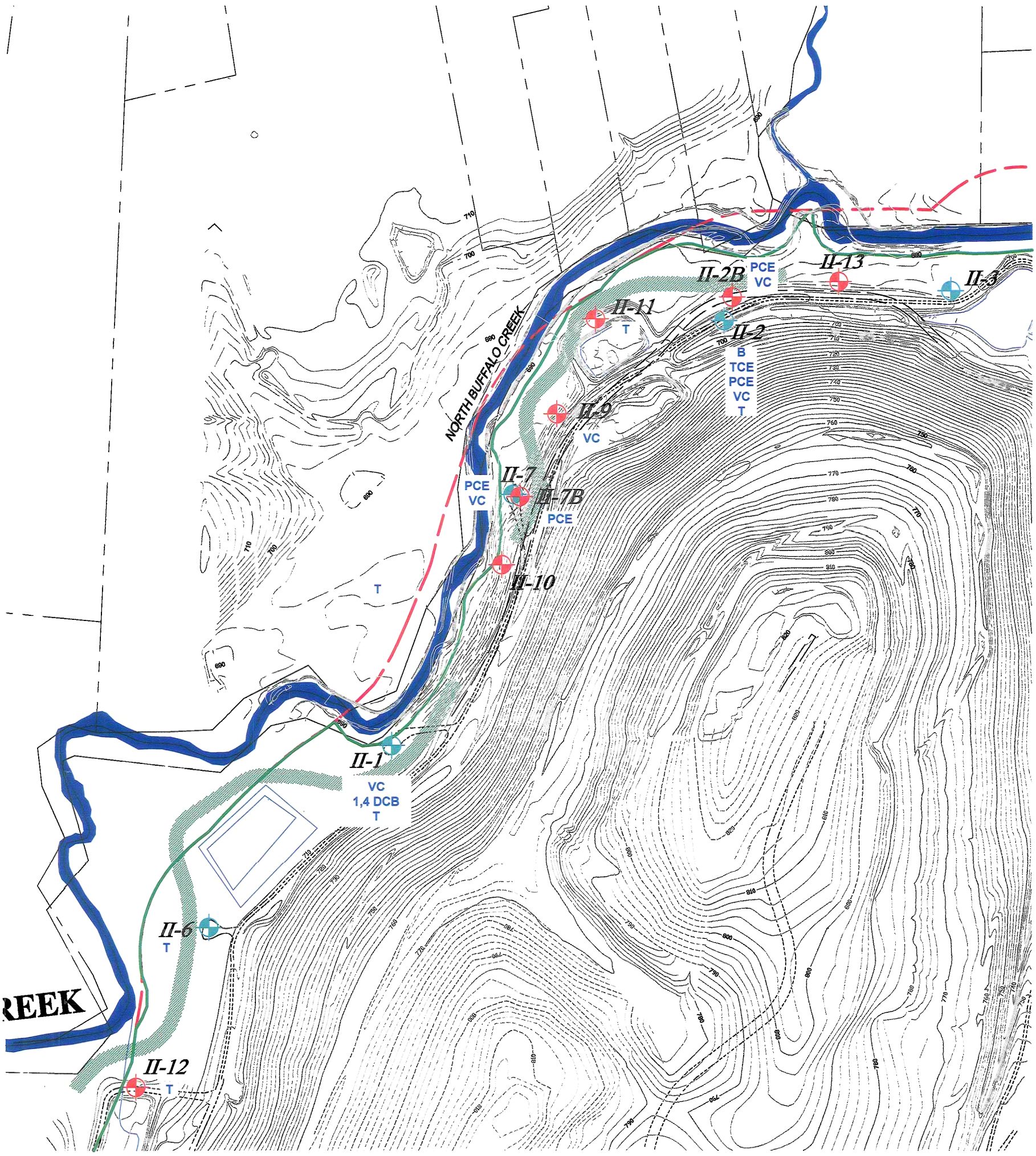
S&ME

CONTAMINANT DISTRIBUTION - METALS
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: RDM	CHECKED BY: CDW
JOB NO. 1584-98-081	DATE: MAY 2008	FIGURE NO. 5



Scale: 1 inch equals 400 feet	S&ME	White Street Landfill	FIGURE
Drawn by: SDM		Greensboro, North Carolina	6
Reviewed by: CW		1/4-Mile Radius Drinking Water Well Receptor Survey	
Date: August 2007		Job No. 1584-98-081	



CONSTITUENT ACRONYMS LIST	
ACRONYM	CONSTITUENT
B	BENZENE
TCE	TRICHLOROETHENE
PCE	TETRACHLOROETHENE
VC	VINYL CHLORIDE
1,4 DCB	1,4 DICHLOROBENZENE
T	THALLIUM

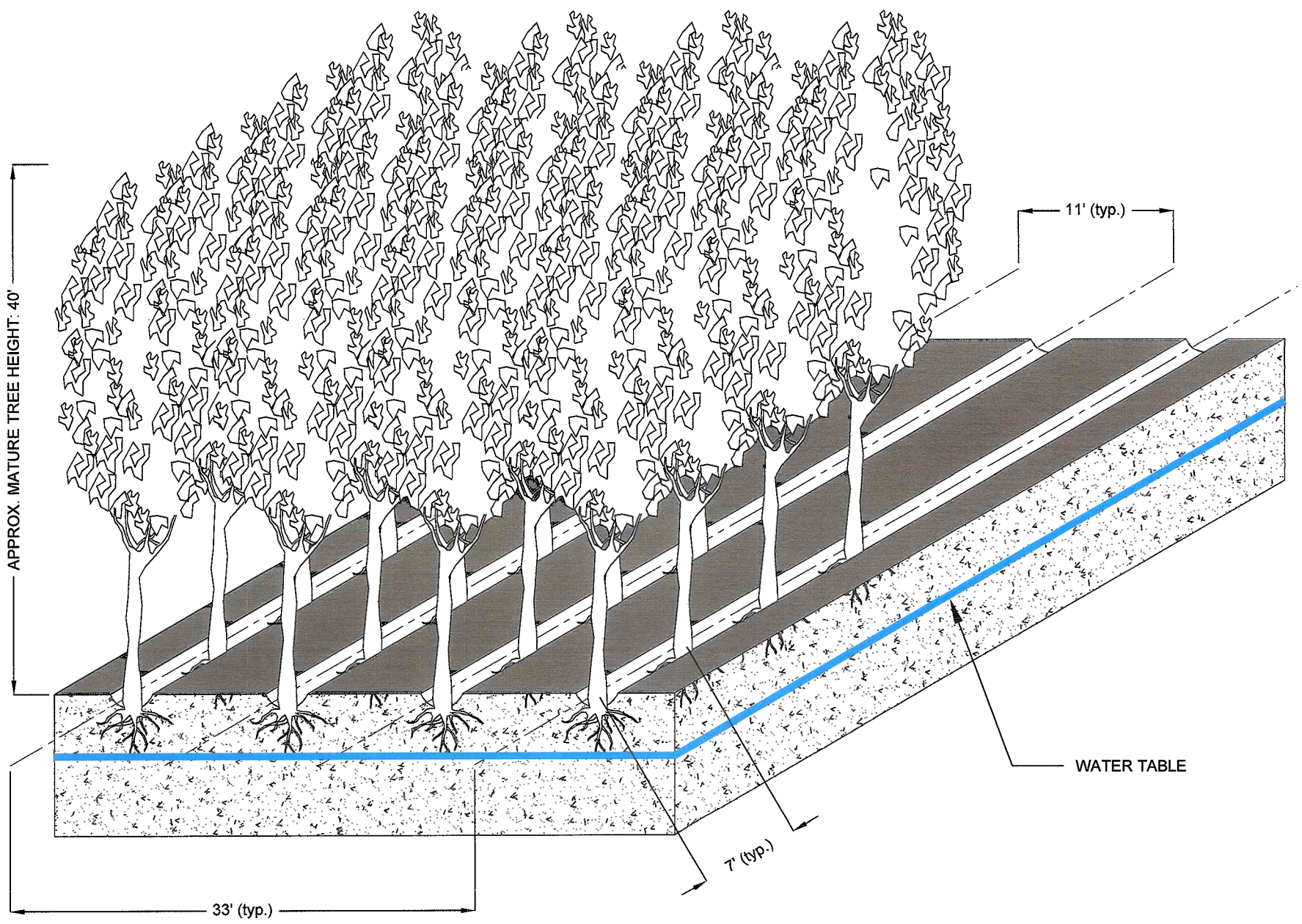
LEGEND
- PROPOSED PHYTOREMEDIATION BED
- GROUNDWATER MONITORING WELL
- PCE VC - CONSTITUENTS DETECTED IN THE DESIGNATED MONITORING WELL
- FORMER COMPLIANCE BOUNDARY

GRAPHIC SCALE
300150300 250 0 500
SCALE: 1" = 300'

S&ME

PROPOSED PHYTOREMEDIATION AREAS
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: RDM	CHECKED BY: CDW
JOB NO. 1584-98-081	DATE: MAY 2008	FIGURE NO. 7



GRAPHIC SCALE

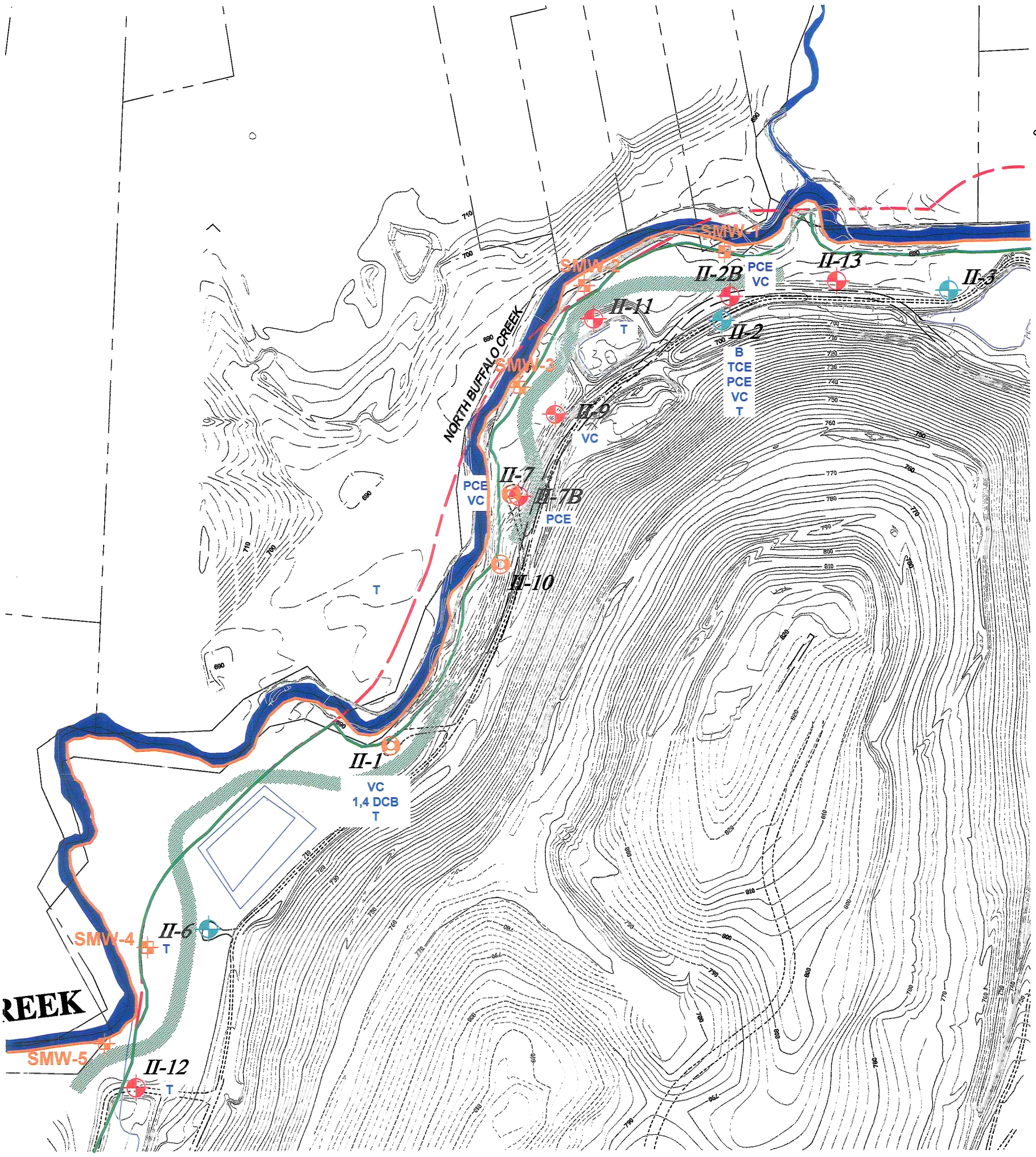
10 5 0 10

SCALE: 1" = 10'

S&ME

PROPOSED PHYTOREMEDIATION DESIGN SCHEMATIC
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: RDM	CHECKED BY: CDW
JOB NO. 1584-98-081	DATE: JUNE 2008	FIGURE NO. 8



CONSTITUENT ACRONYMS LIST	
ACRONYM	CONSTITUENT
B	BENZENE
TCE	TRICHLOROETHENE
PCE	TETRACHLOROETHENE
VC	VINYL CHLORIDE
1,4 DCB	1,4 DICHLOROBENZENE
T	THALLIUM

LEGEND

- PROPOSED SENTINEL WELL
- EXISTING SENTINEL WELL
- PROPOSED PHYTOREMEDIATION BED
- GROUNDWATER MONITORING WELL
- PCE VC - CONSTITUENTS DETECTED IN THE DESIGNATED MONITORING WELL
- FORMER COMPLIANCE BOUNDARY
- NEW COMPLIANCE BOUNDARY

GRAPHIC SCALE

300150300 250 0 500

SCALE: 1" = 300'

S&ME

PROPOSED SENTINEL WELL LOCATION MAP
WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: RDM	CHECKED BY: CDW
JOB NO. 1584-98-081	DATE: JUNE 2008	FIGURE NO. 9

APPENDIX I

September 2007 Groundwater Velocity Calculations

GROUNDWATER ELEVATION DATA SUMMARY (9/07)
PHASE II - WHITE STREET LANDFILL
GREENSBORO, NORTH CAROLINA
S&ME PROJECT NO. 1584-98-081

Well No.	Elevation TOC (feet)	Depth of Well (feet)	October 19-20, 2006		September 25, 2007	
			DTGW (feet)	Elevation (feet)	DTGW (feet)	Elevation (feet)
I-5	701.42	27.07	11.66	689.76	14.13	687.29
II-1	692.34	26.50	16.85	675.49	17.78	674.56
II-2	690.05	32.24	20.20	669.85	21.77	668.28
II-3	688.05	32.45	17.14	670.91	17.21	670.84
II-4	703.27	28.72	12.58	690.69	16.05	687.22
II-5	714.31	15.96	7.60	706.71	9.50	704.81
II-6	698.47	20.57	13.26	685.21	15.33	683.14
II-7	684.08	27.54	14.23	669.85	15.51	668.57
II-7B	687.21	101.50	17.60	669.61	18.82	668.39
II-8	707.09	34.95	9.64	697.45	10.15	696.94
MW-13	741.30	33.78	19.61	721.69	23.83	717.47
MW-14	765.30	34.28	28.14	737.16	29.38	735.92

TOC = Top of Casing. Elevations determined by survey: HDR Engineering, Inc.
Depth of well data as reported by BPA Environmental & Engineering, Inc.
DTGW = Depth to Groundwater
Elevation = calculated groundwater elevation
NG = Not Gauged

APPENDIX II

Summary of Select Research Documents and Interviews with Phytoremediation Experts

Summary of Select Research Documents and Interviews with Phytoremediation Experts

To begin our research, Connel Ware of S&ME contacted Ms. Jackie Drummond with the NCDENR – DWM to inquire about other landfills in North Carolina which have used phytoremediation to successfully remediate landfill constituents in groundwater. Ms. Drummond provided S&ME with a publicly available Corrective Action Plan for the Needmore Road Landfill Facility in Salisbury, North Carolina, Earth Tech, Inc. November 2007. This corrective Action Plan utilized a phytoremediation program which was initiated in December of 2005 for the purpose of enhancing remediation of 1,4-dioxane-impacted groundwater downgradient of the landfill. The program also provided the secondary effect of intercepting most of the surface water flow emanating from the landfill. This landfill was an industrial landfill which received waste from Hoechst Celanese Corporation. While the constituents of concern at this landfill differed from the constituents of concern at the White Street Landfill, the landfills have some similarities. Both are old landfills which have been receiving waste for a number of years, and both landfills are bounded in the downgradient portion by a river/creek. The downgradient portion of the Needmore Road Landfill is bounded by the Yadkin River. The phytoremediation system at the Needmore Road Landfill was designed and installed by Ecolotree®, a firm which is nationally recognized for its expertise regarding phytoremediation research and its uses to successfully remediate impacted groundwater. Ecolotree® is also known for their experience in designing and installing phytoremediation systems at sites requiring corrective measures for groundwater quality (including landfills) throughout the mid west and southeastern portions of the United States.

S&ME contacted Dr. Louis A. Licht, President and founder of Ecolotree®, to further discuss phytoremediation as a viable technology to remediate groundwater impacted with the COCs identified at the White Street Landfill. We also discussed the existing site specific parameters including; depth to groundwater, soil type, topography, and available acreage where we are proposing to install the phytoremediation system at the Facility. It was Dr. Licht's opinion, based on the information provided to him, that the White Street Landfill is likely a good candidate for implementation of a successful phytoremediation system to restore groundwater quality at the Facility.

Dr. Licht conveyed to S&ME that his company has successfully installed phytoremediation systems at several landfills though out the southeastern US including North Carolina to remediate chlorinated solvent impacted groundwater. As an example of the potential success of phytoremediation at remediating chlorinated solvents in the uppermost aquifer, Dr. Licht provided S&ME with a report titled 2006 Year-End Report Summary, Ecolotree® Phytoremediation Buffer (EBuffer®), Watertower Paint and Repair Facility in Clear Lake Iowa. The report summarizes the effectiveness of the phytoremediation buffer (EBuffer®) at remediating the constituents of concern at this Facility from the date the system was installed in 2002 through the date of the report.

The primary constituent of concern at this Facility is the chlorinated solvent tetrachloroethene but also included the chlorinated hydrocarbon constituents ethyl benzene and xylene. The primary COCs at the White Street Landfill include tetrachloroethene and the chlorinated hydrocarbon benzene. The results of the report show that within a five year period the concentration of tetrachloroethene dropped on average by 5 orders of magnitude in growndwater samples collected from previously impacted groundwater monitoring wells. In one particular monitoring well, the 2002 concentration averaged 13.91 mg/L; in 2006 the concentration averaged 0.5 mg/L. A statistically significant downward concentration trend was observed in all of the sentinel monitoring wells at the Facility.

David Loftis, P.E. of S&ME completed graduate research on a phytoremediation project under Dr. John Novak of Virginia Tech's environmental engineering program. This project was completed for Norfolk Southern Corporation and involved a leaking creosote holding pond. Connel Ware of S&ME contacted Dr. Novak to discuss his knowledge and expertise regarding phytoremediation systems. As with Dr. Licht, the site specific parameters of the White Street Landfill including the site specific COCs, depth to groundwater, site soils, topography, and available space for a phytoremediation system were discussed with Dr. Novak. It was also Dr. Novak's opinion that, based on the information provided to him, that the White Street Landfill is likely a good candidate for implementation of a successful phytoremediation system to restore groundwater quality at the Facility. Additionally, Dr. Novak referred S&ME to Dr. Licht and Ecolotree® before he knew we had already contacted Dr. Licht.

Dr. Novak provided S&ME with an online link to the Environmental Science and Technology Journal which posts several publications he has either authored and/or coauthored on phytoremediation. S&ME obtained two reports from this website. The first report Remediation of Polycyclic Aromatic Hydrocarbon Compounds in Groundwater Using Poplar Trees, Mark A. Widdowson, Sandra Shearer, Rikke G. Andersen, and John T. Novak; 2/11/05, was a seven year study conducted to assess the effectiveness of hybrid poplar trees to remediate polycyclic aromatic hydrocarbon (PAH) compounds in soil and groundwater at a creosote-contaminated site. A reduction in the extent of the plume was observed in the upper half of the 2 m thick saturated soil zone, and PAH concentration levels in the groundwater declined throughout the plume. PAH concentrations began to decline during the period between the third and fourth growing seasons, which coincided with the propagation of the tree roots to the water table region. PAH concentrations in soil and aquifer sediment samples also declined over time. The second report obtained by S&ME; Push-Pull Tests to Quantify In Situ Degradation Rates at a Phytoremediation Site, Mark T. Pitterle, Rikke G. Andersen, John T. Novak, and Mark A. Widdowson, 10/26/2005; discusses the results of single-well injection-withdrawal tests, or push-pull tests (PPTs), performed to determine in-situ aerobic respiration rates at a creosote-contaminated site and to assess the contribution of hybrid poplar trees to the remediation of polynuclear aromatic hydrocarbons (PAH) in groundwater. PPTs were conducted by injecting a solution containing dissolved oxygen and naphthalene (reactive tracers) with bromide (nonreactive tracer) into wells constructed in a shallow unconfined aquifer. The objective of the study was to determine

seasonal variation and spatial differences (contaminated versus uncontaminated areas and treed versus untried areas) in the rate of consumption of dissolved oxygen. First-order aerobic respiration rates varied from 0.0 (control well) to 1.25 hr^{-1}, which occurred at a planted area in early summer (June). Rates measured in winter at treed areas were greater by a factor of 3-5 when compared to winter rates determined at non-treed areas of the site. Rates at treed regions were found to increase by over 4 times in summer relative to winter at the same location. The results of this study show that poplar trees are effective in ameliorating PAHs, and the benefits of phytoremediation using poplar trees is not limited to the growth seasons during the summer months.

S&ME conducted additional online research which also supports the selection of phytoremediation at the White Street Landfill. The Groundwater Remediation Technologies Analysis Center of Pittsburg, PA has determined through their studies that; "All plants extract necessary nutrients, including metals, from their soil and water environments. Some plants, called hyperaccumulators, have the ability to store large amounts of metals, even some metals that do not appear to be required for plant functioning. In addition, plants can take up various organic chemicals from environmental media and degrade or otherwise process them for use in their physiological processes." The United States Air Force is utilizing phytoremediation to treat groundwater impacted with volatile organic compounds as well as select metals at Air Force Plant #4, in Carswell Texas.

APPENDIX III

Laboratory Results Report – Preliminary Screening Of Anaerobic Biodegradation Processes

Environmental Conservation Laboratories, Inc.
102-A Woodwinds Industrial Court
Cary NC, 27511
Phone: 919.467.3090 FAX: 919.467.3515
www.encolabs.com

Tuesday, May 20, 2008

S&ME, Inc. (SM004)

Attn: Connel Ware

3718 Old Battleground Rd.

Greensboro, NC 27410

RE: Laboratory Results for
Project Number: [none], Project Name/Desc: White Street Landfill ABP
ENCO Workorder: C804447

Dear Connel Ware,

Enclosed is a copy of your laboratory report for test samples received by our laboratory on Tuesday, May 6, 2008.

Unless otherwise noted in an attached project narrative, all samples were received in acceptable condition and processed in accordance with the referenced methods/procedures. Results for these procedures apply only to the samples as submitted.

The analytical results contained in this report are in compliance with NELAC standards, except as noted in the project narrative. This report shall not be reproduced except in full, without the written approval of the Laboratory.

This report contains only those analyses performed by Environmental Conservation Laboratories. Unless otherwise noted, all analyses were performed at ENCO Cary. Data from outside organizations will be reported under separate cover.

If you have any questions or require further information, please do not hesitate to contact me.

Sincerely,

Stephanie Franz

Project Manager

Enclosure(s)

The total number of pages in this report, including this page is 30.

PROJECT NARRATIVE

Date: 20 May 2008
Client: S&ME
Project: White Street Landfill ABP
Lab ID: C804447

Overview

Environmental Conservation Laboratories, Inc. (ENCO) analyzed all submitted samples in accordance with the methods referenced in the laboratory report. Any particular difficulties encountered during sample handling by ENCO are discussed in the QC Remarks section below.

Quality Control Samples

Chloride, Nitrite, and Nitrate/Nitrite (NOx) were detected in the associated Method Blanks at low-level concentrations (less than half of the MRL). Associated samples with concentrations of these analytes less than ten times that of the detections in the Method Blanks should be considered to have a possible high bias.

Quality Control Remarks

The spike recoveries of Chloride, Sulfate, and TOC in the MS and/or MSD samples were outside of control limits. The QC batches were approved based on acceptable LCS recoveries of these analytes.

The determination of Ferrous Iron is considered by the EPA to be a field parameter, and as such, has a hold time of 0.01 days (14.4 minutes). As the samples were expired prior to receipt by ENCO, the analyses were performed on the out of hold samples, and the results are appropriately qualified (Q-flagged).

Other Comments

The analytical data presented in this report are consistent with the methods as referenced in the analytical report. Any exceptions or deviations are noted in the QC remarks section of this narrative or in the Flags/Notes and Definitions section of the report.

Released By:
Environmental Conservation Laboratories, Inc.

Stephanie Franz
Project Manager

www.encolabs.com

SAMPLE SUMMARY/LABORATORY CHRONICLE

Client ID: II-1 **Lab ID:** C804447-01 **Sampled:** 05/05/08 07:50 **Received:** 05/06/08 08:30

Parameter	Hold Date/Time(s)		Prep Date/Time(s)		Analysis Date/Time(s)
EPA 300.0	06/02/08		05/09/08	14:22	5/10/2008 09:15
EPA 353.2	05/07/08	07:50	05/06/08	13:15	5/6/2008 15:40
EPA 353.2	06/02/08		05/13/08	09:00	5/13/2008 12:00
EPA 353.2	06/02/08		05/19/08	10:53	5/19/2008 10:53
EPA 376.2	05/12/08		05/09/08	08:44	5/9/2008 08:44
EPA 415.1	06/02/08		05/07/08	10:35	5/7/2008 12:28
RSK 175	05/19/08		05/08/08	07:48	5/8/2008 13:25
SM18 3500-Fe D	05/05/08	08:04	05/07/08	16:23	5/7/2008 16:23
SM4500-Cl/E	06/02/08		05/19/08	07:54	5/19/2008 10:35

Client ID: II-2 **Lab ID:** C804447-02 **Sampled:** 05/05/08 11:10 **Received:** 05/06/08 08:30

Parameter	Hold Date/Time(s)		Prep Date/Time(s)		Analysis Date/Time(s)
EPA 300.0	06/02/08		05/09/08	14:22	5/10/2008 09:45
EPA 353.2	05/07/08	11:10	05/06/08	13:15	5/6/2008 15:44
EPA 353.2	06/02/08		05/13/08	09:00	5/13/2008 12:05
EPA 353.2	06/02/08		05/19/08	10:53	5/19/2008 10:53
EPA 376.2	05/12/08		05/09/08	08:44	5/9/2008 08:44
EPA 415.1	06/02/08		05/07/08	10:35	5/7/2008 12:28
RSK 175	05/19/08		05/08/08	07:48	5/8/2008 13:34
SM18 3500-Fe D	05/05/08	11:24	05/07/08	16:23	5/7/2008 16:23

Client ID: II-2B **Lab ID:** C804447-03 **Sampled:** 05/05/08 12:30 **Received:** 05/06/08 08:30

Parameter	Hold Date/Time(s)		Prep Date/Time(s)		Analysis Date/Time(s)
EPA 300.0	06/02/08		05/09/08	14:22	5/10/2008 10:15
EPA 353.2	05/07/08	12:30	05/06/08	13:15	5/6/2008 15:45
EPA 353.2	06/02/08		05/13/08	09:00	5/13/2008 12:06
EPA 353.2	06/02/08		05/19/08	10:53	5/19/2008 10:53
EPA 376.2	05/12/08		05/09/08	08:44	5/9/2008 08:44
EPA 415.1	06/02/08		05/07/08	10:35	5/7/2008 12:28
RSK 175	05/19/08		05/08/08	07:48	5/8/2008 13:43
SM18 3500-Fe D	05/05/08	12:44	05/07/08	16:23	5/7/2008 16:23

Client ID: II-7 **Lab ID:** C804447-04 **Sampled:** 05/05/08 09:10 **Received:** 05/06/08 08:30

Parameter	Hold Date/Time(s)		Prep Date/Time(s)		Analysis Date/Time(s)
EPA 300.0	06/02/08		05/09/08	14:22	5/10/2008 11:44
EPA 353.2	05/07/08	09:10	05/06/08	13:15	5/6/2008 15:46
EPA 353.2	06/02/08		05/13/08	09:00	5/13/2008 12:07
EPA 353.2	06/02/08		05/19/08	10:53	5/19/2008 10:53
EPA 376.2	05/12/08		05/09/08	08:44	5/9/2008 08:44
EPA 415.1	06/02/08		05/07/08	10:35	5/7/2008 12:28
RSK 175	05/19/08		05/08/08	07:48	5/8/2008 13:52
SM18 3500-Fe D	05/05/08	09:24	05/07/08	16:23	5/7/2008 16:23

www.encolabs.com

Client ID:	II-7B	Lab ID:	C804447-05	Sampled:	05/05/08 10:00	Received:	05/06/08 08:30

Parameter	Hold Date/Time(s)	Prep Date/Time(s)	Analysis Date/Time(s)
EPA 300.0	06/02/08	05/09/08 14:22	5/10/2008 12:13
EPA 353.2	05/07/08 10:00	05/06/08 13:15	5/6/2008 15:47
EPA 353.2	06/02/08	05/13/08 09:00	5/13/2008 12:08
EPA 353.2	06/02/08	05/19/08 10:53	5/19/2008 10:53
EPA 376.2	05/12/08	05/09/08 08:44	5/9/2008 08:44
EPA 415.1	06/02/08	05/07/08 10:35	5/7/2008 12:28
RSK 175	05/19/08	05/08/08 07:48	5/8/2008 14:08
SM18 3500-Fe D	05/05/08 10:14	05/07/08 16:23	5/7/2008 16:23

Client ID:	II-9	Lab ID:	C804447-06	Sampled:	05/05/08 15:00	Received:	05/06/08 08:30

Parameter	Hold Date/Time(s)	Prep Date/Time(s)	Analysis Date/Time(s)
EPA 300.0	06/02/08	05/09/08 14:22	5/10/2008 13:03
EPA 353.2	05/07/08 15:00	05/06/08 13:15	5/6/2008 15:48
EPA 353.2	06/02/08	05/13/08 09:00	5/13/2008 12:08
EPA 353.2	06/02/08	05/19/08 10:53	5/19/2008 10:53
EPA 376.2	05/12/08	05/09/08 08:44	5/9/2008 08:44
EPA 415.1	06/02/08	05/07/08 10:35	5/7/2008 12:28
RSK 175	05/19/08	05/08/08 07:48	5/8/2008 16:07
SM18 3500-Fe D	05/05/08 15:14	05/07/08 16:23	5/7/2008 16:23

www.encolabs.com

NORTH CAROLINA SWS SAMPLE DETECTION SUMMARY

Client ID: II-1 **Lab ID: C804447-01**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	450	BD	5	2.4	25	NE	mg/L	SM4500-Cl/E	QB-01
Nitrite as N	0.015	JB	1	0.010	0.10	1	mg/L	EPA 353.2	J-01
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Total Organic Carbon	15		1	0.32	1.0	NE	mg/L	EPA 415.1	

Client ID: II-2 **Lab ID: C804447-02**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	12		1	0.25	5.0	NE	mg/L	EPA 300.0	
Nitrite as N	0.013	JB	1	0.010	0.10	1	mg/L	EPA 353.2	J-01
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Total Organic Carbon	2.2		1	0.32	1.0	NE	mg/L	EPA 415.1	

Client ID: II-2B **Lab ID: C804447-03**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	11		1	0.25	5.0	NE	mg/L	EPA 300.0	
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Sulfate as SO4	25	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Total Organic Carbon	3.3		1	0.32	1.0	NE	mg/L	EPA 415.1	

Client ID: II-7 **Lab ID: C804447-04**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	4.3	J	1	0.25	5.0	NE	mg/L	EPA 300.0	
Nitrate as N	2.2	J	1	0.010	0.10	10	mg/L	EPA 353.2	
Nitrate/Nitrite as N	2.2	B	1	0.022	0.10	NE	mg/L	EPA 353.2	QB-01
Sulfate as SO4	4.7	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Sulfate as SO4	4.7	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Total Organic Carbon	1.3		1	0.32	1.0	NE	mg/L	EPA 415.1	

Client ID: II-7B **Lab ID: C804447-05**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	4.8	J	1	0.25	5.0	NE	mg/L	EPA 300.0	
Nitrate/Nitrite as N	0.023	JB	1	0.022	0.10	NE	mg/L	EPA 353.2	J-01
Nitrite as N	0.20	JB	1	0.010	0.10	1	mg/L	EPA 353.2	QB-01
Total Organic Carbon	3.1		1	0.32	1.0	NE	mg/L	EPA 415.1	

Client ID: II-9 **Lab ID: C804447-06**

Analyte	Results	Flag	DF	MDL	MRL	NC SWSL	Units	Method	Notes
Chloride	6.0		1	0.25	5.0	NE	mg/L	EPA 300.0	
Nitrate as N	0.39	J	1	0.010	0.10	10	mg/L	EPA 353.2	
Nitrate/Nitrite as N	0.41	B	1	0.022	0.10	NE	mg/L	EPA 353.2	QB-01
Nitrite as N	0.018	JB	1	0.010	0.10	1	mg/L	EPA 353.2	J-01
Sulfate as SO4	40	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Sulfate as SO4	40	J	1	0.25	5.0	250	mg/L	EPA 300.0	
Total Organic Carbon	9.2		1	0.32	1.0	NE	mg/L	EPA 415.1	

www.encolabs.com

ANALYTICAL RESULTS

Description: II-1
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-01
Sampled: 05/05/08 07:50
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6] ^	**450**	BD	mg/L	5	2.4	25	NE	SM4500-Cl/E	05/19/08 10:35	PEV	QB-01
Nitrate as N [14797-55-8] ^	0.010	U	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	0.022	U	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:00	PEV	
Nitrite as N [14797-65-0] ^	**0.015**	JB	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:40	PEV	J-01
Sulfate as SO4 [14808-79-8]	**25**	J	mg/L	1	0.25	5.0	250	EPA 300.0	05/10/08 09:15	AJ	
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description:	II-1	**Lab Sample ID:**	C804447-01	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 07:50	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	0.042	U	mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**15**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-1	**Lab Sample ID:**	C804447-01	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 07:50	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**0.135**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 13:25	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

Description: II-2
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-02
Sampled: 05/05/08 11:10
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6]	**12**		mg/L	1	0.25	5.0	NE	EPA 300.0	05/10/08 09:45	AJ	
Nitrate as N [14797-55-8] ^	0.010	U	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	0.022	U	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:05	PEV	
Nitrite as N [14797-65-0] ^	**0.013**	JB	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:44	PEV	J-01
Sulfate as SO4 [14808-79-8]	**25**	J	mg/L	1	0.25	5.0	250	EPA 300.0	05/10/08 09:45	AJ	
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description:	II-2	**Lab Sample ID:**	C804447-02	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 11:10	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	0.042	U	mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**2.2**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-2	**Lab Sample ID:**	C804447-02	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 11:10	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**3.49**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 13:34	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

Description: II-2B
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-03
Sampled: 05/05/08 12:30
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6]	**11**		mg/L	1	0.25	5.0	NE	EPA 300.0	05/10/08 10:15	AJ	
Nitrate as N [14797-55-8] ^	0.010	U	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	0.022	U	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:06	PEV	
Nitrite as N [14797-65-0] ^	0.010	U	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:45	PEV	
Sulfate as SO4 [14808-79-8]	**25**	J	mg/L	1	0.25	5.0	250	EPA 300.0	05/10/08 10:15	AJ	
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description:	II-2B	**Lab Sample ID:**	C804447-03	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 12:30	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	**1.7**		mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**3.3**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-2B	**Lab Sample ID:**	C804447-03	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 12:30	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**2.33**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 13:43	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

Description: II-7
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-04
Sampled: 05/05/08 09:10
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6]	**4.3**	J	mg/L	1	0.25	5.0	NE	EPA 300.0	05/10/08 11:44	AJ	
Nitrate as N [14797-55-8] ^	**2.2**	J	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	**2.2**	B	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:07	PEV	QB-01
Nitrite as N [14797-65-0] ^	0.010	U	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:46	PEV	
Sulfate as SO4 [14808-79-8]	**4.7**	J	mg/L	1	0.25	5.0	250	EPA 300.0	05/10/08 11:44	AJ	
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description:	II-7	**Lab Sample ID:**	C804447-04	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 09:10	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	0.042	U	mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**1.3**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-7	**Lab Sample ID:**	C804447-04	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 09:10	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**0.009**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 13:52	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

Description: II-7B
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-05
Sampled: 05/05/08 10:00
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6]	**4.8**	J	mg/L	1	0.25	5.0	NE	EPA 300.0	05/10/08 12:13	AJ	
Nitrate as N [14797-55-8] ^	0.010	U	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	**0.023**	JB	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:08	PEV	J-01
Nitrite as N [14797-65-0] ^	**0.20**	JB	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:47	PEV	QB-01
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description:	II-7B	**Lab Sample ID:**	C804447-05	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 10:00	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	0.042	U	mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**3.1**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-7B	**Lab Sample ID:**	C804447-05	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 10:00	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**0.003**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 14:08	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

Description: II-9
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-06
Sampled: 05/05/08 15:00
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

^ - ENCO Cary certified analyte [NC 591]

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Chloride [16887-00-6]	**6.0**		mg/L	1	0.25	5.0	NE	EPA 300.0	05/10/08 13:03	AJ	
Nitrate as N [14797-55-8] ^	**0.39**	J	mg/L	1	0.010	0.10	10	EPA 353.2	05/19/08 10:53	PEV	
Nitrate/Nitrite as N [NA] ^	**0.41**	B	mg/L	1	0.022	0.10	NE	EPA 353.2	05/13/08 12:08	PEV	QB-01
Nitrite as N [14797-65-0] ^	**0.018**	JB	mg/L	1	0.010	0.10	1	EPA 353.2	05/06/08 15:48	PEV	J-01
Sulfate as SO4 [14808-79-8]	**40**	J	mg/L	1	0.25	5.0	250	EPA 300.0	05/10/08 13:03	AJ	
Sulfide [18496-25-8]	0.10	U	mg/L	1	0.10	0.10	1	EPA 376.2	05/09/08 08:44	GPW	

www.encolabs.com

Description: II-9
Matrix: Ground Water
Project: White Street Landfill ABP

Lab Sample ID: C804447-06
Sampled: 05/05/08 15:00
Sampled By: Gary Simcox

Received: 05/06/08 08:30
Work Order: C804447

Classical Chemistry Parameters

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Iron, Ferrous [NA]	0.042	U	mg/L	1	0.042	0.050		SM18 3500-Fe D	05/07/08 16:23	dps	Q
Total Organic Carbon [NA]	**9.2**		mg/L	1	0.32	1.0	NE	EPA 415.1	05/07/08 12:28	DPS	

www.encolabs.com

Description:	II-9	**Lab Sample ID:**	C804447-06	**Received:**	05/06/08 08:30
Matrix:	Ground Water	**Sampled:**	05/05/08 15:00	**Work Order:**	C804447
Project:	White Street Landfill ABP	**Sampled By:**	Gary Simcox		

Dissolved Gases by GC

Analyte [CAS Number]	Results	Flag	Units	DF	MDL	MRL	NC SWSL	Method	Analyzed	By	Notes
Methane	**0.002**		mg/L	1	0.0004	0.001		RSK 175	05/08/08 16:07	MYE	

This report relates only to the sample as received by the laboratory, and may only be reproduced in full.

www.encolabs.com

QUALITY CONTROL

Classical Chemistry Parameters - Quality Control

Batch 8E06023 - NO PREP

Blank (8E06023-BLK1) Prepared: 05/06/2008 13:15 Analyzed: 05/06/2008 15:37

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrite as N	**0.015**	**J**	0.10	mg/L							

LCS (8E06023-BS1) Prepared: 05/06/2008 13:15 Analyzed: 05/06/2008 15:39

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrite as N	0.99	B	0.10	mg/L	1.00		99	80-120			

Matrix Spike (8E06023-MS1) Prepared: 05/06/2008 13:15 Analyzed: 05/06/2008 15:41

Source: C804447-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrite as N	1.0	B	0.10	mg/L	1.00	0.015	100	80-120			

Matrix Spike Dup (8E06023-MSD1) Prepared: 05/06/2008 13:15 Analyzed: 05/06/2008 15:42

Source: C804447-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrite as N	1.0	B	0.10	mg/L	1.00	0.015	100	80-120	0.02	25	

Batch 8E09002 - NO PREP

Blank (8E09002-BLK1) Prepared & Analyzed: 05/09/2008 08:44

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Sulfide	0.10	U	0.10	mg/L							

LCS (8E09002-BS1) Prepared & Analyzed: 05/09/2008 08:44

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Sulfide	0.42		0.10	mg/L	0.401		105	80-120			

Matrix Spike (8E09002-MS1) Prepared & Analyzed: 05/09/2008 08:44

Source: C801910-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Sulfide	0.42		0.10	mg/L	0.401	0.10 U	104	80-120			

Matrix Spike Dup (8E09002-MSD1) Prepared & Analyzed: 05/09/2008 08:44

Source: C801910-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Sulfide	0.41		0.10	mg/L	0.401	0.10 U	103	80-120	0.7	25	

Batch 8E09018 - NO PREP

Blank (8E09018-BLK1) Prepared: 05/09/2008 14:22 Analyzed: 05/09/2008 23:22

QUALITY CONTROL

Classical Chemistry Parameters - Quality Control

Batch 8E09018 - NO PREP

Blank (8E09018-BLK1) Continued Prepared: 05/09/2008 14:22 Analyzed: 05/09/2008 23:22

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	0.25	U	5.0	mg/L							
Sulfate as SO4	0.25	U	5.0	mg/L							

LCS (8E09018-BS1) Prepared: 05/09/2008 14:22 Analyzed: 05/10/2008 00:21

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	53		5.0	mg/L	50.0		107	90-110			
Sulfate as SO4	46		5.0	mg/L	50.0		93	90-110			

Matrix Spike (8E09018-MS1) Prepared: 05/09/2008 14:22 Analyzed: 05/10/2008 01:21

Source: C801910-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	60		5.0	mg/L	50.0	2.8	113	90-110			QM-13
Sulfate as SO4	48		5.0	mg/L	50.0	8.0	81	90-110			QM-13

Matrix Spike Dup (8E09018-MSD1) Prepared: 05/09/2008 14:22 Analyzed: 05/10/2008 01:50

Source: C801910-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	61		5.0	mg/L	50.0	2.8	116	90-110	2	10	QM-13
Sulfate as SO4	50		5.0	mg/L	50.0	8.0	84	90-110	3	10	QM-13

Batch 8E11003 - NO PREP

Blank (8E11003-BLK1) Prepared: 05/13/2008 09:00 Analyzed: 05/13/2008 11:28

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrate/Nitrite as N	**0.032**	**J**	0.10	mg/L							

LCS (8E11003-BS1) Prepared: 05/13/2008 09:00 Analyzed: 05/13/2008 11:31

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrate/Nitrite as N	1.2	B	0.10	mg/L	1.25		95	80-120			

Matrix Spike (8E11003-MS1) Prepared: 05/13/2008 09:00 Analyzed: 05/13/2008 11:35

Source: C802021-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrate/Nitrite as N	1.3	B	0.10	mg/L	1.28	0.084	96	80-120			

Matrix Spike Dup (8E11003-MSD1) Prepared: 05/13/2008 09:00 Analyzed: 05/13/2008 11:37

Source: C802021-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Nitrate/Nitrite as N	1.3	B	0.10	mg/L	1.28	0.084	97	80-120	1	25	

QUALITY CONTROL

Classical Chemistry Parameters - Quality Control

Batch 8E11003 - NO PREP

Batch 8E19005 - NO PREP

Blank (8E19005-BLK1) Prepared: 05/19/2008 07:54 Analyzed: 05/19/2008 10:29

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	**1.0**	**J**	5.0	mg/L							

LCS (8E19005-BS1) Prepared: 05/19/2008 07:54 Analyzed: 05/19/2008 10:29

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	99	B	5.0	mg/L	100		99	80-120			

Matrix Spike (8E19005-MS1) Prepared: 05/19/2008 07:54 Analyzed: 05/19/2008 10:30

Source: C804574-02

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	170	B	5.0	mg/L	100	83	87	80-120			

Matrix Spike Dup (8E19005-MSD1) Prepared: 05/19/2008 07:54 Analyzed: 05/19/2008 10:31

Source: C804574-02

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chloride	170	B	5.0	mg/L	100	83	88	80-120	0.5	25	

QUALITY CONTROL

Dissolved Gases by GC - Quality Control

Batch 8E08002 - NO PREP ANALYTIX

Blank (8E08002-BLK1) Prepared: 05/08/2008 07:48 Analyzed: 05/08/2008 10:46

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Methane	0.0004	U	0.001	mg/L							
Ethene	0.001	U	0.002	mg/L							
Ethane	0.0009	U	0.002	mg/L							

LCS (8E08002-BS1) Prepared: 05/08/2008 07:48 Analyzed: 05/08/2008 10:59

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Methane	0.0920		0.001	mg/L	0.0952		97	68-140			
Ethene	0.158		0.002	mg/L	0.166		95	67-134			
Ethane	0.171		0.002	mg/L	0.178		96	62-153			

Matrix Spike (8E08002-MS1) Prepared: 05/08/2008 07:48 Analyzed: 05/08/2008 11:08

Source: B803210-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Methane	0.0977		0.001	mg/L	0.0952	0.000570	102	68-140			
Ethene	0.164		0.002	mg/L	0.166	0.001 U	99	67-134			
Ethane	0.178		0.002	mg/L	0.178	0.0009 U	100	62-153			

QUALITY CONTROL

Dissolved Gases by GC - Quality Control

Batch 8E08002 - NO PREP ANALYTIX

Matrix Spike Dup (8E08002-MSD1) Prepared: 05/08/2008 07:48 Analyzed: 05/08/2008 11:17

Source: B803210-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Methane	0.0877		0.001	mg/L	0.0952	0.000570	91	68-140	11	19	
Ethene	0.152		0.002	mg/L	0.166	0.001 U	91	67-134	8	19	
Ethane	0.162		0.002	mg/L	0.178	0.0009 U	91	62-153	10	20	

QUALITY CONTROL

Classical Chemistry Parameters - Quality Control

Batch 8E07008 - NO PREP

Blank (8E07008-BLK1) Prepared: 05/07/2008 10:35 Analyzed: 05/07/2008 12:28

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Organic Carbon	0.32	U	1.0	mg/L							

LCS (8E07008-BS1) Prepared: 05/07/2008 10:35 Analyzed: 05/07/2008 12:28

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Organic Carbon	43		1.0	mg/L	41.6		104	85-113			

Matrix Spike (8E07008-MS1) Prepared: 05/07/2008 10:35 Analyzed: 05/07/2008 12:28

Source: A802457-04

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Organic Carbon	44		1.0	mg/L	40.0	1.9	105	85-113			

Matrix Spike Dup (8E07008-MSD1) Prepared: 05/07/2008 10:35 Analyzed: 05/07/2008 12:28

Source: A802457-04

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Organic Carbon	48		1.0	mg/L	40.0	1.9	116	85-113	10	21	QM-07

Batch 8E07020 - NO PREP

Blank (8E07020-BLK1) Prepared & Analyzed: 05/07/2008 16:23

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Iron, Ferrous	0.042	U	0.050	mg/L							

LCS (8E07020-BS1) Prepared & Analyzed: 05/07/2008 16:23

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Iron, Ferrous	1.5		0.050	mg/L	1.50		99	90-118			

Matrix Spike (8E07020-MS1) Prepared & Analyzed: 05/07/2008 16:23

Source: A802410-01

QUALITY CONTROL

Classical Chemistry Parameters - Quality Control

Batch 8E07020 - NO PREP

Matrix Spike (8E07020-MS1) Continued Prepared & Analyzed: 05/07/2008 16:23

Source: A802410-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Iron, Ferrous	1.5		0.050	mg/L	1.50	0.042 U	103	90-118			

Matrix Spike Dup (8E07020-MSD1) Prepared & Analyzed: 05/07/2008 16:23

Source: A802410-01

Analyte	Result	Flag	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Iron, Ferrous	1.6		0.050	mg/L	1.50	0.042 U	105	90-118	2	10	

FLAGS/NOTES AND DEFINITIONS

B	The analyte was detected in the associated method blank.
D	The sample was analyzed at dilution.
J	The reported value is between the laboratory method detection limit (MDL) and the laboratory method reporting limit (MRL), adjusted for actual sample preparation data and moisture content, where applicable.
U	The analyte was analyzed for but not detected to the level shown, adjusted for actual sample preparation data and moisture content, where applicable.
MRL	Method Reporting Limit. The MRL is roughly equivalent to the practical quantitation limit (PQL) and is based on the low point of the calibration curve, when applicable, sample preparation factor, dilution factor, and, in the case of soil samples, moisture content.
I-01	Result is estimated due to positive results in the associated method blank.
Q	Analysis performed outside of method - specified holding time.
QB-01	The method blank had a positive result for the analyte; however, the concentration in the method blank is less than 10% of the sample result, which minimizes the impact of the deviation.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM-13	Suspected matrix effects

ENVIRONMENTAL CONSERVATION LABORATORIES CHAIN-OF-CUSTODY RECORD

10775 Central Port Dr.
Orlando, FL 32824
(407) 826-5314 Fax (407) 850-6945

4810 Executive Park Court, Suite 211
Jacksonville, FL 32216-6089
(904) 296-3007 Fax (904) 296-6210

162-A Woodwinds Industrial Ct.
Cary, NC 27511
(919) 467-3090 Fax (919) 467-3515

Page ____ of ____

Client Name: S&ME, Inc. (SM004)	Project Number: [none]
Address: 3718 Old Battleground Rd.	Project Name/Desc: White Street Landfill ABP
City/ST/Zip: Greensboro, NC 27410	PO # / Billing Info:
Tel: (336) 288-7180 / Fax: (336) 288-8980	Reporting Contact: Connel Ware
Sampler(s) Name, Affiliation (Print): Gary Simcox S&ME	Billing Contact: Accounts Payable
Sampler(s) Signature:	Facility # (if required):

Requested Analyses: Chloride 300, Sulfate 300; Fe/Ferrous; Nitrate Calc 353.2; Nitrite as N 353.2; NOX 353.2; RSK175; Sulfide 376.2; TOC 415.1

Requested Turnaround Times

Note: Rush requests subject to acceptance by the facility

___ Standard

___ Expedited

Due ___/___/___

Lab Workorder: C804447

Preservation (See Codes) (Combine as necessary)

Item #	Sample ID (Field Identification)	Collection Date	Collection Time	Comp / Grab	Matrix (see codes)	Total # of Containers	Chloride 300, Sulfate 300	Fe/Ferrous	Nitrate Calc 353.2	Nitrite as N 353.2	NOX 353.2	RSK175	Sulfide 376.2	TOC 415.1			Sample Comments
	II-1	5/5/08	0750	G	GW	9	X	X	X	X	X	X	X	X			
	II-2	5/5/08	1110	G	GW	9	X	X	X	X	X	X	X	X			
	II-2B	5/5/08	1230	G	GW	9	X	X	X	X	X	X	X	X			
	II-7	5/5/08	0910	G	GW	9	X	X	X	X	X	X	X	X			
	II-7B	5/5/08		G	GW	9	X	X	X	X	X	X	X	X			
	II-9	5/5/08	1500	G	GW	9	X	X	X	X	X	X	X	X			

<-- Total # of Containers

Sample Kit Prepared By:	Date/Time: 5/1/08 11:45	Reinquished By:	Date/Time:	Received By:	Date/Time:
Comments:		Reinquished By:	Date/Time:	Received By:	Date/Time:
		Reinquished By:	Date/Time:	Received By: John Lowth	Date/Time: 5/6 830
		Cooler #'s & Temps of Receipt: C-35 / C-50 2 5.4 4.6		Condition Upon Receipt: ___ Acceptable ___ Unacceptable	

Matrix: GW-Groundwater SO-Soil SE-Sediment SW-Surface Water WW-Wastewater A-Air O-Other (detail in comments)

Preservation: I-Ice H-HCl N-HNO3 S-H2SO4 NO-NaOH O-Other (detail in comments)

Note: All samples submitted to ENCO Labs are in accordance with the terms and conditions listed on the reverse of this form, unless prior written agreements exist

www.encolabs.com

GROUNDWATER SAMPLING FIELD DATA

Location: White Street Landfill
Purge Date: 5/5/08
Project No.: 1584-98-081
Purge Time:
Source Well: II-1
Sample Date: 5/5/08
Locked? (Yes) No
Sample Time: 0750
(PVC) Steel Stainless
Weather: CLOUDY
Sampled By: GWS
Air Temp: 58°

Water Level and Well Data

Depth to water from measuring point: 14.51 feet

Depth to well bottom from measuring point: _____ feet

Height of water column: _____ feet

Measuring Point: TOC

Well Purging and Sample Collection

Purge Method: PUMP

Sample Method: PUMP

Sample Collection Time
Start: 0745 Stop: 0800

Purge Time
Start: 0715 Stop: _____

Purge Rate: 1000 mliter/min

control settings changes?: 3.5 on 22 off 2.1 psi

cycles: _____

duration: _____

Volume of Water in well
2" well (volume = 0.163 x h): _____
4" well (volume = 0.651 x h): _____

Volume of water removed: 5.5 gallon (liters)

Was well purged dry: Yes (No)

Field Analyses

** Stabilization Parameters*

Time	0720	0725	0730	0735	0740	0745		
Temp	13.42	13.26	13.25	13.29	13.32	13.36		
pH	6.35	6.33	6.34	6.32	6.33	6.33		
Conductivity	2.58	2.57	2.57	2.55	2.55	2.55		
ORP*	-200	-254	-278	-308	-316	-316		
D.O.*	1.22	.93	.82	.56	.48	.47		
Turbidity*	21	10	6.48	6.27	4.55	3.96		
H_2O	15.03	15.16	15.28	15.24	15.20			

GROUNDWATER SAMPLING FIELD DATA

Location	White Street Landfill	Purge Date	5/5/08
Project No.	1584-98-081	Purge Time	
Source Well	II - 2	Sample Date	5/5/08
Locked?	(Yes) No	Sample Time	1110
(PVC) Steel Stainless		Weather	CLOUDY / WINDY
Sampled By	GWS	Air Temp	60°

Water Level and Well Data

Depth to water from measuring point	19.62	feet
Depth to well bottom from measuring point		feet
Height of water column		feet
Measuring Point	TOC	

Well Purging and Sample Collection

Purge Method: PUMP

Sample Method: PUMP

Sample Collection Time: Start 1100 Stop 1115

Purge Time: Start 1025 Stop 1055

Purge Rate: 100 ml liter/min

control settings changes?: 2.4 on 30 off 27 psi

cycles:

duration:

Volume of Water in well

2" well (volume = 0.163 x h)

4" well (volume = 0.651 x h)

Volume of water removed: gallon (liters)

Was well purged dry: Yes (No)

Field Analyses

** Stabilization Parameters*

Time	1030	1035	1040	1045	1050	1055		
Temp	16.24	16.04	16.23	16.30	17.43	17.86		
pH	7.28	6.82	6.80	6.82	6.85	6.86		
Conductivity	1.078	1.095	1.079	1.080	1.081	1.085		
ORP*	-179	-250	-272	-306	-308	-302		
D.O.*	1.91	1.24	.97	.75	.71	.78		
Turbidity*	11.13	6.62	3.13	2.29	2.86	2.71		
H_2O	19.96	19.98	20.01	20.07	20.09	20.09		

BERNIE

777-0006

GROUNDWATER SAMPLING FIELD DATA

Location: White Street Landfill
Purge Date: 5/5/08

Project No.: 1584-98-081
Purge Time:

Source Well: II-2B
Sample Date: 5/5/08

Locked? (Yes) No
Sample Time: 1230

(PVC) Steel Stainless
Weather: P/CLOUDY WINDY

Sampled By: GWS
Air Temp: 60°

Water Level and Well Data

Depth to water from measuring point: 14.29 feet

Depth to well bottom from measuring point: _____ feet

Height of water column: _____ feet

Measuring Point: TOC

Well Purging and Sample Collection

Purge Method: PERISTALTIC PUMP

Sample Method: " "

Sample Collection Time
Start: 1220 Stop: 1235

Purge Rate: < 100 mliter/min

Purge Time
Start: 1025 Stop: 1215

control settings changes? _____

cycles: _____
duration: _____

Volume of Water in well
2" well (volume = 0.163 x h) _____
4" well (volume = 0.651 x h) _____

Volume of water removed _____ gallon (liters)

Was well purged dry Yes (No)

Field Analyses

* *Stabilization Parameters*

Time	0130	0135	0140	0145	0150	0155	1200	1205	1210	1215
Temp	18.21	18.50	19.79	19.37	19.31	19.77	20.77	20.31	19.22	19.0
pH	6.34	6.27	6.26	6.29	6.26	6.26	6.28	6.31	6.32	6.32
Conductivity	.758	.742	.736	.734	.734	.734	.735	.736	.737	.735
ORP*	-310	-328	-334	-341	-348	-354	-358	-375	-375	-376
D.O.*	.49	.39	.35	.28	.23	.22	.21	.18	.16	.15
Turbidity*	11.17	64.5	40.5	25.8	32.8	17.20	12.73	6.01	4.95	4.71
H_2O	14.46	14.45	14.44	14.43						

GROUNDWATER SAMPLING FIELD DATA

Location: White Street Landfill
Purge Date: 5/5/08
Project No.: 1584-98-081
Purge Time:
Source Well: II-7
Sample Date: 5/5/08
Locked? (Yes) No
Sample Time: 0910
(PVC) Steel Stainless
Weather: CLOUDY
Sampled By: GWS
Air Temp: 60°

Water Level and Well Data

Depth to water from measuring point: 13.63 feet

Depth to well bottom from measuring point: _____ feet

Height of water column: _____ feet

Measuring Point: TOC

Well Purging and Sample Collection

Purge Method: PUMP

Sample Method: PUMP

Sample Collection Time
Start: 0905 Stop: 0920

Purge Time
Start: 0830 Stop: 0900

Purge Rate: 100 ml liter/min

control settings changes?: 2.2 on 20 off 24 psi

cycles: _____

duration: _____

Volume of Water in well
2" well (volume = 0.163 x h): _____
4" well (volume = 0.651 x h): _____

Volume of water removed: _____ gallon (liters)

Was well purged dry: Yes (No)

Field Analyses

** Stabilization Parameters*

Time	0835	0840	0845	0850	0855	0900		
Temp	14.27	14.12	14.13	14.23	14.22	14.27		
pH	6.05	5.73	5.58	5.48	5.45	5.42		
Conductivity	.305	.148	.125	.120	.120	.120		
ORP*	-166	-219	-235	-250	-261	-268		
D.O.*	1.68	1.32	1.21	1.08	.97	.96		
Turbidity*	4.13	3.22	4.02	3.72	2.76	2.91		
	13.81	13.88	13.90	13.99	13.97	14.00		

GROUNDWATER SAMPLING FIELD DATA

Location: White Street Landfill
Purge Date: 5/5/08
Project No.: 1584-98-081
Purge Time:
Source Well: II-7B
Sample Date: 5/5/08
Locked? (Yes) No
Sample Time:
(PVC) Steel Stainless
Weather: CLOUDY
Sampled By: GWS
Air Temp: 60°

Water Level and Well Data

Depth to water from measuring point: 17.49 feet

Depth to well bottom from measuring point: _____ feet

Height of water column: _____ feet

Measuring Point: TOC

Well Purging and Sample Collection

Purge Method: PUMP

Sample Method: PUMP

Sample Collection Time
Start: 0955 Stop: 1010

Purge Time
Start: 0930 Stop: 0950

Purge Rate: 100 mliter/min

control settings changes?: 4on 27 off 50psi

cycles: _____

duration: _____

Volume of Water in well
2" well (volume = 0.163 x h): _____
4" well (volume = 0.651 x h): _____

Volume of water removed: _____ gallon (liters)

Was well purged dry: Yes (No)

Field Analyses

** Stabilization Parameters*

Time	0935	0940	0945	0950				
Temp	15.01	15.11	15.12	15.14				
pH	9.55	10.10	10.35	10.43				
Conductivity	.647	.679	.699	.702				
ORP*	-245	-275	-281	-282				
D.O.*	1.14	.96	.93	.92				
Turbidity*	2.05	.94	1.11	1.08				
	18.47	18.89	19.25	19.59				

GROUNDWATER SAMPLING FIELD DATA

Location	White Street Landfill	Purge Date	5/5/08
Project No.	1584-98-081	Purge Time	
Source Well	II - 9	Sample Date	5/5/08
Locked?	(Yes) No	Sample Time	1500
(PVC) Steel Stainless		Weather	CLOUDY / THUNDER
Sampled By	GWS	Air Temp	65°

Water Level and Well Data

Depth to water from measuring point	10.0	feet
Depth to well bottom from measuring point		feet
Height of water column		feet
Measuring Point	TOC	

Well Purging and Sample Collection

Purge Method: PERISTALTIC PUMP

Sample Method: " "

Sample Collection Time — Start: 1450 Stop: 1505

Purge Rate: < 100 ml liter/min

Purge Time — Start: 1425 Stop: 1445

control settings changes? _____ cycles _____ duration _____

Volume of Water in well

2" well (volume = 0.163 x h) _____

4" well (volume = 0.651 x h) _____

Volume of water removed _____ gallon (liters)

Was well purged dry Yes (No)

Field Analyses

** Stabilization Parameters*

Time	1430	1435	1440	1445				
Temp	14.55	14.79	15.18	15.37				
pH	5.49	5.50	5.50	5.51				
Conductivity	.234	.232	.232	.235				
ORP*		-322	-320	-319				
D.O.*	.56	.23	.21	.19				
Turbidity*	8.76	7.25	6.78	6.63				
H_2O	10.38	10.52	10.56	10.62				

APPENDIX IV

Comments Received From The June 19, 2008 Public Meeting

Groundwater Findings and Corrective Measures
Public Meeting Minutes
City of Greensboro – Environmental Services Department

Attendees:

Jeryl W. Covington, Director, Environmental Services Department
Scott Boss, Acting Solid Waste Disposal Manager
Greg Thomasson, Technical & Planning Support Manager
Chris Marriott, Environmental Compliance Manager
Connel Ware, S&ME
Ed Henriques, S&ME

A copy of the sign-in sheet which identifies who attended from the public is attached.

Meeting Summary:

At 6:30 PM on December 20, 2007, the Environmental Services Department of the City of Greensboro held a public meeting to discuss the groundwater findings and potential corrective measures associated with the formerly operated Phase II municipal solid waste landfill at the White Street Landfill. The public meeting was located at the Peeler Recreation Facility located at 1300 Sykes Avenue.

Ms. Jeryl W. Covington opened the public meeting with an introduced of herself and the technical staff present from the City of Greensboro and S&ME. She also provided a brief statement as to the purpose of the meeting and introduced Mr. Ed Henriques of S&ME to give the formal presentation. Mr. Henriques presentation included the attached slides and several exhibits. One exhibit was an aerial of the general area including Phase II waste boundaries, the approximate plume location, groundwater flow direction, groundwater monitoring wells, and surface water monitoring locations. Other exhibits included a typical well schematic and a cross section view of the waste boundary, groundwater table, and groundwater monitoring well.

At the end of that presentation, Mr. Henriques opened the meeting to questions. The following questions were asked by the public and answered by Ms. Covington and Mr. Henriques.

- Is this meeting a requirement of the regulations?
- One attendee wanted to discuss the potential corrective measure of building a wall to protect Buffalo Creek.
- Is Buffalo Creek in danger from the landfill?
- Once the corrective measure is chosen, will the corrective measure be an on-going process?
- If you install a barrier or wall, will it be designed for wet weather as well as dry weather?
- Would there be a barrier or wall on the southern end of Phase II?

No written comments were received from the public before, during, or after the meeting.

At the end of the public meeting, Ms. Jeryl Covington proceeded to discuss some of the financial issues regarding the landfill and transfer station and future development of Phase IV for C&D disposal at the White Street Landfill.

White Street Landfill Public Meeting - June 9, 2008

The White Street Landfill's public meeting began at 6:35 p.m. Eighteen guests attended including one media representative. Attendees were requested to sign a registration sheet in order to document their attendance.

The meeting was conducted by Ms. Jeryl Covington, Environmental Services Director and began with the introduction of the attending staff, Mr. David Bost, Acting Waste Disposal Manager, and Mr. Greg Thomasson, Technical and Planning Support Manager (Waste Disposal Engineer). Following the introduction of staff, the purpose of the meeting was provided which stated that this meeting was being held in accordance with applicable waste disposal regulations associated with the proposed landfill activities.

As originally reported at the public meeting held on Thursday, December 20, 2007, the City of Greensboro is submitting information to the North Carolina Department of Environment and Natural Resources – Division of Waste Management regarding three activities at two of the operating units located at the White Street Landfill. These submissions include: re-permitting the construction and demolition landfill located above a formerly operated sanitary landfill; changing the municipal solid waste landfill's configuration by modifying the side slopes; thus, increasing the disposal capacity; and adding an additional remediation technology to the groundwater corrective action plan.

The City of Greensboro reported that the groundwater was consistently monitored in accordance with the regulatory requirements. One area adjacent to the formerly operated Phase II landfill continued to detect the occurrence of groundwater impact above the regulatory limits. The location of this impact was identified on an aerial photograph and a brief discussion educating the audience on the principals of groundwater flow was provided. The general direction of groundwater flow was described referencing the aerial photograph and identified as flowing from the southerly direction toward a northern-northeast direction. Residential neighborhoods were identified on the aerial photograph as being located uphill (up gradient) of the landfill's property. The groundwater flow direction was described as flowing from higher elevations (residential area) to lower elevations (North Buffalo Creek). In addition, it was reported that the recent groundwater sampling event (May 2008) revealed that the level of groundwater contamination was decreasing. In light of the recent sampling results, the City is proposing the planting of trees within the property boundaries and adjacent to North Buffalo Creek as an additional solution in remediating the groundwater. This form of remediation was referenced as phytoremediation. The process of phytoremediation was described as utilizing the root system of hybrid poplar trees to uptake existing contaminates in the groundwater. The poplars will require placement in a manner that will promote growth and reduce the opportunity for insect infestation and fungal diseases. The City hopes to obtain agronomy assistance from one of the local colleges or universities. The phytoremediation will be completed in conjunction with the monitored natural attenuation (MNA) that was originally discussed at the December 20, 2007 public meeting. A brief review of MNA was provided to the audience and described as being a natural breakdown in the contaminates due to the composition and make-up of subsurface media and oxygen levels in and around the subsurface groundwater.

The City of Greensboro reported that a permit modification has been submitted for the Phase III municipal solid waste landfill. This permit modification will request a change in the side slopes of the unit. A cross-sectional schematic was shown to the audience. The currently approved side slope configuration was identified and the proposed increase was depicted on the schematic. No change in the height of the landfill will result with the proposed side slope modification. The height of the landfill will remain at 872 feet above mean sea level. Approximately one (1) million cubic yards of disposal capacity will be gained with this modification. The audience was provided information regarding the current capacity of the Phase III unit. Mr. Jim Kee made inquiry about household waste returning to the site. If it were decided to return disposal activities to the site, the existing available landfill area would be consumed in less than five years. This is due to the fact that both construction and demolition waste and household waste will be utilizing the same landfill during the operational life of this unit during this period. Based upon current volumes, the construction and demolition landfill (phase II) will be full on or about 2011. As originally permitted in 1997, the Phase III landfill was designed for a ten-year capacity. The next landfill area could not be constructed and permitted during this timeframe.

The audience was provided a copy of the current waste generation volume being managed by the transfer station. The audience was recommended to participate in the City's recycling program and increase their recycling efforts. The transfer station operations were briefly described and photos of the operation were shown to the audience. The current hauling and disposal costs for the facility beginning June 2008 are $36.08 per ton with a $36.00 per ton rate being charged to the users. This increase results from the dramatic escalation in fuel costs. Mr. Harold Fields raised a question about the solid waste fee charges being increased due to this event. It was explained that the household solid waste fee was eliminated in 2004 and this fee was converted to the property tax. Mr. Fields further stated that the message being sent to the community is that the recent property tax increases are due to the closing of the landfill. A brief explanation was provided clarifying that a portion of the property tax increase was due to the opening of the transfer station. This portion was approximately $0.25 of the total property tax amount; other portions of the increase included costs for public safety and other municipal activities. Currently, no property tax increase is being proposed in the upcoming budget.

The audience was reminded that the solid waste disposal tax of $2.00 per ton will be in effect July 1, 2008. The solid waste legislation passed by the general assembly increased the regulatory requirements for the development of landfills within the state; thus, fewer landfills may be developed and the competition for disposal capacity may increase. The regulatory agency has provided information on the state's currently available solid waste disposal capacity to the legislature. They have stated that North Carolina will be facing a disposal capacity dilemma in future years. As a result, it is anticipated that the City will be facing competition for landfill disposal capacity as other cities consume their landfill space and resolve to find other disposal locations. Ms. Valeria Niles made inquiry about waste-to-energy (WTE) options. It was explained that currently one WTE facility operates in the state and is located in New Hanover County. This community decided to develop the WTE unit and preserve their lands for tourism and recreation. The cost associated with the operations of the WTE plant exceeds the cost of landfilling. The City of Greensboro's waste volume makes the development of a WTE plant in our community cost prohibitive. Ms. Niles referenced the St. Lucia, Florida WTE operation being developed. It was explained that the cost of land for landfill development makes the WTE development in Florida an equitable

solution for managing waste. North Carolina is currently considered a rural area, the cost of land is still relatively inexpensive; thus, landfill development remains relatively inexpensive in comparison to other alternatives. Other communities that have WTE or alternative waste disposal methods have landfill costs exceeding $60.00 per ton; North Carolina's average is $34.00 - $38.00 per ton. If WTE is developed within this area, other communities will need to participate in order to acquire the volume necessary to make the operation profitable. Currently, the cities of Winston-Salem and High Point have secured land to manage their waste generation for 15-20± years. Reverend Samuel Connor asked if the landfill were to reopen, what are the risks to the closest residents? It was explained that the landfill currently conducts groundwater monitoring and has a landfill gas collection in-placed to manage emissions. Both of these operations are required by the state for environmental protection. An audience member made inquiry regarding the arrangements made with Cone Mills for the landfill gas. It was explained that Cone Mills receives this gas at no charge. Inquiry was made with respect to the City's arrangements and the reasoning that allowed Cone Mills to receive the landfill gas for free. It was explained that department staff were not involved with the agreement and Councilmember Wells is not present to provide the background on the City Council's actions. Ms. Valerie Niles stated that Cone Mills received the landfill gas as an incentive in order to remain open and keep jobs; but instead, they have laid-off employees. Ms. Niles asked whether the City could sell the landfill gas? The response provided stated that there are other interested parties willing to purchase the gas and acquire the system; however, all of the currently generated landfill gas is provided to Cone Mills; there are no other sources of landfill gas available to sell.

The City of Greensboro reported that a permit submission will be made in order to continue the construction and demolition landfill operations above the formerly utilized sanitary landfill (Phase II). New construction and demolition regulations were adopted and facilities wishing to continue their operations are required to re-submit an application and request permit renewal. The application submissions are due on June 30, 2008. The City is proposing to continue the construction and demolition disposal activities at the White Street landfill. The materials being disposed will originate from construction and demolition sites and include brick, shingles, concrete, wood, and sheetrock, etc. Waste is screened at the entrance gate and at the lift. The City does not accept asbestos containing material nor does the City recycle this waste stream. Currently, the generators of construction and demolition waste remove any marketable recyclable materials prior to delivery to the landfill.

The City of Greensboro discussed future development plans for the landfill. The proposed Phase IV region was identified on the aerial photograph. The City is proposing to acquire two additional tracts of land prior to the development of this portion of the landfill. Mr. Harold Fields asked whether the City would purchase land located south of Huffine Mill Road for future landfill development. It was explained that the City has no plans to expand the boundaries in this direction. If this option were to be considered, it would be an expensive proposition based upon the number of homes required to be purchased in order to satisfy the regulatory buffer requirements. Mr. Harold Fields further expressed concern regarding the lack of maintenance along the roadway. It was explained that the City of Greensboro does not maintain the right-of-ways on state maintained roadways. Mr. David Bost provided his contact information to Mr. Fields in order to assist in addressing this concern.

The meeting concluded at 8:10 p.m.

APPENDIX V

Proposed Phytoremediation Bed Planting Area Photos

Proposed Phytoremediation Bed Planting Areas
White Street Landfill CAP
Project #: 1584-98-081
Sheet 1 of 5

3718 Old Battleground Road
Greensboro, NC 27410

Date: 5/12/08

Photographer: Connel Ware

1	**Location / Orientation**	View looking west between II-13 and II-2B
	Remarks	

Date: 5/12/08

Photographer: Connel Ware

2	**Location / Orientation**	Area immediately downgradient of II-2 and II-2B
	Remarks	The fence around II-2 can be seen in the background

Proposed Phytoremediation Bed Planting Areas
White Street Landfill CAP
Project #: 1584-98-081
Sheet 2 of 5

S&ME
3718 Old Battleground Road
Greensboro, NC 27410

Date: 5/12/08

Photographer: Connel Ware

3	**Location / Orientation**	View looking west immediately downgradient of II-2 and II-2B
	Remarks	

Date: 5/12/08

Photographer: Connel Ware

4	**Location / Orientation**	View looking west between II-2 and II-11
	Remarks	

Proposed Phytoremediation Bed Planting Areas
White Street Landfill CAP
Project #: 1584-98-081
Sheet 3 of 5

S&ME
3718 Old Battleground Road
Greensboro, NC 27410

Date: 5/12/08

Photographer: Connel Ware

5	**Location / Orientation**	View looking south behind II-11
	Remarks	

Date5/12/08

Photographer: Connel Ware

6	**Location / Orientation**	Area behind II-9
	Remarks	

Proposed Phytoremediation Bed Planting Areas
White Street Landfill CAP
Project #: 1584-98-081
Sheet 4 of 5

S&ME
3718 Old Battleground Road
Greensboro, NC 27410

Date: 5/12/08

Photographer: Connel Ware

7	**Location / Orientation**	Area behind II-9 looking southwest toward II-7
	Remarks	

Date: 5/12/08

Photographer: Connel Ware

8	**Location / Orientation**	Area behind II-9 looking southwest toward II-7
	Remarks	

Proposed Phytoremediation Bed Planting Areas
White Street Landfill CAP
Project #: 1584-98-081
Sheet 5 of 5

S&ME
3718 Old Battleground Road
Greensboro, NC 27410

Date: 5/12/08

Photographer: Connel Ware

9	**Location / Orientation**	Bench immediately behind II-7 (creek is to photographer's back)
	Remarks	The distance between II-7 and the creek bank is only 20-25 feet wide In this area. The creek bank is very steep and plunges off sharply.

Date: 5/12/08

Photographer: Connel Ware

10	**Location / Orientation**	Bench between II-1 and Buffalo Creek (in background)
	Remarks	View is looking southwest with II-1 to the left out of the picture.

APPENDIX VI

Example Phytoremediation Assessment Log

PROJECT:		**JOB NUMBER:**	
LOCATION:		**DATE:**	
CLIENT:		**INSPECTED BY:**	

General Site Conditions

Site Conditions:	Dry	☐	Wet	☐	Weather:
Water Flow From Culvert:	Yes	☐	No	☐	

Rain Gauge Readings (unit in inches)

Date				
Reading				

Tree Farm Inspection

Tree Observation: Change in Tree Health Observed: ☐ Improving/Positive ☐ Declining ☐ No Change

Area of Declining Health (if any): _____

Tree Status:

Tree Identification:				
Trunk Size (Diameter in inch)				
Approx Tree Height				
Foliage Condition				

Other Observations: _____
(attach additional pages if needed)

Tree Farm Maintenance

					Notes: (Please provide the chemical brand name when applicable)
Grass Seeding:	Yes	☐	No	☐	
Grass Mowing:	Yes	☐	No	☐	
Fertilize the Tree:	Yes	☐	No	☐	
Site Irrigation:	Yes	☐	No	☐	
Apply Herbicide:	Yes	☐	No	☐	
Tree Prune:	Yes	☐	No	☐	
Fence Condition:	Intact	☐	Damaged	☐	Repaired ☐
Evidence of Grazing:	Yes	☐	No	☐	
Photos Taken:	Yes	☐	No	☐	
Tree Growth Audit by Others:	Yes	☐	No	☐	

PROJECT:		**JOB NUMBER:**	
LOCATION:		**DATE:**	
CLIENT:		**INSPECTED BY:**	

Landfill Cap Inspection

Landfill Cap Observation:

Landfill Cap Maintenance Activities:

Other Activities

Form Reviewed By:

Date:

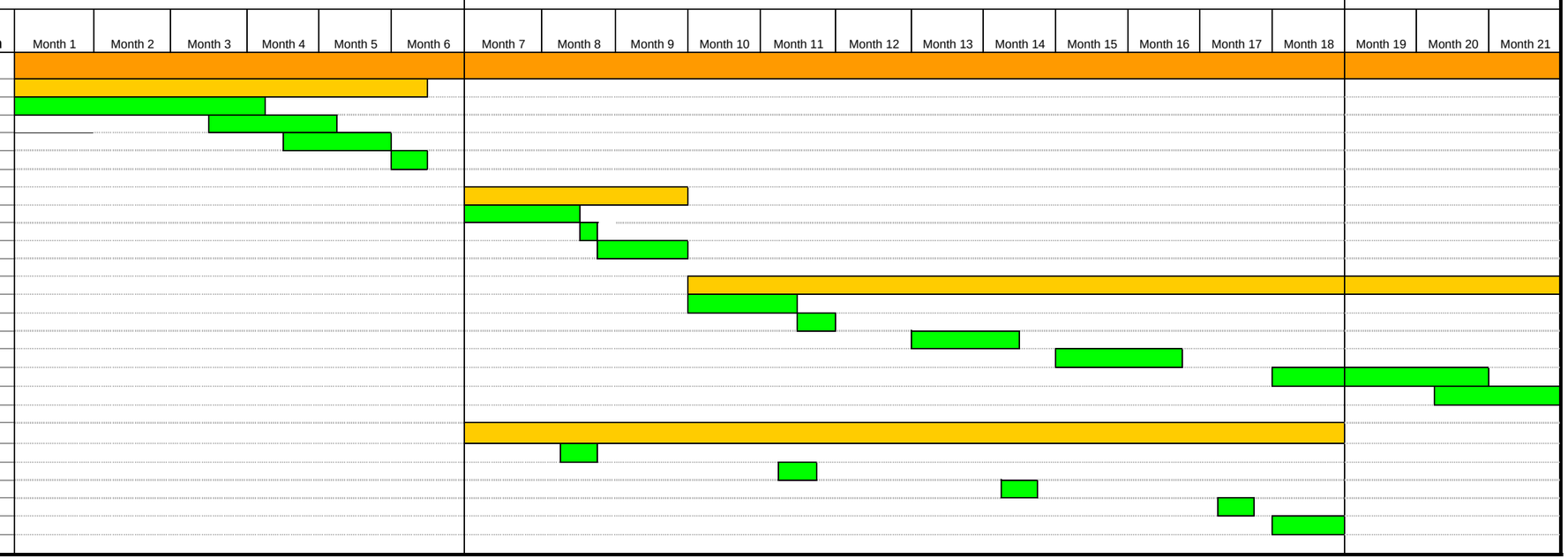
Rev. 11/15/2007

APPENDIX VII

Proposed Timeline For Corrective Action Plan Implementation

Proposed Timeline For Corrective Action Plan Implementation
White Street Landfill
Greensboro, North Carolina
S&ME Project No. 1584-98-081
Prepared 6/8/08 by Connel Ware

Task Name	Duration	Start	Finish
Corrective Action Plan Implementation			
Task A - Corrective Action Plan Completion			
1.0 Initial Submittal to DENR and DENR Review Process			
2.0 CAP Revision per NCDENR Review Comments			
3.0 Second Submittal and NCDENR Final Review			
4.0 Receipt of NCDENR CAP Approval Letter			
Task B - CAP Implementation Bid Process and Proposal Preparation			
1.0 Invitation for Bids/Proposals for Phytoremediation System Design			
2.0 Award Contract for Phytoremediation System Design			
3.0 Phytoremediation Design Phase			
Task C - Phytoremediation System Installation, CAP Implementation			
1.0 Invitation for Bids/Porposals for Phytoremediation System Installation			
2.0 Award Contract for Phytoremediation System Installation			
3.0 Site Clearing and Grading			
4.0 Sentinel Monitoring Well INstallations Installations			
5.0 Phytoremediation System Installation			
6.0 Phytoremediation System Installation Report Preparation and Submittal			
Task D - MNA Indicator Background Sampling Events			
1.0 First MNA Quarterly Sampling Event			
2.0 Second MNA Quarterly Sampling Event			
3.0 Third MNA Quarterly Sampling Event			
4.0 Fourth MNA Quarterly Sampling Event			
5.0 MNA Indicator Parameter Background Sampling Report			



APPENDIX VIII

Financial Assurance Documentation

Capital Improvement Project FY 2008-2009
White Street Landfill Phase II Groundwater Remediation - Regulatory Compliance

Capital Project Background

The White Street Phase II landfill currently operates under a municipal solid waste disposal permit number 41-03. Historically, the Phase II landfill was owned and operated as an unlined sanitary landfill by Guilford County. Ownership of the landfill was transferred to the City of Greensboro. Disposal activities continued until State regulations required the closure of all unlined sanitary landfills. The City complied with the closure requirements and the Phase II landfill was later approved to be re-permitted for construction and demolition debris disposal above the regulatory closure cap. Since 1998, the Phase II landfill has been utilized for construction and demolition disposal.

Modifications in the State's waste disposal regulations required an assessment of groundwater quality with respect to the established State's groundwater standards. Groundwater monitoring wells were installed around the perimeter of the Phase II landfill. Topographically, upgradient groundwater monitoring wells were additionally constructed to establish the background groundwater quality conditions prior to the groundwater intercepting in-situ waste.

Groundwater sampling events were completed on a semi-annual basis. Results of this analysis detected groundwater quality exceedances for the following compounds: tetrachloroethene, vinyl chloride, 2-butanone, and vanadium. These compounds were repeatedly documented above the established North Carolina Administrative Code 2L groundwater standard and the groundwater protection standards. However, the detection level of vanadium was determined to be influence by its presence of in-situ soils. Per 15A NCAC 13B.1635 of the North Carolina Department of Environment and Natural Resources (NC DENR) – Division of Waste Management, whenever it is documented that one or more constituents listed in the Appendix II groundwater standard has been detected at a statistically significant level exceeding the groundwater standards, an assessment of corrective actions measures must be completed. A corrective actions assessment evaluated potential remedies to control and remediate impacted groundwater. A Nature and Extent report documenting the groundwater exceedances was submitted to NC DENR in August 2007 and a public meeting was held in December 2007 to discuss the groundwater impact within Phase II of the landfill and possible remediation solutions.

The Environmental Services Department has contracted with environmental consultants to develop possible groundwater remediations solutions. To date, NC DENR has not approved any recommended options for this property. The Environmental Services Department will recommend the implementation of a conventional groundwater pump and treatment remediation system in conjunction with monitored natural attenuation.

The proposed groundwater pump and treatment system removes contaminants that are dissolved in groundwater for treatment at the surface. The system's implementation involves the installation of subsurface, extraction wells. The extracted groundwater is discharged to a publicly owned treatment works. The remediation timeframe for a pump

and treatment system is dependent on the placement of the extraction wells. The remediation goal at the compliance boundary may be achieved as soon as three to five years. The natural attenuation process reduces the mass concentration of the contaminate by physical, biological, and chemical degradation.

Capital Improvement Expenditure Estimates

Engineering estimates for the implementation of the groundwater remediation systems are as follows:

Pump and Treatment System with Discharge to POTW

Design costs:

Pilot test.....$15,000 - $20,000
Engineering costs.....$20,000 - $40,000
Permitting costs.....$5,000 - $10,000

Equipment Costs:

Collection system, pumps, piping, control, etc.....$50,000 - $100,000
Transfer piping and lift station.....$135,000 - $160,000

Construction costs

Extraction well and system installation..... $40,000 - $80,000
Construction oversight and documentation.....$30,000 $60,000
Power supply to the site.....$5,000 - $10,000

Contingencies.....$45,000 - $72,000
Total estimated Implementation costs.....$345,000 - $552,000

Annual maintenance and upkeep costs associated with the pump and treatment system is approximately $30,000.

Monitored Natural Attenuation

Initial start-up costs:

Pilot study and baseline data collection..... $20,000 - $40,000

Design Costs

Engineering costs..... $10,000 - $20,000
Permitting costs..... $0 - $5,000

Construction costs:

Additional wells as needed.....$30,000 - $40,000

Contingencies.....$9,000 - $15,750
Total estimated natural attenuation costs.....$69,000 - $120,750

Annual monitoring and reporting costs associated with monitored natural attenuation are estimated as $20,000 to $40,000.