Imagine the result

ExxonMobil Environmental Services Company

Site Delineation Report and Removal Action Work Plan

Former Virginia-Carolina Chemical Corporation Site

Charlotte, North Carolina

December 2012

ARCADIS

Kirstyn White, P.E.
Project Environmental Engineer

Matthew T. Pelton, P.E.
Senior Environmental Engineer

Geoffrey Germann, P.E.
Principal Engineer

Site Delineation Report and Removal Action Work Plan

Former Virginia-Carolina Chemical Corporation Site, Charlotte, Mecklenburg County, North Carolina

Prepared for:
ExxonMobil Environmental Services Company

Prepared by:
ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Dr.
Suite 300
Raleigh
North Carolina 27607
Tel 919.854.1282
Fax 919.854.5448

Our Ref.:
B0085793

Date:
December 2012

ARCADIS G&M of North Carolina, Inc.
NC Engineering License # C-1869

ARCADIS

1. Introduction 1

1.1 Project Objectives 1

1.2 Site Description and Background 1

1.2.1 Former Facility Description 1

1.2.2 Site Location 2

1.2.3 Land Cover and Vegetation 2

1.2.4 Area Geology and Hydrogeology 3

1.2.5 Site Geology and Hydrogeology 4

1.3 Report Organization 5

2. Data Collection Activities 7

2.1 Introduction 7

2.2 Delineation Strategy 7

2.2.1 April 2010 RSE Sampling 7

2.2.2 Delineation Sampling 7

2.2.2.1 Soil Delineation Sampling 7

2.2.2.2 Groundwater Sampling and Monitoring Well Installation 7

2.3 Pre-Delineation Activities 8

2.4 Soil Sampling and Analysis Activities 8

2.5 Groundwater Sampling and Analysis Activities 9

2.5.1 Permanent Monitoring Well Installation 9

2.5.2 Groundwater Elevation Measurements 9

2.5.3 Groundwater Sample Collection and Analyses 9

2.5.4 Hydraulic Conductivity Testing 10

2.6 Investigation-Derived Waste Sampling 10

2.7 Surveying 10

2.8 Data Validation 11

ARCADIS

3. Summary of Results **12**

3.1 Introduction 12

3.2 Development of Medium-Specific Action Levels 12

3.2.1 Soil Standards 12

3.2.2 Groundwater Standards 14

3.3 Soil Sample Results 14

3.4 Waste Characterization Results 14

3.5 Groundwater Occurrence and Movement 15

3.6 Groundwater Sample Results 16

3.6.1 March 2011 Groundwater Sampling 16

3.6.2 May 2012 Groundwater Sampling 17

3.6.3 October 2012 Groundwater Sampling 17

3.6.4 Summary of Groundwater Sampling Results 17

3.7 Investigation-Derived Waste Sampling and Disposal 18

3.8 Field Quality Control Sample Results 18

4. Removal Action Strategy **19**

4.1 Introduction 19

4.1.1 Soil 19

4.1.2 Groundwater 20

4.2 Objectives 20

4.3 Removal Action 20

4.3.1 Soil Removal Action 21

4.3.2 Groundwater Monitoring 23

4.3.3 Land Use Restrictions 23

5. Removal Action Work Plan **24**

5.1 Introduction 24

5.1.1 Work Plan Objectives 24

ARCADIS

5.2 Project Organization 25

5.2.1 Regulators/Agencies 25

5.2.2 Responsible Party 25

5.2.3 Engineer 26

5.2.4 Removal Action Contractor 26

5.2.5 Waste Disposal Facility 27

5.2.6 Analytical Laboratory 28

5.3 Technical Approach and Scope of Work 28

5.3.1 Securing Access Agreements for Construction 28

5.3.2 Mobilization 28

5.3.3 Preparation of the Site for Removal Action Activities 29

5.3.3.1 Installation of Erosion and Sediment Control Measures 29

5.3.3.2 Subsurface Utility Markout 29

5.3.4 Clearing and Grubbing 30

5.3.5 Excavation and Stabilization of Impacted Soil 30

5.3.5.1 Soil Excavation 30

5.3.5.2 Soil Stabilization 32

5.3.6 Confirmation Sampling Plan 33

5.3.7 Transport to Disposal Facility 34

5.3.8 Submittals 35

5.3.8.1 Site Operations Plan 35

5.3.8.2 Health and Safety Plan 39

5.3.9 Site Restoration 41

5.4 Reporting 42

5.4.1 Weekly Reports 42

5.4.2 Post-Removal Site Control Plan 42

5.4.3 Final Report 42

ARCADIS

5.5 Institutional Controls 43

5.6 Schedule 43

6. References 44

Tables

2-1 Summary of Sampling and Analytical Program

2-2 Groundwater Monitoring Well Specifications

2-3 Groundwater Elevations

3-1 Summary of Arsenic and Lead Concentrations in Soil Samples

3-2 Summary of Waste Characterization Analytical Results

3-3 Groundwater Analytical Results and Field Measurements

3-4 Summary of Investigation-Derived Waste – Liquid Analytical Results

3-5 Summary of Investigation-Derived Waste – Solid Sample Analytical Results

3-6 Summary of Field Quality Control Sample Results

5-1 Summary of Excavation Areas and Volumes

5-2 Summary of Confirmation Sampling Program

Figures

1-1 Site Location Map

1-2 Site Plan

1-3 Current and Historical Site Features

2-1 Soil Sample Locations

2-2 Groundwater Monitoring Well Locations

3-1 Locations of Soil Samples Exceeding Screening Levels

3-2 Shallow Groundwater Potentiometric Surface Map – May 10, 2012

3-3 Groundwater Analytical Data

ARCADIS

4-1 Soil Excavation Areas and Depths

5-1 Project Schedule

Appendices

A Visual Soil Classifications

B Monitoring Well Construction Logs

C Development of Health-Based Remediation Goals

D Hydraulic Conductivity Memorandum

E Waste Manifests

ARCADIS

List of Acronyms and Abbreviations

amsl	above mean sea level
ARCADIS	ARCADIS G&M of North Carolina, Inc.
bgs	below ground surface
bss	below sediment surface
CFR	Code of Federal Regulations
COCs	constituents of concern
DOT	Department of Transportation
E&SC	erosion and sediment control
EDR	Environmental Data Resource
EMES	ExxonMobil Environmental Services Company
HASP	Health and Safety Plan
Haz-mat	Haz-mat Transportation and Disposal, Inc.
IDW	investigation-derived waste
IHSB	Inactive Hazardous Sites Branch
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MSDS	Material Safety Data Sheet
NAD	North American Datum
NC 2L	North Carolina Groundwater Standards
NCDENR	North Carolina Department of Environment and Natural Resources
NCGS	North Carolina Geological Survey
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
PCBs	polychlorinated biphenyls
PODS	Portable On Demand Storage
PPE	personal protective equipment
PWR	partially weathered rock
PSRG	Preliminary Health Based Soil Remediation Goals
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAC	Removal Action Contractor
RAWP	Removal Action Work Plan

ARCADIS

RCRA	Resource Conservation and Recovery Act
RSE	Removal Site Evaluation
SCS	Soil Conservation Service
SDR	Site Delineation Report
SDWP	Site Delineation Work Plan
SOP	Site Operations Plan
SRGs	Soil Remediation Goals
SSAL	site-specific action level
STATSGO	State Soil Geographic Database
SVOCs	semi-volatile organic compounds
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TestAmerica	TestAmerica, Inc.
TOC	total organic carbon
ug/L	micrograms per liter
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTS	Universal Treatment Standards
VCC	Virginia Carolina Chemical Corporation
VOCs	volatile organic compounds
Work Plan	Site Delineation Report and Removal Action Work Plan
XRF	x-ray fluorescence

1. Introduction

This Site Delineation Report and Removal Action Work Plan (Work Plan) has been prepared by ARCADIS G&M of North Carolina, Inc. (ARCADIS) on behalf of ExxonMobil Environmental Services Company (EMES) to present the results of site delineation activities and describe the proposed removal action strategy to address arsenic and lead impacted media at the former Virginia-Carolina Chemical Corporation (VCC) site located in Charlotte, Mecklenburg, North Carolina (the Site). Figure 1-1 identifies the Site location on the United States Geological Survey (USGS) 7.5-minute quadrangle for West and East Charlotte, North Carolina. Figure 1-2 depicts the Site Plan.

Unless otherwise specified in this report, the site delineation activities described herein were performed in accordance with the United States Environmental Protection Agency (USEPA) and North Carolina Department of Environment and Natural Resources (NCDENR)-approved *Site Delineation Work Plan, Former Virginia-Carolina Chemical Corporation Site, Charlotte, Mecklenburg County, North Carolina* (SDWP) (ARCADIS, 2011).

1.1 Project Objectives

The objective of the site delineation activities was to evaluate and refine the magnitude and extent of arsenic and lead concentrations previously detected in site media. These data, in conjunction with data obtained during previous site investigation activities, were used to accomplish the second objective for this project, which was to develop an appropriate removal action strategy for the Site that is protective of both human health and the environment. This report summarizes the cumulative Site data and the proposed removal action strategy.

1.2 Site Description and Background

1.2.1 Former Facility Description

Virginia-Carolina Chemical Company purchased the Charlotte fertilizer plant in 1901 from Charlotte Oil and Fertilizer Company and operated the plant until entering bankruptcy in 1924. At the conclusion of Virginia-Carolina Chemical Company's bankruptcy and reorganization proceedings in 1926, VCC of Richmond, Virginia emerged as a new company and continued to own the Charlotte fertilizer plant until 1970. VCC merged into Socony Mobil Oil Company, Inc. in 1963, and the company name changed in 1966 to Mobil Oil Corporation. Mobil Oil Corporation sold the

Charlotte plant site in 1970 to Swift Agricultural Chemical Corporation. In 1999, Exxon Corporation merged with Mobil Corporation to form Exxon Mobil Corporation. Mobil Oil became ExxonMobil Oil Corporation, the corporate successor to VCC. Exxon Mobil Corporation is the parent company of ExxonMobil Oil Corporation.

A review of available historical Sanborn maps confirmed that the VCC Charlotte facility was a complete plant, with acid production facilities. Fertilizer manufacturing began at this site prior to 1890 and continued until sometime between 1929 and 1934. Historical documents indicate that the last year for acid production was 1934. Figure 1-3 depicts the general locations of the former site features.

1.2.2 Site Location

The Site is located in Charlotte, Mecklenburg County, North Carolina (Figure 1-1). The current street address that most closely matches the former acid chamber location is 349 West Tremont Avenue. The geographical location of the center of the Site is at 35.21020° North Latitude and 80.86517° West Longitude (North American Datum of 1983 [NAD83]).

The Site is currently occupied with commercial and light industrial facilities located within the Tremont Center owned by Tremont Industrial Park, LLC. Based on sampling activities described herein, the extent of the Site has expanded to include other adjacent commercial/industrial properties to the east, south, and west as well. The former VCC property can be accessed from West Tremont Avenue, which forms the northern boundary of the site. A vast majority of the former site is currently hardscaped with asphalt/concrete driveways and parking lots or buildings.

Currently, the former Charlotte site is occupied by thirteen tax parcels (including the two parcels owned by Tremont Industrial Park, LLC and eleven other privately owned parcels). Four other tax parcels are also adjacent to the former VCC property. These parcels were not investigated either due to soil delineation being achieved on adjacent properties prior to reaching the property lines (3 parcels: 12103201, 12103202, and 12103216), or refusal by the property owner to grant access for sampling (1 parcel: 12103213). Property ownership information was provided by the Mecklenburg County GIS and Property Ownership Land Records Information System.

1.2.3 Land Cover and Vegetation

Surrounding land use of the former VCC property includes commercial and industrial facilities, residential apartments, restaurants, a music hall, a shopping mall, and an

abandoned gas station. The nearest residential properties are two apartment buildings located east and southeast of Hawkins Street.

The Site is located near the border of the Catawba and Yadkin River Basin. No surface water features are present on, or immediately adjacent to, the Site. The two closest surface water features are tributaries of Irwin Creek and Dairy Branch. Irwin Creek is located approximately 3,000 feet west of the Site (Figure 1-1). Irwin Creek flows southwest and joins with Sugar Creek which feeds into the Catawba River. Tributaries of Dairy Branch are located approximately 2,000 feet southeast of the Site. Dairy Branch flows southeast and joins with Little Sugar Creek which feeds into the Catawba River. The Catawba River ultimately discharges to the Atlantic Ocean.

Water is supplied to the area around the Site by Charlotte-Mecklenburg Utilities. Mountain Island Lake and Lake Norman supply the drinking water and are located approximately 10 miles and 15 miles northwest of the Site, respectively. There are no active public water supply wells in the vicinity of the Site (EDR, 2009 and personal communication with Jack Stutts of the Mecklenburg County Department of Groundwater and Wastewater in October 2010).

1.2.4 Area Geology and Hydrogeology

The Site is located in the Upland Piedmont Physiographic Province in North Carolina, which is characterized by gently rolling, well-rounded hills and ridges with a few hundred feet of elevation difference between the hills and valleys (NCGS, 1985). Specifically, the Site is located within a lithotectonic region known as the Charlotte Belt (Goldsmith et. al., 1988). Bedrock geology in the Charlotte Belt is dominated by crystalline rocks that formed between 900 million and 248 million years ago. Goldsmith et. al. (1988) have mapped and classified the bedrock in the vicinity of the site as metamorphosed quartz diorite and tonolite. These closely related rock types are characteristically grey in color, generally exhibit a massive to weakly foliated structure, and are composed of a variety of minerals including plagioclase feldspar, quartz, biotite, hornblende, and epidote.

In the North Carolina Piedmont, bedrock is typically overlain by a layer of regolith, also known as overburden. Overburden varies in thickness and composition depending on the topography and geologic history of the area, but commonly consists of a variety of unconsolidated soil types including topsoil, alluvium, saprolite, and partially weathered rock (PWR). Saprolite, a major component of overburden, is the residual product of in-place chemical weathering of crystalline bedrock. PWR commonly exists in a transition zone between highly weathered saprolite and competent bedrock. Although the

mineral composition of PWR differs from the parent bedrock due to weathering, PWR commonly retains many of the structural features of the parent bedrock including fractures, joints, and foliation. The contact between PWR and competent bedrock is often irregular and erratic, even over relatively short horizontal distances, due to variability in resistance to weathering controlled by structural features and natural variations in mineral composition.

The hydrogeology of the region is characterized by a two-part groundwater system, consisting of overburden and bedrock aquifers. Overburden is the primary storage reservoir for the underlying bedrock and has high porosity and low permeability. Precipitation is stored as groundwater in the intergranular spaces of the overburden as it infiltrates through the subsurface. The water table typically exists within the overburden and the direction of shallow groundwater flow generally mimics the slope of the land surface.

Review of the State Soil Geographic Database (STATSGO) soil survey data compiled by United States Department of Agriculture (USDA) Soil Conservation Service (SCS) indicates that the underlying soils of the Site (Mecklenburg County) are classified as urban land and are variable in texture. Native soils in the immediate Site vicinity are classified as Cecil sandy clay loam, and consist of well drained, coarse-grained sand, clay, and silt with moderate infiltration rates (EDR, 2009).

1.2.5 Site Geology and Hydrogeology

Based on data collected from shallow soil borings and deeper monitoring well borings advanced at the Site to a maximum depth of 34 feet bgs, the subsurface generally consists of orange brown to reddish brown silty clay and clayey silt with varying amounts of fine-grained gravel and rootlets. Orange brown to dark brown silt and sandy silt were also observed in the shallow subsurface in several of the soil borings. Gravel was encountered at depths varying from the ground surface to 4 feet below ground surface (bgs).

The shallow silts, clays, and fill material are generally underlain by soft, reddish brown micaceous silt that extends to variable depths across the Site, and is underlain by saprolite, a silty weathering product of rock that has degraded in-situ. Relic rock structure was noted in the saprolitic zones at the Site, which were encountered at depths varying from approximately 5 to 20 feet bgs. Reddish brown to yellowish brown medium plasticity clay was observed from approximately 5 to 20 feet bgs at monitoring well CH-MW-02. This clayey interval was not observed at other monitoring well locations. Rock fragments were noted at approximately 26 feet bgs at CH-MW-07, and

may indicate the presence of PWR or bedrock. Lithology at other monitoring wells was collected at depths ranging from 24 to 32 feet bgs and bedrock was not observed.

Fill materials consisting of sulfur-like (in borings CH-SB-23, CH-SB-24, and CH-SB-35) and coal-like (in borings CH-SB-24 and CH-SB-39) fragments were observed in soil borings advanced in the southeastern and southwestern portions of the Site extending from 0.5 to 4 feet bgs. Additional limited fill materials, including black and magenta slag and brick fragments, were observed in soil borings advanced in the central (in borings CH-SB-10, CH-SB-11, and CH-SB-51), northeastern (in boring CH-MW-02), southeastern (in borings CH-SB-39, CH-SB-40, CH-SB-77, and CH-SB-78), and southwestern (borings CH-SB-23, CH-SB-52, CH-SB-53, CH-SB-94, and CH-MW-05) portions of the Site, at depths varying from the ground surface to 4 feet bgs. No fill materials or magenta slag were observed in any of the remaining soil borings. Groundwater was not encountered in any of the soil borings during the field activities. A more detailed description of the subsurface materials encountered during the assessments is provided in the soil classification logs included in Appendix A.

The depth to groundwater was measured at seven locations (monitoring wells CH-MW-01 through CH-MW-07) during four separate gauging events conducted March 1, 2011, March 29, 2011, May 10, 2012, and October 3, 2012. The depth to groundwater at the Site varies from approximately 14 to 23 ft bgs. Groundwater elevations were consistent during the four events and on October 3, 2012, groundwater elevations varied from 709.32 ft amsl in CH-MW-04 to 719.81 ft amsl in CH-MW-01. Groundwater flow direction was also consistent during the gauging events and generally to the northwest across the Site. Section 2.5 presents the locations of groundwater monitoring wells and boreholes and information about their installation. Monitoring well construction logs are provided in Appendix B.

1.3 Report Organization

The introduction provided in this section is followed in Section 2 by a description of the delineation activities performed to characterize the extent of arsenic and lead in site media. Section 3 summarizes the data generated during these and previous delineation activities. Section 4 presents the proposed removal action strategy and Section 5 presents specific details of the proposed removal action. References cited in this report are included in Section 6.

This report also has five appendices. These appendices include the visual soil classifications, monitoring well construction logs, development of Health-Based

Remediation Goals, hydraulic conductivity calculations, and a copy of the waste manifests documenting the removal of investigation-derived waste (IDW).

2. Data Collection Activities

2.1 Introduction

Soil and groundwater samples were collected to evaluate and refine the presence and extent of arsenic and lead impacted media at the Site. Representatives of ARCADIS implemented and oversaw all field activities in support of the investigation, which took place in February 2011, March 2011, December 2011, May 2012, and October 2012. Unless otherwise specified in this report, all investigation activities were performed in accordance with the SDWP (ARCADIS, 2011).

2.2 Delineation Strategy

2.2.1 April 2010 RSE Sampling

In April 2010 ARCADIS, on behalf of EMES, collected soil samples from the Site. Analytical results generally indicated the presence of elevated concentrations of arsenic and lead in the soil collected from the southwest, eastern, and northern portions of the Site. The results of this initial investigation were described in the *Removal Site Evaluation Report, Former Virginia-Carolina Chemical Corporation Site, Charlotte North Carolina (ARCADIS, 2010).*

2.2.2 Delineation Sampling

2.2.2.1 Soil Delineation Sampling

In February 2011 ARCADIS, on behalf of EMES, collected additional soil samples from the Tremont Industrial Center Parcels (12103217 and 12103218) to delineate arsenic and lead impacts identified during the removal site evaluation. Analytical data were compared to NCDENR and USEPA screening levels considered to be protective of human health and the environment. Results indicated that certain soils contained arsenic and lead at concentrations exceeding the NCDENR and USEPA screening levels. Based on these results, EMES performed additional sampling activities on adjacent properties in December 2011, May 2012, and October 2012 to further delineate the extent of impacted soil.

2.2.2.2 Groundwater Sampling and Monitoring Well Installation

Permanent monitoring wells were installed at seven locations in February 2011. Groundwater samples were collected from the newly installed monitoring wells in

March 2011. Based on the analytical results, a second set of samples were collected from two monitoring wells (CH-MW-03 and CH-MW-07) in late March 2011 to confirm the initial results. Additionally, groundwater samples were collected from all seven wells in May and October 2012.

2.3 Pre-Delineation Activities

Prior to the start of sampling, EMES obtained written permission from each of the affected property owners to enter the properties, collect samples, and install monitoring wells. Before beginning any subsurface activities, the locations of underground utilities were identified by the public utility locating service to minimize the possibility of disrupting services to the property and to protect the safety of the workers. To further confirm the absence of utilities, a private utility locating company, Taylor Wiseman Taylor of Charlotte, North Carolina, was contracted to clear all areas where subsurface work was to be performed.

2.4 Soil Sampling and Analysis Activities

During the April 2010 RSE activities, a total of 79 samples were collected from 25 soil boring locations. As described above, ARCADIS returned in February 2011, December 2011, May 2012, and October 2012 to complete the delineation discussed in the SDWP and collected an additional 256 soil samples from 82 additional soil borings locations. In all, a total of 335 soil samples were collected from 107 soil borings advanced at the locations shown on Figure 2-1.

Generally, soil samples were screened in the field for arsenic and lead using a portable x-ray fluorescence (XRF) device and were submitted to TestAmerica, Inc. of Nashville, Tennessee (TestAmerica) for arsenic, lead, and pH analyses. A summary of the soil samples collected is presented in Table 2-1; physical descriptions of these soil samples are presented in Appendix A.

Toxicity Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) arsenic and lead analyses were performed on 12 soil samples collected in February 2011, December 2011, and May 2012 from locations where arsenic and/or lead concentrations exceeded the screening levels. The purpose of these analyses was to determine appropriate disposal requirements for soil for evaluating potential soil removal alternatives. In general, TCLP analyses were performed using a composite of the soil samples collected from the ground surface to the maximum depth at which laboratory analyses indicated the presence of arsenic or lead at concentrations above screening levels. The specific samples selected for TCLP

analyses were determined based on laboratory analytical data. The composite soil samples were analyzed for TCLP arsenic, TCLP lead, total arsenic, total lead, and pH. Additionally, one composite soil sample was collected in May 2012 for TCLP volatile organic compounds (VOCs), TCLP semi-volatile organic compounds (SVOCs), TCLP metals, and polychlorinated biphenyls (PCBs).

Locations of soil samples analyzed for TCLP are shown on Figure 2-1. A summary of the TCLP waste characterization soil samples is provided in Table 2-1.

2.5 Groundwater Sampling and Analysis Activities

2.5.1 Permanent Monitoring Well Installation

In February 2011, seven permanent groundwater monitoring wells (CH-MW-01 through CH-MW-07) were installed to assess shallow groundwater quality and to evaluate the occurrence and flow direction of shallow groundwater at the Site. The locations of the groundwater monitoring wells are depicted on Figure 2-2.

All newly installed wells were completed as single-cased monitoring wells, screened across the water table and developed in accordance with the procedures specified in the SDWP. Development of all wells was completed in February 2011 after installation. Groundwater monitoring well specifications are provided in Table 2-2. Construction details and well construction logs for the newly installed wells are presented in Appendix B.

2.5.2 Groundwater Elevation Measurements

Groundwater elevations were measured at all seven newly installed monitoring wells to provide data for the development of a groundwater potentiometric surface map. Depth-to-water measurements were performed in accordance with the procedures specified in the SDWP. Groundwater elevations are provided in Table 2-3.

2.5.3 Groundwater Sample Collection and Analyses

Groundwater samples were collected in March 2011, May 2012, and October 2012 using low-flow/low-stress sampling techniques in accordance with the procedures specified in the SDWP. The groundwater samples were analyzed by TestAmerica for total and dissolved arsenic and lead. Field-filtered samples were collected from each monitoring well using a 0.45 μm filter to evaluate dissolved arsenic and lead concentrations. In addition, the groundwater samples were measured in the field for

pH, temperature, conductivity, dissolved oxygen, turbidity, and redox potential using a properly calibrated YSI-556 multi-parameter water quality meter with a flow-through cell. A summary of the groundwater sampling program is presented in Table 2-1.

2.5.4 Hydraulic Conductivity Testing

On March 2, 2011, hydraulic conductivity testing (i.e., slug testing) was conducted at all seven groundwater monitoring wells following the procedures detailed in the SDWP. Both rising-head and falling-head slug tests were performed at each well to provide data to facilitate the calculation of hydraulic conductivity values for the shallow water-bearing unit beneath the Site. A pressure transducer was installed near the bottom of each well to measure the static water level prior to, and immediately after, the start of the slug tests. The falling-head slug tests were conducted by submerging a solid slug below the water table to displace a known volume of water and then measuring the changing water levels over time until the water level returned to static conditions. For each rising-head slug test, the slug was submerged below the water level in the well to allow the displacement of water. Once the water level equilibrated, the slug was removed and the subsequent water levels were recorded until the water level returned to equilibrium. The data collected during the slug tests was evaluated using the Bouwer-Rice method, as specified in the SDWP. The results of the March 2011 hydraulic conductivity testing are discussed in Section 3.6.

2.6 Investigation-Derived Waste Sampling

A total of 42 drums (12 containing decontamination fluids/purge water and 30 containing soil/debris/personal protective equipment) were generated during the April 2010 through October 2012 sampling activities at the Site. Drums containing solids were analyzed for TCLP metals, while drums containing liquids were analyzed for target analyte list (TAL) metals and pH. Samples were collected in accordance with the procedures specified in the SDWP. A summary of the investigation-derived waste (IDW) sampling program is provided in Table 2-1.

2.7 Surveying

ARCADIS contracted Taylor Wiseman & Taylor of Charlotte, North Carolina to survey the locations of soil borings, groundwater monitoring wells, relevant site features (i.e., buildings, utilities, etc.) and property lines. All survey data was referenced to the North American Horizontal Datum of 1983 and the North American Vertical Datum of 1988.

2.8 Data Validation

Laboratory analytical data were validated by ARCADIS in accordance with the procedures outlined in the Quality Assurance Project Plan (QAPP) contained in the SDWP. Data validation entails a review of the quality control (QC) data and the raw data to verify that the laboratory was operating within required limits, the analytical results are correctly transcribed from the instrument read outs, and which, if any, environmental samples are related to any deficient QC samples. The objective of the data validation is to identify any questionable or invalid laboratory measurements and to determine if the quality is sufficient to meet the data quality objectives.

3. Summary of Results

3.1 Introduction

This section of the report summarizes the results of the data collection activities described in Section 2.

3.2 Development of Medium-Specific Action Levels

The acid chambers used in the fertilizer production process represent the greatest potential for adverse environmental impacts (USEPA, 1997). During periodic cleaning of the lead chambers, it is believed that wash down water containing acid and soluble lead was flushed onto the ground surface. Pyrite cinders that did not burn completely in the combustion chambers were frequently used as onsite fill material. This slag material has a reddish (magenta) appearance and has been found to contain elevated levels of inorganic constituents. Magenta slag material can contain arsenic and lead.

Site characterization at other former VCC Sites in USEPA Region 4 established that site-related constituents of concern (COCs) are arsenic and lead. At this Site, arsenic and lead are the COCs; therefore, Section 3 addresses these metals. Action levels for arsenic and lead for each medium of concern are presented below.

3.2.1 Soil Standards

The NCDENR Preliminary Health Based Soil Remediation Goals (PSRGs) for residential contact with soil for arsenic and lead are 0.39 milligrams per kilogram (mg/kg) and 400 mg/kg, respectively. However, exposure to arsenic can be evaluated for both carcinogenic and noncarcinogenic effects. The PSRG for arsenic is based on the carcinogenic endpoint at a 1×10^{-6} target risk level. The PSRG for arsenic can also be calculated based on the non-cancer endpoint. If this is done, the PSRG is calculated to be 4.4 mg/kg assuming a target non-cancer hazard quotient of 0.2 based on NCDENR guidance and the assumption that there are four other chemicals at the Site, in addition to arsenic, with the same critical effect. However, since there are no other COCs at the Site with the same critical effect, the PSRG for arsenic for the non-cancer endpoint is actually 22 mg/kg (5 x 4.4 mg/kg). This corresponds to a risk of 6 in 100,000 which is acceptable for residential usage. The PSRG for lead is based on USEPA guidance on lead cleanup levels for child exposure to lead and cannot be adjusted.

The NCDENR Protection of Groundwater SRGs for arsenic and lead are 5.8 mg/kg and 270 mg/kg, respectively. Both health-based and protection of groundwater remediation goals must be met. Since total arsenic has not been detected above the groundwater standards promulgated under Chapter 2L, Title 15A of the North Carolina Administrative Code (NC 2L), the Protection of Groundwater SRG for arsenic does not apply. However, since lead was detected in several wells onsite at concentrations above the NC2L standard, the Protection of Groundwater SRG of 270 mg/kg would apply.

Based on the fact that land use restrictions will likely be required in the future at this site, the Health-Based Remediation Goals previously developed for soil at the VCC-Durham site were considered. As discussed on a September 17, 2012 call between USEPA, NCDENR, ExxonMobil, and ARCADIS, calculation of new site-specific Health-Based Remediation goals was not necessary for this site because the same exposure assumptions made and previously approved for the VCC Durham site would apply, which would result in the same calculated values. The details on the procedures used for developing these Health-Based Remediation Goals are provided in Appendix C and were originally presented as part of the *Site Delineation Report and Removal Action Work Plan*, Former Virginia-Carolina Chemical Corporation Site, Durham, North Carolina (ARCADIS 2012). The calculations demonstrate that an arsenic soil concentration of 55 mg/kg and a lead soil concentration of 941 mg/kg would be protective of both direct soil exposure, and leaching to groundwater, for the expected future land use and exposure scenarios presented.

These calculated Remediation Goals suggest that SRGs higher than the published values are appropriate for protection of human health and groundwater at the site. However, EMES desires to accomplish all soil removal objectives required by both the USEPA and NCDENR on a one-time basis to avoid future soil removal actions at the Site. Therefore, EMES has committed itself to employing the more conservative remedial goals, the USEPA action level for arsenic (27 mg/kg) and the NCDENR Protection of Groundwater SRG for lead (270 mg/kg) as final remediation goals for the Site. A summary of the site-specific action levels (SSALs) for soil is provided below:

Constituent of Concern	USEPA Action Level (mg/kg)	NCDENR Protection of Groundwater SRG (mg/kg)	Calculated Risk-Based Protection of Human Health (mg/kg)	Site-Specific Action Level (mg/kg)
Arsenic	27	NA	55	27
Lead	895	270	941	270

Note: NA = Not Applicable

3.2.2 Groundwater Standards

Groundwater standards are based on the North Carolina Groundwater Standards (NC 2L) as promulgated under Chapter 2L, Title 15A of the North Carolina Administrative Code. Similar to the soil standards described above, NC 2L standards are considered to be applicable only for the Site-related COCs (arsenic and lead). The NC 2L standards for arsenic and lead are 10 micrograms per liter (µg/L) and 15 µg/L, respectively.

3.3 Soil Sample Results

During the 2010, 2011, and 2012 site investigation and delineation activities, 335 soil samples were collected from 107 soil borings advanced at the Site and analyzed for arsenic, lead, and pH. The maximum arsenic concentration of 4,270 mg/kg was present in a sample from soil boring CH-SB-28, located on Parcel 12103218 (Figure 3-1), at a depth of 2 to 4 feet bgs. The maximum lead concentration of 20,100 mg/kg was present in a sample from soil boring CH-SB-19, located on Parcel 12103218 (Figure 3-1), at a depth of 0 to 0.5 feet bgs. Soil pH levels varied between 3.0 and 7.9 standard units. A summary of soil boring locations exceeding the arsenic and/or lead SSALs of 27 mg/kg and 270 mg/kg, respectively, are presented on Figure 3-1. Laboratory analytical data for soil samples are presented in Table 3-1.

3.4 Waste Characterization Results

A total of 12 soil samples were analyzed for TCLP arsenic and lead. In general, samples were composited from the ground surface to the depth at which laboratory analyses indicated the presence of arsenic and/or lead at concentrations above

SSALs. Additionally, one composite soil sample was analyzed for TCLP VOCs, TCLP SVOCs, TCLP metals, and PCBs. The purpose of the TCLP analyses is to provide data which may be used to characterize the impacted soil and sediment for off-site disposal.

Detected concentrations of TCLP metals were compared to the RCRA standard, described in 40 Code of Federal Regulations (CFR) Part 261.24, to determine if the soil may be a characteristically hazardous waste. TCLP arsenic was only detected in 4 of the 13 soil samples. The maximum TCLP arsenic concentration was 0.501 milligrams per liter (mg/L), which is below the RCRA standard of 5.0 mg/L for arsenic. All 13 soil samples contained detectable concentrations of lead in the TCLP leachate. The following 2 soil samples contained TCLP lead at concentrations above the standard of 5.0 mg/L:

- DU-SB-51, collected from 0 to 2 feet bgs; and
- DU-SB-94, collected from 0 to 4 feet bgs.

The other RCRA metals were either not detected or detected below their respective RCRA standard. Additionally, TCLP VOCs, SVOCs, BTEX, and PCB constituents were not detected above the laboratory reporting limit. A summary of the waste characterization results are presented in Table 3-2 and sample locations are depicted on Figure 3-1.

3.5 Groundwater Occurrence and Movement

Water level measurements were collected under static groundwater conditions on March 1, 2011, March 29, 2011, May 10, 2012, and October 3, 2012 (as shown in Table 2-3). Groundwater elevations were generally consistent during the four gauging events, noted water level variations are most likely due to seasonal fluctuation in the water table. Groundwater elevations observed on October 3, 2012 varied from 709.32 feet amsl at well CH-MW-04 to 719.81 feet amsl at well CH-MW-01. A groundwater potentiometric surface map for the October 2012 gauging event is depicted on Figure 3-2. The depth to groundwater and groundwater elevations are presented in Table 2-3. As shown on the shallow groundwater potentiometric surface map (Figure 3-2), groundwater generally flows from the southeast to the northwest across the Site.

Hydraulic conductivity values were calculated for groundwater monitoring wells CH-MW-01 through CH-MW-07 using data collected from the slug tests performed on March 2, 2011. Hydraulic conductivity values, based on rising-head data, varied from 0.3 feet per day (ft/day) at well CH-MW-04 and CH-MW-05 to 2.8 ft/day at well CH-

MW-01. The hydraulic conductivity values calculated using the falling-head slug test data varied from 0.3 ft/day at well CH-MW-02 and CH-MW-04 to 2.7 ft/day at well CH-MW-01. Overall, the ranges of hydraulic conductivity values calculated using data from both the rising-head and falling-head slug tests were similar. The methodology and results of the hydraulic conductivity calculations are summarized in Appendix D.

3.6 Groundwater Sample Results

Groundwater samples were collected from the Site in March 2011, May 2012, and October 2012. Groundwater samples were submitted to the laboratory and analyzed for total arsenic and lead as specified in the SDWP. Samples collected from each well were also field-filtered and submitted to the laboratory for dissolved arsenic and lead analyses. Arsenic and lead concentrations in the groundwater were compared to the NC 2L standards of 10 µg/L and 15 µg/L, respectively. Field parameters including pH, temperature, conductivity, dissolved oxygen, and redox potential, were measured at each sample location. Groundwater analytical results and field parameter data for samples collected from seven groundwater monitoring wells are presented in Table 3-4 and shown on Figure 3-3.

3.6.1 March 2011 Groundwater Sampling

Groundwater samples were collected from the seven newly installed monitoring wells on March 1, 2011. Arsenic was only detected in one (CH-MW-03) of the seven wells and concentrations were less than the NC 2L standard of 10 µg/L. Total and dissolved lead were not detected above the NC 2L standards in five of the seven wells. Lead was detected in unfiltered groundwater samples collected from CH-MW-03 and CH-MW-07 at concentrations of 17.4 µg/L and 18.2 µg/L, respectively. These concentrations are slightly above the NC 2L standard of 15 µg/L. However, lead was detected at lower concentrations (8.2 µg/L and 3.9 µg/L, respectively) in the filtered sample collected from these two wells, indicating that at least a portion of the lead concentration was due to the mobilization of lead from particulate or colloidal matter. The groundwater pH during the sampling event varied from 3.77 to 5.7 standard units.

On March 29, 2011, a second set of samples were collected from CH-MW-03 and CH-MW-07 and analyzed for total and dissolved arsenic and lead. The results were consistent with the March 1, 2011 event.

3.6.2 May 2012 Groundwater Sampling

On May 10, 2012, groundwater samples were collected from all seven monitoring wells. The groundwater pH varied from 2.84 to 4.64 standard units and was approximately 1 standard unit less at each monitoring well than the March 2011 event. Arsenic was only detected in one (CH-MW-03) of the seven wells. Dissolved arsenic was detected at a concentration of 10.6 µg/L ; however, the total arsenic concentration was less than the NC 2L standard of 10 µg/L. Lead was not detected or detected at concentrations less than the NC 2L standard in all filtered samples. Total lead was detected in all seven wells at concentrations greater than the NC 2L standard of 15 µg/L. The maximum lead concentration of 99.5 µg/L was detected in monitoring well CH-MW-07.

The change in groundwater pH and lead concentrations from March 2011 to May 2012 was unexpected and not easily explained without the collection of additional data. Therefore, EMES resampled the wells in October 2012 to evaluate seasonal and temporal fluctuations in total lead concentrations in the wells.

3.6.3 October 2012 Groundwater Sampling

On October 3, 2012, groundwater samples were collected from all seven monitoring wells. The groundwater pH varied from 3.63 to 5.46 standard units. The groundwater pH increased in all wells when compared to May 2012, but remained slightly lower than the March 2011 event. Arsenic was only detected in one (CH-MW-03) of the seven wells at concentrations greater than the NC 2L standard of 10 µg/L. Dissolved arsenic was detected at a concentration of 11.2 µg/L at this location; however, the total arsenic concentration was less than the NC 2L standard. Lead was only detected in one (CH-MW-07) of the seven wells at concentrations greater than the NC 2L standard of 15 µg/L. Total and dissolved lead were detected in groundwater collected from CH-MW-07 at concentrations of 15.4 µg/L and 22.8 µg/L, respectively.

The October sampling results are consistent with the original sampling event and suggest that the May sampling results may not have been an accurate indication of groundwater conditions at the site, as discussed further below.

3.6.4 Summary of Groundwater Sampling Results

Analytical data from groundwater samples collected between March 2011 and October 2012 indicate that arsenic was only detected in filtered samples from one well at concentrations above the NC 2L standards. Lead was detected at concentrations

above the NC 2L standards; however, the analytical results from May 2012 differed significantly from the other two events. Based on the data, lead concentrations are pH dependent. Well installation activities could have created a mechanism for sulfate oxidation which resulted in the temporary decrease in pH observed during the May 2012 event. In October 2012, when pH levels increased and stabilized, lead was only detected above the NC 2L standards in groundwater from one well (CH-MW-07).

3.7 Investigation-Derived Waste Sampling and Disposal

A total of 42 drums (12 containing decontamination fluids/purge water and 30 containing soil/debris/personal protective equipment) were generated during the April 2010 through October 2012 sampling activities at the Site. IDW sample results from the April 2010 through October 2012 sampling activities are presented in Tables 3-4 and 3-5. Based on the laboratory analytical results, two drums of solid IDW were classified as hazardous waste due to the presence of lead at a concentration of 123 mg/L. Haz-Mat Transportation and Disposal, Inc. (Haz-Mat) transported the hazardous solid drums for disposal at the Clean Harbors Deer Park facility in LaPorte, Texas. All remaining waste was classified as non-hazardous material. Haz-Mat transported and disposed of non-hazardous liquid waste at their Charlotte, North Carolina facility and all other waste materials at the BFI/Charlotte Motor Speedway Landfill in Concord, North Carolina. Copies of the waste manifests are provided in Appendix E.

3.8 Field Quality Control Sample Results

ARCADIS collected field quality control samples in accordance with the QAPP contained in the SDWP. Field quality control samples were collected in order to check the adequacy of equipment decontamination procedures and to allow for the evaluation of potential cross-contamination of samples due to the equipment. Lead was detected at a low concentration (0.0519 mg/L) in the equipment blank sample collected on April 21, 2010. This low blank detection did not have any impact on the sample data quality or result in data qualifications. Arsenic was detected at a low estimated concentration (0.00830 mg/L) in the dissolved equipment blank sample collected on October 3, 2012. Some of the dissolved groundwater samples collected on the same day were qualified based on this detection; however, all data remained usable. Arsenic and lead were not detected in any of the other equipment blanks. Field quality control sample results are presented in Table 3-6.

4. Removal Action Strategy

4.1 Introduction

4.1.1 Soil

As described in Section 3, arsenic and lead were detected in soil above the SSALs of 27 mg/kg and 270 mg/kg, respectively. The conservative SSALs were selected to accomplish all soil removal required by both agencies at the site on a one-time basis to eliminate the potential need to perform future soil removal actions at the site.

To address arsenic-and lead-impacted media, EMES will:

- excavate shallow impacted soil where accessible from the unpaved areas of Parcels 12103203, 12103204, 12103205, 12103206, 12103207, 12103208, 12103209, 12103211, 12103212, 12103217, 12103218, and 12103219 and transport off-site for disposal;

- Ensure that an adequate cap (asphalt, concrete, or clean soil over a demarcation liner) is in place over areas that cannot be accessed; and

- implement Land Use Restrictions (LURs), as needed, to prohibit excavation in any areas where soils with arsenic and/or lead above SSALs cannot be practically removed.

EMES will excavate arsenic and lead containing soil to the extent practical considering the highly developed nature of the Site and dispose of these materials off-site. The removal areas encompass a total area of approximately 1.4 acres. Excavation depths are estimated to vary from 1 to 4 feet bgs for an approximate total volume of 4,825 cubic yards. The primary goal of the soil removal is to eliminate the potential for direct exposure, by removing surficial soil containing arsenic and/or lead above the SSALs and covering any remaining arsenic/lead-containing soils with a minimum of 2’ of clean soil fill, or maintaining/improving existing asphalt/concrete cover. The secondary goal of the soil removal is to reduce the potential for lead migration from soil into groundwater by removing as much soil containing lead above the SSAL as practical based on accessibility.

4.1.2 Groundwater

As described in Section 3, arsenic was only detected in filtered samples from one well at a concentration above the NC 2L standard of 10 μg/L. Lead concentrations were dependent upon pH, but did exceed the NC 2L standard of 15 μg/L in at least one well. Although the impacts to groundwater at the Site are not considered significant, groundwater at the Site does exhibit the presence of lead in excess of the NC 2L groundwater standard.

Upon completion of the removal action, groundwater quality at the Site is expected to improve in direct response to the source material removed. A groundwater monitoring plan will be submitted with the removal action completion report following site restoration activities. This plan will include the collection and analysis of groundwater samples from existing groundwater monitoring wells to document improvements in groundwater quality.

4.2 Objectives

The overall objective of the removal action is to safely remove impacted soil to the extent practical while:

- minimizing the disruption to the business owners adjacent to the construction area by completing construction activities in a timely manner;
- protecting the structural integrity of permanent features (roadways, buildings, utilities, etc.);
- restoring the properties to conditions that are as close to original as can be reasonably expected considering the nature of the planned construction, or in a manner that is agreeable to EMES and the affected property owners; and
- Prevent exposure to groundwater containing elevated lead.

4.3 Removal Action

The removal action for this Site was developed in consideration of a number of factors. At a minimum, the removal action must be protective of human health and the environment. The presence of arsenic and lead in soil above the SSALs represents a potential contact exposure risk to persons working in impacted soil.

The removal plan for this Site includes the excavation of soil located on 12 parcels covering a total area of approximately 1.4 acres. Soil will be removed based on detected concentrations of arsenic and/or lead above the SSALs and the ability to access those soils while meeting the objectives listed in Section 4.1. The removal of all impacted soil will not be practical due to the presence of subsurface utilities, paved surfaces, buildings, adjacent roadways, and steep topography in some portions of the site. Additional details on the soil removal actions are included in the sections below.

4.3.1 Soil Removal Action

The first portion of the removal plan for this Site includes the excavation and off-site disposal of impacted soil. The proposed horizontal and vertical removal limits are depicted on Figure 4-1. This figure also depicts areas where soils are expected to require stabilization prior to offsite disposal as discussed below. Polygons were used to illustrate the anticipated depths of excavation in removal areas where impacted soil was detected during site investigation activities. The horizontal limits are based on the midpoint between soil borings, property lines (where applicable), or the edge of an impervious surface. The vertical limits of impacted soil are based on the maximum depth at which arsenic and/or lead was detected above the SSALs in individual sample locations, the depth required to allow installation of a soil cap to minimize the potential for exposure by future workers, or the maximum depth expected to be achieved based on limitations such as structural integrity of buildings/paved areas, utilities, etc. Approximately 1.4 acres of impacted soil are proposed for removal at depths varying from 1 to 4 feet bgs, with a total estimated volume of approximately 4,825 cubic yards. Excavation limits may be extended both vertically and horizontally in the field, if practical, in the event that:

- Magenta-stained soils are present in the sidewalls and/or base of the excavation areas; and/or

- Soil containing arsenic and/or lead above the SSALs are detected at the base of the excavation and additional vertical excavation will not jeopardize the integrity of nearby structures.

The intent of the removal action is to remove the maximum amount of impacted soil from each property, to the extent practicable. However, soil removal may be limited by the presence of structures (i.e., pavement, buildings, roadways, etc.), presence of groundwater or rock, and presence of utilities. If soil removal is not practical to the maximum depth of impacted media, and arsenic and/or lead are shown to still be present in subsurface soil at concentrations above the SSALs, a high visibility,

degradation resistant, demarcation liner will be installed at the base of the excavation and backfilled in place to identify the boundary between backfilled soil and unexcavated soil that contains arsenic and/or lead above SSALs.

Waste characterization results are presented in Table 3-2 and sample locations are presented on Figure 3-1. The following two samples contained TCLP lead concentrations above 5.0 mg/L:

- DU-SB-51, collected from 0 to 2 feet bgs; and
- DU-SB-94, collected from 0 to 4 feet bgs.

The soil surrounding these locations will require either stabilization to reduce leachable lead prior to offsite disposal at a RCRA Subtitle D landfill, or transportation to a RCRA Subtitle C landfill for disposal.

Soil excavation will be performed adjacent to roadways and buildings. Soils along roadways and buildings will be removed to the extent shown on Figure 4-1 or as close to the extent such that the structural integrity of these features will not be impacted. Additionally, soil will not be excavated beneath areas that are paved or covered with concrete or asphalt. The sidewalls of the excavations adjacent to these areas will be sloped or benched at an initial ratio of 1V:2H (vertical to horizontal grade). Steeper excavation may be performed based on site conditions and a review of soil conditions by a competent person. Sloping or benching of the excavation will also be performed adjacent to utility poles, utility pedestals, and utility guy wires. Excavation around utility lines and pipes will be performed to the extent that these lines can be adequately protected during excavation. Based on a review of utilities observed at the Site, numerous gas lines, water lines, sewer lines, underground/overhead cable/telephone lines, and underground/overhead electric lines are present at the site.

All properties at which arsenic and/or lead have been detected above the SSALs that have impacted soil remaining at the conclusion of the removal action will be deed-restricted to limit the future use of the properties. In the event that it becomes necessary in the future to excavate or remove additional impacted soil from an individual property, soil removal activities will be coordinated with, and performed by, representatives of EMES. Such activities may include, but are not limited to, the repair or replacement of subsurface utilities.

4.3.2 Groundwater Monitoring

As discussed above, a plan for further groundwater evaluation will be developed following the removal action.

4.3.3 Land Use Restrictions

The second portion of the removal plan for this Site includes the implementation of LURs. Some soils containing arsenic and/or lead above SSALs will not be practical to remove due to proximity to the structures onsite, because they can be effectively capped in place, or because they are located beneath buildings or areas that are currently paved. LURs will be used to manage the risk for potential contact exposure to persons working on the property in the future.

5. Removal Action Work Plan

5.1 Introduction

The Removal Action Work Plan (RAWP) presented in this section has been prepared to outline the technical approach and methods for conducting a removal action at the Site. This RAWP includes two types of actions. The first includes the excavation, onsite stabilization as necessary, and offsite disposal of soils that exceed SSALs. Soil will not be removed from beneath areas that are paved or covered with asphalt/concrete or buildings, and only limited excavation will be performed around subsurface utilities (e.g., utility poles, service pedestals, etc.), and adjacent to the roadways and buildings. Excavated areas will be backfilled and restored to existing conditions to the extent practical, or in a manner that is acceptable to EMES and the affected property owners. The second type of action is the implementation of LURs to prevent access to impacted soil remaining on the site beneath buildings, asphalt/concrete, hardscapes, or beneath or adjacent to subsurface utilities.

Because residual concentrations of arsenic and/or lead above SSALs will remain in some areas, EMES will negotiate LURs as needed with the affected property owners following the completion of the removal action. Properties where arsenic and/or lead will remain at concentrations above SSALs will be enrolled in an annual monitoring program. This program will include inspections to maintain the integrity of the restored areas and ground cover, and assistance to property owners or utility companies when it is necessary to excavate impacted soils for relocating/repairing utilities. A Post-Removal Site Control Plan will be developed which identifies all post-removal monitoring for the Site. The Post-Removal Site Control Plan will be submitted to NCDENR and USEPA for review, comment, and approval as part of the final Removal Action Summary Report (discussed in further detail in Section 5.4.3).

This RAWP provides a description of the overall strategy for implementation of the removal action at the Site. Detailed plans for implementing this strategy, including the protection of workers during construction activities, will be prepared by EMES's Removal Action Contractor (RAC). Plans prepared by the RAC will be submitted to USEPA for review, comment, and approval prior to the start of work.

5.1.1 Work Plan Objectives

The objectives of the removal action are to:

- Excavate and dispose of impacted soil containing greater than or equal to 270 mg/kg of lead and 27 mg/kg of arsenic, to the extent practicable, in a manner satisfactory to USEPA and NCDENR;
- Backfill all excavated areas with imported materials;
- Maintain, and enhance if needed, existing asphalt/concrete cover in areas where asphalt/concrete currently covers impacted soils.
- Restore the affected properties to the extent practicable; and
- Repair site features in the event of accidental contact/damage.

5.2 Project Organization

This section describes the roles of the various organizations involved in developing and implementing the removal action.

5.2.1 Regulators/Agencies

The USEPA is the lead regulatory agency for this project and the soil removal will be conducted in accordance with the AOC for the Site to be issued by USEPA prior to the start of work. The USEPA On-Scene Coordinator (OSC) will be responsible for providing and coordinating regulatory oversight and direction, as necessary, including the review, comment, and approval of all required submittals. The USEPA OSC, or his designee, will also perform field oversight of all removal action activities on behalf of the USEPA. The USEPA OSC for this project is still to be assigned by USEPA Region 4. The USEPA Project Manager for this project is Mr. Ken Mallary.

NCDENR will also provide regulatory oversight for this project. The NCDENR Project Manager will be responsible for providing and coordinating all NCDENR regulatory oversight and direction, as necessary, including review of, and comment on, all required submittals. The NCDENR Project Manager for this project is Mr. David Mattison.

5.2.2 Responsible Party

EMES is the party responsible for VCC-related impacts to the Site. While EMES will be represented in the field by the Engineer and RAC (as described below), EMES representatives will maintain an active role in the project through periodic Site visits,

participation in project meeting updates, and review/approval of project activities and reports. The EMES Project Manager is Mr. Bruce Frink.

5.2.3 Engineer

On behalf of EMES, ARCADIS of Raleigh, North Carolina will be responsible for the engineering aspects of the removal action. General ARCADIS responsibilities include, but are not limited to, the following:

- preparing this RAWP and appendices;
- reviewing materials prior to submittal to the USEPA and NCDENR;
- interfacing with regulatory agency personnel;
- collecting post-excavation and waste characterization samples;
- preparing and submitting status reports to the USEPA and NCDENR;
- managing field activities; and
- preparing and submitting the final report to the USEPA and NCDENR.

ARCADIS has designated Mr. Matthew Pelton, P.E. as the Project Manager and Ms. Kirstyn White, P.E. as the Assistant Project Manager to oversee implementation of the above activities.

5.2.4 Removal Action Contractor

EMES will retain a RAC to perform the removal action. Responsibilities of the RAC include, but are not limited to, the following:

- preparing and submitting all plans, permits, and other submittals specified in this RAWP for approval by EMES and the USEPA;
- providing the labor, material, and equipment necessary to complete the removal action activities in accordance with this RAWP and the approved project plans;

- coordinating the handling, transport, and disposal of waste material, including soils, residuals, and personal protective equipment (PPE);
- performing surveying; and
- providing site health and safety monitoring.

The RAC will appoint one member of its onsite removal action team as the Site Supervisor. The Site Supervisor will be a qualified professional with experience in removal actions and will coordinate all activities in accordance with the RAWP. In the event that an unexpected circumstance may hinder or prevent the RAC from adhering to the RAWP or approved project plans, the Site Supervisor will consult immediately with the Engineer.

5.2.5 Waste Disposal Facility

Excavated soils that do not contain TCLP arsenic and/or lead concentrations equal to or greater than 5.0 mg/L will be disposed at the following RCRA Subtitle D landfill:

BFI / Charlotte Motor Speedway Landfill
5105 Morehead Road
Concord, NC 28027
704-782-2004
EPA ID: NCD9862124880

Excavated soil that contains TCLP arsenic and/or lead concentrations equal to or greater than 5.0 mg/L will either be stabilized onsite and disposed of at the facility listed above, or will be disposed of offsite without stabilization at the following RCRA Subtitle C landfill:

Chemical Waste Management
P.O. Box 55
Highway 17 North, Mile Marker 163
Emelle, AL 35459
205-652-8156
RCRA No.: ALD000622464

Notifications for scheduled waste shipments will be submitted to the USEPA OSC prior to shipment. Soils will only be sent to the Chemical Waste Management Subtitle C

landfill in the event that arsenic and/or lead concentrations cannot be stabilized onsite to achieve TCLP concentrations below 5.0 mg/L or if project timing requires more rapid disposal of soils with TCLP concentrations above 5.0 mg/L.

5.2.6 Analytical Laboratory

Test America, Inc. (TestAmerica) of Nashville, Tennessee has been selected for the analysis of post-excavation confirmation samples collected as part of this project. If additional laboratories are needed to process confirmation samples from the Site, approval will be requested from the USEPA.

5.3 Technical Approach and Scope of Work

This removal action consists of soil removal activities and maintenance of an existing asphalt/concrete cap. Figure 4-1 depicts the soil removal areas and approximate depths of excavation. As part of the removal action, impacted media will be excavated, dewatered (if needed), stabilized using a phosphate-based stabilization reagent (as needed to facilitate disposal of the soil at a Subtitle D landfill), and disposed of off-site in accordance with all applicable regulations. All excavated soil areas will be backfilled with imported fill and restored as described in Section 5.3.10.

The following sections describe these activities in more detail.

5.3.1 Securing Access Agreements for Construction

Upon approval of this RAWP by USEPA and NCDENR, EMES will start the process of contacting affected property owners to obtain access agreements to perform the work. No work will be performed on any property until a reasonable access agreement has been signed by the existing property owner.

5.3.2 Mobilization

Prior to mobilization, the RAC will prepare submittals for review and approval by the USEPA and NCDENR. These submittals include a Site Operations Plan (SOP) (which includes an Erosion and Sedimentation Control Plan, Traffic Management Plan, Dust Control Plan, Noise Control Plan, Stormwater Management Plan, Excavation Equipment Decontamination Plan, Site Security Plan, Contingency Plan, and Project Schedule) and a Health and Safety Plan (HASP). A detailed description of the required contents of these submittals is presented in Section 5.3.8. Equipment and personnel needed to implement the removal action will then be mobilized to the Site. Local

suppliers for goods and services (e.g., backfill, water, landscaping materials) will be identified upon mobilization to the Site. Mobilization will also include establishing temporary facilities (e.g., sanitation, refueling, material laydown areas, etc.) and establishing temporary access roads, as needed.

5.3.3 Preparation of the Site for Removal Action Activities

The following sections describe the activities that will be performed at the Site to prepare for the intrusive phases of the removal action.

5.3.3.1 Installation of Erosion and Sediment Control Measures

Erosion and sedimentation control (E&SC) measures (e.g., silt fence, etc.) will be installed at the Site to prevent the migration of soil-bound contaminants to surface water bodies. The type and location of E&SC measures to be installed will be specified in the E&SC Plan to be prepared by the RAC and submitted to the Land Quality Section of NCDENR and the City of Charlotte Land Development Division for informational purposes. E&SC measures will be inspected regularly by the RAC to monitor their continued effectiveness. Additional E&SC measures will be installed, as necessary, as the removal action progresses to prevent the transport of eroded soil from the Site.

Appropriate measures will be taken to minimize the volume of water accumulating in areas of disturbed soil that potentially contain elevated arsenic and/or lead concentrations. Water that does not come into direct contact with disturbed soil will be directly discharged into an appropriate drainage feature. Water that has contacted disturbed soil that potentially contains elevated concentrations of arsenic or lead will be allowed to naturally infiltrate/evaporate, or will be sampled and/or treated in accordance with the Stormwater Management Plan prepared by the RAC prior to removal for offsite disposal or discharge.

5.3.3.2 Subsurface Utility Markout

All necessary precautions will be taken to protect the various subsurface and aboveground utilities that exist at the Site from damage. A review of all available Site plans and/or as-builts will be conducted to identify the general location of subsurface utilities. Necessary permits and utility clearances will be obtained prior to any subsurface activities. The utility companies (and/or any private organization that is authorized by the utility companies to delineate the presence of all subsurface services) will be contacted at least 72 hours before onsite intrusive activities are

started. A utility markout will be conducted at the Site to locate all subsurface utilities (e.g., electrical, telephone, sewer, water, gas, etc.). In addition, a private utility locating contractor (or equivalent) will scan the area for the presence of subsurface utilities prior to excavation. The field copy of the Site plans will then be updated with the information obtained from the markout. During the markout, the location of aboveground utilities will also be identified. Section 5.3.5.2 describes the minimum requirements that will be taken to protect the utilities.

5.3.4 Clearing and Grubbing

Clearing and grubbing of the soil removal areas will be performed prior to or concurrent with excavation activities. The aboveground portions of any trees will either be disposed of off-site or chipped and reused on-site for dust control. Portions of the vegetation in contact with the soil (e.g., stumps, roots) will be excavated with the soil and disposed of off-site.

5.3.5 Excavation and Stabilization of Impacted Soil

The first portion of the removal action plan includes the excavation and off-site disposal of arsenic and lead impacted soil. To the extent practicable, soil will be excavated and loaded directly into trucks and transported to a RCRA Subtitle D landfill. It has been determined that some of the materials may require stabilization to reduce leachable lead concentrations prior to offsite disposal at a RCRA Subtitle D landfill. If stabilizing the soil onsite proves to be impractical, these materials will be transported to a RCRA Subtitle C landfill for disposal.

Excavated soil may need to be dewatered prior to off-site disposal. The method of dewatering or solidification (e.g., use of solidification agents) will be proposed by the RAC in the Site Operations Plan but will, at a minimum, be required to pass USEPA's liquid waste characterization test (also known as the paint filter test).

5.3.5.1 Soil Excavation

Soil will be excavated from the areas shown on Figure 4-1. The estimated areal dimensions, depths, and in-place volumes for each excavated area are presented in Table 5-1. Soil will generally be removed using standard construction equipment (e.g., backhoe, trackhoe) and manual shoveling. Large pieces of construction debris (e.g., chunks of concrete, brick foundations, railroad ties) greater than or equal to approximately 1 cubic yard, will either be left in place or will be cleaned and left on site at a location agreeable to the property owner. Dry decontamination methods (e.g.,

brushing) will be used to remove impacted soil from the surfaces of this debris. Wet decontamination methods, such as pressure washing, may be used to remove residual soils if dry decontamination methods are not adequate. Smaller debris such as bricks will be excavated and handled with the excavated soil.

The depth of excavation at the Site will generally vary from 1 to 4 feet bgs; however, the actual limits of excavation will be determined in the field based on the results of the confirmation soil sampling program and the presence of subsurface utilities, shallow groundwater or bedrock, etc. The initial depths of excavation are shown on Figure 4-1 and are based on data generated from soil sampling performed at the Site.

Soil will not be excavated from beneath areas that are paved or covered with concrete, structures, buildings, or other permanent features. At a minimum, excavation sidewalls adjacent to these areas will be sloped to prevent undermining. At the elevation of the bottom of the concrete or pavement, excavation will be performed at least 6 inches laterally from the toe of the concrete or pavement before deeper excavation continues. Additional excavation will be performed by sloping or benching the excavation adjacent to these areas at a slope no greater than a 1V:2H, or as determined by a structural engineer. The RAC will perform a structural analysis prior to mobilization to evaluate the appropriate sloping/benching requirements that will allow for a safe excavation that does not undermine hard features at the Site which include, but are not limited to, roadways, asphalt/concrete parking lots, utilities, etc. This structural analysis will be presented in the SOP as an appendix for USEPA's review and approval. In the event that this analysis supports a more aggressive sloping that would result in the excavation of additional impacted materials, this revised sloping will be used in lieu of the proposed 1V:2H slope described above.

Waste characterization analyses have been performed at select boring locations within the excavation areas. The purpose of this sampling was to characterize impacted soils for disposal. Soils with TCLP lead concentrations greater than or equal to 5.0 mg/L will either be stabilized and disposed of at a RCRA Subtitle D landfill or disposed of without stabilization at a RCRA Subtitle C landfill. Stabilization, if performed, will be conducted in place or at a centralized location at the Site.

Excavation within utility corridors will be conducted by hand or in accordance with utility owner specifications. No mechanical excavation (e.g., by excavators) will take place within 2.5 feet of a marked subsurface utility. All excavation to be performed within 2.5 feet of a marked subsurface utility will be performed by hand or using other approved methods (air knife, etc.). Utilities will be protected in the manner prescribed by the utility

company. The following describes the general actions that will be taken to protect the utilities:

1. Excavation of soil above and adjacent to a known utility will be performed manually in accordance with the methods, tolerances, and directions specified by the utility owner. At a minimum, all excavation above or within 2.5 feet of a marked utility will be performed manually. The use of an air knife or other similar equipment to remove soil around utilities will be discussed with utility owners on an individual basis.

2. Soil beneath any piped utilities or electric lines may be removed based on the ability to relocate the utility during excavation. Piped utilities include water lines and underground drain lines (if present). Piped utilities do not include phone lines and cable television lines. These lines are generally flexible and can be relocated within the excavation areas as work progresses.

3. If piped utilities are to be left in place during excavation, a soil shelf equal to the width of the pipe, plus a minimum of 6 inches on each side of the pipe will be left in place beneath the exposed piped utility for support. Soil beneath the piped utilities will then be sloped from the top edge of the shelf to the bottom of the excavation at a slope no greater than 1V:2H.

Modifications to the above procedures may be proposed and, if approved, included in the SOP (Section 5.3.8.1).

5.3.5.2 Soil Stabilization

Lead present in the excavated soil may be stabilized as needed to reduce its leachability to levels that will facilitate acceptance of the soil at a RCRA Subtitle D landfill. Pending approval of the waste profile by the landfill, stabilized soil will have leachable arsenic and lead concentrations that are below the RCRA standards.

The Universal Treatment Standards (UTS) for lead and arsenic are 0.75 mg/L TCLP and 5.0 mg/L TCLP respectively. However, based on the federal alternative treatment standards for soil (promulgated at 40 CFR 268.49), which state that successful treatment of a characteristically hazardous soil (such as the soil present at the Site) requires that the characteristic be eliminated and that the underlying hazardous constituents are reduced by 90%, or to concentrations less than 10 times the UTS. Therefore, the alternative treatment standards for soil at this Site are 7.5 mg/L TCLP for lead and 50 mg/L TCLP for arsenic. However, because this soil is to be disposed of

at a Subtitle D Landfill, the TCLP limits of 5.0 mg/L for lead and arsenic apply. Therefore, 5.0 mg/L TCLP for lead and arsenic will be used as the standard for treatment at the Site. The final treatment standard will be determined by the receiving landfill after its review of the waste profile.

Stabilization (as needed) will be achieved via the mixing of a phosphate-based stabilization reagent (or equivalent) with the soil. Mixing will be performed via mechanical means using equipment such as an excavator bucket. Soil will be treated with stabilization reagent in batches of approximately 200 tons so that efficient and uniform blending of the stabilization reagent with the soil can be achieved. Soil samples will be collected to evaluate compliance with the above standards at a minimum frequency of one sample per 600 tons of treated soil to be disposed at the landfill, or at a frequency determined by the landfill. Each disposal compliance sample will consist of a composite of 10 subsamples collected from the soil pile. Each disposal compliance sample will be analyzed for TCLP arsenic and lead.

5.3.6 Confirmation Sampling Plan

A confirmation sampling and analysis program will be conducted during the soil removal work to guide the excavation activities and confirm that impacted materials have been removed. This program will include the collection of samples from the base of the excavations as described below.

Following removal of the soil to the initial depths listed in Table 5-1 and shown on Figure 4-1, field screening will be conducted at the base of the excavation using a portable XRF instrument. If XRF screening of the surficial soil at the base of the excavation indicates that arsenic and/or lead concentrations are greater than the SSALs, additional rounds of soil removal and XRF screening may be conducted, as appropriate, to verify that sufficient soil has been removed from the excavation; or the area may be capped with a demarcation liner and clean soil fill. This XRF screening procedure may be modified in the field, as necessary, to improve its effectiveness.

Upon completion of removal activities, individual confirmation samples will be collected from individual sub areas excavated to the same depth at a frequency not to exceed one sample (5-point composite) per 5,000 square feet of excavation. All samples will be collected from the base of the excavation from 0 to 6 inches below ground surface and will be analyzed for total arsenic and lead. All samples will be analyzed in accordance with USEPA Contract Laboratory Program procedures. Samples, including field QC samples, will be collected and analyzed in accordance with the procedures in

the Field Sampling Plan and QAPP included in the SDWP (ARCADIS, 2011). A summary of proposed confirmation samples is presented in Table 5-2.

Rapid (24- to 48-hour) turn-around of sample analyses will be requested so that results can be reviewed and evaluated prior to the onset of backfilling. If analyses indicate arsenic and lead concentrations are below the SSALs, the excavation area will be backfilled and restored as described in Section 5.3.10. However, if arsenic or lead are detected at concentrations above the SSALs, additional rounds of vertical soil removal and confirmation sampling will be conducted as appropriate. Vertical soil removal may be limited by the presence of groundwater/rock and the stability of adjacent utilities or structures.

5.3.7 Transport to Disposal Facility

Stabilized and non-stabilized soil containing TCLP concentrations of arsenic and lead below 5.0 mg/L will be transported to a RCRA Subtitle D landfill for disposal; and soils containing TCLP concentrations of arsenic and/or lead equal to or greater than 5.0 mg/L will be transported to the RCRA Subtitle C facility. The RAC will be responsible for coordinating and scheduling the transport vehicles and loading the materials. All waste streams will be characterized before disposal, as required by applicable federal, state, and local laws, rules, and regulations, as well as any additional requirements imposed by the receiving landfill or disposal facility.

Excavated soil will be loaded into dump trucks for transport to the disposal facility. Traffic patterns will be established in the Traffic Control Plan to minimize or prevent trucks that are hauling soil and sediment offsite from traversing bare soil in impacted areas. Trucks that traverse areas containing impacted soils will be decontaminated prior to exiting the impacted areas. Decontamination procedures will be described in the RAC's SOP.

All containers used for the offsite transport of materials will be covered with tarps prior to offsite transport. The RAC will be responsible for verifying that all transportation containers are tarped, manifested, and placarded in accordance with appropriate RCRA and Department of Transportation (DOT) requirements before leaving the Site.

The weight of the transportation containers prior to departure from the Site will be within its allowable loaded capacity for subsequent transport and in compliance with any and all DOT regulations. A daily log of information that includes the date, container identification number, and measured weight of each loaded transportation container to have departed the Site will be compiled.

5.3.8 Submittals

The RAC will prepare documents that describe in detail how the project will be performed. The following documents will be submitted to USEPA and NCDENR for review and comment/approval prior to mobilization to the Site:

- Site Operations Plan; and
- HASP.

The contents of each of these plans are described in the following sections.

5.3.8.1 Site Operations Plan

The RAC will prepare a SOP that will include, but not be limited to, the following items:

- detailed description of the strategy and procedures to be used to accomplish the work;
- detailed description of the sequence of Site excavation and restoration activities;
- detailed description of the procedures used to document pre-removal Site conditions;
- detailed description of methods and materials used to stabilize soil and to control dust/vapors/gasses generated during treatment;
- list of equipment to be used onsite;
- proposed locations for storage areas, stabilization areas, access roads, and material loading areas;
- structural analysis defining safe excavation tolerances adjacent to the utility poles, buildings, and other structures or areas covered with concrete or pavement;
- Erosion and Sedimentation Control Plan;
- Traffic Management Plan;
- Dust Control Plan;
- Noise Control Plan;
- Stormwater Management Plan;
- Excavation Equipment Decontamination Plan;
- Site Security Plan;
- Contingency Plan; and
- Project Schedule.

The SOP will summarize the materials, procedures, controls, and equipment that the RAC intends to utilize during performance of the removal action. The SOP will also address all appropriate issues associated with performing the work and will include detail sufficient for USEPA and NCDENR review and approval.

The proposed method for site remediation must minimize the disruption to the lives of tenants and business owners. To the extent possible, all utilities should remain operable. Any temporary shutdown of utilities will be scheduled in advance and coordinated with the local utility companies, affected property owner(s), and representatives of EMES. To the extent possible, open excavation areas will also be minimized.

Erosion and Sedimentation Control Plan

During the performance of the removal action, the RAC will take all necessary precautions to protect the environment. In doing so, the RAC will protect all water courses, surface waters, groundwater, soils, and air from degradation or damage in accordance with all federal, state, and local laws and regulations.

The RAC will prepare an Erosion and Sedimentation Control Plan (E&SC Plan) that will describe procedures and controls that will be employed to prevent accelerated erosion of areas subject to remediation and to prevent excess sedimentation in drainage pathways. At a minimum, this will include the placement and maintenance of silt fences or other appropriate controls at the appropriate locations around all excavations and temporary material staging areas. All erosion and sedimentation control measures will be inspected regularly and especially after any significant rainfall event to document that maximum control continues to be provided. Following inspection, the erosion and sedimentation control measures will be modified, cleaned, reinforced, replaced, and/or maintained, as necessary. A copy of the E&SC Plan will be submitted to the Land Quality Section of NCDENR and the City of Charlotte Land Development Division for informational purposes.

Traffic Management Plan

The RAC will prepare a Traffic Management Plan that will describe procedures for the movement of trucks and equipment across the Site and to the selected disposal facility in a safe and responsible manner. The Traffic Management Plan will include descriptions of traffic and/or equipment flow patterns across the Site, descriptions of how trucks transporting materials to the landfill will be staged, and other appropriate

provisions for personnel (e.g., flagmen, traffic cones, signs) that will be required to promote the safe passage of trucks/equipment across and adjacent to the Site.

Dust Control Plan

Dust will be controlled based on visual observations and the results of airborne particulate monitoring performed by the RAC. Measures will be taken to control dust produced by excavation, backfilling, loading, and other work-area activities. The RAC will develop a Dust Control Plan to address the safety of both the workers and owners/tenants. In the event that action levels are exceeded, the RAC will investigate the source of the particulates and reduce work productivity and/or employ dust-control measures. Appropriate dust-control measures include spraying equipment and excavation faces with a fine water mist and covering excavated areas and materials with polyethylene after excavation activities. A supply of water and means of dispersion (e.g., a water tank and sprayer) will be maintained onsite for immediate dust control, if necessary. The RAC's plan will identify methods for dust control and provisions for work stoppage based on the appropriate dust action levels.

Noise Control Plan

The RAC will provide for noise monitoring to evaluate employee exposure levels and potential impacts to adjacent properties. The Noise Control Plan will include provisions for Site monitoring (including methods and frequency), hearing protection for workers, and limited work schedules in the event that excessive noise is anticipated. If specific work types result in unacceptable noise levels (> 85 decibels) at the boundaries of the adjacent commercial businesses, the RAC will make provisions for installing noise control measures and/or using alternate equipment or work procedures.

Stormwater Management Plan

To the extent possible, the RAC will make all appropriate provisions to minimize the volume of water accumulating in disturbed areas (i.e., open excavation areas, stockpile areas) containing impacted soils. The RAC will prepare a Water Management Plan that (1) describes the means and methods that will be used to minimize the accumulation of stormwater in excavation areas, and (2) identifies the requirements and procedures for sampling and disposing of water contacting impacted soils. The plan will address coordination of sampling and disposal with the publicly owned treatment works or other permitted facility and will provide procedures that will ensure that all water discharged meets all applicable standards and requirements. Water that does not come into direct

contact with disturbed soil can be rerouted and directly discharged into an appropriate drainage feature.

Excavation Equipment Decontamination Plan

The RAC will prepare a decontamination plan that describes the measures to be used to remove impacted materials from excavation equipment prior to leaving the exclusion zone. Portions of the excavation equipment and transport vehicles that come into contact with impacted soil will be decontaminated prior to leaving the Site or relocated to an area that does not contain elevated concentrations of arsenic and/or lead. Decontamination wastes will be combined with other materials being excavated from the Site and will be transported to a RCRA Subtitle C or Subtitle D landfill, as appropriate.

Site Security Plan

The RAC will prepare a Site Security Plan that describes the measures to be used to safeguard equipment and prevent unauthorized access to open excavation areas and other work areas during the removal action. At a minimum, Site security includes restrictive barriers around all open excavation areas and other areas where hazards may be present. Twenty-four hour surveillance may also be required during portions of the project depending on site conditions.

Contingency Plan

The RAC will prepare a Contingency Plan that includes, at a minimum, the following items:

- Spill Prevention Control and Countermeasures Plan for all materials brought to the work area;
- emergency vehicular access/egress;
- emergency action/evacuation procedures of personnel from the work area;
- listing of all contact personnel with phone numbers, including EMES; the RAC; the Engineer; fire officials; ambulance service; local, county, and State Police; and local hospitals, including routes to local hospitals and procedures for notifying each;
- listing of all contact personnel with phone numbers for the owners of above- and below-ground utilities who are to be contacted in case of damage to any utilities; and

- identification of responsible personnel who will be in a position at all times to receive incoming phone calls and to dispatch contractor personnel and equipment in the event of an emergency situation.

Project Schedule

A Project Schedule will be prepared that includes all elements of the removal action. Work hours and accessibility to the site must be confirmed with the property owners. Additional requirements include:

- horizontal bar chart (Gantt) with separate lines for each section of work, identifying the first work day of each week;
- at a minimum, the following work items:
    - mobilization;
    - site preparation;
    - excavation activities;
    - restoration activities;
    - demobilization; and
- revision and submittal of a construction progress schedule on a weekly basis.

5.3.8.2 Health and Safety Plan

The RAC will prepare, submit, and implement a site-specific HASP that, at a minimum, meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1926.65) and any applicable state regulations. The HASP will be prepared by a Certified Industrial Hygienist and cover all personnel who will be employed by the RAC to perform work at the Site, including direct employees and subcontractors.

For work involving the potential for contact with or exposure to arsenic- and/or lead-containing media, the HASP will comply with 29 CFR 1910, 29 CFR 1926, 40 CFR 260-267, and related regulations that call for the development and implementation of a safety and health program for employees involved in hazardous waste operations.

The HASP will be prepared in accordance with 40 CFR 1910.120 and 29 CFR 1926.65 and will address, at a minimum, the following components:

1. Identification of Key Personnel – Identify, by name and by title, the on- and offsite health and safety personnel responsible for the implementation of health and safety procedures. All onsite personnel involved in the measures must have Occupational Safety and Health Administration (OSHA) 40-hour

Hazardous Waste Training (29 CFR 1910.120 and 1926.65) and the corresponding 8-hour refresher course update. In addition, all onsite personnel must have completed the Loss Prevention System™ safety training required by EMES.

2. Training – Describe and provide certification of all supervisory and onsite personnel having received appropriate health and safety training. Training requirements will also include attending an initial work-area orientation before engaging in any onsite activities. Sign-off sheets acknowledging attendance will be provided.

3. Medical Surveillance – Certify that all supervisory and onsite personnel have received appropriate medical examinations and are able to conduct the tasks required for this project, including, but not limited to, working with chemicals, using respiratory protection, using PPE, and conducting hazardous waste operations in accordance with 29 CFR 1910.120 and 1926.65. Medical monitoring may also include additional clearances as required by EMES.

4. Task-Specific Hazard/Risk Analysis – Identify and provide a means of mitigating all foreseeable biological, chemical, and physical hazards associated with the work, including, but not limited to, hazards associated with exposure to COCs, heavy equipment operation, work area conditions, weather, biological hazards, materials handling, and work around excavated areas.

5. Work Zones – Provide a work area plan that depicts the designation of zones including: (1) Exclusion Zones; (2) Decontamination Zones; and (3) Support Zones. The level of personal protection for each zone must be included.

6. Personal Safety Equipment and Protective Clothing – Identify personal safety equipment and protective clothing to be used and available onsite. This will include the identification of expected levels of protection (A, B, C, D) for each task, and the action levels for PPE upgrades. A respiratory protection program that meets the requirements of 29 CFR 1910.134 and establishes specific requirements for any respirator use will be included.

7. Personal Air Monitoring – Identify protocols and criteria associated with personal air monitoring of onsite personnel.

8. Personnel Decontamination – Describe methods and procedures to be used for decontamination of site personnel and management of PPE.

9. Material Safety Data Sheets (MSDSs) – Provide MSDSs for all materials to be brought to the work area and constituents that are expected to be encountered in the course of implementation of the removal action.

10. Construction Safety Procedures (OSHA 1926.1 – 1926.652, Subpart A-P) – Provide procedures to address excavation and trenching safety procedures, as well as a daily work area safety inspection checklist to evaluate these items.

11. Standard Operating Procedures and Safety Programs – Provide those required by applicable sections of 29 CFR 1910 and 1926.

Determination of the appropriate level of worker safety equipment, procedures, or modification to equipment and procedures based on work-area conditions will be made by the RAC as a result of work-area visit(s), review of available information, and anticipated work area activities.

5.3.9 Site Restoration

Upon completion of the excavation activities and receipt of acceptable confirmation sample analytical results, the Site will be restored as closely as possible to the pre-excavation conditions, or in an alternate manner that is agreeable to EMES and the affected property owners.

In general, excavation areas in vegetated areas will be backfilled and compacted within 6 inches of existing grade. The remaining 6 inches will be backfilled with: (1) topsoil in areas expected to support vegetation or ground cover; or (2) crusher run stone in areas expected to support vehicular traffic. Subsurface fill and topsoil proposed by the RAC for site restoration will be analyzed for pH, grain size, total organic carbon (TOC), TAL metals, Target Compound List (TCL) volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs). Sources that contain elevated concentrations of any of the aforementioned constituents or significantly different physical characteristics (pH, grain size, TOC) than the existing Site soils will be rejected. Sample analytical results will be submitted to both USEPA and NCDENR for review and approval prior to use.

5.4 Reporting

5.4.1 Weekly Reports

Brief written progress reports that describe actions taken pursuant to the AOC will be submitted by EMES to the USEPA OSC and NCDENR on a weekly basis. Each weekly report will:

- describe all significant developments of the preceding 7-day period, including actions performed and any problems encountered;
- describe developments anticipated during the next reporting period, including anticipated problems and a schedule of work to be performed; and
- discuss planned resolutions of past and anticipated future problems.

5.4.2 Post-Removal Site Control Plan

A Post-Removal Site Control Plan will be developed which identifies all post-removal monitoring for the Site. The Post-Removal Site Control Plan will be submitted to NCDENR and USEPA for review, comment, and approval as part of the final Removal Action Summary Report (discussed in further detail below).

5.4.3 Final Report

A final report summarizing the actions taken will be submitted to the USEPA and NCDENR for review and approval within 60 days of completion of the removal action. The final report will conform, at a minimum, with the requirements of Section 300.165 (“OSC Reports”) of the National Contingency Plan and will include the following:

- a listing of the quantities and types of materials removed from the Site;
- discussion of the removal and disposal options considered for removed materials;
- a listing of the ultimate destinations of all removed materials;
- a presentation of the analytical results of all sampling and analyses performed; and

- appendices containing all relevant documentation generated during the removal action (e.g., manifests, permits).

The final report will also include the following certification signed by a person who supervised or directed the preparation of the report:

"Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

5.5 Institutional Controls

Institutional controls may be implemented for certain parcels at the Site following completion of the removal action if all impacted soil cannot be removed. While specific language has not yet been developed, it is expected that the following issues will likely be addressed in the institutional controls:

- a description of the post-removal action Site conditions;
- location, depth, and description of demarcation liners used (if applicable);
- description of any restrictions on groundwater use at the site;
- reference to the Site Delineation Report and Removal Action Work Plan and the Removal Action Completion Report; and
- notification that post-removal Site conditions may result in the need for implementation of additional safety procedures during future subsurface construction activities.

5.6 Schedule

The estimated schedule for the removal action is presented on Figure 5-1. The project schedule is dependent, in part, on securing the necessary access agreements from property owners, negotiation with property owners regarding Site restoration, and the RAC's schedule, which will be included in the Site Operations Plan. Other potential issues that could lead to project delays include, but are not limited to, weather and the requisition of necessary permits.

6. References

ARCADIS, 2010. Removal Site Evaluation Report, Former Virginia-Carolina Chemical Corporation Site, Charlotte, North Carolina, July 2010.

ARCADIS, 2011. Site Delineation Work Plan, Former Virginia-Carolina Chemical Corporation Site, Charlotte, North Carolina, Revised January 2011.

ARCADIS, 2012. Site Delineation Report and Removal Action Work Plan, Former Virginia-Carolina Chemical Corporation Site, Durham, North Carolina, Revised January 2012.

Environmental Data Resources (EDR), 2009. The EDR Radius Map™ with GeoCheck®, VCC-Charlotte, 301 West Tremont Avenue, Charlotte, NC 28203, Inquiry Number: 2662591.2s. December 18, 2009.

Goldsmith et. al., 1988. *Geologic Map of the Charlotte 1º x 2º Quadrangle, North Carolina and South Carolina*. Goldsmith, Richard et. al. United States Geological Survey (USGS) Miscellaneous Investigation Series Map I-1251-E. 1988.

LeGrand, 2004. *A Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina: A Guidance Manual.* LeGrand, H.E. Prepared for the North Carolina Department of Environment and Natural Resources (DENR), Division of Water Quality, Groundwater Section. February 2004.

North Carolina Geological Survey (NCGS), 1985. *Geologic Map of North Carolina: North Carolina Department of Natural Resources and Community Development*, scale 1:500000.

USEPA, 1997. Work Plan for Former Phosphate/Fertilizer Plants Initiative, North Charleston, South Carolina. Prepared by Craig Zeller, USEPA Region 4, Atlanta, Georgia, December 16, 1997.

Tables

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
Soil												
CH-SB-01_0_0.5	0-0.5	4/19/2010	X	X		X						
CH-SB-01_0.5_2	0.5_2	4/19/2010	X	X		X						
CH-SB-01_2_4	2_4	4/19/2010	X	X		X						
CH-SB-02_0_0.5	0_0.5	4/19/2010	X	X		X						
QAQC_DUP_01	0_0.5	4/19/2010	X	X		X						Field Duplicate of CH-SB-02_0_0.5
CH-SB-02_0.5_2	0.5_2	4/19/2010	X	X		X						MS/MSD
CH-SB-02_2_4	2_4	4/19/2010	X	X		X						
CH-SB-03_0_0.5	0_0.5	4/19/2010	X	X		X						
CH-SB-03_0.5_2	0.5_2	4/19/2010	X	X		X						
CH-SB-03_2_4	2_4	4/19/2010	X	X		X						
CH-SB-04_0_0.5	0_0.5	4/19/2010	X	X		X						
CH-SB-04_0.5_2	0.5_2	4/19/2010	X	X		X						
CH-SB-04_2_4	2_4	4/19/2010	X	X		X						
CH-SB-05_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-05_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-05_2_2.3	2_2.3	4/20/2010	X	X		X						
CH-SB-06_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-06_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-06_2_4	2_4	4/20/2010	X	X		X						MS/MSD
CH-SB-07_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-07_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-07_2_4	2_4	4/20/2010	X	X		X						
CH-SB-08_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-08_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-08_2_4	2_4	4/20/2010	X	X		X						
QAQC_DUP_02	2_4	4/20/2010	X	X		X						Field Duplicate of CH-SB-08_2_4
CH-SB-09_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-09_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-09_2_4	2_4	4/20/2010	X	X		X						
CH-SB-10_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-10_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-10_2_4	2_4	4/20/2010	X	X		X						
CH-SB-11_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-11_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-11_2_4	2_4	4/20/2010	X	X		X						
CH-SB-12_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-12_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-12_2_3	2_3	4/20/2010	X	X		X						
CH-SB-12_4_6	4_6	4/21/2010	X	X		X						
CH-SB-13_0_0.5	0_0.5	4/20/2010	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-13_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-13_2_4	2_4	4/20/2010	X	X		X						
CH-SB-14_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-14_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-14_2_4	2_4	4/20/2010	X	X		X						
CH-SB-15_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-15_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-15_2_4	2_4	4/20/2010	X	X		X						
CH-SB-16_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-16_0.5_2	0.5_2	4/20/2010	X	X		X						
QAQC_DUP_03	0.5_2	4/20/2010	X	X		X						Field Duplicate of CH-SB-16_0.5_2
CH-SB-16_2_4	2_4	4/20/2010	X	X		X						MS/MSD
CH-SB-17_0_0.5	0_0.5	4/20/2010	X	X		X						
CH-SB-17_0.5_2	0.5_2	4/20/2010	X	X		X						
CH-SB-17_2_4	2_4	4/20/2010	X	X		X						
CH-SB-18_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-18_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-18_2_4	2_4	4/21/2010	X	X		X						
CH-SB-19_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-19_0.5_2	0.5_2	4/21/2010	X	X		X						
QAQC_DUP_04	0.5_2	4/21/2010	X	X		X						Field Duplicate of CH-SB-19_0.5_2
CH-SB-19_2_4	2_4	4/21/2010	X	X		X						
CH-SB-20_0_0.5	0_0.5	4/21/2010		X								
CH-SB-20_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-20_2_4	2_4	4/21/2010	X	X		X						
CH-SB-21_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-21_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-21_2_4	2_4	4/21/2010	X	X		X						
CH-SB-22_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-22_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-22_2_4	2_4	4/21/2010	X	X		X						
CH-SB-23_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-23_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-23_2_4	2_4	4/21/2010	X	X		X						
CH-SB-23_4_6	4_6	4/22/2010	X	X		X						
QAQC_DUP_05	4_6	4/22/2010	X	X		X						Field Duplicate of CH-SB-23_4_6
CH-SB-23_6_8	6_8	4/22/2010	X	X		X						
CH-SB-24_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-24_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-24_2_4	2_4	4/21/2010	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-25_0_0.5	0_0.5	4/21/2010	X	X		X						
CH-SB-25_0.5_2	0.5_2	4/21/2010	X	X		X						
CH-SB-25_2_4	2_4	4/21/2010	X	X		X						MS/MSD
CH-SB-25_4_6	4_6	4/22/2010	X	X		X						
CH-SB-26_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-26_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-26_2_4	2_4	2/10/2011	X	X		X						
CH-SB-27_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-QAQC-DUP-07	0-0.5	2/10/2011	X	X		X						Field Duplicate of CH-SB-27_0_0.5
CH-SB-27_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-27_2_4	2_4	2/10/2011	X	X		X						
CH-SB-28_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-28_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-28_2_4	2_4	2/10/2011	X	X		X						
CH-SB-29_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-29_0.5_2	0.5_2	2/10/2011	X	X		X						MS/MSD
CH-SB-29_2_4	2_4	2/10/2011	X	X		X						
CH-SB-30_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-QAQC-DUP-09	0-0.5	2/10/2011	X	X		X						Field duplicate of CH-SB-30_0_0.5
CH-SB-30_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-30_2_4	2_4	2/10/2011	X	X		X						
CH-SB-31_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-31_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-31_2_4	2_4	2/10/2011	X	X		X						
CH-SB-32_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-32_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-32_2_4	2_4	2/10/2011	X	X		X						
CH-SB-33_0_0.5	0_0.5	2/8/2011	X	X		X						
CH-QAQC-DUP-06	0-0.5	2/8/2011	X	X		X						Field duplicate of CH-SB-33_0_0.5
CH-SB-33_0.5_2	0.5_2	2/8/2011	X	X		X						
CH-SB-33_2_4	2_4	2/8/2011	X	X		X						
CH-SB-34_0_0.5	0_0.5	2/8/2011	X	X		X						
CH-SB-34_0.5_2	0.5_2	2/8/2011	X	X		X						
CH-SB-34_2_4	2_4	2/8/2011	X	X		X						
CH-SB-35_0_0.5	0_0.5	2/8/2011	X	X		X						
CH-SB-35_0.5_2	0.5_2	2/8/2011	X	X		X						
CH-SB-35_2_4	2_4	2/8/2011	X	X		X						MS/MSD
CH-SB-37_0_0.5	0_0.5	2/10/2011	X	X		X						MS/MSD
CH-SB-37_0.5_2	0.5_2	2/10/2011	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-QAQC-DUP-08	0.5-2	2/10/2011	X	X		X						Field duplicate of CH-SB-37_0.5_2
CH-SB-37_2_4	2_4	2/10/2011	X	X		X						
CH-SB-38_0_0.5	0_0.5	2/10/2011	X	X		X						MS/MSD
CH-SB-38_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-38_2_4	2_4	2/10/2011	X	X		X						
CH-SB-39_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-39_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-39_2_4	2_4	2/10/2011	X	X		X						
CH-SB-40_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-40_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-40_2_4	2_4	2/10/2011	X	X		X						
CH-SB-41_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-QAQC-DUP-10	0-0.5	2/10/2011	X	X		X						Field duplicate of CH-SB-41_0_0.5
CH-SB-41_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-41_2_4	2_4	2/10/2011	X	X		X						
CH-SB-42_0_0.5	0_0.5	2/7/2011	X	X		X						
CH-SB-42_0.5_2	0.5_2	2//7/2011	X	X		X						
CH-SB-42_2_4	2_4	2/7/2011	X	X		X						
CH-SB-43_0_0.5	0_0.5	2/7/2011	X	X		X						
CH-SB-43_0.5_2	0.5_2	2//7/2011	X	X		X						
CH-SB-43_2_4	2_4	2/7/2011	X	X		X						
CH-SB-44_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-44_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-44_2_4	2_4	2/10/2011	X	X		X						
CH-SB-45_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-45_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-45_2_4	2_4	2/10/2011	X	X		X						MS/MSD
CH-SB-46_0_0.5	0_0.5	2/8/2011	X	X		X						
CH-SB-46_0.5_2	0.5_2	2/8/2011	X	X		X						
CH-SB-46_2_4	2_4	2/8/2011	X	X		X						
CH-SB-47_0_0.5	0_0.5	2/8/2011	X	X		X						
CH-SB-47_0.5_2	0.5_2	2/8/2011	X	X		X						
CH-SB-47_2_4	2_4	2/8/2011	X	X		X						
CH-SB-48_0_0.5	0_0.5	2/11/2011	X	X		X						
CH-SB-48_0.5_2	0.5_2	2/11/2011	X	X		X						
CH-SB-48_2_4	2_4	2/11/2011	X	X		X						
CH-SB-49_0_0.5	0_0.5	2/11/2011	X	X		X						
CH-SB-49_0.5_2	0.5_2	2/11/2011	X	X		X						
CH-SB-49_2_4	2_4	2/11/2011	X	X		X						
CH-SB-50_0_0.5	0_0.5	2/11/2011	X	X		X						
CH-SB-50_0.5_1.5	0.5_1.5	2/11/2011	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-51_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-51_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-51_2_4	2_4	2/10/2011	X	X		X						
CH-SB-52_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-52_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-52_2_4	2_4	2/10/2011	X	X		X						
CH-SB-53_0_0.5	0_0.5	2/10/2011	X	X		X						
CH-SB-53_0.5_2	0.5_2	2/10/2011	X	X		X						
CH-SB-53_2_4	2_4	2/10/2011	X	X		X						
CH-SB-54_0_0.5	0_0.5	2/11/2011	X	X		X						
CH-SB-54_0.5_2	0.5_2	2/11/2011	X	X		X						
CH-SB-54_2_2.5	2_2.5	2/11/2011	X	X		X						
CH-MW-01_0_0.5	0_0.5	2/14/2011	X	X		X						
CH-MW-01_0.5_2	0.5_2	2/14/2011	X	X		X						
CH-QAQC-MW-DUP-01	0.5_2	2/14/2011	X	X		X						Field Duplicate of CH-MW-01_0.5_2
CH-MW-01_2_4	2_4	2/14/2011	X	X		X						MS/MSD
CH-MW-02_0.5_1	0.5_1	2/14/2011	X	X		X						
CH-MW-02_1_2.5	1_2.5	2/14/2011	X	X		X						
CH-MW-02_2.5_4.5	2.5_4.5	2/14/2011	X	X		X						
CH-MW-03_0.5_1	0.5_1	2/15/2011	X	X		X						
CH-MW-03_1_2.5	1_2.5	2/15/2011	X	X		X						
CH-MW-03_2.5_4.5	2.5_4.5	2/15/2011	X	X		X						
CH-MW-04_0.5_1	0.5_1	2/16/2011	X	X		X						
CH-MW-04_1_2.5	1_2.5	2/16/2011	X	X		X						
CH-QAQC-MW-DUP-02	1_2.5	2/16/2011	X	X		X						Field Duplicate of CH-MW-04_1.0_2.5
CH-MW-04_2.5_4.5	2.5_4.5	2/16/2011	X	X		X						MS/MSD
CH-MW-05_0.5_1	0.5_1	2/17/2011	X	X		X						
CH-MW-05_1_2.5	1_2.5	2/17/2011	X	X		X						
CH-MW-05_2.5_4.5	2.5_4.5	2/17/2011	X	X		X						
CH-MW-05_4.5_6.5	4.5_6.5	2/17/2011	X	X		X						
CH-MW-06_0.5_1	0.5_1	2/15/2011	X	X		X						
CH-MW-06_1_2.5	1_2.5	2/15/2011	X	X		X						
CH-MW-06_2.5_4.5	2.5_4.5	2/15/2011	X	X		X						
CH-MW-07_0.5_1	0.5_1	2/16/2011	X	X		X						
CH-MW-07_1_2.5	1_2.5	2/16/2011	X	X		X						
CH-MW-07_2.5_4.5	2.5_4.5	2/16/2011	X	X		X						
CH-MW-07_4.5_6.5	4.5_6.5	2/16/2011	X	X		X						
CH-SB-55_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-55_0.5_2	0.5_2	12/13/2011	X	X		X						
CH-SB-55_2_4	2_4	12/13/2011	X	X		X						
CH-SB-56_0_0.5	0_0.5	12/13/2011	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-56_0.5_1.5	0.5_1.5	12/13/2011	X	X		X						
CH-SB-57_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-57_0.5_2	0.5_2	12/13/2011	X	X		X						
CH-SB-58_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-58_0.5_2.0	0.5_2.0	12/13/2011	X	X		X						
CH-SB-58_2_4	2_4	12/13/2011	X	X		X						
CH-SB-59_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-59_0.5_2.0	0.5_2.0	12/13/2011	X	X		X						
CH-SB-59_2_4	2_4	12/13/2011	X	X		X						
CH-SB-60_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-QAQC-DUP_01	0_0.5	12/13/2011	X	X		X						Field Duplicate of CH-SB-60_0_0.5
CH-SB-60_0.5_2	0.5_2	12/13/2011	X	X		X						MS/MSD
CH-SB-60_2_4	2_4	12/13/2011	X	X		X						
CH-SB-61_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-61_0.5_2	0.5_2	12/13/2011	X	X		X						
CH-SB-61_2_4	2_4	12/13/2011	X	X		X						
CH-SB-62_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-62_0.5_2.0	0.5_2.0	12/13/2011	X	X		X						
CH-SB-62_2_4	2_4	12/13/2011	X	X		X						
CH-SB-63_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-63_0.5_2	0.5_2.0	12/13/2011	X	X		X						
CH-SB-63_2_4	2_4	12/13/2011	X	X		X						
CH-SB-64_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-64_0.5_2	0.5_2.0	12/13/2011	X	X		X						
CH-SB-64_2_4	2_4	12/13/2011	X	X		X						
CH-SB-65_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-65_0.5_2	0.5_2.0	12/13/2011	X	X		X						
CH-SB-65_2_4	2_4	12/13/2011	X	X		X						
CH-SB-66_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-66_0.5_2	0.5_2.0	12/13/2011	X	X		X						
CH-SB-66_2_4	2_4	12/13/2011	X	X		X						
CH-SB-67_0_0.5	0_0.5	12/13/2011	X	X		X						
CH-SB-67_0.5_2	0.5_2	12/13/2011	X	X		X						
CH-QAQC-DUP_02	0.5_2	12/13/2011	X	X		X						Field Duplicate of CH-SB-67_0.5_2
CH-SB-67_2_4	2_4	12/13/2011	X	X		X						MS/MSD
CH-SB-68_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-68_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-68_2_4	2_4	12/14/2011	X	X		X						
CH-SB-69_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-QAQC-DUP_03	0_0.5	12/14/2011	X	X		X						Field Duplicate of CH-SB-69_0_0.5

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-69_0.5_2	0.5_2	12/14/2011	X	X		X						
CH-SB-69_2_4	2_4	12/14/2011	X	X		X						MS/MSD
CH-SB-70_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-70_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-70_2_4	2_4	12/14/2011	X	X		X						
CH-SB-71_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-71_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-71_2_4	2_4	12/14/2011	X	X		X						
CH-SB-72_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-72_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-72_2_4	2_4	12/14/2011	X	X		X						
CH-SB-73_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-73_0.5_2	0.5_2	12/14/2011	X	X		X						
CH-QAQC-DUP_04	0.5_2	12/14/2011	X	X		X						Field Duplicate of CH-SB-73_0.5_2
CH-SB-73_2_4	2_4	12/14/2011	X	X		X						MS/MSD
CH-SB-74_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-74_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-74_2_4	2_4	12/14/2011	X	X		X						
CH-SB-75_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-75_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-75_2_4	2_4	12/14/2011	X	X		X						
CH-SB-76_0_0.5	0_0.5	12/14/2011	X	X		X						
CH-SB-76_0.5_2	0.5_2.0	12/14/2011	X	X		X						
CH-SB-76_2_4	2_4	12/14/2011	X	X		X						
CH-SB-77_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-77_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-77_2_4	2_4	12/15/2011	X	X		X						
CH-SB-78_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-78_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-78_2_4	2_4	12/15/2011	X	X		X						
CH-SB-79_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-79_0.5_2	0.5_2	12/15/2011	X	X		X						
CH-QAQC-DUP_05	0.5_2	12/15/2011	X	X		X						Field Duplicate of CH-SB-79_0.5_2
CH-SB-79_2_4	2_4	12/15/2011	X	X		X						MS/MSD
CH-SB-80_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-80_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-80_2_4	2_4	12/15/2011	X	X		X						
CH-SB-81_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-81_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-81_2_4	2_4	12/15/2011	X	X		X						
CH-SB-82_0_0.5	0_0.5	12/15/2011	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-82_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-82_2_4	2_4	12/15/2011	X	X		X						
CH-SB-83_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-83_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-83_2_4	2_4	12/15/2011	X	X		X						
CH-SB-84_0_0.5	0_0.5	12/15/2011	X	X		X						
CH-SB-84_0.5_2	0.5_2.0	12/15/2011	X	X		X						
CH-SB-84_2_4	2_4	12/15/2011	X	X		X						
CH-SB-85_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-85_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-85_2_4	2_4	5/8/2012	X	X		X						
CH-SB-86_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-86_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-86_2_4	2_4	5/8/2012	X	X		X						
CH-SB-87_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-87_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-87_2_4	2_4	5/8/2012	X	X		X						
CH-SB-88_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-88_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-88_2_4	2_4	5/8/2012	X	X		X						
CH-SB-89_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-89_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-89_2_4	2_4	5/8/2012	X	X		X						
CH-SB-89_4_6	4_6	5/8/2012	X	X		X						MS/MSD
CH-SB-90_0_0.5	0_0.5	5/8/2012	X	X		X						
CH-SB-90_0.5_2	0.5_2.0	5/8/2012	X	X		X						
CH-SB-90_2_4	2_4	5/8/2012	X	X		X						
CH-SB-90_4_6	4_6	5/8/2012	X	X		X						
CH-SB-90_6_8	6_8	5/8/2012	X	X		X						
CH-SB-91_0_0.5	0_0.5	5/9/2012	X	X		X						
CH-SB-91_0.5_2	0.5_2.0	5/9/2012	X	X		X						
CH-SB-91_2_4	2_4	5/9/2012	X	X		X						
CH-SB-91_4_6	4_6	5/9/2012	X	X		X						
CH-SB-92_0_0.5	0_0.5	5/9/2012	X	X		X						
CH-SB-92_0.5_2	0.5_2.0	5/9/2012	X	X		X						
CH-SB-92_2_4	2_4	5/9/2012	X	X		X						
CH-SB-93_0_0.5	0_0.5	5/9/2012	X	X		X						
CH-SB-93_0.5_2	0.5_2.0	5/9/2012	X	X		X						
CH-QAQC-Dup01	0.5_2.0	5/9/2012	X	X		X						Field Duplicate of CH-SB-93_0.5_2
CH-SB-93_2_4	2_4	5/9/2012	X	X		X						
CH-SB-93_4_6	4_6	5/9/2012	X	X		X						
CH-SB-94_0_0.5	0_0.5	5/9/2012	X	X		X						

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-94_0.5_2	0.5_2.0	5/9/2012	X	X		X						
CH-SB-94_2_4	2_4	5/9/2012	X	X		X						
CH-SB-94_4_6	4_6	5/9/2012	X	X		X						
CH-SB-94_6_8	6_8	5/9/2012	X	X		X						
CH-QAQC-Dup02	6_8	5/9/2012	X	X		X						Field Duplicate of CH-SB-94_6_8
CH-SB-94_8_10	8_10	5/9/2012	X	X		X						
CH-SB-94_10_12	10_12	5/9/2012	X	X		X						
CH-SB-94_12_13	12_13	5/9/2012	X	X		X						
CH-SB-95_0_0.5	0_0.5	5/10/2012	X	X		X						
CH-SB-95_0.5_2	0.5_2.0	5/10/2012	X	X		X						
CH-SB-95_2_4	2_4	5/10/2012	X	X		X						
CH-SB-95_4_6	4_6	5/10/2012	X	X		X						
CH-SB-95_6_8	6_8	5/10/2012	X	X		X						
CH-SB-95_8_10	8_10	5/10/2012	X	X		X						MS/MSD
CH-SB-96_0_0.5	0_0.5	5/10/2012	X	X		X						
CH-SB-96_0.5_2	0.5_2.0	5/10/2012	X	X		X						MS/MSD
CH-QAQC-Dup03	0.5_2	5/10/2012	X	X		X						Field Duplicate of CH-SB-96_0.5_2
CH-SB-96_2_4	2_4	5/10/2012	X	X		X						
CH-SB-97_0_0.5	0_0.5	5/10/2012	X	X		X						
CH-SB-97_0.5_2	0.5_2.0	5/10/2012	X	X		X						
CH-SB-97_2_4	2_4	5/10/2012	X	X		X						
CH-SB-98_0_0.5	0_0.5	5/9/2012	X	X		X						
CH-SB-98_0.5_2	0.5_2.0	5/9/2012	X	X		X						
CH-SB-98_2_4	2_4	5/9/2012	X	X		X						
CH-SB-99_0_0.5	0_0.5	10/2/2012		X		X						
CH-SB-99_0.5_2	0.5_2	10/2/2012		X		X						
CH-SB-100_0_0.5	0_0.5	10/2/2012		X		X						MS/MSD
CH-SB-100_0.5_2	0.5_2	10/2/2012		X		X						
CH-QAQC-DUP-01	0.5_2	10/2/2012		X		X						Field Duplicate of CH-SB-100_0.5_2
CH-SB-101_0_0.5	0_0.5	10/2/2012		X		X						
CH-SB-101_0.5_2	0.5_2	10/2/2012		X		X						
Waste Characterization												
CH-SB-40-TCLP_0_2	0_2	2/10/2011		X		X		X				
CH-SB-42-TCLP_0_4	0_4	2/7/2011		X		X		X				
CH-SB-47-TCLP_0_2	0_2	2/8/2011		X		X		X				
CH-SB-51-TCLP_0_2	0_2	2/11/2001		X		X		X				
CH-SB-52-TCLP_0_4	0_4	2/10/2011		X		X		X				
CH-SB-54-TCLP_0_2	0_2	2/11/2011		X		X		X				
CH-SB-61-TCLP_0_0.5	0_0.5	12/13/2011		X		X		X				

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-SB-66-TCLP_0_0.5	0_0.5	12/13/2011		X		X		X				
CH-SB-79-TCLP_0_2	0_2	12/15/2011		X		X		X				
CH-SB-89-TCLP_0_6	0_6	5/8/2012		X		X		X				
CH-SB-93-TCLP_0_4	0_4	5/9/2012		X		X		X				
CH-SB-TCLP-13_0_2	0_2	5/10/2012		X		X		X				
CH-SB-94_0_4	0_4	5/10/2012									X	
CH-SB-TCLP-94_0_4	0_4	5/10/2012							X	X		
Groundwater												
CH-MW-01	NA	3/1/2011		X	X							MS/MSD
CH-MW-02	NA	3/1/2011		X	X							
CH-MW-03	NA	3/1/2011		X	X							
CH-MW-04	NA	3/1/2011		X	X							
CH-MW-05	NA	3/1/2011		X	X							
CH-MW-06	NA	3/1/2011		X	X							
CH-MW-07	NA	3/1/2011		X	X							
CH-QAQC-DUP-01	NA	3/1/2011		X	X							Field duplicate of CH-MW-07
CH-MW-03	NA	3/29/2011		X	X							
CH-MW-07	NA	3/29/2011		X	X							
CH-MW-01	NA	5/10/2012		X	X							MS/MSD
CH-MW-02	NA	5/10/2012		X	X							
CH-QAQC-DUP-01	NA	5/10/2012		X	X							Field duplicate of CH-MW-02
CH-MW-03	NA	5/10/2012		X	X							
CH-MW-04	NA	5/10/2012		X	X							
CH-MW-05	NA	5/10/2012		X	X							
CH-MW-06	NA	5/10/2012		X	X							
CH-MW-07	NA	5/10/2012		X	X							
CH-MW-01	NA	10/3/2012		X	X							MS/MSD
CH-MW-02	NA	10/3/2012		X	X							
CH-MW-03	NA	10/3/2012		X	X							
CH-MW-04	NA	10/3/2012		X	X							
CH-MW-05	NA	10/3/2012		X	X							
CH-MW-06	NA	10/3/2012		X	X							
CH-MW-07	NA	1/3/2012		X	X							
CH-QAQC-DUP-01	NA	10/3/2012		X	X							Field Duplicate of CH-MW-07
Field Quality Control												
QAQC_EB_01	NA	4/19/2010		X								Field Equipment Blank

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
QAQC_EB_02	NA	4/20/2010		X								Field Equipment Blank
QAQC_EB_03	NA	4/21/2010		X								Field Equipment Blank
QAQC_EB_04	NA	4/22/2010		X								Field Equipment Blank
CH-QAQC-EB-05	NA	2/7/2011		X								Field Equipment Blank
CH-QAQC-EB-06	NA	2/8/2011		X								Field Equipment Blank
CH-QAQC-EB-07	NA	2/9/2011		X								Field Equipment Blank
CH-QAQC-EB-08	NA	2/10/2011		X								Field Equipment Blank
CH-QAQC-EB-09	NA	2/11/2011		X								Field Equipment Blank
CH-QAQC-MW-EB-01	NA	2/14/2011		X								Field Equipment Blank
CH-QAQC-MW-EB-02	NA	2/15/2011		X								Field Equipment Blank
CH-QAQC-MW-EB-03	NA	2/16/2011		X								Field Equipment Blank
CH-QAQC-MW-EB-04	NA	2/17/2011		X								Field Equipment Blank
CH-QAQC-EB-01	NA	3/1/2011		X	X							Field Equipment Blank
CH-QAQC-EB-01	NA	3/29/2011		X	X							Field Equipment Blank
CH-QAQC-EB-01	NA	12/13/2011		X	X							Field Equipment Blank
CH-QA-QC-EB-02	NA	12/14/2011		X	X							Field Equipment Blank
CH-QAQC-EB-03	NA	12/15/2011		X	X							Field Equipment Blank
CH-QAQC-EB01	NA	5/8/2012		X								Field Equipment Blank
CH-QAQC-EB02	NA	5/9/2012		X								Field Equipment Blank
CH-QAQC-EB03	NA	5/10/2012		X								Field Equipment Blank
CH-QAQC-EB04	NA	5/10/2012		X								Field Equipment Blank

Table 2-1
Summary of Sampling and Analytical Program
SDR and RAWP
VCC Charlotte, North Carolina

				Laboratory Measurement								
Sample Name	**Depth (feet)**	**Sample Date**	**Arsenic and Lead Field Measurement**	**Arsenic and Lead**	**Dissolved Arsenic and Lead**	**pH**	**TAL Metals**	**TCLP Arsenic and Lead**	**TCLP Metals**	**TCLP VOCs and SVOCs**	**PCBs**	**Comments**
CH-QAQC-EB-01	NA	10/2/2012		X								Field Equipment Blank
CH-QAQC-EB-01	NA	10/3/2012		X	X							Field Equipment Blank
Investigation Derived Waste												
CH-IDW_Soil	NA	4/21/2010		X					X			Investigation Derived Waste - Soil
CH-IDW_Decon Water	NA	4/21/2010				X	X					Investigation Derived Waste - Water
CH-IDW-01	NA	3/2/2011				X	X					Investigation Derived Waste - Water
CH-IDW-02	NA	3/2/2011				X	X					Investigation Derived Waste - Water
CH-IDW-03	NA	3/2/2011				X	X					Investigation Derived Waste - Water
CH-IDW-04	NA	3/2/2011							X			Investigation Derived Waste - Soil
CH-IDW-05	NA	3/2/2011							X			Investigation Derived Waste - Soil
CH-IDW-06	NA	3/2/2011							X			Investigation Derived Waste - Soil
CH-IDW-07	NA	3/2/2011							X			Investigation Derived Waste - Soil
CH-IDW-08	NA	3/2/2011							X			Investigation Derived Waste - Soil
CH-IDW-01	NA	12/15/2011							X			Investigation Derived Waste - Soil
CH-IDW-02	NA	12/15/2011				X	X					Investigation Derived Waste - Water
CH-IDW_Water	NA	5/11/2012				X	X					Investigation Derived Waste - Water
CH-IDW_Soil	NA	5/11/2012							X			Investigation Derived Waste - Soil
CH-IDW-01	NA	10/3/2012				X	X					Investigation Derived Waste - Water

Notes:
1. Samples depths are measured in feet below ground surface.
2. Laboratory measurements were performed by TestAmerica, Inc. of Nashville, Tennessee.
3. Sample locations are shown on Figures 2-1 and 2-2.
4. MS/MSD - matrix spike/matrix spike duplicate.
TAL - Target Analyte List
TCLP - Toxicity Characteristic Leaching Procedure

Table 2-2
Groundwater Monitoring Well Specifications
SDR and RAWP
VCC - Charlotte, North Carolina

Monitoring Well ID	Installation Date	Measured Well Depth from TOPC (feet)	Surface Casing Length (feet)	Screen Length (feet)	Well Casing Diameter (inches)	Well Screen Slot Size (inches)	Elevation (feet amsl)				Coordinates		Well Completion
							TOPC	Ground Surface	Top of Screen	Bottom of Screen	Northing	Easting	
CH-MW-01	02/14/11	25.05	15.05	10	2	0.01	734.42	734.25	719.4	709.4	536500.41	1443303.19	Flush Mount
CH-MW-02	02/14/11	29.75	14.75	15	2	0.01	733.19	733.39	718.4	708.4	536848.17	1443286.65	Flush Mount
CH-MW-03	02/15/11	25.85	15.85	10	2	0.01	732.65	733.12	716.8	706.8	536879.37	1443062.90	Flush Mount
CH-MW-04	02/16/11	34.25	24.25	10	2	0.01	731.85	732.21	707.6	697.6	536921.33	1442797.43	Flush Mount
CH-MW-05	02/17/11	29.75	19.75	10	2	0.01	731.37	731.60	711.6	701.6	536494.28	1442724.51	Flush Mount
CH-MW-06	02/15/11	26.75	16.75	10	2	0.01	732.51	732.84	715.8	705.8	536446.78	1443010.04	Flush Mount
CH-MW-07	02/16/11	32.25	22.25	10	2	0.01	732.24	732.64	710.0	700.0	536713.97	1442854.62	Flush Mount

Notes:

TOPC - top of PVC casing

ft amsl - feet above mean sea level

Top of casing and ground surface elevations were surveyed based on National American Vertical Datum (NAVD 29).

Groundwater monitoring well locations were surveyed based on North American Datum (NAD 83).

Groundwater elevations were calculated by subtracting the measured depth to water from the surveyed top of casing elevations.

Table 2-3
Groundwater Elevations
SDR and RAWP
VCC Charlotte, North Carolina

Monitoring Well ID	Top of Casing (ft amsl)	Ground Surface Elevation (ft amsl)	Depth to Groundwater 3/1/11 (ft btoc)	Depth to Groundwater 3/1/11 (bgs)	Groundwater Elevation 3/1/11 (ft amsl)	Depth to Groundwater 3/29/11 (ft btoc)	Depth to Groundwater 3/29/11 (bgs)	Groundwater Elevation 3/29/11 (ft amsl)
CH-MW-01	734.42	734.25	15.25	15.08	719.17	14.50	14.33	719.92
CH-MW-02	733.19	733.39	17.60	17.80	715.59	16.75	16.95	716.44
CH-MW-03	732.65	733.12	20.53	20.99	712.12	20.02	20.48	712.63
CH-MW-04	731.85	732.21	23.25	23.61	708.60	22.60	22.96	709.25
CH-MW-05	731.37	731.60	18.91	19.14	712.46	18.03	18.26	713.34
CH-MW-06	732.51	732.84	16.35	16.68	716.16	15.73	16.06	716.78
CH-MW-07	732.24	732.64	20.85	21.26	711.39	20.30	20.71	711.94

Notes:

bgs - below ground surface

ft btoc - feet below top of casing

ft amsl - feet above mean sea level

Top of casing and ground surface elevations were surveyed based on National American Vertical Datum (NAVD 29).

Groundwater monitoring well locations were surveyed based on North American Datum (NAD 83).

Groundwater elevations were calculated by subtracting the measured depth to water from the surveyed top of casing elevations.

Table 2-3
Groundwater Elevations
SDR and RAWP
VCC Charlotte, North Carolina

Monitoring Well ID	Top of Casing (ft amsl)	Ground Surface Elevation (ft amsl)	Depth to Groundwater 05/10/12 (ft btoc)	Depth to Groundwater 05/10/12 (bgs)	Groundwater Elevation 05/10/12 (ft amsl)	Depth to Groundwater 10/03/12 (ft btoc)	Depth to Groundwater 10/03/12 (bgs)	Groundwater Elevation 10/03/12 (ft amsl)
CH-MW-01	734.42	734.25	14.05	13.88	720.37	14.61	14.44	719.81
CH-MW-02	733.19	733.39	16.95	17.15	716.24	16.84	17.04	716.35
CH-MW-03	732.65	733.12	19.32	19.78	713.33	20.55	21.01	712.10
CH-MW-04	731.85	732.21	22.28	22.64	709.57	22.53	22.89	709.32
CH-MW-05	731.37	731.60	17.69	17.92	713.68	17.88	18.11	713.49
CH-MW-06	732.51	732.84	15.01	15.34	717.50	15.77	16.10	716.74
CH-MW-07	732.24	732.64	19.45	19.86	712.79	20.30	20.71	711.94

Notes:

bgs - below ground surface

ft btoc - feet below top of casing

ft amsl - feet above mean sea level

Top of casing and ground surface elevations were surveyed based on National American Vertical Datum (NAVD 29).

Groundwater monitoring well locations were surveyed based on North American Datum (NAD 83).

Groundwater elevations were calculated by subtracting the measured depth to water from the surveyed top of casing elevations.

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-MW-01	0 - 0.5	2/14/2011	53.1 J	206 J	6.4
	0.5 - 2	2/14/2011	1.18 J [2.97 J]	17.4 J [11.6 J]	5.5 [5.4]
	2 - 4	2/14/2011	1.37 UJ	12.1 J	4.5
CH-MW-02	0.5 - 1	2/14/2011	1.12 UJ	7.78 J	7.1
	1 - 2.5	2/14/2011	26.8 J	183 J	7.5
	2.5 - 4.5	2/14/2011	6.25 J	12.8 J	6.6
CH-MW-03	0.5 - 1	2/15/2011	49.5 J	171 J	7
	1 - 2.5	2/15/2011	1.39 UJ	11.5 J	4.5
	2.5 - 4.5	2/15/2011	1.33 UJ	12.9 J	4
CH-MW-04	0.5 - 1	2/16/2011	1.88 J	14.4 J	6.8
	1 - 2.5	2/16/2011	1.53 UJ [1.66 UJ]	11.8 J [9.95 J]	6.9 [4.9]
	2.5 - 4.5	2/16/2011	1.41 U	14.2 J	4.9
CH-MW-05	0.5 - 1	2/17/2011	235	978	6.5
	1 - 2.5	2/17/2011	113	223	6.6
	2.5 - 4.5	2/17/2011	35.2	22.4	4.3
	4.5 - 6.5	2/17/2011	2.43	18.0	4.1
CH-MW-06	0.5 - 1	2/15/2011	2.46 J	17.1 J	4.6
	1 - 2.5	2/15/2011	1.65 J	23.8 J	4
	2.5 - 4.5	2/15/2011	1.32 UJ	4.77 J	3.9
CH-MW-07	0.5 - 1	2/16/2011	178 J	4,090 J	5.7
	1 - 2.5	2/16/2011	2.52 J	23.2 J	4
	2.5 - 4.5	2/16/2011	35.8 J	22.2 J	3.8
	4.5 - 6.5	2/16/2011	13.4 J	27.7 J	3.9
CH-SB-01	0 - 0.5	4/19/2010	24.7	289 J	6.4 J
	0.5 - 2	4/19/2010	14.1	172 J	6.1 J
	2 - 4	4/19/2010	0.955 U	38.0 J	4.5 J
CH-SB-02	0 - 0.5	4/19/2010	24.8 [22.3]	175 J [161 J]	6.2 J [6.2 J]
	0.5 - 2	4/19/2010	7.41	38.7 J	4.9 J
	2 - 4	4/19/2010	2.32	5.91 J	4.6 J
CH-SB-03	0 - 0.5	4/19/2010	6.94	46.1 J	5.8 J
	0.5 - 2	4/19/2010	3.25	7.67 J	5 J
	2 - 4	4/19/2010	3.42	5.13 J	4.6 J
CH-SB-04	0 - 0.5	4/19/2010	12.6	145 J	5.8 J
	0.5 - 2	4/19/2010	7.58	82.6 J	6.2 J
	2 - 4	4/19/2010	3.87	11.3 J	6 J
CH-SB-05	0 - 0.5	4/20/2010	42.5	280 J	5.9 J
	0.5 - 2	4/20/2010	53.7	391 J	6.4 J
	2 - 2.3	4/20/2010	24.6	158 J	6.4 J
CH-SB-06	0 - 0.5	4/20/2010	0.955 J	17.1	7 J
	0.5 - 2	4/20/2010	0.967 UJ	4.53	6.2 J
	2 - 4	4/20/2010	0.956 UJ	9.53	5.7 J
CH-SB-07	0 - 0.5	4/20/2010	32.8 J	178	5.6 J
	0.5 - 2	4/20/2010	17.6 J	92.1	5.2 J
	2 - 4	4/20/2010	4.57 J	14.9	4.8 J
CH-SB-08	0 - 0.5	4/20/2010	0.895 UJ	11.6	4.5 J
	0.5 - 2	4/20/2010	0.909 UJ	12.7	4 J
	2 - 4	4/20/2010	1.07 UJ [0.947 UJ]	16.9 [9.50]	3.7 J [3.7 J]

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-09	0 - 0.5	4/20/2010	0.846 UJ	7.76	4.2 J
	0.5 - 2	4/20/2010	0.885 UJ	5.91	3.7 J
	2 - 4	4/20/2010	3.35	7.77	3.5 J
CH-SB-10	0 - 0.5	4/20/2010	2.94 J	27.8	5.7 J
	0.5 - 2	4/20/2010	23.6 J	284	5.9 J
	2 - 4	4/20/2010	0.832 UJ	9.51	4.6 J
CH-SB-11	0 - 0.5	4/20/2010	51.8 J	7.07	3.9 J
	0.5 - 2	4/20/2010	7.08 J	84.0	5 J
	2 - 4	4/20/2010	3.25 J	16.1	3.9 J
CH-SB-12	0 - 0.5	4/20/2010	46.3	308	6.6 J
	0.5 - 2	4/20/2010	25.3 J	149	5.6 J
	2 - 3	4/20/2010	22.0 J	139	7.1 J
	4 - 6	4/21/2010	0.934 UJ	33.8	4 J
CH-SB-13	0 - 0.5	4/20/2010	112	777	5.3 J
	0.5 - 2	4/20/2010	154	780	6.3 J
	2 - 4	4/20/2010	15.0	59.8	5.6 J
CH-SB-14	0 - 0.5	4/20/2010	35.8	13.5	4.7 J
	0.5 - 2	4/20/2010	2.80	5.05	3.9 J
	2 - 4	4/20/2010	2.65	7.95	3.8 J
CH-SB-15	0 - 0.5	4/20/2010	5.97	14.1	3.6 J
	0.5 - 2	4/20/2010	9.00	7.37	3.4 J
	2 - 4	4/20/2010	13.8	32.7	3.1 J
CH-SB-16	0 - 0.5	4/20/2010	3.07	6.44	4.6 J
	0.5 - 2	4/20/2010	2.45 [2.72]	6.71 [6.49]	3.9 J [3.7 J]
	2 - 4	4/20/2010	1.45	3.95	3.6 J
CH-SB-17	0 - 0.5	4/20/2010	4.96	8.89	7 J
	0.5 - 2	4/20/2010	0.983 J	4.08	3.6 J
	2 - 4	4/20/2010	1.69	4.49	4.1 J
CH-SB-18	0 - 0.5	4/21/2010	0.873 UJ	103	4.1 J
	0.5 - 2	4/21/2010	0.899 UJ	18.2	3.7 J
	2 - 4	4/21/2010	4.79	17.6	3.5 J
CH-SB-19	0 - 0.5	4/21/2010	71.7 J	20,100	6.5 J
	0.5 - 2	4/21/2010	9.01 J [5.03 J]	679 [169]	4.8 J [4.7 J]
	2 - 4	4/21/2010	2.37 J	20.3	4.2 J
CH-SB-20	0 - 0.5	4/21/2010	10.3 J	161	6.2 J
	0.5 - 2	4/21/2010	0.878 UJ	26.6	6.3 J
	2 - 4	4/21/2010	0.963 UJ	30.9	4.5 J
CH-SB-21	0 - 0.5	4/21/2010	9.22 J	64.2	5.8 J
	0.5 - 2	4/21/2010	11.2 J	56.5	5.2 J
	2 - 4	4/21/2010	1.24 J	5.37	4.6 J
CH-SB-22	0 - 0.5	4/21/2010	7.17	15.4	4.6 J
	0.5 - 2	4/21/2010	6.80 J	14.8	4.3 J
	2 - 4	4/21/2010	6.04 J	58.7	4.2 J

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-23	0 - 0.5	4/21/2010	10.1 J	48.6	7.6 J
	0.5 - 2	4/21/2010	19.6 J	188	6.7 J
	2 - 4	4/21/2010	55.6 J	297	6.2 J
	4 - 6	4/22/2010	54.7 [27.6]	309 J [61.1 J]	3.8 J [3.6 J]
	6 - 8	4/22/2010	5.09	10.4 J	3.5 J
CH-SB-24	0 - 0.5	4/21/2010	88.6 J	47.9	4.9 J
	0.5 - 2	4/21/2010	267 J	133	5.5 J
	2 - 4	4/21/2010	11.2 J	21.2	3.8 J
CH-SB-25	0 - 0.5	4/21/2010	96.7 J	393	6.3 J
	0.5 - 2	4/21/2010	20.4 J	127	6.1 J
	2 - 4	4/21/2010	53.6 J	177	6 J
	4 - 6	4/22/2010	4.13	6.22 J	5.7 J
CH-SB-26	0 - 0.5	2/10/2011	20.5	125	5.6
	0.5 - 2	2/10/2011	24.0	64.4	5.2
	2 - 4	2/10/2011	18.0	148	4.9
CH-SB-27	0 - 0.5	2/10/2011	51.3 [58.7]	54.5 [53.2]	4.9 [4.9]
	0.5 - 2	2/10/2011	141	7.87 J	4
	2 - 4	2/10/2011	21.0	13.3 U	4.1
CH-SB-28	0 - 0.5	2/10/2011	316	930	5
	0.5 - 2	2/10/2011	333	463	4.6
	2 - 4	2/10/2011	4,270	20.7	3.8
CH-SB-29	0 - 0.5	2/10/2011	16.3	40.3	6.6
	0.5 - 2	2/10/2011	12.1 UJ	12.1 UJ	4.1
	2 - 4	2/10/2011	13.9 U	11.4 J	4
CH-SB-30	0 - 0.5	2/10/2011	68.4 [127]	903 [1,830]	6.7 [6.6]
	0.5 - 2	2/10/2011	178	3,460	4.8
	2 - 4	2/10/2011	577	1,230	5.2
CH-SB-31	0 - 0.5	2/10/2011	12.4 UJ	12.4 J	7.5
	0.5 - 2	2/10/2011	12.8 UJ	23.0 J	6.7
	2 - 4	2/10/2011	12.8 UJ	8.99 J	4.6
CH-SB-32	0 - 0.5	2/10/2011	13.7	111	6
	0.5 - 2	2/10/2011	13.3	59.8	5.9
	2 - 4	2/10/2011	9.95 J	14.2 U	4.4
CH-SB-33	0 - 0.5	2/8/2011	20.9 [26.0]	139 [186]	6.9 J [6.9 J]
	0.5 - 2	2/8/2011	67.3 J	360 J	6.9 J
	2 - 4	2/8/2011	12.9 U	50.4	7.1 J
CH-SB-34	0 - 0.5	2/8/2011	17.0 J	174 J	5.5 J
	0.5 - 2	2/8/2011	12.8 UJ	71.0 J	4.7 J
	2 - 4	2/8/2011	13.4 UJ	11.0 J	5.1 J
CH-SB-35	0 - 0.5	2/8/2011	15.3 J	108 J	6.2 J
	0.5 - 2	2/8/2011	10.3 J	68.0 J	6.1 J
	2 - 4	2/8/2011	12.2 UJ	7.34 J	4.9 J
CH-SB-37	0 - 0.5	2/10/2011	12.0 UJ	11.5 J	4.5
	0.5 - 2	2/10/2011	12.3 U [12.3 U]	14.7 [19.7]	4.4 [4.3]
	2 - 4	2/10/2011	11.8 U	11.8 U	3.9

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-38	0 - 0.5	2/10/2011	12.1 UJ	21.9 J	6.9
	0.5 - 2	2/10/2011	12.7 J	12.0 J	4.4
	2 - 4	2/10/2011	12.0 UJ	45.8 J	4.4
CH-SB-39	0 - 0.5	2/10/2011	27.8	907	7.9
	0.5 - 2	2/10/2011	42.4	396	7.5
	2 - 4	2/10/2011	10.7 J	40.3	5.1
CH-SB-40	0 - 0.5	2/10/2011	247	1,390	4.1
	0.5 - 2	2/10/2011	193	1,060	3.8
	2 - 4	2/10/2011	15.2	58.3	4.2
CH-SB-41	0 - 0.5	2/10/2011	11.1 J [12.6 UJ]	132 J [97.7 J]	4.9 [4.9]
	0.5 - 2	2/10/2011	12.7 UJ	111 J	4.9
	2 - 4	2/10/2011	13.3 UJ	13.5 J	4.4
CH-SB-42	0 - 0.5	2/7/2011	178 J	240 J	6.2 J
	0.5 - 2	2/7/2011	105 J	12.0 U	5.9 J
	2 - 4	2/7/2011	155 J	13.8 U	5.8 J
CH-SB-43	0 - 0.5	2/7/2011	27.0 J	611 J	6.3 J
	0.5 - 2	2/7/2011	40.5 J	252 J	5.8 J
	2 - 4	2/7/2011	12.9 UJ	12.9 U	4.7 J
CH-SB-44	0 - 0.5	2/10/2011	13.9 U	12.5 J	4.3
	0.5 - 2	2/10/2011	13.3 U	10.7 J	4.1
	2 - 4	2/10/2011	14.1 U	9.60 J	4.1
CH-SB-45	0 - 0.5	2/10/2011	10.8 U	40.5	6.3
	0.5 - 2	2/10/2011	20.0	137	4.9
	2 - 4	2/10/2011	12.1 U	7.98 J	4.8
CH-SB-46	0 - 0.5	2/8/2011	36.1 J	234 J	6.4 J
	0.5 - 2	2/7/2011	15.9 J	64.8 J	6.3 J
	2 - 4	2/8/2011	12.5 UJ	13.3 J	5.4 J
CH-SB-47	0 - 0.5	2/8/2011	125 J	761 J	6.3 J
	0.5 - 2	2/8/2011	99.4 J	508 J	6.3 J
	2 - 4	2/8/2011	12.6 UJ	14.6 J	6.2 J
CH-SB-48	0 - 0.5	2/11/2011	9.69 J	51.8 J	5.5
	0.5 - 2	2/11/2010	12.9 J	51.2 J	5.3
	2 - 4	2/11/2011	13.6 UJ	15.0 J	4.2
CH-SB-49	0 - 0.5	2/11/2011	22.4	138	5.9
	0.5 - 2	2/11/2011	8.81 J	22.0	5.9
	2 - 4	2/11/2011	12.8 UJ	10.5 J	6.2
CH-SB-50	0 - 0.5	2/11/2011	50.4 J	385 J	5.4
	0.5 - 1.5	2/11/2010	57.0 J	536 J	5.4
CH-SB-51	0 - 0.5	2/11/2011	68.6 J	4,850 J	4.1
	0.5 - 2	2/11/2010	303 J	200 J	3.8
	2 - 4	2/11/2011	17.1 J	10.8 J	3.5
CH-SB-52	0 - 0.5	2/10/2011	1,470	1,930	4.2
	0.5 - 2	2/10/2011	505	1,800	3
	2 - 4	2/10/2011	859	292	3.6
CH-SB-53	0 - 0.5	2/10/2011	431	2,330	3.7
	0.5 - 2	2/10/2011	53.4	27.4	3.7
	2 - 4	2/10/2011	8.93 J	11.7 U	4

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-54	0 - 0.5	2/11/2011	49.2 J	105 J	4.9
	0.5 - 2	2/11/2011	32.3 J	91.5 J	4.8
	2 - 2.5	2/11/2011	12.0 UJ	69.7 J	5.8
CH-SB-55	0 - 0.5	12/13/2011	19.3	280 J	5.7
	0.5 - 2	12/13/2011	1.89	13.9 J	4.5
	2 - 4	12/13/2011	1.22 J	4.68 J	4.5
CH-SB-56	0 - 0.5	12/13/2011	29.2 J	182 J	6.5
	0.5 - 1.5	12/13/2011	6.27 J	66.2 J	6.6
CH-SB-57	0 - 0.5	12/13/2011	5.68	213 J	5.7
	0.5 - 2	12/13/2011	42.1	86.4 J	5.1
CH-SB-58	0 - 0.5	12/13/2011	2.95	23.6 J	6.3
	0.5 - 2	12/13/2011	2.90	15.9 J	4.2
	2 - 4	12/13/2011	0.917 J	5.43 J	4
CH-SB-59	0 - 0.5	12/13/2011	4.02	91.2 J	7.7
	0.5 - 2	12/13/2011	7.77	154 J	4.5
	2 - 4	12/13/2011	3.78	10.1 J	3.8
CH-SB-60	0 - 0.5	12/13/2011	5.10 [5.83]	57.1 J [65.3 J]	6.1 [5.6]
	0.5 - 2	12/13/2011	7.32	37.3 J	3.7
	2 - 4	12/13/2011	1.79	8.96 J	3
CH-SB-61	0 - 0.5	12/13/2011	56.0	94.4 J	5.7
	0.5 - 2	12/13/2011	4.66	27.7 J	7.9
	2 - 4	12/13/2011	1.63	15.2 J	7.4
CH-SB-62	0 - 0.5	12/13/2011	675	990 J	5.5
	0.5 - 2	12/13/2011	430	32.3 J	5.4
	2 - 4	12/13/2011	0.710 U	15.1 J	5.2
CH-SB-63	0 - 0.5	12/13/2011	2.23	4.29 J	6.7
	0.5 - 2	12/13/2011	4.64	16.5 J	7.1
	2 - 4	12/13/2011	10.9	8.72 J	5.2
CH-SB-64	0 - 0.5	12/13/2011	8.05	14.4 J	5.9
	0.5 - 2	12/13/2011	6.28	23.3 J	4.3
	2 - 4	12/13/2011	4.80	9.06 J	4.7
CH-SB-65	0 - 0.5	12/13/2011	3.47	8.22 J	6.7
	0.5 - 2	12/13/2011	3.58	29.9 J	5.3
	2 - 4	12/13/2011	6.44	41.9 J	4.4
CH-SB-66	0 - 0.5	12/13/2011	78.8	207 J	5.9
	0.5 - 2	12/13/2011	0.664 U	19.5 J	5.7
	2 - 4	12/13/2011	0.668 U	22.1 J	4.9
CH-SB-67	0 - 0.5	12/13/2011	32.4	2,430 J	6.1
	0.5 - 2	12/13/2011	56.8 [53.9]	851 J [781 J]	5.2 [5.4]
	2 - 4	12/13/2011	3.60	15.3 J	4.1
CH-SB-68	0 - 0.5	12/14/2011	7.41 J	210 J	6.9
	0.5 - 2	12/14/2011	9.55 J	117 J	6.9
	2 - 4	12/14/2011	1.83 J	12.9 J	7.2
CH-SB-69	0 - 0.5	12/14/2011	470 J [247 J]	753 J [582 J]	7.8 [6.7]
	0.5 - 2	12/14/2011	14.8 J	47.4 J	7.4
	2 - 4	12/14/2011	24.1 J	52.8 J	6.4

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-70	0 - 0.5	12/14/2011	25.8 J	207 J	5.1
	0.5 - 2	12/14/2011	20.4 J	68.7 J	6.3
	2 - 4	12/14/2011	R	40.8 J	4.5
CH-SB-71	0 - 0.5	12/14/2011	12.2 J	96.2 J	6
	0.5 - 2	12/14/2011	R	23.1 J	4.8
	2 - 4	12/14/2011	R	16.4 J	4.6
CH-SB-72	0 - 0.5	12/14/2011	1.91 J	12.1 J	6.3
	0.5 - 2	12/14/2011	8.70 J	69.5 J	5.9
	2 - 4	12/14/2011	1.89 J	10.2 J	5.4
CH-SB-73	0 - 0.5	12/14/2011	3.35 J	18.5	5.7
	0.5 - 2	12/14/2011	10.0 J [6.75 J]	31.3 [13.4]	5.7 [6.2]
	2 - 4	12/14/2011	5.23 J	9.64	6.4
CH-SB-74	0 - 0.5	12/14/2011	9.72 J	140	6.4
	0.5 - 2	12/14/2011	4.36 J	14.8	6.3
	2 - 4	12/14/2011	4.04 J	14.5	4.7
CH-SB-75	0 - 0.5	12/14/2011	46.8 J	139	6.6
	0.5 - 2	12/14/2011	35.9 J	881	5
	2 - 4	12/14/2011	5.01 J	22.6	4.9
CH-SB-76	0 - 0.5	12/14/2011	51.6 J	108	6.9
	0.5 - 2	12/14/2011	51.0 J	211	4.3
	2 - 4	12/14/2011	7.04 J	18.0	4.2
CH-SB-77	0 - 0.5	12/15/2011	51.3	69.7	7.7
	0.5 - 2	12/15/2011	81.7	632	6.5
	2 - 4	12/15/2011	2.24	8.18	4.2
CH-SB-78	0 - 0.5	12/15/2011	84.5	191	5.8
	0.5 - 2	12/15/2011	107	152	5.3
	2 - 4	12/15/2011	2.19	15.8	4.2
CH-SB-79	0 - 0.5	12/15/2011	140	256	6.1
	0.5 - 2	12/15/2011	208 [281]	435 [656]	5.8 [5.9]
	2 - 4	12/15/2011	2.15	12.5	4.4
CH-SB-80	0 - 0.5	12/15/2011	29.9	279	6.4
	0.5 - 2	12/15/2011	11.9	108	4.4
	2 - 4	12/15/2011	0.667 U	29.7	4.5
CH-SB-81	0 - 0.5	12/15/2011	3.27	222	7
	0.5 - 2	12/15/2011	2.93	23.9	6
	2 - 4	12/15/2011	0.626 U	23.3	5.4
CH-SB-82	0 - 0.5	12/15/2011	3.10	83.1	5.9
	0.5 - 2	12/15/2011	17.1	105	7
	2 - 4	12/15/2011	3.32	14.3	6.9
CH-SB-83	0 - 0.5	12/15/2011	3.72	41.3	7.4
	0.5 - 2	12/15/2011	4.24	18.8	7.3
	2 - 4	12/15/2011	2.93	11.0	6.6
CH-SB-84	0 - 0.5	12/15/2011	24.7	280	6.3
	0.5 - 2	12/15/2011	42.8	297	5
	2 - 4	12/15/2011	5.15	43.9	4.6

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-85	0 - 0.5	5/8/2012	1.14 UJ	21.8	7.9
	0.5 - 2	5/8/2012	1.26 UJ	6.03	7.4
	2 - 4	5/8/2012	1.45 UJ	27.3	7.1
CH-SB-86	0 - 0.5	5/8/2012	2.59 J	25.3	6.9
	0.5 - 2	5/8/2012	1.26 UJ	10.1	6.7
	2 - 4	5/8/2012	1.23 UJ	13.7	6.3
CH-SB-87	0 - 0.5	5/8/2012	14.5 J	204	7.5
	0.5 - 2	5/8/2012	6.48 J	104	7.7
	2 - 4	5/8/2012	1.35 UJ	15.4	4.6
CH-SB-88	0 - 0.5	5/8/2012	3.64 J	78.1	6.2
	0.5 - 2	5/8/2012	5.98 J	162	7.5
	2 - 4	5/8/2012	1.30 UJ	18.4	6.8
CH-SB-89	0 - 0.5	5/8/2012	32.4 J	97.8	7
	0.5 - 2	5/8/2012	176 J	120	6.1
	2 - 4	5/8/2012	52.4 J	17.2	4.6
	4 - 6	5/8/2012	33.6	20.1	6.5 J
CH-SB-90	0 - 0.5	5/8/2012	1.09 UJ	6.34	6.3
	0.5 - 2	5/8/2012	2.16 J	55.6	7.5
	2 - 4	5/8/2012	3.43	27.6	6.3
	4 - 6	5/8/2012	12.2 U	18.3	5.8 J
	6 - 8	5/8/2012	13.2 U	8.99 J	4.7 J
CH-SB-91	0 - 0.5	5/9/2012	1.13 U	7.92	6.9
	0.5 - 2	5/9/2012	1.18 U	8.43	5.4
	2 - 4	5/9/2012	6.00	36.6	4.7
	4 - 6	5/9/2012	13.7 U	188	3.2 J
CH-SB-92	0 - 0.5	5/9/2012	31.9	286	4.3
	0.5 - 2	5/9/2012	10.0	131	3.5
	2 - 4	5/9/2012	1.36 U	30.0	3.2
CH-SB-93	0 - 0.5	5/9/2012	661	563	4.1
	0.5 - 2	5/9/2012	548 [533]	208 [227]	3.4 [3.6]
	2 - 4	5/9/2012	152	29.6	3.3
	4 - 6	5/9/2012	19.7	32.1	3.4 J
CH-SB-94	0 - 0.5	5/9/2012	347	4,400	4.4
	0.5 - 2	5/9/2012	145	1,300	4.5
	2 - 4	5/9/2012	625	275	4.5
	4 - 6	5/9/2012	1,120	164	3.6 J
	6 - 8	5/9/2012	1,090 [1,020]	233 [219]	3.6 J [3.6 J]
	8 - 10	5/9/2012	1,520	649 J	4.8 J
	10 - 12	5/9/2012	1,670	149 J	3.7 J
	12 - 13	5/9/2012	1,340	647	4.4 J
CH-SB-95	0 - 0.5	5/10/2012	84.6	126	4.9
	0.5 - 2	5/10/2012	966	671	6.4
	2 - 4	5/10/2012	1,140	305	4.7
	4 - 6	5/10/2012	919	194	3.6 J
	6 - 8	5/10/2012	440	15.9	3.5 J
	8 - 10	5/10/2012	4.83	11.3 J	3.8 J

Table 3-1
Summary of Arsenic and Lead Concentrations in Soil Samples
SDR and RAWP
VCC Charlotte, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)	pH (SU)
Screening Level			27	270	- -
CH-SB-96	0 - 0.5	5/10/2012	3.54	68.9 J	6.6
	0.5 - 2	5/10/2012	1.26 J [1.78]	9.86 J [19.4 J]	5.8 [5.4]
	2 - 4	5/10/2012	3.24	6.45 J	5
CH-SB-97	0 - 0.5	5/10/2012	7.89	74.4 J	6.5
	0.5 - 2	5/10/2012	4.39	69.4 J	6.5
	2 - 4	5/10/2012	0.950 J	12.2 J	5.9
CH-SB-98	0 - 0.5	5/9/2012	2.61	592	6.5
	0.5 - 2	5/9/2012	1.34	47.8	4.9
	2 - 4	5/9/2012	1.23 U	17.1	4.5
CH-SB-99	0 - 0.5	10/2/2012	37.0 J	803 J	5.6
	0.5 - 2	10/2/2012	28.6 J	83.8 J	4.8
CH-SB-100	0 - 0.5	10/2/2012	42.7 J	83.9 J	6
	0.5 - 2	10/2/2012	11.9 J [12.8 J]	53.6 J [133 J]	5.1 [4.6]
CH-SB-101	0 - 0.5	10/2/2012	5.84	10.7	3.9 J
	0.5 - 2	10/2/2012	4.03	6.11	6.5 J

Notes:

mg/kg - milligrams per kilogram

ft bgs - feet below ground surface

SU - standard units

J - estimated value

U - not detected

UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate

R = Rejected data

Duplicate sample concentrations are in brackets

Site-specific screening levels of 27 mg/kg for arsenic and 270 mg/kg for lead.

Shaded values exceed screening levels.

Table 3-2
Summary of Waste Characterization Analytical Results
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:												
Analyte	**Screening Levels**	**Units**	**CH-SB-13 0 - 2 ft bgs 5/10/2012**	**CH-SB-40 0 - 2 ft bgs 2/10/2011**	**CH-SB-42 0 - 4 ft bgs 2/7/2011**	**CH-SB-47 0 - 2 ft bgs 2/8/2011**	**CH-SB-51 0 - 2 ft bgs 2/11/2011**	**CH-SB-52 0 - 4 ft bgs 2/10/2011**	**CH-SB-54 0 - 2 ft bgs 2/11/2011**	**CH-SB-61 0 - 0.5 ft bgs 12/13/2011**	**CH-SB-66 0 - 0.5 ft bgs 12/13/2011**	**CH-SB-79 0 - 2 ft bgs 12/15/2011**	**CH-SB-89 0 - 6 ft bgs 5/8/2012**	**CH-SB-93 0 - 4 ft bgs 5/9/2012**	**CH-SB-94 0 - 4 ft bgs 5/10/2012**
VOCs-TCLP															
1,1-Dichloroethene	0.7	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
1,2-Dichloroethane	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
2-Butanone	200	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.25 U
Benzene	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Carbon Tetrachloride	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Chlorobenzene	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Chloroform	6	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Tetrachloroethene	0.7	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Trichloroethene	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Vinyl Chloride	0.2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
PCBs															
Aroclor-1016	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1221	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1232	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1242	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1248	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1254	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Aroclor-1260	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
Total PCBs	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0522 U
SVOCs-TCLP															
1,4-Dichlorobenzene	7.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
2,4,5-Trichlorophenol	400	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
2,4,6-Trichlorophenol	2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
2,4-Dinitrotoluene	0.13	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
3&4-Methylphenol	--	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04 U
Hexachlorobenzene	0.13	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Hexachlorobutadiene	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Hexachloroethane	3	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Nitrobenzene	2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Pentachlorophenol	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Pyridine	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Metals															
Arsenic	27	mg/kg	127	278	188	88.1	310	326	12.7	NA	NA	9.09	167	635	NA
Lead	270	mg/kg	592	1390	180	502	366	1560	955	NA	NA	234	136	590	NA
Metals - TCLP															
Arsenic	5	mg/L	0.117 B	0.1 U	0.1 U	0.051 J	0.501	0.1 U	0.1 U	0.1 U	0.054 J	0.1 U	0.1 U	0.1 U	0.1 U
Barium	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.853
Cadmium	1	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.004 J
Chromium	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
Lead	5	mg/L	0.052	0.706	0.056	0.168	25.5	0.073	0.054	0.273	0.227	0.149	0.04 J	0.023 J	10.3
Mercury	.2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01 U
Selenium	1	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Silver	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
Miscellaneous															
pH		SU	6.6	3.6	5.3	6.2	6.6	2.3	3.3	NA	NA	4.7	6.5	3.7	NA

Notes:
U - not detected
J - estimated value
B - analyte was detected in the associated method blank.
mg/L - milligrams per liter
mg/kg - milligrams per kilogram
TCLP - toxicity characterization leaching procedure
SU - standard units
ft bgs - feet below ground surface
Shaded values exceed screening levels.

Table 3-3
Groundwater Analytical Results and Field Measurements
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:					
Analyte	**NC 2L GW Standards**	**Units**	**CH-MW-01 3/1/2011**	**CH-MW-01 5/10/2012**	**CH-MW-01 10/3/12**	**CH-MW-02 3/1/2011**	**CH-MW-02 5/10/2012**	**CH-MW-02 10/3/12**
Inorganics-Unfiltered								
Arsenic	10	ug/L	10 U	10 UJ	10 U	10 U	10 UJ [10 UJ]	10 U
Lead	15	ug/L	3.6 J	15.7	2.3 J	4.8 J	33.5 [33.4]	6.3
Inorganics-Filtered								
Arsenic	10	ug/L	10 U	10 U	10 UJ	10 U	10 U [10 U]	5.3 UBJ
Lead	15	ug/L	5 U	5 U	5 U	5 U	3.3 J [2.7 J]	5 U
Field Parameters								
Dissolved Oxygen	- -	mg/L	1.92	1.34	0.96	2.27	0.96	0.76
ORP	- -	mV	172	204.4	141	150	123.3	95
pH	- -	SU	5.48	4.64	5.10	5.7	4.6	5.46
Specific Conductivity	- -	mS/cm	0.377	0.348	0.326	0.222	0.243	0.255
Temperature	- -	°C	18.68	19.2	21.38	21.4	22.57	24.51
Turbidity	- -	NTU	2	1.1	2.12	2	3	2.20

Notes:
U - not detected
J - estimated value
UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate
UBJ - the analyte is considered non-detect at the listed value due to blank contamination; however, the concentration is an estimate
ug/L - micrograms per liter
mg/L - milligrams per liter
mV - millivolt
SU - standard units
mS/cm - millisiemens per centimeter
°C - degrees Celsius
NTU - nephelometric turbidity units
Duplicate sample concentrations are in brackets
Shaded values exceed the NC 2L Groundwater Standards.

Table 3-3
Groundwater Analytical Results and Field Measurements
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:					
Analyte	**NC 2L GW Standards**	**Units**	**CH-MW-03 3/1/2011**	**CH-MW-03 3/29/2011**	**CH-MW-03 5/10/2012**	**CH-MW-03 10/3/12**	**CH-MW-04 3/1/2011**	**CH-MW-04 5/10/2012**
Inorganics-Unfiltered								
Arsenic	10	ug/L	8.1 J	8.9 J	8.6 J	9 J	10 U	10 UJ
Lead	15	ug/L	17.4	17.4	45.6	7.8	5.8	39.5
Inorganics-Filtered								
Arsenic	10	ug/L	7.3 J	4 J	10.6 J	11.2 UBJ	10 U	10 U
Lead	15	ug/L	8.2	8.7	6.1	8	3.6 J	3.4 J
Field Parameters								
Dissolved Oxygen	- -	mg/L	2.81	2.16	0.29	0.36	4.02	4.82
ORP	- -	mV	255	319	200.2	168	295	258.7
pH	- -	SU	4.65	4.38	3.5	4.16	4.11	2.84
Specific Conductivity	- -	mS/cm	2.317	2.46	2.489	2.397	0.491	0.508
Temperature	- -	°C	21.31	21.49	23.24	25.72	19.38	22.11
Turbidity	- -	NTU	2	3	1.1	1.58	1	4.1

Notes:

U - not detected

J - estimated value

UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate

UBJ - the analyte is considered non-detect at the listed value due to blank contamination; however, the concentration is an estimate

ug/L - micrograms per liter

mg/L - milligrams per liter

mV - millivolt

SU - standard units

mS/cm - millisiemens per centimeter

°C - degrees Celsius

NTU - nephelometric turbidity units

Duplicate sample concentrations are in brackets

Shaded values exceed the NC 2L Groundwater Standards.

Table 3-3
Groundwater Analytical Results and Field Measurements
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:					
Analyte	**NC 2L GW Standards**	**Units**	**CH-MW-04 10/3/12**	**CH-MW-05 3/1/2011**	**CH-MW-05 5/10/2012**	**CH-MW-05 10/3/12**	**CH-MW-06 3/1/2011**	**CH-MW-06 5/10/2012**
Inorganics-Unfiltered								
Arsenic	10	ug/L	10 U	10 U	10 UJ	10 U	10 U	10 UJ
Lead	15	ug/L	6.4	5.3	38.3	4.7 J	4.3 J	21
Inorganics-Filtered								
Arsenic	10	ug/L	10 UBJ	10 U	10 U	10 UJ	10 U	10 U
Lead	15	ug/L	7.5	5 U	3.9 J	2.4 J	5 U	5 U
Field Parameters								
Dissolved Oxygen	- -	mg/L	4.78	3.68	0.27	0.40	1.05	0.38
ORP	- -	mV	228	248	231.8	172	201	141
pH	- -	SU	3.80	5.32	3.35	4.41	5.22	4.52
Specific Conductivity	- -	mS/cm	0.498	0.561	0.648	0.512	0.978	0.942
Temperature	- -	°C	22.68	18.75	20.26	22.59	20.15	22.29
Turbidity	- -	NTU	1.94	1	2.2	1.39	7	1.3

Notes:

U - not detected

J - estimated value

UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate

UBJ - the analyte is considered non-detect at the listed value due to blank contamination; however, the concentration is an estimate

ug/L - micrograms per liter

mg/L - milligrams per liter

mV - millivolt

SU - standard units

mS/cm - millisiemens per centimeter

°C - degrees Celsius

NTU - nephelometric turbidity units

Duplicate sample concentrations are in brackets

Shaded values exceed the NC 2L Groundwater Standards.

Table 3-3
Groundwater Analytical Results and Field Measurements
SDR and RAWP
VCC Charlotte, North Carolina

Analyte	NC 2L GW Standards	Units	Concentration in Sample: CH-MW-06 10/3/12	CH-MW-07 3/1/2011	CH-MW-07 3/29/2011	CH-MW-07 5/10/2012	CH-MW-07 10/3/12
Inorganics-Unfiltered							
Arsenic	10	ug/L	10 U	10 U [10 U]	10 U	10 UJ	10 U [10 U]
Lead	15	ug/L	3.1 J	18.2 [18.2]	19.2	99.5	15.4 [15.3]
Inorganics-Filtered							
Arsenic	10	ug/L	10 UJ	10 U [10 U]	10 UJ	10 U	10 UBJ [10 UBJ]
Lead	15	ug/L	5 U	3.9 J [4.8 J]	5 U	7	22.8 [26.8]
Field Parameters							
Dissolved Oxygen	- -	mg/L	0.40	1.5	0.86	0.28	0.38
ORP	- -	mV	120	355	399	301.6	221
pH	- -	SU	5.03	3.95	3.77	3.07	3.63
Specific Conductivity	- -	mS/cm	0.926	3.677	3.777	2.735	3.658
Temperature	- -	°C	24.46	20.37	20.57	21.66	23.49
Turbidity	- -	NTU	1.40	9	5	1.1	2.06

Notes:

U - not detected

J - estimated value

UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate

UBJ - the analyte is considered non-detect at the listed value due to blank contamination; however, the concentration is an estimate

ug/L - micrograms per liter

mg/L - milligrams per liter

mV - millivolt

SU - standard units

mS/cm - millisiemens per centimeter

°C - degrees Celsius

NTU - nephelometric turbidity units

Duplicate sample concentrations are in brackets

Shaded values exceed the NC 2L Groundwater Standards.

Table 3-4
Summary of Investigation-Derived Waste - Liquid Analytical Results
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:						
Analyte	**Regulatory Standard**	**Units**	**CH-IDW_DeconWater 4/21/2010**	**CH-IDW-01 3/2/2011**	**CH-IDW-02 3/2/2011**	**CH-IDW-03 3/2/2011**	**CH-IDW-02 12/15/2011**	**CH-IDW_DeconWater 5/11/2012**	**CH-IDW-01 10/3/2012**
TAL Metals									
Aluminum	- -	mg/L	97.9	58.6	5.15	44.2	40.7	40.1	11.6
Antimony	- -	mg/L	0.021 U	0.019	0.01 U	0.01 U	0.005 U	0.18	0.0034 U
Arsenic	5	mg/L	0.063 J	0.582	0.01 U	0.0092 J	0.0669	1.24	0.0061 J
Barium	100	mg/L	0.179	2.59	0.196	0.228	0.174	0.16	0.134
Beryllium	- -	mg/L	0.01 U	0.004 U	0.004 U	0.005	0.002 U	0.0026 J	0.0024 J
Cadmium	1	mg/L	0.006 U	0.001 U	0.001 U	0.0036	0.0006 U	0.0048	0.002
Calcium	- -	mg/L	18.9	8.74	19.6	159	28.1	58.2	63
Chromium	5	mg/L	0.174	0.109	0.0186	0.108	0.077	0.0798	0.0314
Cobalt	- -	mg/L	0.05 U	0.0667	0.0322	0.375	0.0227	0.135	0.115
Copper	- -	mg/L	0.409	0.288	0.0626	0.265	0.243	0.506	0.287
Iron	- -	mg/L	173	139	13.2	58	96.1	98.8	29.8
Lead	5	mg/L	0.325	0.961	0.0198	0.0348	0.206	4.84	0.0232
Magnesium	- -	mg/L	2.66 J	2.02	5.66	49.5	3.07	15.4	16.3
Manganese	- -	mg/L	2.7	2.18	1.07	9.01	0.926	3.56	3.33
Mercury	0.2	mg/L	0.00052	0.0023	0.0004 U	0.000624	0.0013 J	0.02 U	0.000281
Nickel	- -	mg/L	0.221	0.0469	0.0137	0.184	0.0473	0.152	0.0372
Potassium	- -	mg/L	7.02 J	3.92	5.09	10.8	1.72	17.5	19.7
Selenium	1	mg/L	0.039 U	0.0046 J	0.01 U	0.0054 J	0.005 U	0.0135	0.0064 J
Silver	5	mg/L	0.028 U	0.005 U	0.005 U	0.005 U	0.0025 U	0.0015 J	0.0025 U
Sodium	- -	mg/L	1740	1160	18.9	16	622	2540	65.2
Thallium	- -	mg/L	0.063 U	0.01 U	0.01 U	0.01 U	0.005 U	0.01 U	0.0042 J
Vanadium	- -	mg/L	0.367	0.241	0.0241	0.0977	0.198	0.182	0.0471
Zinc	- -	mg/L	5.02	4.01	0.134	1.8	0.487	10.4	0.665 B
Miscellaneous									
pH	≤ 2; ≥ 12.5	SU	6.5	7.1	6.6	4.9	7.2	8	6.6

Notes:

mg/L - milligrams per liter

U - not detected

J - estimated value

B - analyte was detected in the associated method blank.

TAL - target analyte list

SU - standard units

Table 3-5
Summary of Investigation-Derived Waste - Solid Sample Analytical Results
SDR and RAWP
VCC Charlotte, North Carolina

			Concentration in Sample:							
Analyte	**Regulatory Standard**	**Units**	**CH-IDW_Soil 4/21/2010**	**CH-IDW-04 3/2/2011**	**CH-IDW-05 3/2/2011**	**CH-IDW-06 3/2/2011**	**CH-IDW-07 3/2/2011**	**CH-IDW-08 3/2/2011**	**CH-IDW-01 12/15/2011**	**CH-IDW_Soil 5/11/2012**
Metals										
Arsenic		mg/kg	21.7	NA	NA	NA	NA	NA	NA	NA
Lead		mg/kg	940	NA	NA	NA	NA	NA	NA	NA
TCLP Metals										
Arsenic	5	mg/L	0.04 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.05 U	0.1 U
Barium	100	mg/L	0.193	0.965	0.483	0.252	0.296	0.234	0.343	0.31
Cadmium	1	mg/L	0.006 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.006 U	0.01 U
Chromium	5	mg/L	0.026 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.025 U	0.05 U
Lead	5	mg/L	123	0.064	0.187	0.05 U	0.088	0.05 U	0.025 J	0.035 J
Mercury	0.2	mg/L	0.001 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.005 U	0.01 U
Selenium	1	mg/L	0.039 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.05 U	0.1 U
Silver	5	mg/L	0.028 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.025 U	0.05 U
Miscellaneous										
pH	≤ 2; ≥ 12.5	SU	NA	NA	NA	NA	NA	NA	6.6	NA

Notes:

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

U - not detected

J - estimated value

SU - standard units

TCLP - toxicity characteristic leaching procedure

Exceeds regulatory standard.

Table 3-6
Summary of Field Quality Control Sample Results
SDR and RAWP
VCC Charlotte, North Carolina

Sample Name:	Date Collected	Total Arsenic (ug/L)	Total Lead (ug/L)	Dissolved Arsenic (ug/L)	Dissolved Lead (ug/L)
QAQC_EB_01_04192010	04/19/10	3.60 U	2.10 U	NA	NA
QAQC_EB_02_04202010	04/20/10	3.60 U	2.10 U	NA	NA
QAQC_EB_03_04212010	04/21/10	3.60 U	51.9	NA	NA
QAQC-EB_04_04222010	04/22/10	3.60 U	2.10 U	NA	NA
CH-QAQC-EB-05_02072011	02/07/11	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-06_02082011	02/08/11	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-07_02092011	02/09/11	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-08_02102011	02/10/11	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-09_02112011	02/11/11	10.0 U	5.00 U	NA	NA
CH-QAQC-MW-EB-01_02142011	02/14/11	10.0 U	5.00 U	NA	NA
CH-QAQC-MW-EB-02_02152011	02/15/11	10.0 U	5.00 U	NA	NA
CH-QAQC-MW-EB-03_02162011	02/16/11	10.0 U	5.00 U	NA	NA
CH-QAQC-MW-EB-04_02172011	02/17/11	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-01_03012011	03/01/11	10.0 U	5.00 U	10.0 U	5.00 U
CH-QAQC-EB-01_03292011	03/29/11	10.0 U	5.00 U	10.0 UJ	5.00 U
CH-QAQC-EB-01_12132011	12/13/11	5.00 U	2.50 U	NA	NA
CH-QAQC-EB-02_12142011	12/14/11	5.00 U	2.50 U	NA	NA
CH-QAQC-EB-03_12152011	12/15/11	5.00 U	2.50 U	NA	NA
CH-QAQC-EB01_05082012	05/08/12	10.0 UJ	5.00 U	NA	NA
CH-QAQC-EB02_05092012	05/09/12	10.0 UJ	5.00 U	NA	NA
CH-QAQC-EB03_05102012	05/10/12	10.0 UJ	5.00 U	NA	NA
CH-QAQC-EB04_05102012	05/10/12	10.0 UJ	5.00 U	NA	NA
CH-QAQC-EB-01_10022012	10/02/12	10.0 U	5.00 U	NA	NA
CH-QAQC-EB-01_10032012	10/03/12	10.0 U	5.00 U	8.30 J	5.00 U

Notes:

U - not detected

J - estimated value

UJ - the analyte was not detected at the indicated concentration; however, the concentration is an estimate

ug/L - micrograms per liter

Table 5-1
Summary of Excavation Areas and Volumes
SDR and RAWP
VCC - Charlotte, North Carolina

Removal Area ID	Approximate Surface Area of Impacted Soil to be Removed (ft^2)	Approximate Depth of Impacted Soil to be Removed (ft bgs)	Estimated In-Place Excavation Quantities	
			cubic yards	tons
1	411	2	30	52
2	516	1	19	32
3	827	1	31	52
4	1,128	2	84	142
5	289	1	11	18
6	1,513	1	56	95
7	769	2	57	97
8	692	4	102	174
9	2,481	1	92	156
10	30,648	2	2,270	3,859
11	5,005	1	185	315
12	799	1	30	50
13	1,762	2	131	222
14	1,671	1	62	105
15	3,317	4	491	835
16	3,347	4	496	843
17	2,160	4	320	544
18	2,907	2	215	366
19	579	1	21	36
20	1,010	2	75	127
21	388	1	14	24
22	819	1	30	52
Total	**63,037**		**4,823**	**8,199**

Notes:

ft^2 - square feet

ft bgs - feet below ground surface

The calculation of cubic yards to tons is based on a conversion factor of 1.7 tons/cubic yard

Table 5-2
Summary of Confirmation Sampling Program
SDR and RAWP
VCC - Charlotte, North Carolina

Removal Area ID	Approximate Surface Area of Impacted Soil to be Removed (ft^2)	Estimated Number of 5-point Confirmation Samples[1]	Estimated Number of Confirmation Sub-Sample Locations[2]
1	411	1	5
2	516	1	5
3	827	1	5
4	1,128	1	5
5	289	1	5
6	1,513	1	5
7	769	1	5
8	692	1	5
9	2,481	1	5
10	30,648	7	35
11	5,005	2	10
12	799	1	5
13	1,762	1	5
14	1,671	1	5
15	3,317	1	5
16	3,347	1	5
17	2,160	1	5
18	2,907	1	5
19	579	1	5
20	1,010	1	5
21	388	1	5
22	819	1	5

Notes:

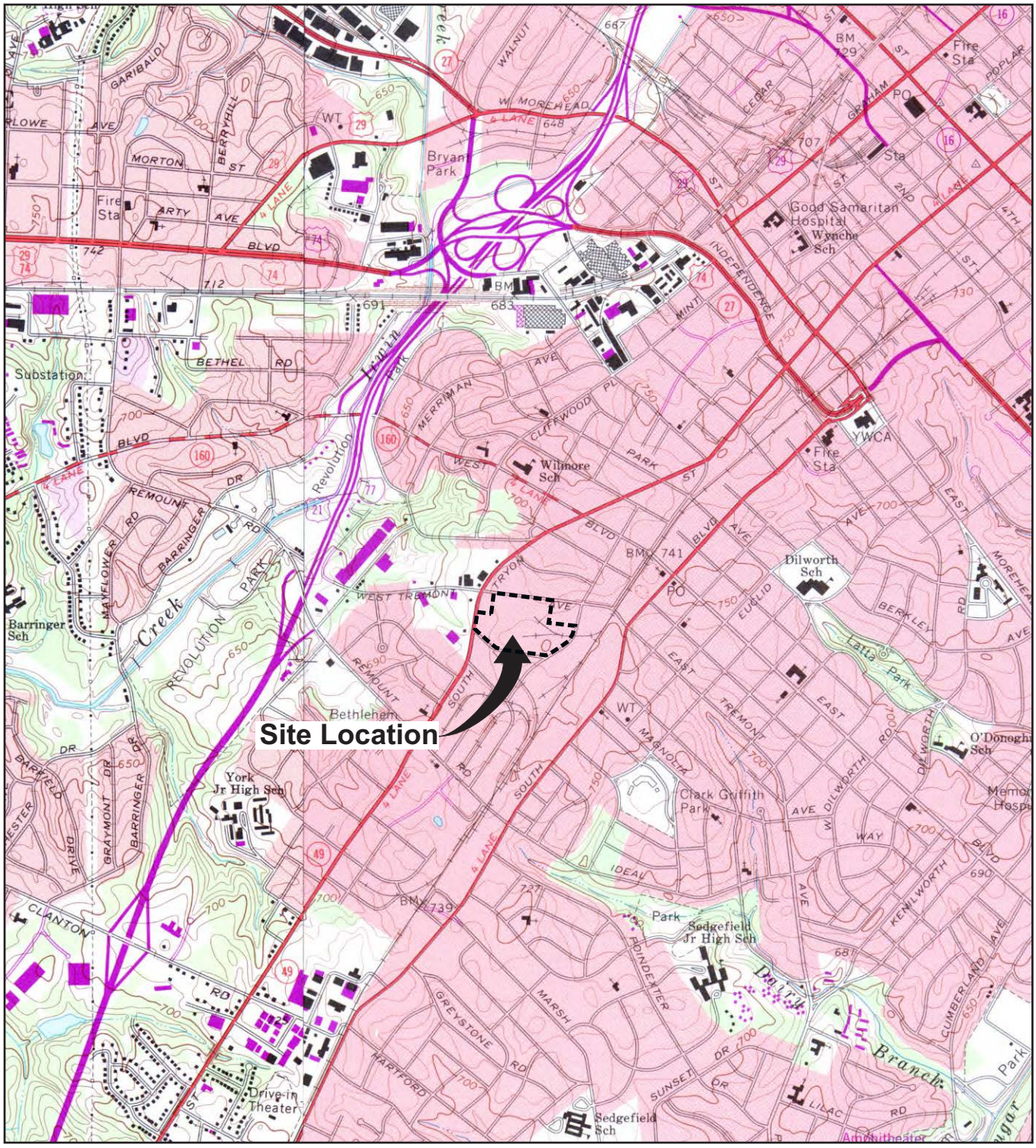
ft^2 - square feet

Surface area estimates are based on inferred limits. Limits will be refined in the field.

[1] One confirmation sample will be collected per 5,000 square feet of excavation, with at least one confirmation sample collected for each subarea.

[2] Confirmation samples will be collected as 5-point composites.

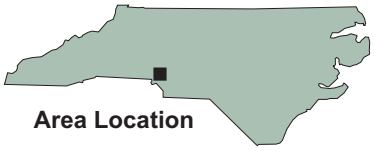
Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., CHARLOTTE WEST & EAST, N.C.,1968/67, PHOTOREVISED 1980/88.

2000' 0 2000'

Approximate Scale: 1" = 2000'



Area Location

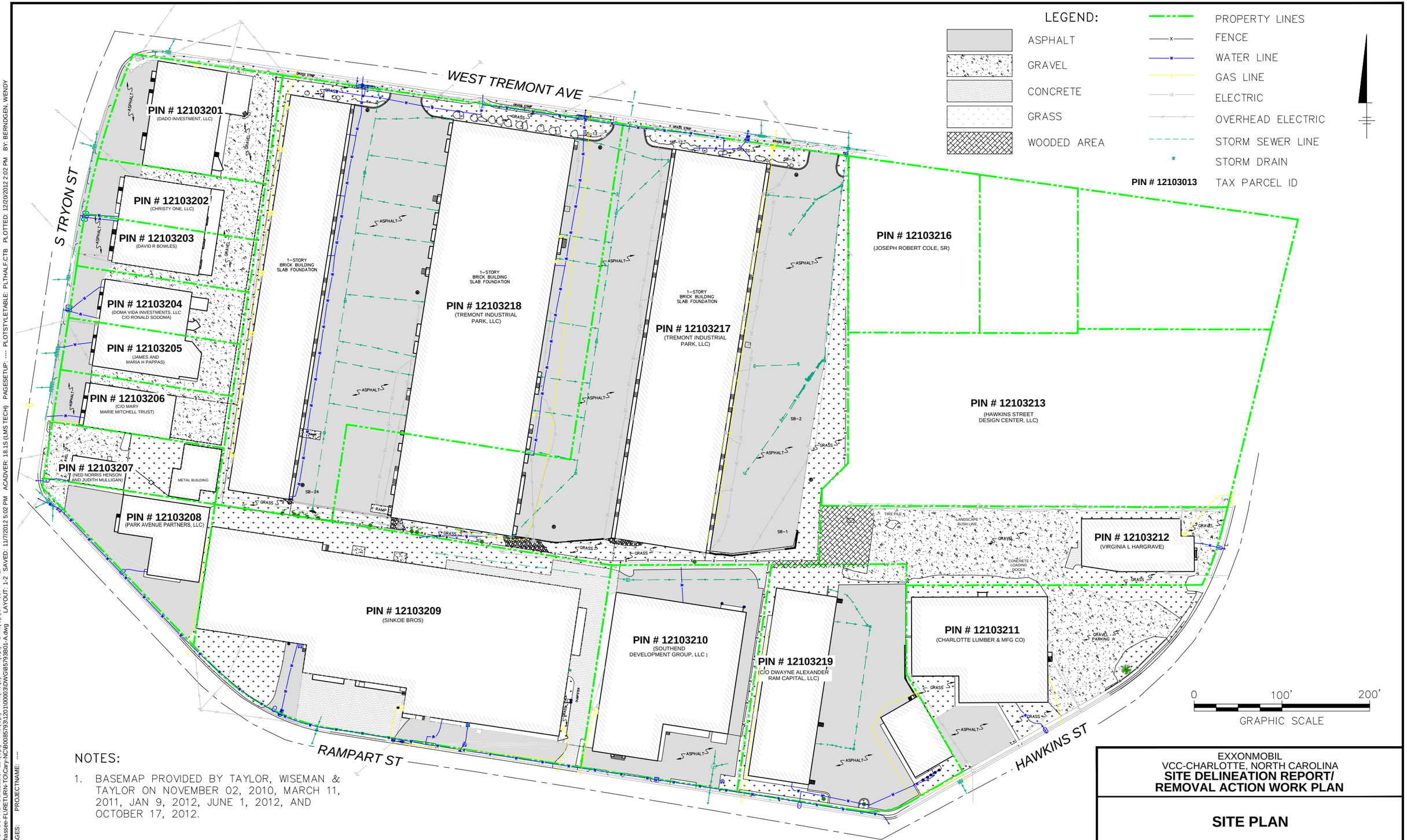
EXXONMOBIL
VCC - CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/
REMOVAL ACTION WORK PLAN

SITE LOCATION MAP

ARCADIS

FIGURE
1-1

G:\ENVCAD\TALLAHASSEE\RETURN TO\CARY-NC\B0085793\120100003\XDATA\85570n01.cdr\WDB\7-30-2012



NOTES:

1. BASEMAP PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010, MARCH 11, 2011, JAN 9, 2012, JUNE 1, 2012, AND OCTOBER 17, 2012.

EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

SITE PLAN

ARCADIS

FIGURE
1-2

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Req'd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\120100003\DWG\85793B01-A.dwg LAYOUT: 1-2 SAVED: 11/7/2012 5:02 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 2:02 PM BY: BERNDGEN, WENDY
XREFS: 85793X02 IMAGES: PROJECTNAME: ----

LEGEND:

- PROPERTY LINES
- PIN # 12103013 TAX PARCEL ID
- APPROXIMATE BOUNDARY OF THE FORMER PROPERTY
- APPROXIMATE LOCATION OF FORMER FERTILIZER PLANT FEATURES

HISTORICAL BUILDING KEY: #

1 BAG HOUSE
2 OFFICE
3 RAILROAD SIDINGS
4 FERTILIZER WAREHOUSE
5 FERTILIZER FACTORY
6 DRY MIXING PLANT
7 SUPPLY HOUSE
8 WASH HOUSE
9 NITRE HOUSE
10 BURNERS
11 ACID CHAMBERS (1929)
12 ACID CHAMBERS (1911)
13 SULFUR BURNERS (1911)
14 50,000 GALLON WATER TOWER

0 125' 250'
GRAPHIC SCALE

NOTES:

1. BASEMAP PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010, MARCH 11, 2011, JAN 9, 2012, JUNE 1, 2012, AND OCTOBER 17, 2012.
2. HISTORICAL SITE FEATURES DIGITIZED FROM 1911 AND 1929 SANBORN MAP.
3. ALL LOCATIONS ARE APPROXIMATE.

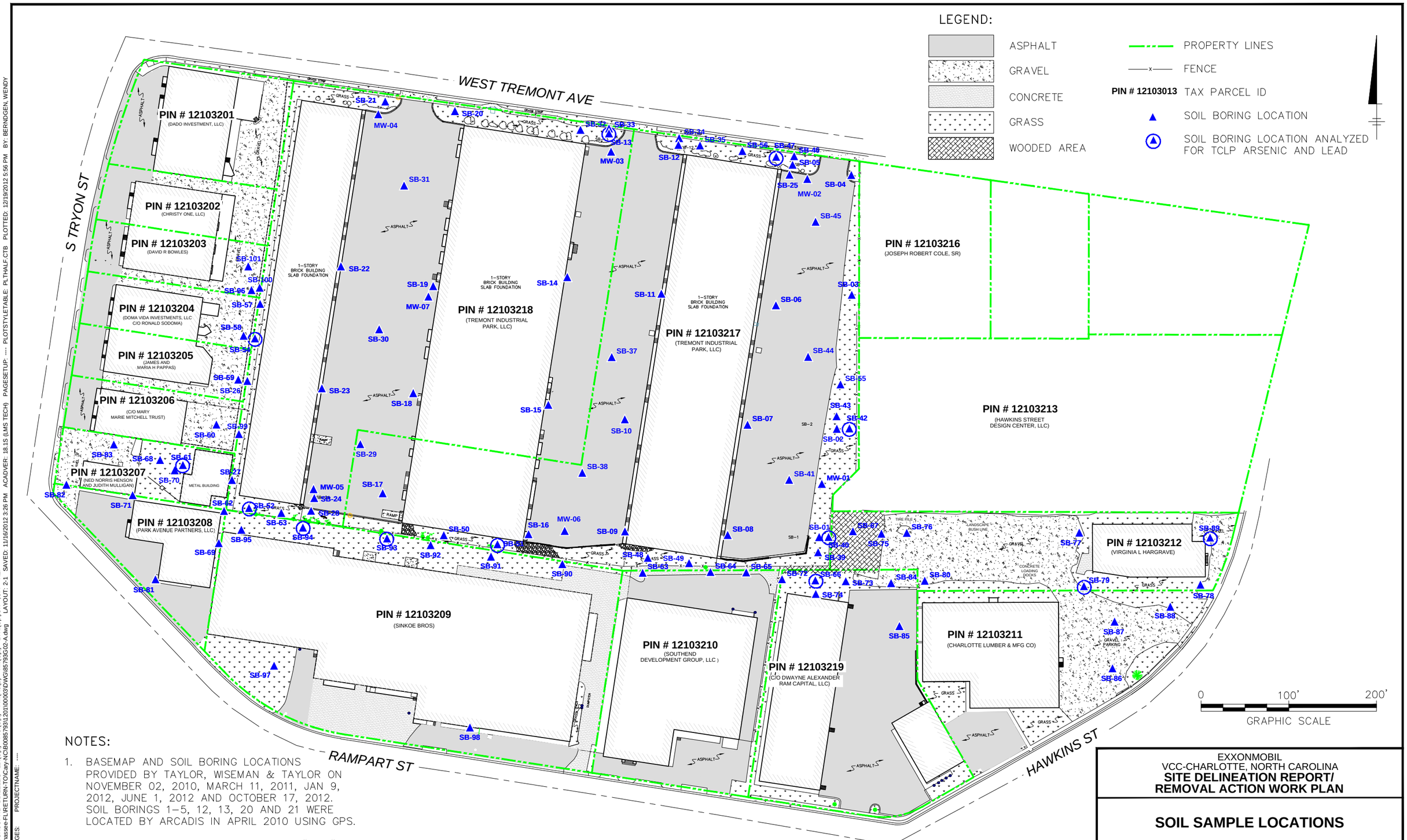
EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

CURRENT AND HISTORICAL SITE FEATURES

ARCADIS

FIGURE
1-3

CITY:CARY DIV/GROUP:41 DB:LELUIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 1:42 PM BY: BERNDGEN, WENDY
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\1201\00003\DWG\857933G01-A.dwg LAYOUT: FIG 1-3 SAVED: 11/16/2012 3:32 PM
XREFS: 857933X02 IMAGES: 857933X01.jpg PROJECTNAME: ----



NOTES:

1. BASEMAP AND SOIL BORING LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010, MARCH 11, 2011, JAN 9, 2012, JUNE 1, 2012 AND OCTOBER 17, 2012. SOIL BORINGS 1–5, 12, 13, 20 AND 21 WERE LOCATED BY ARCADIS IN APRIL 2010 USING GPS.
2. SOIL BORINGS BEGIN WITH THE PREFIX "CH–".
3. TCLP = TOXICITY CHARACTERISTIC LEACHING PROCEDURE.

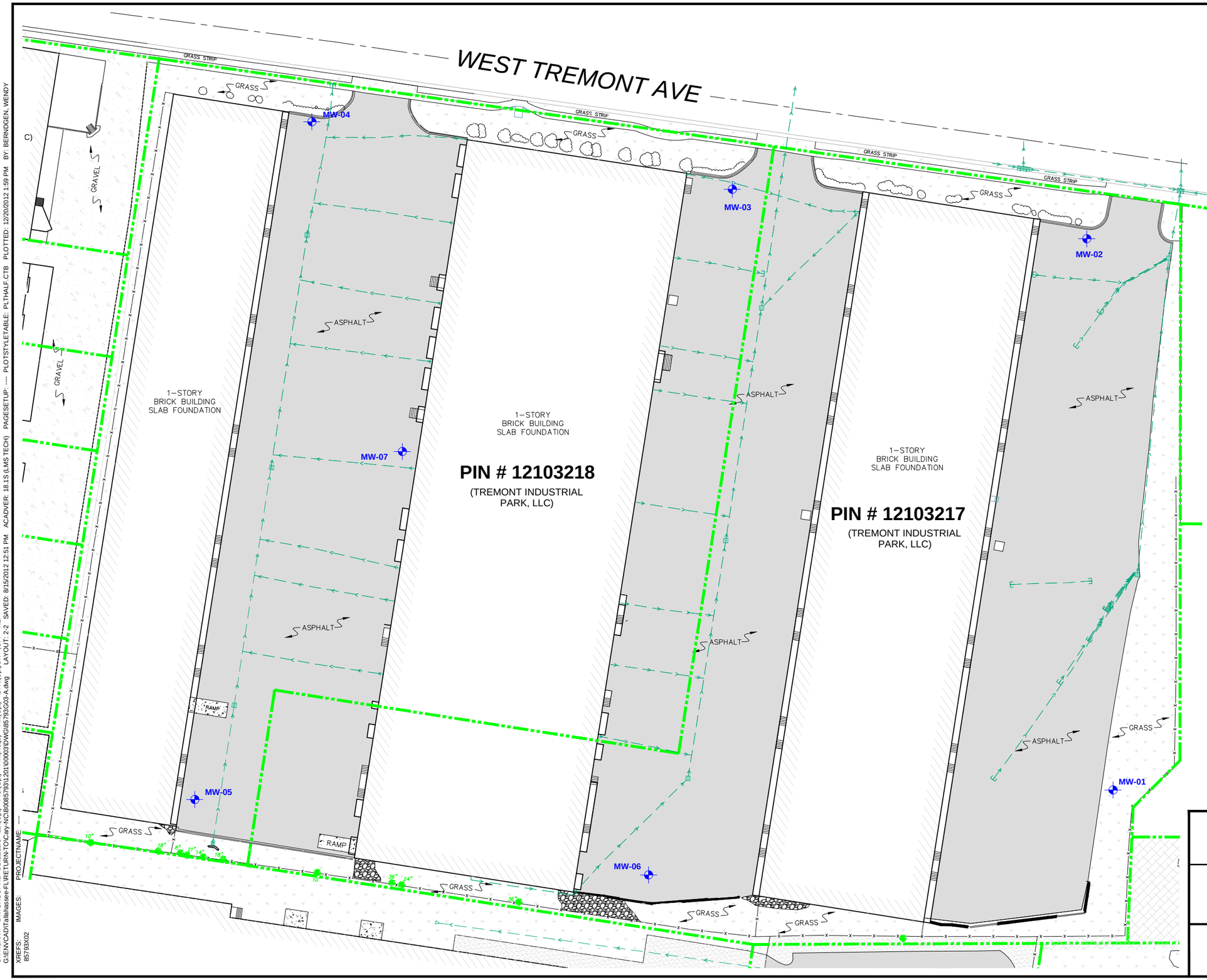
EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

SOIL SAMPLE LOCATIONS

ARCADIS

FIGURE **2-1**

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary,NC\B0085793\12201000\03\DWG\85793G02-A.dwg LAYOUT: 2-1 SAVED: 11/16/2012 3:26 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/19/2012 5:56 PM BY: BERNDGEN, WENDY
XREFS: 85793X02 IMAGES: PROJECTNAME: ----



LEGEND:

- PROPERTY LINES
- FENCE
- TREES
- RIP RAP
- GROUNDWATER MONITORING WELL LOCATION
- **PIN # 12103013** TAX PARCEL ID
- ASPHALT
- GRAVEL
- CONCRETE
- GRASS
- WOODED AREA

NOTES:

1. BASEMAP AND GROUNDWATER MONITORING WELL LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010 AND MARCH 11, 2011.

0 60' 120'
GRAPHIC SCALE

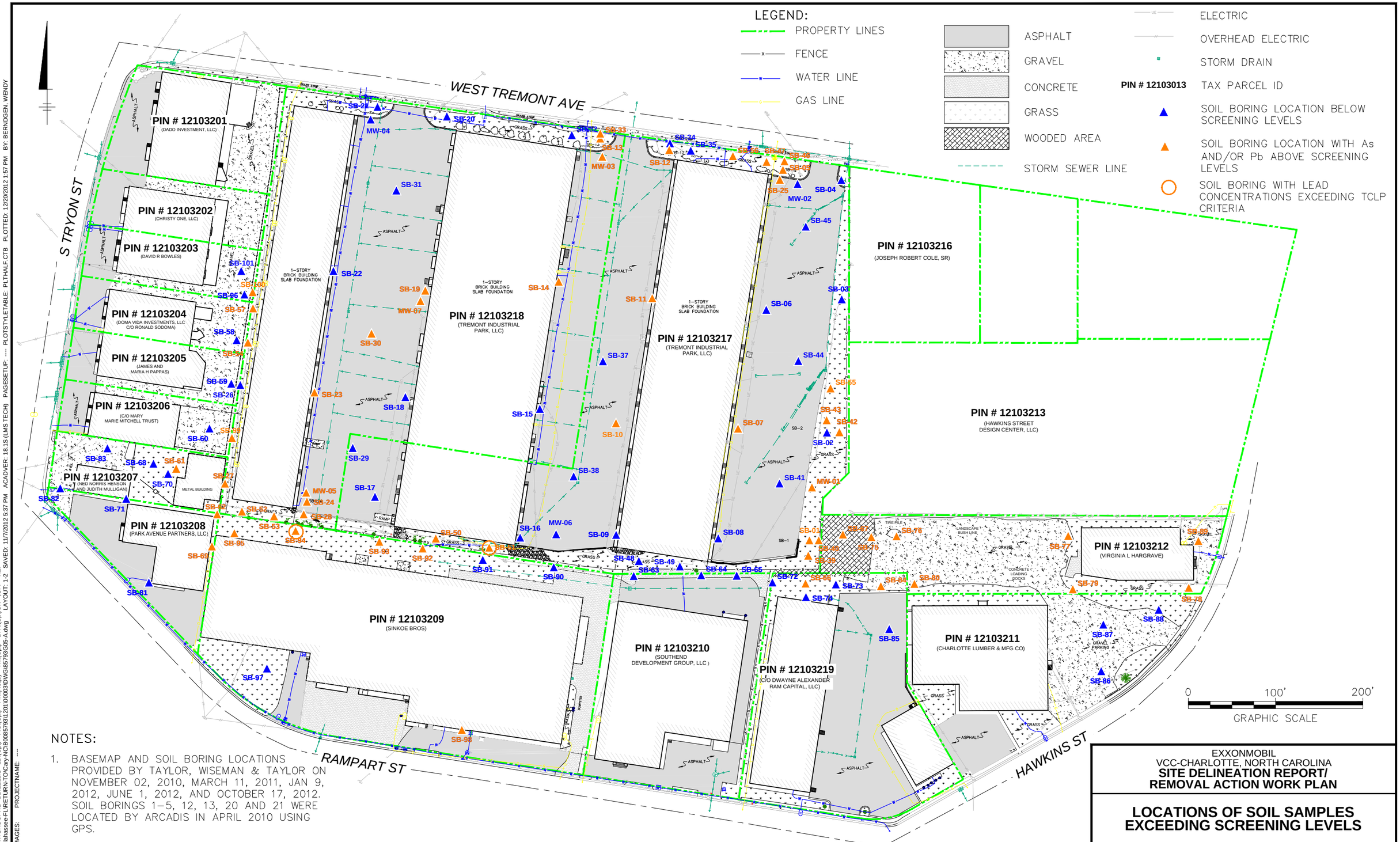
EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

GROUNDWATER MONITORING WELL LOCATIONS

ARCADIS

FIGURE
2-2

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\12010\00003\DWG\85793G03-A.dwg LAYOUT: 2-2 SAVED: 9/15/2012 12:51 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 1:59 PM BY: BERNDGEN, WENDY
XREFS: 85793X02 IMAGES: PROJECTNAME: ----



NOTES:

1. BASEMAP AND SOIL BORING LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010, MARCH 11, 2011, JAN 9, 2012, JUNE 1, 2012, AND OCTOBER 17, 2012. SOIL BORINGS 1–5, 12, 13, 20 AND 21 WERE LOCATED BY ARCADIS IN APRIL 2010 USING GPS.
2. SOIL BORINGS BEGIN WITH THE PREFIX "CH–".
3. mg/kg – MILLIGRAMS PER KILOGRAM.

SITE–SPECIFIC SCREENING LEVELS (SSSLs)	
ARSENIC (As)	27 mg/kg
LEAD (Pb)	270 mg/kg

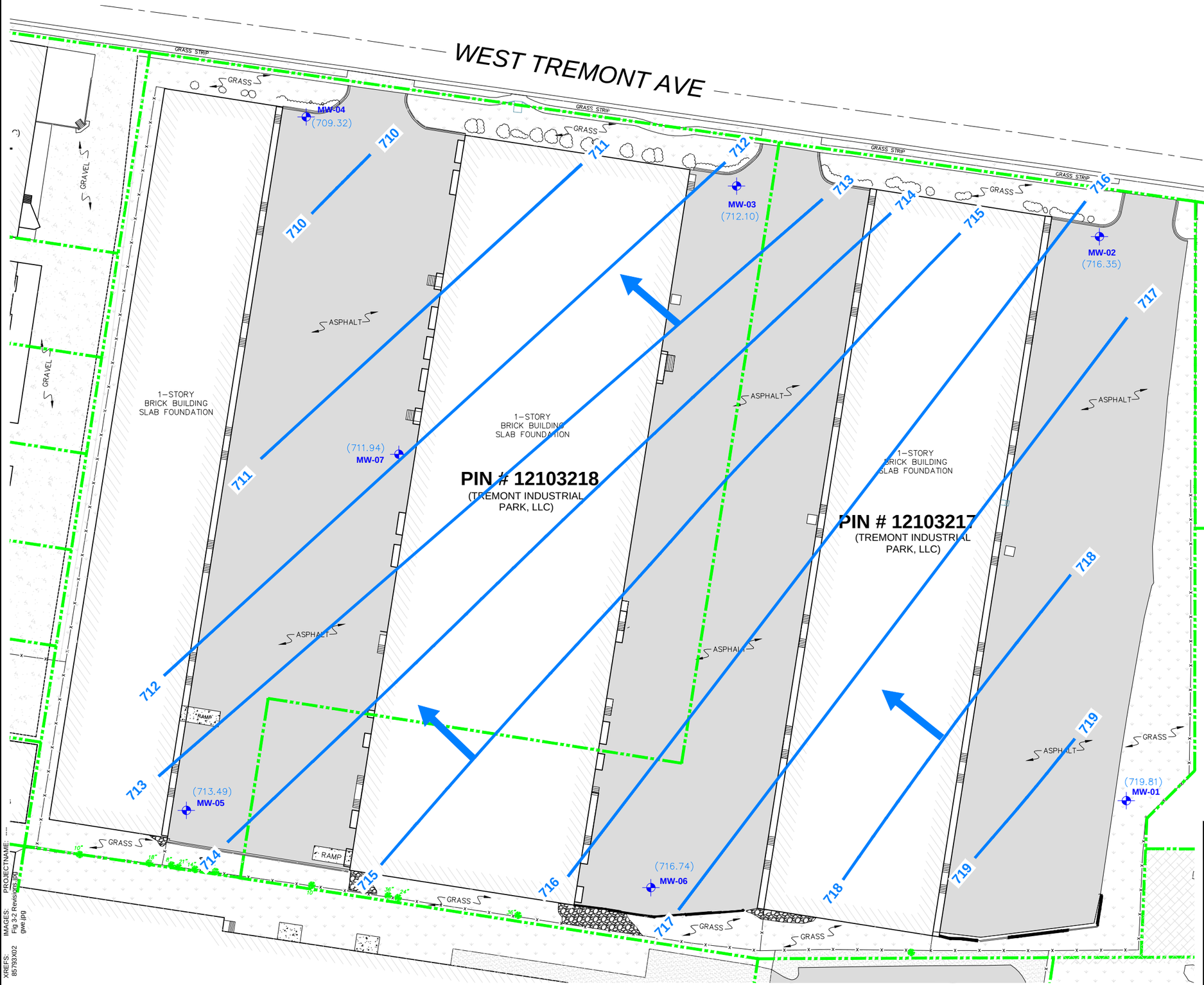
EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

LOCATIONS OF SOIL SAMPLES EXCEEDING SCREENING LEVELS

ARCADIS

FIGURE
3-1

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 1:57 PM BY: BERNDGEN, WENDY
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\12010\00003\DWG\85793G05-A.dwg LAYOUT: 1-2 SAVED: 11/7/2012 5:37 PM
XREFS: 85793X02 IMAGES: PROJECTNAME: ----



LEGEND:

- PROPERTY LINES
- FENCE
- TREES
- RIP RAP
- ASPHALT
- GRAVEL
- CONCRETE
- GRASS
- WOODED AREA
- SHALLOW GROUNDWATER MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (FEET AMSL)
- (716.35) GROUNDWATER ELEVATION (FEET AMSL)
- APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION

1. BASEMAP AND GROUNDWATER MONITORING WELL LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010 AND MARCH 11, 2011.
2. GROUNDWATER ELEVATIONS SHOWN ARE BASED ON GAUGING DATA COLLECTED ON OCTOBER 3, 2012.
3. SHALLOW GROUNDWATER MONITORING WELLS MW-01 THROUGH MW-07 WERE INSTALLED FROM FEBRUARY 14-17, 2011.
4. WELL IDs HAVE THE PREFIX "CH-".

0 60' 120'
GRAPHIC SCALE

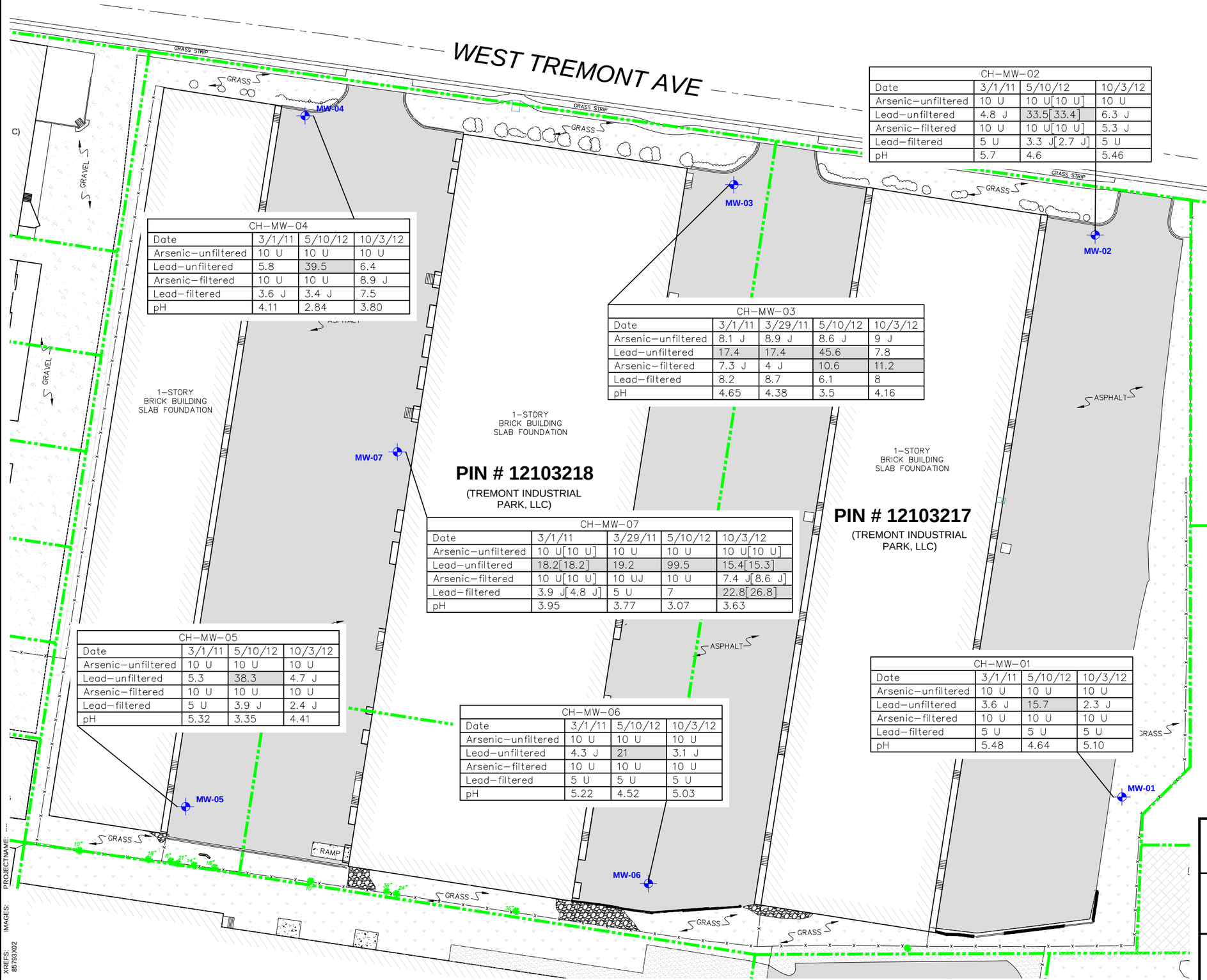
EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAP OCTOBER 3, 2012

ARCADIS

FIGURE
3-2

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\1201\00003\DWG\85793W02-A.dwg LAYOUT: 2-2 SAVED: 12/7/2012 4:18 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 1:55 PM BY: BERNDGEN, WENDY
XREFS: 85793X02 IMAGES: Fig 3-2 Revisions.jpg gwe.jpg PROJECTNAME: ----



CH-MW-02			
Date	3/1/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U	10 U[10 U]	10 U
Lead-unfiltered	4.8 J	33.5[33.4]	6.3 J
Arsenic-filtered	10 U	10 U[10 U]	5.3 J
Lead-filtered	5 U	3.3 J[2.7 J]	5 U
pH	5.7	4.6	5.46

CH-MW-04			
Date	3/1/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U	10 U	10 U
Lead-unfiltered	5.8	39.5	6.4
Arsenic-filtered	10 U	10 U	8.9 J
Lead-filtered	3.6 J	3.4 J	7.5
pH	4.11	2.84	3.80

CH-MW-03				
Date	3/1/11	3/29/11	5/10/12	10/3/12
Arsenic-unfiltered	8.1 J	8.9 J	8.6 J	9 J
Lead-unfiltered	17.4	17.4	45.6	7.8
Arsenic-filtered	7.3 J	4 J	10.6	11.2
Lead-filtered	8.2	8.7	6.1	8
pH	4.65	4.38	3.5	4.16

CH-MW-07				
Date	3/1/11	3/29/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U[10 U]	10 U	10 U	10 U[10 U]
Lead-unfiltered	18.2[18.2]	19.2	99.5	15.4[15.3]
Arsenic-filtered	10 U[10 U]	10 UJ	10 U	7.4 J[8.6 J]
Lead-filtered	3.9 J[4.8 J]	5 U	7	22.8[26.8]
pH	3.95	3.77	3.07	3.63

CH-MW-05			
Date	3/1/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U	10 U	10 U
Lead-unfiltered	5.3	38.3	4.7 J
Arsenic-filtered	10 U	10 U	10 U
Lead-filtered	5 U	3.9 J	2.4 J
pH	5.32	3.35	4.41

CH-MW-06			
Date	3/1/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U	10 U	10 U
Lead-unfiltered	4.3 J	21	3.1 J
Arsenic-filtered	10 U	10 U	10 U
Lead-filtered	5 U	5 U	5 U
pH	5.22	4.52	5.03

CH-MW-01			
Date	3/1/11	5/10/12	10/3/12
Arsenic-unfiltered	10 U	10 U	10 U
Lead-unfiltered	3.6 J	15.7	2.3 J
Arsenic-filtered	10 U	10 U	10 U
Lead-filtered	5 U	5 U	5 U
pH	5.48	4.64	5.10

LEGEND:

- PROPERTY LINES
- FENCE
- TREES
- RIP RAP
- GROUNDWATER MONITORING WELL LOCATION
- PIN # 12103013 TAX PARCEL ID
- ASPHALT
- GRAVEL
- CONCRETE
- GRASS
- WOODED AREA

NOTES:

1. BASEMAP AND GROUNDWATER MONITORING WELL LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010 AND MARCH 11, 2011.
2. ARSENIC AND LEAD CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L). pH IS IN STANDARD UNITS.
3. DUPLICATE RESULTS ARE IN BRACKETS.
4. J = ESTIMATED VALUE.
5. U = NOT DETECTED.
6. SHADED SAMPLE RESULTS EXCEED NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES 2L GROUNDWATER STANDARDS OF 10 µg/L FOR ARSENIC AND 15 µg/L FOR LEAD.

0 60' 120'
GRAPHIC SCALE

EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

GROUNDWATER ANALYTICAL DATA

ARCADIS

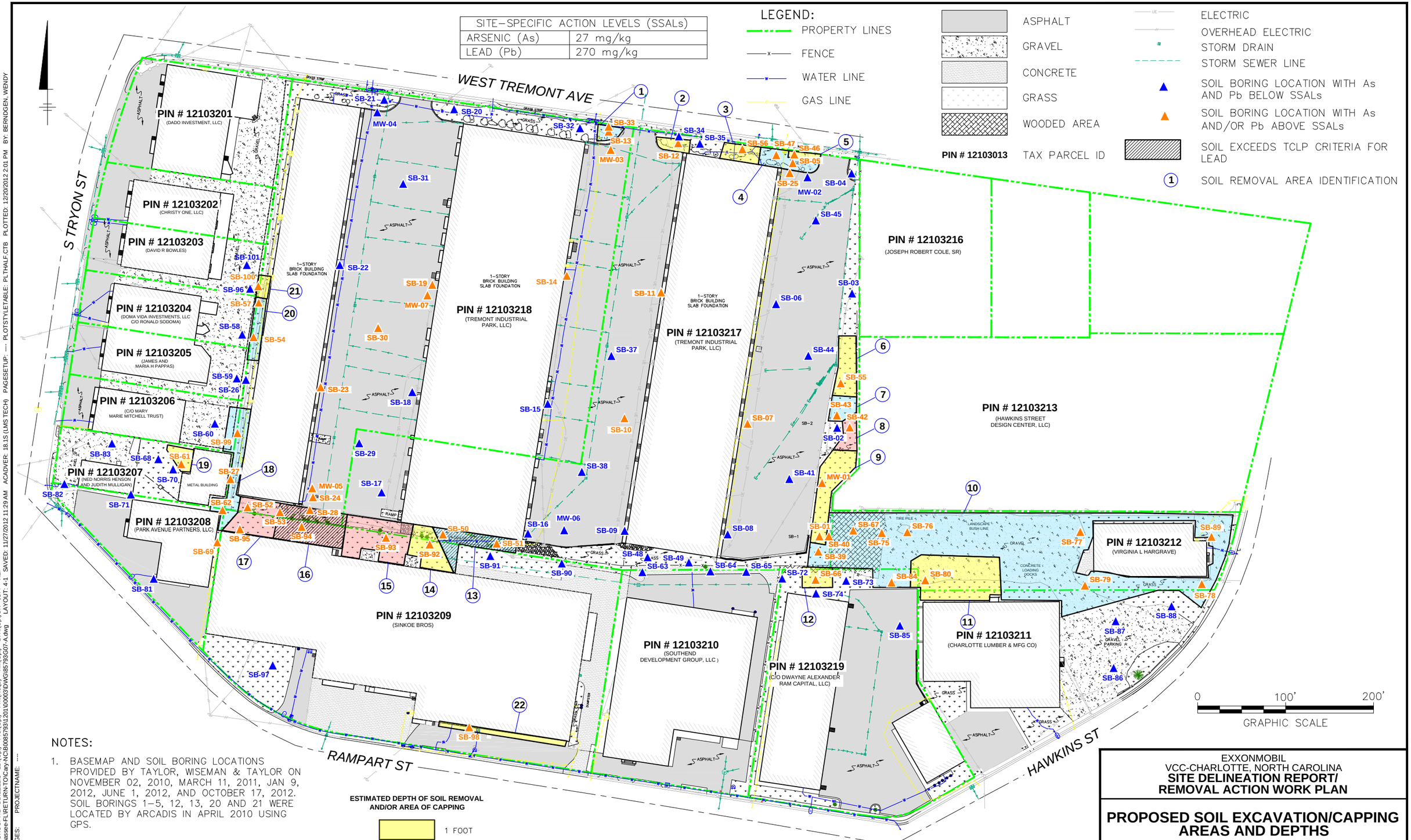
FIGURE
3-3

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 1:56 PM BY: BERNDGEN, WENDY
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\12010\00003\DWG\85793\G08-A.dwg LAYOUT: 3-3 SAVED: 11/16/2012 4:18 PM ACADVER: 18.1S (LMS TECH)
XREFS: 85793X02 IMAGES: PROJECTNAME: ----

SITE-SPECIFIC ACTION LEVELS (SSALs)	
ARSENIC (As)	27 mg/kg
LEAD (Pb)	270 mg/kg

LEGEND:

- PROPERTY LINES
- FENCE
- WATER LINE
- GAS LINE
- ASPHALT
- GRAVEL
- CONCRETE
- GRASS
- WOODED AREA
- PIN # 12103013 TAX PARCEL ID
- ELECTRIC
- OVERHEAD ELECTRIC
- STORM DRAIN
- STORM SEWER LINE
- SOIL BORING LOCATION WITH As AND Pb BELOW SSALs
- SOIL BORING LOCATION WITH As AND/OR Pb ABOVE SSALs
- SOIL EXCEEDS TCLP CRITERIA FOR LEAD
- (1) SOIL REMOVAL AREA IDENTIFICATION



NOTES:

1. BASEMAP AND SOIL BORING LOCATIONS PROVIDED BY TAYLOR, WISEMAN & TAYLOR ON NOVEMBER 02, 2010, MARCH 11, 2011, JAN 9, 2012, JUNE 1, 2012, AND OCTOBER 17, 2012. SOIL BORINGS 1–5, 12, 13, 20 AND 21 WERE LOCATED BY ARCADIS IN APRIL 2010 USING GPS.
2. SOIL BORINGS BEGIN WITH THE PREFIX "CH–".
3. mg/kg – MILLIGRAMS PER KILOGRAM.
4. TCLP=TOXICITY CHARACTERISTIC LEACHING PROCEDURE.

ESTIMATED DEPTH OF SOIL REMOVAL AND/OR AREA OF CAPPING

- 1 FOOT
- 2 FEET
- 4 FEET

EXXONMOBIL
VCC-CHARLOTTE, NORTH CAROLINA
SITE DELINEATION REPORT/ REMOVAL ACTION WORK PLAN

PROPOSED SOIL EXCAVATION/CAPPING AREAS AND DEPTHS

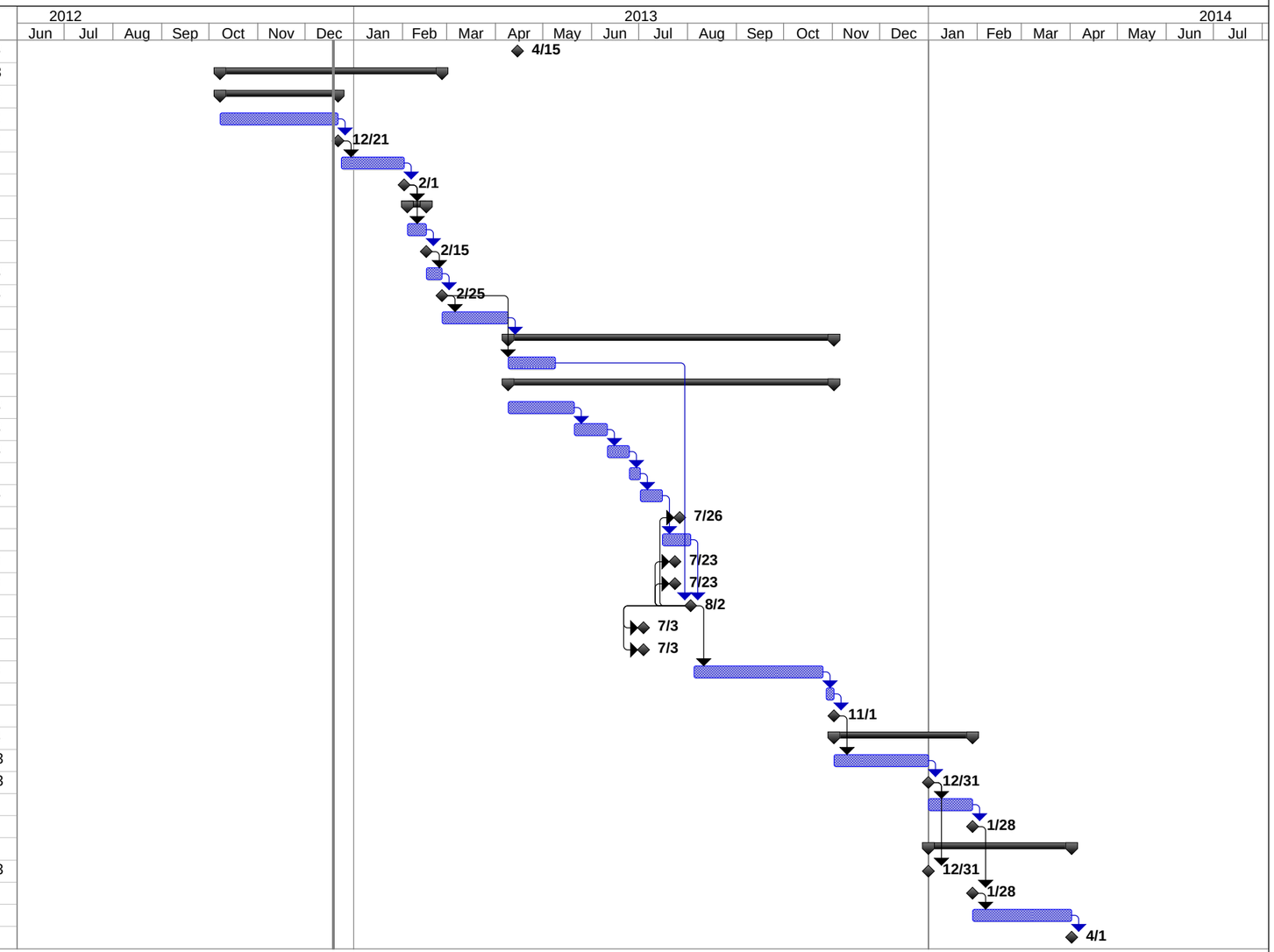
ARCADIS

FIGURE **4-1**

CITY:CARY DIV/GROUP:41 DB:LELLIS LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTHALF.CTB PLOTTED: 12/20/2012 2:01 PM BY: BERNDGEN, WENDY
G:\ENVCAD\Tallahassee-FL\RETURN-TO\Cary-NC\B0085793\1201\00003\DWG\85793G07-A.dwg LAYOUT: 4-1 SAVED: 11/27/2012 11:29 AM ACADVER: 18.1S (LMS TECH)
XREFS: 85793X02 IMAGES: PROJECTNAME: ----

Figure 5-1
Project Schedule
Site Delineation Report and Removal Action Work Plan
Former VCC Charlotte Site - Charlotte, North Carolina

ID	Task Name	Duration	Start Date	Finish Date
1	**AOC Effective Date**	0 d	Mon 4/15/13	Mon 4/15/13
2	**Site Delineation Report and Removal Action Work Plan (RAWP)**	**101 d**	**Mon 10/8/12**	**Mon 2/25/13**
3	**Prepare SDR/RAWP**	**55 d**	**Mon 10/8/12**	**Fri 12/21/12**
4	Prepare Draft SDR/RAWP	55 d	Mon 10/8/12	Fri 12/21/12
5	Submit Draft Data SDR/RAWP to USEPA and NCDENR	0 d	Fri 12/21/12	Fri 12/21/12
6	USEPA and NCDENR Review	30 d	Mon 12/24/12	Fri 2/1/13
7	USEPA and NCDENR Submits Comments	0 d	Fri 2/1/13	Fri 2/1/13
8	**Prepare Final SDR/RAWP**	**10 d**	**Mon 2/4/13**	**Fri 2/15/13**
9	Prepare Final SDR/RAWP	10 d	Mon 2/4/13	Fri 2/15/13
10	Submit Revised SDR/RAWP to USEPA and NCDENR	0 d	Fri 2/15/13	Fri 2/15/13
11	USEPA and NCDENR Review Revised SDR/RAWP	10 ed	Fri 2/15/13	Mon 2/25/13
12	USEPA Approves SDR/RAWP	0 d	Mon 2/25/13	Mon 2/25/13
13	**Public Comment Period**	**30 d**	**Tue 2/26/13**	**Mon 4/8/13**
14	**Removal Action**	**149 d**	**Mon 4/8/13**	**Fri 11/1/13**
15	Obtain Access Agreements for Removal	30 ed	Mon 4/8/13	Wed 5/8/13
16	**Implement Removal Action**	**149 d**	**Tue 4/9/13**	**Fri 11/1/13**
17	Prepare Contractor Bid Documents	30 d	Tue 4/9/13	Mon 5/20/13
18	Contractor Bid Period	15 d	Tue 5/21/13	Mon 6/10/13
19	Evaluate/Select Contractor	10 d	Tue 6/11/13	Mon 6/24/13
20	Submit Contractor Name/Quals. to USEPA	5 d	Tue 6/25/13	Mon 7/1/13
21	USEPA Approves Contractor	10 d	Tue 7/2/13	Mon 7/15/13
22	Submit Contractor Insurance Certs. To USEPA	0 d	Fri 7/26/13	Fri 7/26/13
23	Contractor Submittal Process	14 d	Tue 7/16/13	Fri 8/2/13
24	Notify USEPA of Onset of Construction	0 d	Tue 7/23/13	Tue 7/23/13
25	Notify Owners of Onset of Construction	0 d	Tue 7/23/13	Tue 7/23/13
26	Mobilize to Site	0 d	Fri 8/2/13	Fri 8/2/13
27	Obtain USEPA Cert. of Waste Receiving Facility	0 d	Wed 7/3/13	Wed 7/3/13
28	Notify EPA of Waste Shipments	0 d	Wed 7/3/13	Wed 7/3/13
29	Perform Removal Action	3 mons	Mon 8/5/13	Fri 10/25/13
30	Demobilize from Site	5 d	Mon 10/28/13	Fri 11/1/13
31	Removal Action Complete	0 d	Fri 11/1/13	Fri 11/1/13
32	**Removal Action Summary Report**	**62 d**	**Fri 11/1/13**	**Tue 1/28/14**
33	Prepare Report	60 ed	Fri 11/1/13	Tue 12/31/13
34	Submit Report to USEPA	0 d	Tue 12/31/13	Tue 12/31/13
35	USEPA Reviews Report	20 d	Wed 1/1/14	Tue 1/28/14
36	USEPA Approves Report	0 d	Tue 1/28/14	Tue 1/28/14
37	**Post-Removal Site Control (TBD)**	**65 d**	**Tue 12/31/13**	**Tue 4/1/14**
38	Submit Proposal for Post-Removal Site Control	0 d	Tue 12/31/13	Tue 12/31/13
39	USEPA Approves Post Removal Site Control	0 d	Tue 1/28/14	Tue 1/28/14
40	Secure Agreements for Post Removal Site Controls	45 d	Wed 1/29/14	Tue 4/1/14
41	**Project Completion**	**0 d**	**Tue 4/1/14**	**Tue 4/1/14**



ARCADIS
801 Corporate Center Drive, Suite 300
Raleigh, NC 27607

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Progress	
Split		External Tasks		Inactive Summary		Manual Summary		Deadline	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

Appendix A

Visual Soil Classifications

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-01	0_0.5	ML	SILT, dark brown, some ROOTLETS, trace GRAVEL, loose, dry.
CH-SB-01	0.5_2	ML	SILT, orange/brown, trace ROOTLETS and CLAY, medium dense, dry.
CH-SB-01	2_4	CL	CLAY, orange-brown, some black SILT, trace GRAVEL, soft, dry to moist.
CH-SB-02	0_0.5	ML	SILT, dark brown, some ORGANICS, trace CLAY and GRAVEL, loose, dry.
CH-SB-02	0.5_2	ML	clayey SILT, orange/brown, trace ROOTLETS and GRAVEL, loose, dry.
CH-SB-02	2_4	ML	clayey SILT, orange/brown, trace GRAVEL, loose, dry.
CH-SB-03	0_0.5	ML	SILT, medium brown, some ROOTS and GRAVEL, trace CLAY, loose, dry.
CH-SB-03	0.5_2	CL	silty CLAY, orange-brown, trace fine SAND and ROOTLETS, medium plasticity, dry.
CH-SB-03	2_4	CL	silty CLAY, orange-brown, trace fine SAND, high plasticity, loose, dry.
CH-SB-04	0_0.5	ML	SILT, medium brown, some ROOTS and GRAVEL, loose, dry.
CH-SB-04	0.5_2	ML	SILT, medium brown, some orange/brown CLAY trace ROOTS and GRAVEL, loose, dry.
CH-SB-04	2_4	CL	CLAY, orange-brown, trace SILT and GRAVEL, medium plasticity, dry.
CH-SB-05	0_0.5	ML	sandy SILT, brown, few ROOTS, nonplastic, dry, no odor.
CH-SB-05	0.5_2	ML	sandy SILT, brown, few fine to medium subangular GRAVEL, nonplastic, dry, no odor.
CH-SB-05	2_2.3	GM	SAND and GRAVEL, dark brown, fine, little SILT, dense, dry, no odor. Refusal at 2.3'
CH-SB-06	0_0.5	ML	sandy SILT with fine GRAVEL, brown, loose, dry, no odor.
CH-SB-06	0.5_2	CL	silty CLAY, yellowish brown, trace fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-06	2_4	CL	silty CLAY, reddish brown, trace fine GRAVEL, brittle, stiff, low plasticity, no odor.
CH-SB-07	0_0.5	GC	silty CLAY, fine SAND, and fine GRAVEL, orangish brown, loose, dry, no odor.
CH-SB-07	0.5_2	ML	clayey SILT, reddish brown, few fine GRAVEL, soft, slightly plastic, dry, no odor.
CH-SB-07	2_4	ML	SILT, reddish brown, soft, nonplastic, dry, no odor.
CH-SB-08	0_0.5	CL	silty CLAY, reddish brown, trace fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-08	0.5_2	CL	silty CLAY, reddish brown, trace fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-08	2_4	CL	silty CLAY, reddish brown with yellowish brown mottling, trace fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-09	0_0.5	CL	silty CLAY, reddish brown, stiff, low plasticity, dry, no odor.
CH-SB-09	0.5_2	CL	silty CLAY, reddish brown, some pale yellow mottling, stiff, brittle, low plasticity, dry, no odor.
CH-SB-09	2_4	CL/ML	CLAY and SILT, reddish brown, dense, brittle, dry, no odor.
CH-SB-10	0_0.5	ML	clayey SILT, orangish brown, few fine GRAVEL and black SLAG, dense, brittle, dry, no odor.
CH-SB-10	0.5_2	ML	clayey SILT, orangish brown, few red BRICK, trace purple SLAG, dense, brittle, dry, no odor.
CH-SB-10	2_4	CL	silty CLAY, orangish brown, trace fine GRAVEL, stiff, dry, no odor.

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-11	0_0.5	CL	silty CLAY, orangish brown, stiff, low plasticity, dry, no odor.
CH-SB-11	0.5_2	CL	silty CLAY, reddish brown, some black SLAG, stiff, medium plasticity, dry, no odor.
CH-SB-11	2_4	CL	silty CLAY, orangish brown, stiff, medium plasticity, dry, no odor.
CH-SB-12	0_0.5	ML	sandy SILT, brown, few ROOTS and fine GRAVEL, soft, dry, no odor.
CH-SB-12	0.5_2	ML	sandy SILT, brown, few ROOTS, fine GRAVEL, and dense SILT lenses, soft, dry, no odor.
CH-SB-12	2_3	CL	silty CLAY, reddish brown, stiff, low plasticity, dry, no odor. Refusal at 3' due to hole collapse.
CH-SB-12	4_6	ML	SILT, orange brown, soft, nonplastic, dry, no odor.
CH-SB-13	0_0.5	ML	sandy SILT, brown, few ROOTS and fine GRAVEL, loose, dry, no odor.
CH-SB-13	0.5_2	ML	sandy SILT, brown, few ROOTS and fine GRAVEL, loose, dry, no odor.
CH-SB-13	2_4	ML	sandy SILT, brown, few ROOTS, fine GRAVEL, and silty CLAY lenses, loose, dry, no odor.
CH-SB-14	0_0.5	CL	silty CLAY, yellowish brown, few fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-14	0.5_2	ML	clayey SILT, yellowish brown, trace fine GRAVEL, dense, slightly plastic, dry, no odor.
CH-SB-14	2_4	ML	clayey SILT, yellowish brown, trace fine GRAVEL, few silty CLAY lenses, dense, slightly plastic, dry, no odor.
CH-SB-15	0_0.5	CL	silty CLAY, orangish brown, few fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-15	0.5_2	CL	silty CLAY, orangish brown, stiff, low plasticity, dry, no odor.
CH-SB-15	2_4	CL	silty CLAY, yellowish brown, stiff, low plasticity, dry, no odor.
CH-SB-16	0_0.5	CL	silty CLAY, orangish brown, few fine GRAVEL, stiff, low plasticity, dry, no odor.
CH-SB-16	0.5_2	ML	clayey SILT, orangish brown, dense, brittle, slightly plastic, dry, no odor.
CH-SB-16	2_4	ML	clayey SILT, orangish brown, dense, brittle, slightly plastic, dry, no odor.
CH-SB-17	0_0.5	ML	sandy SILT, orangish brown, few fine GRAVEL, soft, dry, no odor.
CH-SB-17	0.5_2	ML	SILT, orange brown, soft, nonplastic, dry, no odor.
CH-SB-17	2_4	ML	SILT, orange brown, soft, nonplastic, dry, no odor.
CH-SB-18	0_0.5	CL	silty CLAY, orangish brown, few fine GRAVEL, medium stiff, low plasticity, dry, no odor.
CH-SB-18	0.5_2	CL	silty CLAY, orangish brown, medium stiff, low plasticity, dry, no odor.
CH-SB-18	2_4	CL	silty CLAY, orangish brown, medium stiff, low plasticity, dry, no odor.
CH-SB-19	0_0.5	GM	SAND, SILT, and GRAVEL, brown, fine, few light gray CLAY lenses, loose, dry, no odor.
CH-SB-19	0.5_2	CL	CLAY, orangish brown, stiff, medium plasticity, dry, no odor.
CH-SB-19	2_4	ML	clayey SILT, yellowish brown, soft, slightly plastic, dry, no odor.
CH-SB-20	0_0.5	ML	SILT, orangish brown, few fine GRAVEL and ROOTS, soft, nonplastic, dry, no odor.
CH-SB-20	0.5_2	CL	silty CLAY, orangish brown, stiff, brittle, low plasticity, dry, no odor.
CH-SB-20	2_4	CL	silty CLAY, orangish brown with pale yellow mottling, stiff, brittle, low plasticity, dry, no odor.

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-21	0_0.5	ML	sandy SILT, orangish brown, few ROOTS, soft, no odor, dry.
CH-SB-21	0.5_2	ML	sandy SILT, orangish brown, soft, no odor, dry.
CH-SB-21	2_4	ML	sandy SILT, orangish brown, soft, no odor, dry.
CH-SB-22	0_0.5	ML	SILT, orange, micaceous, soft, nonplastic, dry, no odor.
CH-SB-22	0.5_2	ML	SILT, orange, micaceous, soft, nonplastic, dry, no odor.
CH-SB-22	2_4	ML	SILT, orange, micaceous, soft, nonplastic, dry, no odor.
CH-SB-23	0_0.5	CL	CLAY, orange brown, few fine GRAVEL, medium stiff, medium plasticity, dry, no odor.
CH-SB-23	0.5_2	CL	silty CLAY, orange brown, few SULFUR fragments, medium stiff, medium plasticity, dry, no odor.
CH-SB-23	2_4	CL	silty CLAY, orange brown, few SULFUR fragments and purple SLAG, medium stiff, low plasticity, dry, no odor.
CH-SB-23	4_6	CL	silty CLAY, orangish brown, stiff, low plasticity, dry, no odor.
CH-SB-23	6_8	ML	clayey SILT, reddish brown, soft, slightly plastic, dry, no odor.
CH-SB-24	0_0.5	CL	silty CLAY, orange brown, little fine GRAVEL, medium stiff to soft, low plasticity, dry, no odor.
CH-SB-24	0.5_2	ML	clayey SILT, orange brown, trace SULFUR and COAL fragments, soft, slightly plastic, dry, no odor.
CH-SB-24	2_4	ML	SILT, orange brown, soft, nonplastic, dry, no odor.
CH-SB-25	0_0.5	ML	sandy SILT, brown, few fine GRAVEL, soft, dry, no odor.
CH-SB-25	0.5_2	CL	silty CLAY, orangish brown, trace fine GRAVEL, medium stiff, low plasticity, dry, no odor.
CH-SB-25	2_4	CL	silty CLAY, orangish brown, trace fine GRAVEL, soft, low plasticity, dry to moist, no odor.
CH-SB-25	4_6	CL	silty CLAY, reddish brown, medium stiff, low plasticity, dry, no odor.
CH-SB-26	0_0.5	ML	clayey SILT, brown, soft, few roots, dry, no odor.
CH-SB-26	0.5_2	CL	silty CLAY, reddish orange, moist, stiff, low plasticity, dry, no odor.
CH-SB-26	2_4	CL	silty CLAY, reddish orange, moist, stiff, low plasticity, dry, no odor.
CH-SB-27	0_0.5	ML	clayey SILT, reddish orange, soft, few roots, dry, no odor.
CH-SB-27	0.5_2	CL	silty CLAY, reddish orange, moist, stiff, low plasticity dry, no odor.
CH-SB-27	2_4	CL	silty CLAY, reddish orange, moist, stiff, low plasticity dry, no odor.
CH-SB-28	0_0.5	CL	silty CLAY, brownish orange, soft, low plasticity, few roots, dry, no odor.
CH-SB-28	0.5_2	CL	silty CLAY, brownish orange, soft, low plasticity, dry, no odor, few fine angular gravel
CH-SB-28	2_4	CL	silty CLAY, brownish orange, soft, low plasticity, dry, no odor.
CH-SB-29	0_0.5	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-29	0.5_2	CL	CLAY, orange, stiff, medium plasticity, dry, no odor.
CH-SB-29	2_4	ML	SILT, orange, micaceous, soft, dry, no odor.

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-30	0_0.5	CL	CLAY, orangish brown, fine sand and silt, few fine angular gravel, loose, dry, no odor.
CH-SB-30	0.5_2	CL	silty CLAY, orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-30	2_4	CL	silty CLAY, orange, medium stiffness, low plasticity, trace fine subrounded quartz gravel, dry, no odor.
CH-SB-31	0_0.5	ML	SILT, light orangeish brown, soft, dry, no odor.
CH-SB-31	0.5_2	ML	SILT, orangeish brown, soft, dry, no odor.
CH-SB-31	2_4	ML	SILT, light orange, soft, dry, no odor.
CH-SB-32	0_0.5	ML	clayey SILT, brown, few roots and fine subangular gravel, soft, dry, no odor.
CH-SB-32	0.5_2	CL	silty CLAY, brownish orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-32	2_4	ML	clayey SILT, brownish orange, soft, dry, no odor.
CH-SB-33	0_0.5	ML	clayey SILT, brown, soft, few roots, dry, no odor.
CH-SB-33	0.5_2	ML	clayey SILT, reddish orange, soft, few fine angular gravel, dry, no odor.
CH-SB-33	2_4	ML	clayey SILT, reddish orange, soft, few fine angular gravel, dry, no odor.
CH-SB-34	0_0.5	ML	clayey SILT, orange, soft, few roots, dry, no odor.
CH-SB-34	0.5_2	CL	CLAY, reddish brown, stiff, medium plasticity, dry, no odor.
CH-SB-34	2_4	CL	CLAY, reddish brown, stiff, medium plasticity, dry, no odor.
CH-SB-35	0_0.5	CL	silty CLAY, reddish orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-35	0.5_2	CL	silty CLAY, reddish orange, medium stiffness, low plasticity, trace black slag and sulfur, dry, no odor.
CH-SB-35	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-37	0_0.5	CL	silty CLAY, orange, stiff, low plasticity, few black mottling, dry, no odor.
CH-SB-37	0.5_2	CL	CLAY, orange with brown mottling, medium stiffness, medium plasticity, dry, no odor.
CH-SB-37	2_4	CL	CLAY, yellowish brown, medium stiffness, medium plasticity, dry, no odor.
CH-SB-38	0_0.5	CL	CLAY, orange, stiff, medium plasticity, dry, no odor.
CH-SB-38	0.5_2	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-38	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-39	0_0.5	SP	SAND, dark brown, fine, purple slag and coal, loose, dry, no odor.
CH-SB-39	0.5_2	SP	SAND, dark brown, fine, purple slag and coal, loose, dry, no odor.
CH-SB-39	2_4	CL	silty CLAY, orangeish brown, medium stiffness, low plasticity, dry, no odor.
CH-SB-40	0_0.5	SP/FILL	SAND, dark brown, fine, purple slag (FILL), loose, dry, no odor.
CH-SB-40	0.5_2	SP/FILL	SAND, dark brown, fine, purple slag (FILL), loose, dry, no odor.
CH-SB-40	2_4	CL	silty CLAY, brownish orange, medium stiffness, low plasticity, dry, no odor.

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-41	0_0.5	CL	CLAY, orange, stiff, medium plasticity, dry, no odor.
CH-SB-41	0.5_2	ML	clayey SILT, reddish orange, soft, dry, no odor.
CH-SB-41	2_4	ML	clayey SILT, reddish orange, soft, dry, no odor.
CH-SB-42	0_0.5	ML	clayey SILT, dark brown, soft, few roots, dry, no odor.
CH-SB-42	0.5_2	CL	silty CLAY, orange, medium stiffness, low plasticity, trace fine subangular quartz gravel, dry, no odor.
CH-SB-42	2_4	ML	clayey SILT, reddish orange, soft, little mica, dry, no odor.
CH-SB-43	0_0.5	ML	clayey SILT, orangeish brown, few roots, soft, dry, no odor.
CH-SB-43	0.5_2	ML	SILT, reddish orange, little mica, soft, dry, no odor.
CH-SB-43	2_4	ML	SILT, reddish orange, little mica, soft, dry, no odor.
CH-SB-44	0_0.5	CL	CLAY, orange, stiff, medium plasticity, dry, no odor.
CH-SB-44	0.5_2	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-44	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-45	0_0.5	GM	sandy GRAVEL, gray, fine, loose, dry, no odor.
CH-SB-45	0.5_2	ML	SILT, reddish brown, few silty clay lenses and fine subangular gravel, soft, dry, no odor.
CH-SB-45	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-46	0_0.5	ML	clayey SILT, brown, soft, slight plasticity, few fine angular gravel, dry, no odor.
CH-SB-46	0.5_2	CL	silty CLAY, reddish orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-46	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-47	0_0.5	ML	clayey SILT, brown, soft, slight plasticity, few roots, trace fine gravel, dry, no odor.
CH-SB-47	0.5_2	CL	silty CLAY, orangeish brown, medium stiffness, low plasticity, few fine angular gravel, dry, no odor.
CH-SB-47	2_4	CL	CLAY, reddish orange, medium stiffness, medium plasticity, dry, no odor.
CH-SB-48	0_0.5	CL	silty CLAY, reddish orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-48	0.5_2	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor
CH-SB-48	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.
CH-SB-49	0_0.5	ML	clayey SILT, brown, soft, dry, no odor, few roots.
CH-SB-49	0.5_2	CL	silty CLAY, brownish orange, medium stiffness, low plasticity, dry, no odor.
CH-SB-49	2_4	CL	CLAY, reddish orange, medium stiffness, medium plasticity, dry, no odor.
CH-SB-50	0_0.5	GM	fine SAND and fine GRAVEL, brown, loose, dry, no odor.
CH-SB-50	0.5_1.5	GM	fine SAND and fine GRAVEL, brown, loose, dry, no odor, refusal at 1.5' (3 attempts).
CH-SB-51	0_0.5	SP/FILL	SAND, brown fine, red brick (FILL), loose, few roots, dry, no odor.
CH-SB-51	0.5_2	ML	SILT, reddish orange, soft, dry, no odor.
CH-SB-51	2_4	CL	CLAY, reddish orange, stiff, medium plasticity, dry, no odor.

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-52	0_0.5	SP	SAND, brown, fine, few roots, trace purple slag, loose, dry, no odor.
CH-SB-52	0.5_2	SP	SAND, brown, fine, few roots, few purple slag, loose, dry, no odor.
CH-SB-52	2_4	ML	clayey SILT, brownish orange, soft, dry, no odor.
CH-SB-53	0_0.5	SP/FILL	SAND, dark brown, fine, purple slag (FILL), loose, dry, no odor.
CH-SB-53	0.5_2	ML	clayey SILT, light brown, soft, dry, no odor.
CH-SB-53	2_4	CL	CLAY, brownish orange, medium stiffness, medium plasticity, dry, no odor.
CH-SB-54	0_0.5	CL	silty CLAY, orangeish brown, soft, low plasticity, damp, no odor.
CH-SB-54	0.5_2	CL	silty CLAY, orangeish brown, soft, low plasticity, damp, no odor.
CH-SB-54	2_2.5	CL	silty CLAY, orangeish brown, soft, low plasticity, damp, little fine subangular gravel, no odor, refusal at 2.5' (3 attempts).
CH-SB-55	0_0.5	CL	silty CLAY, red brown, soft, damp
CH-SB-55	0.5_2	CL	silty CLAY, red brown, soft, damp
CH-SB-55	2_4	CL	silty CLAY, red brown, soft, damp
CH-SB-56	0_0.5	CL	silty CLAY, red brown with some fine gravel
CH-SB-56	0.5_1.5	CL	silty CLAY, red brown, stiff
CH-SB-57	0_0.5	CL	silty CLAY, red brown, rootlets, soft, damp
CH-SB-57	0.5_2	CL	silty CLAY, red brown, soft, damp
CH-SB-58	0_0.5	ML	sandy SILT, brown, with fine gravel and rootlets, damp
CH-SB-58	0.5_2	CL	silty CLAY, red brown, cohesive, damp
CH-SB-58	2_4	ML	clayey SILT, light red brown to light brown, powdery, soft, damp
CH-SB-59	0_0.5	SP	silty SAND, brown, with fine gravel and rootlets, loose
CH-SB-59	0.5_2	ML	sandy SILT, brown and red brown with clay, damp, loose, soft
CH-SB-59	2_4	CL	silty CLAY, red brown, stiff, cohesive
CH-SB-60	0_0.5	ML	sandy SILT, dark brown, with fine gravel, loose
CH-SB-60	0.5_2	ML	clayey SILT, red brown, soft, damp
CH-SB-60	2_4	ML	clayey SILT, red brown, soft, damp
CH-SB-61	0_0.5	ML	sandy SILT, red brown with fine gravel, damp
CH-SB-61	0.5_2	SP	silty SAND, brown with fine gravel throughout, damp
CH-SB-61	2_4	CL	silty CLAY, red brown, soft, cohesive, damp
CH-SB-62	0_0.5	ML	sandy SILT, brown
CH-SB-62	0.5_2	CL	silty CLAY, red brown, soft, cohesive, damp
CH-SB-62	2_4	CL	silty CLAY, red brown, soft, cohesive, damp

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-63	0_0.5	ML	sandy SILT, brown, with fine gravel, loose, damp
CH-SB-63	0.5_2	ML	sandy SILT, brown, with fine gravel, loose, damp
CH-SB-63	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-64	0_0.5	ML	sandy SILT, brown, with fine gravel, damp
CH-SB-64	0.5_2	ML	clayey SILT, red brown, with fine gravel, damp
CH-SB-64	2_4	ML	clayey SILT, red brown, loose, dry
CH-SB-65	0_0.5	SP	silty SAND, brown with fine gravel and rootlets, damp
CH-SB-65	0.5_2	SP	silty SAND, brown, loose, damp
CH-SB-65	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-66	0_0.5	SP	silty SAND, brown, with fine gravel, loose, damp
CH-SB-66	0.5_2	CL	silty CLAY, red brown, trace fine gravel, soft, damp
CH-SB-66	2_4	CL	silty CLAY, red brown, trace fine gravel, soft, damp
CH-SB-67	0_0.5	SP+ML	SAND and SILT, very fine, with rootlets, powdery, dry
CH-SB-67	0.5_2	ML	sandy SILT, brown, loose trace clay
CH-SB-67	2_4	CL	silty CLAY, red brown, cohesive, damp
CH-SB-68	0_0.5	SP	silty SAND, dark brown with fine gravel, loose, damp
CH-SB-68	0.5_2	CL	sandy silty CLAY, brown to red brown with debris and some fine gravel
CH-SB-68	2_4	CL	silty CLAY, light red brown, soft, damp
CH-SB-69	0_0.5	CL	silty CLAY, red brown with some brown silty sand, cohesive, damp
CH-SB-69	0.5_2	CL	silty CLAY, red brown, cohesive, damp
CH-SB-69	2_4	CL	silty CLAY, red brown, cohesive, damp
CH-SB-70	0_0.5	SP	silty SAND, brown with fine gravel and rootlets, damp
CH-SB-70	0.5_2	CL	silty CLAY, red brown, cohesive, damp
CH-SB-70	2_4	CL	silty CLAY, red brown, cohesive, damp
CH-SB-71	0_0.5	CL	silty CLAY, brown and red brown with silty sand, damp
CH-SB-71	0.5_2	CL	silty CLAY, red brown, stiff, damp
CH-SB-71	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-72	0_0.5	ML	sandy SILT, light brown and yellow brown, some fine gravel, cohesive, wet
CH-SB-72	0.5_2	CL	silty CLAY, red brown, trace fine gravel, stiff, damp
CH-SB-72	2_4	CL	silty CLAY, red brown, stiff, damp

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-73	0_0.5	ML	sandy SILT, brown with fine gravel
CH-SB-73	0.5_2	CL	silty CLAY, red brown
CH-SB-73	2_4	CL	silty CLAY, light red brown, damp
CH-SB-74	0_0.5	CL	silty CLAY, brown and red brown with fine gravel, damp
CH-SB-74	0.5_2	CL	silty CLAY, red brown, stiff, damp
CH-SB-74	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-75	0_0.5	SP	silty SAND, brown, loose with fine gravel, damp
CH-SB-75	0.5_2	ML	sandy SILT, brown to red brown with some fine gravel, damp
CH-SB-75	2_4	CL	silty CLAY, red brown, stiff, cohesive, damp
CH-SB-76	0_0.5	SP	silty SAND, brown with fine gravel, loose, damp
CH-SB-76	0.5_2	SP	silty SAND, brown and red brown with some fine gravel
CH-SB-76	2_4	CL	silty CLAY, red brown, stiff, cohesive
CH-SB-77	0_0.5	SP	silty SAND, brown with fine gravel, loose, some slag
CH-SB-77	0.5_2	CL	silty CLAY, red brown with some brown silty sand, loose
CH-SB-77	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-78	0_0.5	SP	silty SAND, brown with fine gravel and some slag, loose, damp
CH-SB-78	0.5_2	SP	silty SAND, brown with red brown silty CLAY, stiff, damp
CH-SB-78	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-79	0_0.5	ML	sandy SILT, brown with some fine gravel, loose, damp
CH-SB-79	0.5_2	ML	sandy SILT, brown and red brown with silty CLAY and trace fine gravel, damp
CH-SB-79	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-80	0_0.5	SP	SAND, brown with some red brown silty CLAY, trace fine gravel, damp
CH-SB-80	0.5_2	CL	silty CLAY, red brown, stiff
CH-SB-80	2_4	CL	silty CLAY, red brown, stiff
CH-SB-81	0_0.5	ML	sandy SILT, dark brown with fine gravel
CH-SB-81	0.5_2	CL	silty CLAY, red brown, stiff, damp
CH-SB-81	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-82	0_0.5	ML	sandy SILT with fine gravel, brown, loose, damp
CH-SB-82	0.5_2	CL	silty CLAY, brown, soft, damp to moist
CH-SB-82	2_4	CL	silty CLAY, red brown, soft, moist

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-83	0_0.5	SP	fine SAND, brown with some silt, some gravel, loose
CH-SB-83	0.5_2	CL	silty CLAY, red brown, with some sandy SILT, damp, stiff
CH-SB-83	2_4	CL	silty CLAY, red brown, stiff, damp
CH-SB-84	0_0.5	ML	sandy SILT, brown with fine gravel, loose, damp
CH-SB-84	0.5_2	CL	sandy CLAY, brown and red brown, stiff, damp
CH-SB-84	2_4	CL	silty CLAY, red brown, stiff
CH-SB-85	0_0.5	SP	very fine to fine SAND, little red clay balls, trace pebbles, small - large subrounded
CH-SB-85	0.5_2.0	CL	silty CLAY,red, soft, moist
CH-SB-85	2_4	CL	silty CLAY, dark red, soft, moist
CH-SB-86	0_0.5	CL	sandy CLAY, dark red, very fine to medium sand, some silt, dry
CH-SB-86	0.5_2.0	CL	silty CLAY, dark red, medium stiffness, moist
CH-SB-86	2_4	CL	silty CLAY, red, soft, moist
CH-SB-87	0_0.5	CL	silty CLAY, reddish brown, pebbles, small- large subangular, dry
CH-SB-87	0.5_2.0	CL	silty CLAY, pebbles, reddish brown, small- large subangular, dry
CH-SB-87	2_4	CL	silty CLAY, red, soft, moist
CH-SB-88	0_0.5	SP	very fine to fine SAND, grey, w/ some pebbles, small - large angular (gravel), dry
CH-SB-88	0.5_2.0	CL	silty CLAY, dark red, medium stiffness, dry
CH-SB-88	2_4	CL	silty CLAY, red, soft, moist
CH-SB-89	0_0.5	SP	very fine to fine SAND, and some pebbles small-round sub angular, trace organics, dry, brown
CH-SB-89	0.5_2.0	SP	silty SAND, little pebbles, small to large subangular, little clay balls, red soft, moist, dark brown
CH-SB-89	2_4	CL	CLAY, red, soft, moist
CH-SB-89	4_6	CL	CLAY, red, soft, moist
CH-SB-90	0_0.5	SL	clayey SILT, reddish brown, trace organics, dry
CH-SB-90	0.5_2.0	SL	clayey SILT, brown, little pebbles, small-large, ,subangular-sub rounded, dry
CH-SB-90	2_4	CL	silty CLAY, dark red, trace gravel, moist
CH-SB-90	4_6	CL	silty CLAY, dark red, medium-stiff-stiffness, moist
CH-SB-90	6_8	CL	silty CLAY, dark red, medium-stiff-stiffness, moist
CH-SB-91	0_0.5	CL	silty CLAY, red, soft, dry
CH-SB-91	0.5_2.0	CL	silty CLAY, red, soft, dry
CH-SB-91	2_4	CL	silty CLAY, red, soft, dry
CH-SB-91	4_6	CL	silty CLAY, red, medium stiffness, moist

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-92	0_0.5	SL	clayey SILT, red brown, gravel, moist
CH-SB-92	0.5_2.0	CL	silty CLAY, red, medium stiffness, moist
CH-SB-92	2_4	CL	silty CLAY, red, medium stiffness, moist
CH-SB-93	0_0.5	SL	clayey SILT, little pebbles, med-large, trace organics, dry, red
CH-SB-93	0.5_2.0	CL	silty CLAY, moist, soft-med stiffness, red
CH-SB-93	2_4	CL	silty CLAY, moist, soft-med stiffness, red
CH-SB-93	4_6	CL	silty CLAY, moist, soft-med stiffness, red
CH-SB-94	0_0.5	SP	silty SAND, reddish brown, some pebbles, med-very large gravel, moist
CH-SB-94	0.5_2.0	CL	silty CLAY, brown, some slag, moist
CH-SB-94	2_4	CL	silty CLAY, tan, trace sand, trace pebbles, wet
CH-SB-94	4_6	CL	silty CLAY, red, soft, moist
CH-SB-94	6_8	CL	silty CLAY, red, soft, moist
CH-SB-94	8_10	CL	silty CLAY, red, soft, moist
CH-SB-94	10_12	CL	silty CLAY, red, soft, moist
CH-SB-94	12_13	CL	silty CLAY, red, soft, moist
CH-SB-95	0_0.5	SP	clayey SAND, red/brown, gravel, moist
CH-SB-95	0.5_2.0	CL	silty CLAY, red, trace gravel, moist
CH-SB-95	2_4	CL	silty CLAY, red, medium stiffness, medium plasticity, moist
CH-SB-95	4_6	CL	silty CLAY, red, medium stiffness, medium plasticity, moist
CH-SB-95	6_8	CL	silty CLAY, red, soft, moist
CH-SB-95	8_10	SL	clayey SILT, tan/red, soft, moist
CH-SB-96	0_0.5	CL	silty CLAY, dark brown, trace organics, little gravel, moist
CH-SB-96	0.5_2.0	CL	silty CLAY, red, soft, moist
CH-SB-96	2_4	CL	silty CLAY, red, soft, moist
CH-SB-97	0_0.5	CL	sandy and silty CLAY, trace gravel, trace organics
CH-SB-97	0.5_2.0	CL	silty CLAY, light red, medium stiffness, dry
CH-SB-97	2_4	CL	silty CLAY, reddish tan, trace rocks, subrounded, difficult to hand auger, medium stiffness, dry
CH-SB-98	0_0.5	CL	sandy CLAY, dark brown, trace organics, fine-coarse sand, moist
CH-SB-98	0.5_2.0	CL	silty CLAY, red, soft, moist
CH-SB-98	2_4	SL	clayey SILT, lighter red, soft, moist
CH-SB-99	0_0.5	CL	silty CLAY, red brown, dry to damp, cohesive
CH-SB-99	0.5-2	CL	silty CLAY, red brown, refusal encountered at 2'

Appendix A
Visual Soil Classifications
Site Delineation Report and Removal Action Work Plan
VCC Charlotte, North Carolina

Soil Boring Identification	Depth Interval (ft bgs)	Visual USCS Classification	Soil Lithology/Characteristics
CH-SB-100	0_0.5	CL	silty CLAY, brown to red brown, soft, damp, rootlets
CH-SB-100	0.5-2	CL	silty CLAY, red brown, stiff, refusal encountered at 2'
CH-SB-101	0-0.5	CL	silty CLAY, very stiff, some coarse gravel, damp
CH-SB-101	0.5-2	CL	silty CLAY, red brown, soft, damp
CH-MW-01	0_0.5	ML	SILT, red brown, micaceous, soft
CH-MW-01	0.5_2	ML	SILT, red brown, micaceous, soft
CH-MW-01	2_4	ML	SILT, red brown, micaceous, soft
CH-MW-02	0.5_1	ML	SILT, red brown, with fine gravel and brick, micaceous
CH-MW-02	1_2.5	ML	SILT, red brown, with brick fragments throughout, micaceous, damp
CH-MW-02	2.5_4.5	ML	SILT, red brown, micaceous, soft, damp
CH-MW-03	0.5_1	CL	silty CLAY, brown, with fine gravel, damp
CH-MW-03	1_2.5	ML	SILT, red brown, micaceous, soft, damp
CH-MW-03	2.5_4.5	ML	SILT, red brown, micaceous, soft, damp
CH-MW-04	0.5_1	ML	SILT, red brown, micaceous, soft, damp
CH-MW-04	1_2.5	ML	SILT, red brown, micaceous, soft
CH-MW-04	2.5_4.5	ML	SILT, red brown, micaceous, soft
CH-MW-05	0.5_1	ML	sandy SILT, brown, with fine gravel, some slag, damp
CH-MW-05	1_2.5	CL	CLAY, red brown, with trace fine gravel, stiff, damp
CH-MW-05	2.5_4.5	ML	(from 2.5 - 3.5) SILT, red brown, with slag (from 3.5 - 4.5) SILT, red brown, soft, damp
CH-MW-05	4.5_6.5	ML	SILT, red brown, micaceous, soft
CH-MW-06	0.5_1	CL	silty CLAY, red brown, with fine gravel, dry
CH-MW-06	1_2.5	CL	silty CLAY, red brown, soft, dry
CH-MW-06	2.5_4.5	CL	silty CLAY, red brown to yellow brown, stiff, damp
CH-MW-07	0.5_1	ML	SILT, brown, with some fine gravel, loose
CH-MW-07	1_2.5	CL	CLAY, red brown, stiff, damp
CH-MW-07	2.5_4.5	ML	SILT, red brown micaceous, soft
CH-MW-07	4.5_6.5	ML	SILT, red brown, micaceous, soft

Notes:
ft bgs - feet below ground surface
USCS - Unified Soil Classification System

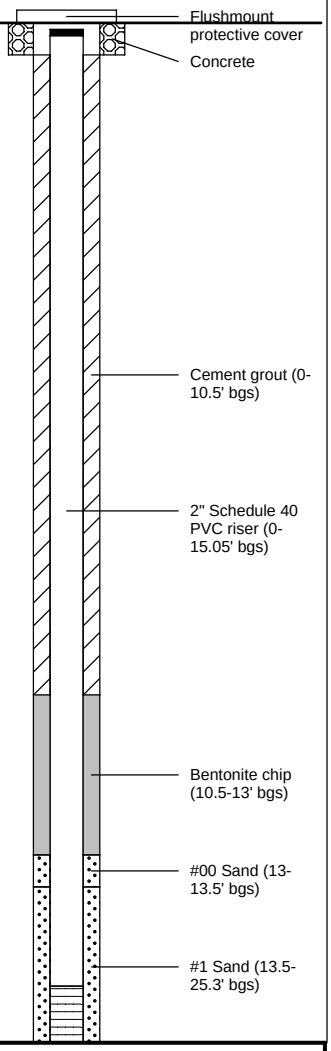
Appendix B

Monitoring Well Construction Logs

Date Start/Finish: 2/14/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Gary Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536500.41 **Easting:** 1443303.19 **Casing Elevation:** 734.42 **Surface Elevation:** 734.25 **Borehole Depth:** 25' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-01** **Client:** ExxonMobil **Location:** VCC-Charlotte	

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
	735							
0		1	0-0.5'	0.5'	N/A			SILT, red brown, soft, micaceous.
		2	0.5-2'	1.5'	N/A			
		3	2-4'	2'	N/A			
	730	4	4-5'	1'	N/A			
5		5	5-8'	3'	N/A			5' bgs- Damp.
							ML	SILT, brown to yellow brown, soft, micaceous, damp, saprolite.
	725	6	8-12'	3'	N/A			
10								
	720	7	12-16'	3.5'	N/A			
15								

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Client: ExxonMobil

Well ID: **CH-MW-01**

Site Location:
VCC-Charlotte

Borehole Depth: 25' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description	Well Construction
715 / 20	8	16-20'	3'	N/A		ML	SILT, brown to yellow brown, soft, micaceous, damp to wet, saprolite. 20' bgs- Wet.	2" Schedule 40 PVC 0.010 slot well screen (15.05-25.05' bgs)
	9	20-24'	3'	N/A			24' bgs- Very dense in spoon tip.	#1 Sand (13.5-25.3' bgs)
710 / 25	N/A	24-25'	N/A	N/A			No soil samples collected for stratigraphic description.	Threaded end plug
705 / 30								
700 / 35								

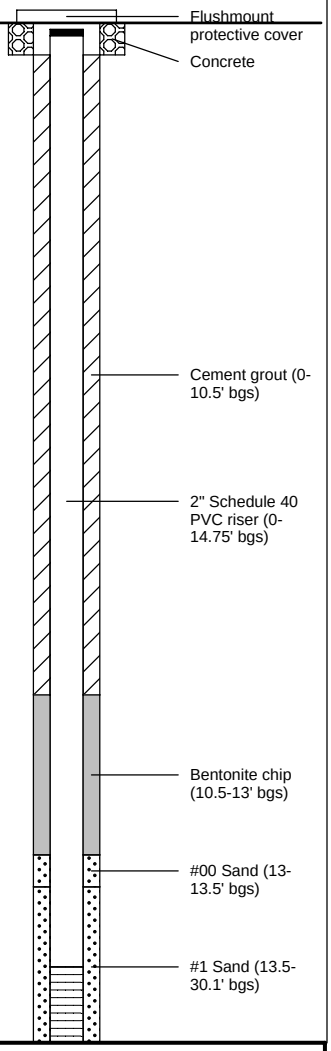
Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

ARCADIS
Infrastructure, environment, buildings

Date Start/Finish: 2/14/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Gary Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536848.17 **Easting:** 1443286.65 **Casing Elevation:** 733.19 **Surface Elevation:** 733.39 **Borehole Depth:** 30' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-02** **Client:** ExxonMobil **Location:** VCC-Charlotte	

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
	735							
0		1	0-0.5'	0.5'	N/A			ASPHALT
		2	0.5-1'	0.5'	N/A			SILT with fine GRAVEL and BRICK, red brown, micaceous
		3	1-2.5'	1.5'	N/A			SILT with fine GRAVEL and BRICK, red brown, micaceous, damp.
	730	4	2.5-5'	2.5'	N/A		ML	SILT, red brown, soft, micaceous, damp.
5		5	5-8'	3'	N/A		CL	CLAY, red brown, stiff, medium plasticity, damp.
	725	6	8-12'	4'	N/A			
10		7	12-16'	4'	N/A			CLAY, red brown to yellow brown, stiff, medium plasticity, damp.
	720							
15								

Well Construction



Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

ARCADIS
Infrastructure, environment, buildings

Client: ExxonMobil

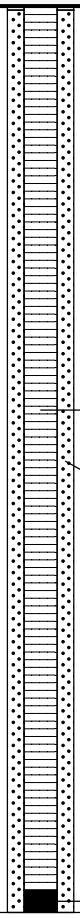
Well ID: **CH-MW-02**

Site Location:
VCC-Charlotte

Borehole Depth: 30' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	8	16-20'	4'	N/A		CL	SILTY CLAY, yellow brown, stiff, medium plasticity, damp to moist.
20	9	20-24'	4'	N/A		ML	SILT, brown, soft, micaceous, damp to moist.
710							
25	10	24-28'	4'	N/A			25' bgs- Wet.
705	N/A	28-30'	N/A	N/A			No soil samples collected for stratigraphic description.
30							
700							
35							

Well Construction



Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

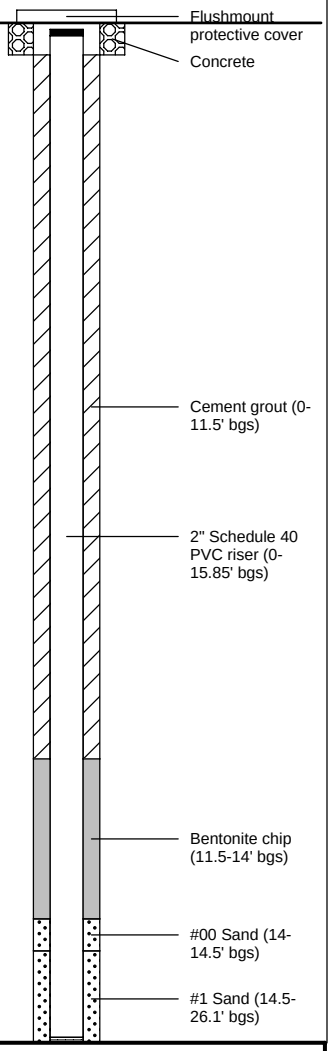
ARCADIS
Infrastructure, environment, buildings

Project: B0085794 Template: G:\COMMON\Exxon Mobil VCC\Well double-cased bedrockEX.ldfx
Data File:CH-MW-02.dat Date: 5/17/2011 Created/Edited by: Ryan Tuttle

Date Start/Finish: 2/15/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Gary Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536879.37 **Easting:** 1443062.90 **Casing Elevation:** 732.65 **Surface Elevation:** 733.12 **Borehole Depth:** 26' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-03** **Client:** ExxonMobil **Location:** VCC-Charlotte	

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
	735							
0		1	0-0.5'	0.5'	N/A			ASPHALT
		2	0.5-1'	0.5'	N/A		CL	SILTY CLAY with fine GRAVEL, brown, damp.
		3	1-2.5'	1.5'	N/A		ML	SILT, red brown, soft, micaceous, damp.
	730	4	2.5-5'	2'	N/A			
5		5	5-8'	0'	N/A			No recovery.
	725	6	8-12'	2'	N/A			SILT, red brown, medium soft, micaceous, damp.
10		7	12-16'	2'	N/A		ML	SILT, red brown to yellow brown, soft, micaceous, saprolitic, damp.
	720							
15								

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Client: ExxonMobil

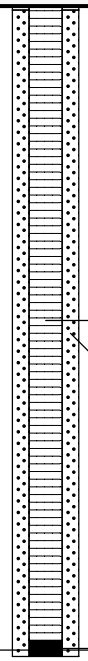
Well ID: **CH-MW-03**

Site Location:
VCC-Charlotte

Borehole Depth: 26' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	8	16-20'	4'	N/A			SILT, red brown to yellow brown, soft, micaceous, saprolitic with rock structure, damp to moist.
20						ML	20' bgs- Wet.
710	9	20-24'	4'	N/A			
25	N/A	24-26'	N/A	N/A			No soil samples collected for stratigraphic description.
705							
30							
700							
35							

Well Construction



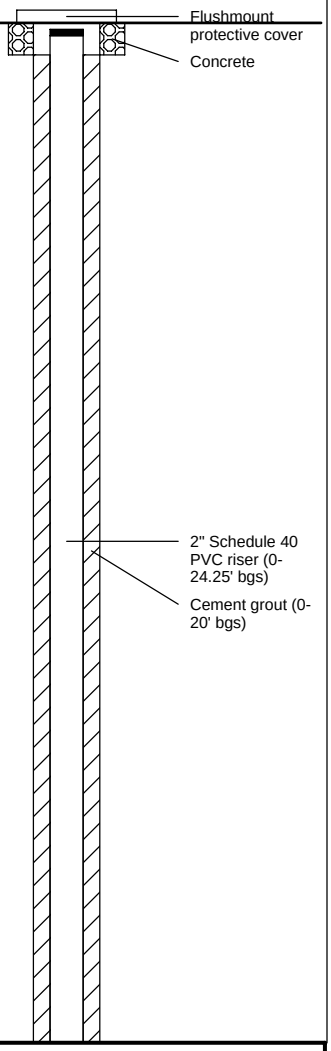
ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Date Start/Finish: 2/16/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Gary Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536921.33 **Easting:** 1442797.43 **Casing Elevation:** 731.85 **Surface Elevation:** 732.21 **Borehole Depth:** 34' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-04** **Client:** ExxonMobil **Location:** VCC-Charlotte		

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
735							
0	1	0-0.5'	0.5'	N/A			ASPHALT
	2	0.5-1'	0.5'	N/A			SILT, red brown, soft, micaceous, damp.
	3	1-2.5'	1.5'	N/A			SILT, red brown, soft, micaceous.
730	4	2.5-5'	2.5'	N/A			
5	5	5-8'	3'	N/A			SILT, red brown, soft, micaceous, saprolitic, damp.
725	6	8-12'	4'	N/A		ML	
10	7	12-16'	4'	N/A			
720							
15							

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Client: ExxonMobil

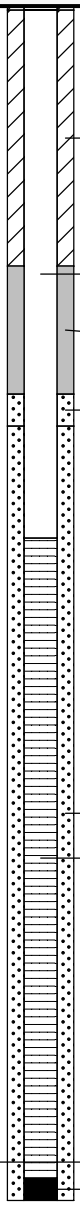
Well ID: **CH-MW-04**

Site Location:
VCC-Charlotte

Borehole Depth: 34' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	8	16-20'	4'	N/A			SILT, red brown, soft to medium soft, saprolitic with rock structure, damp.
20							
710	9	20-24'	4'	N/A			SILT, yellow brown, micaceous, saprolitic with rock structure, damp.
25	10	24-28'	4'	N/A		ML	
705							
30	11	28-32'	4'	N/A			30' bgs- Wet.
700	N/A	32-34'	N/A	N/A			No soil samples collected for stratigraphic description.
35							

Well Construction



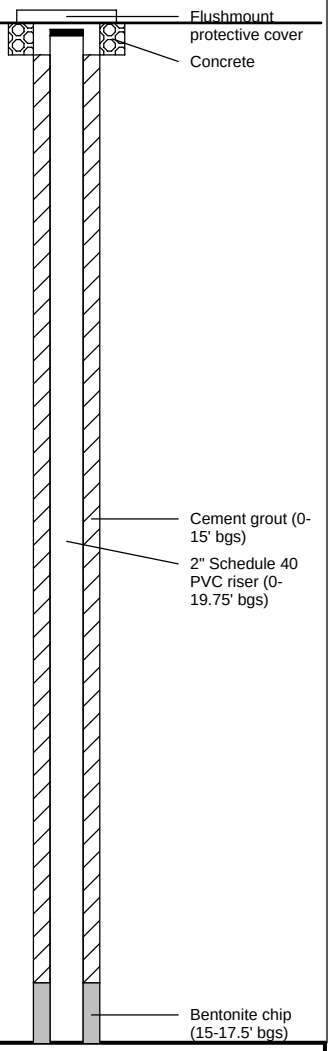
ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Date Start/Finish: 2/17/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Josh Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536494.28 **Easting:** 1442724.51 **Casing Elevation:** 731.37 **Surface Elevation:** 731.60 **Borehole Depth:** 30' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-05** **Client:** ExxonMobil **Location:** VCC-Charlotte	

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
0		1	0-0.5'	0.5'	N/A			ASPHALT
		2	0.5-1'	0.5'	N/A		ML	SANDY SILT with fine GRAVEL, brown, some Slag, damp.
	730	3	1-2.5'	1.5'	N/A		CL	CLAY, red brown, stiff, trace fine Gravel, damp.
		4	2.5-4.5'	2'	N/A			SILT with SLAG, red brown. SILT, red brown, soft, damp.
5		5	4.5-5'	0.5'	N/A			SILT, red brown, soft, micaceous. 5' bgs- Damp.
	725	6	5-8'	3'	N/A			
10		7	8-12'	4'	N/A		ML	
	720	8	12-16'	4'	N/A			
15								

Well Construction



Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

ARCADIS
Infrastructure, environment, buildings

Client: ExxonMobil

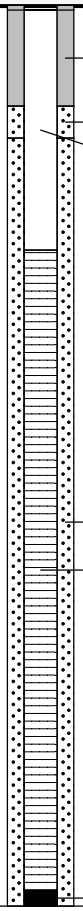
Well ID: **CH-MW-05**

Site Location:
VCC-Charlotte

Borehole Depth: 30' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	9	16-20'	4'	N/A			SILT, red brown, soft, micaceous, damp.
20 / 710	10	20-24'	4'	N/A		ML	SILT, yellow brown to light brown, soft, micaceous, wet.
25 / 705	11	24-28'	4'	N/A			
30	N/A	28-30'	N/A	N/A			No soil samples collected for stratigraphic description.
700							
35							

Well Construction



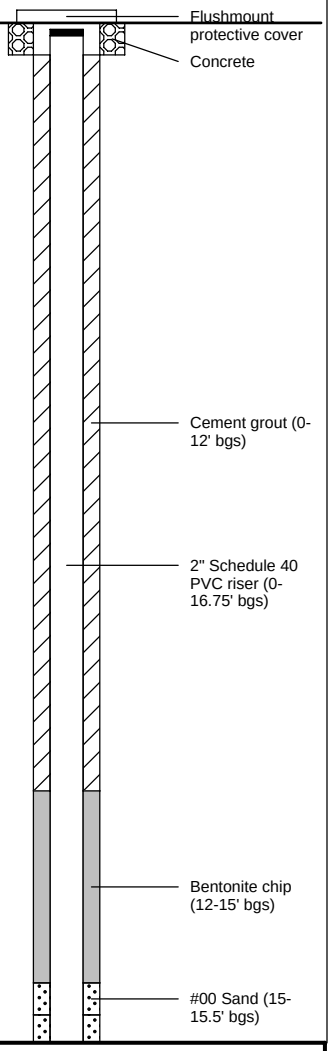
Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

ARCADIS
Infrastructure, environment, buildings

Date Start/Finish:	2/15/2011	**Northing:**	536446.78	**Well ID:**	**CH-MW-06**
Drilling Company:	Parratt Wolff	**Easting:**	1443010.04		
Driller's Name:	Gary Ellingworth			**Client:**	ExxonMobil
Drilling Method:	Hollow Stem Auger Hand Auger	**Casing Elevation:**	732.51		
		Surface Elevation:	732.84		
Sampler Size:	4' Macrocore	**Borehole Depth:**	28' bgs		
Auger Size:	4.25"			**Location:**	VCC-Charlotte
Rig Type:	Ingersoll Rand A-300	**Geologist:**	Brian Lovgren		

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
	735							
0		1	0-0.5'	0.5'	N/A			ASPHALT
		2	0.5-1'	0.5'	N/A			SILTY CLAY with fine GRAVEL, red brown, dry.
		3	1-2.5'	1.5'	N/A			SILTY CLAY, red brown, soft, dry.
	730	4	2.5-5'	2.5'	N/A			SILTY CLAY, red brown to yellow brown, stiff, damp.
5		5	5-8'	3'	N/A		CL	SILTY CLAY, red brown to yellow brown, stiff, damp.
	725	6	8-12'	4'	N/A			
10								
	720	7	12-16'	4'	N/A		ML	SILT, red brown to yellow brown, medium soft, micaceous, damp, saprolite.
15								

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Client: ExxonMobil

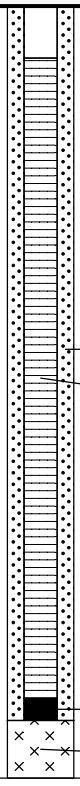
Well ID: **CH-MW-06**

Site Location:
VCC-Charlotte

Borehole Depth: 28' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	8	16-20'	4'	N/A		ML	SILT, red brown, medium soft, micaceous, damp, saprolite.
20							20' bgs- Soft.
710	9	20-24'	4'	N/A			
25	10	24-28'	4'	N/A			SILT, yellow brown, micaceous, saprolite. 25' bgs- Wet.
705							ROCK, light gray, highly weathered, soft, brittle.
30							
700							
35							

Well Construction



Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

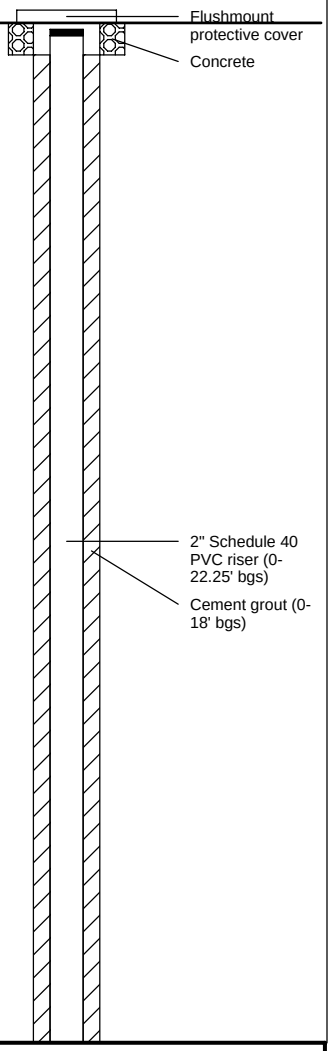
ARCADIS
Infrastructure, environment, buildings

Project: B0085794 Template: G:\COMMON\Exxon Mobil VCC\Well double-cased bedrockEX.ldfx
Data File:CH-MW-06.dat Date: 5/17/2011 Created/Edited by: Ryan Tuttle

Date Start/Finish: 2/16/2011 **Drilling Company:** Parratt Wolff **Driller's Name:** Gary Ellingworth **Drilling Method:** Hollow Stem Auger Hand Auger **Sampler Size:** 4' Macrocore **Auger Size:** 4.25" **Rig Type:** Ingersoll Rand A-300	**Northing:** 536713.97 **Easting:** 1442854.62 **Casing Elevation:** 732.24 **Surface Elevation:** 732.64 **Borehole Depth:** 32' bgs **Geologist:** Brian Lovgren	**Well ID:** **CH-MW-07** **Client:** ExxonMobil **Location:** VCC-Charlotte	

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	USCS Code	Stratigraphic Description
735							
0	1	0-0.5'	0.5'	N/A			ASPHALT
	2	0.5-1'	0.5'	N/A		ML	SILT, brown, loose, some fine Gravel.
	3	1-2.5'	1.5'	N/A		CL	CLAY, red brown, stiff, damp.
730	4	2.5-4.5'	2'	N/A			SILT, red brown, soft, micaceous.
5	5	4.5-6.5'	2'	N/A			
725	6	6.5-8.5'	2'	N/A			8' bgs- Soft.
10	7	8-12'	4'	N/A		ML	
720	8	12-16'	4'	N/A			SILT, yellow brown, soft, micaceous, damp.
15							

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Client: ExxonMobil

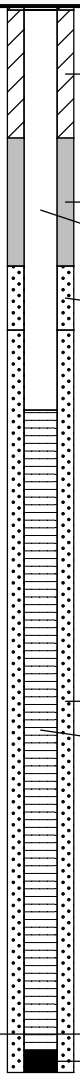
Well ID: **CH-MW-07**

Site Location:
VCC-Charlotte

Borehole Depth: 32' bgs

Depth (ft. bgs) / Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
715	9	16-20'	4'	N/A			SILT, yellow brown, soft, micaceous, damp.
20 / 710	10	20-24'	4'	N/A		ML	SILT, yellow brown, medium soft, micaceous, rock structure, damp.
25 / 705	11	24-28'	4'	N/A			SILT, yellow brown, medium soft, micaceous. 25' bgs- Wet. 26-26.2' bgs- Rock piece with some fine Gravel.
30	N/A	28-32'	N/A	N/A			No soil samples collected for stratigraphic description.
700 / 35							

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: ags = above ground surface
bgs = below ground surface
N/A = Not Applicable/Available
AMSL = Above Mean Sea Level

Appendix C

Development of Health-Based Remediation Goals

ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Drive
Suite 300
Raleigh
North Carolina 27607
Tel 919 854 1282
Fax 919 854 5448

MEMO

To:
Kirstyn White

Copies:
Matt Pelton

ARCADIS G&M of North Carolina, Inc.

NC Engineering License # C-1869
NC Surveying License # C-1869

From:
Shawn Sager

Date:
4 October 2012

ARCADIS Project No.:
B0085793.1201.00003

Subject:
Qualitative Risk Assessment, former Virginia-Carolina Chemical Corporation (VCC), Charlotte, North Carolina

---

The purpose of this memo is to evaluate potential exposures to arsenic and lead detected in soil and groundwater at the former VCC Charlotte, North Carolina site located at 349 West Tremont Avenue, Charlotte, Mecklenburg County, North Carolina (the Site). The potential exposures will be compared to those evaluated in the risk assessment performed for the former VCC site located at 2700 Anger Avenue, Durham, Durham County, North Carolina. For the former VCC Durham site, site-specific health-based remediation goals (HGBs) were developed for several potential receptors. Thus, if the exposure scenarios are comparable, then the HBGs developed for the former VCC Durham site will be applicable to the former VCC Charlotte site. This memo documents the similarities between the exposure assumptions to justify the applicability and use of the risk calculations for the VCC Durham site to the VCC Charlotte site, and a copy of the VCC Durham *Development of Health-Based Remediation Goals* is attached for reference.

Site Description

Fertilizer manufacturing began at the site prior to 1890 and continued until sometime between 1929 and 1934. Historical documents indicate that the last year for acid production was 1934. The Site is currently occupied with commercial and light industrial facilities located within the Tremont Center owned by Tremont Industrial Park, LLC. Based on sampling activities, the extent of the Site has expanded to include other adjacent commercial/industrial properties to the east, south, and west as well. A vast majority of the former site is currently hardscaped with asphalt/concrete driveways and parking lots or buildings.

Surrounding land use of the former VCC property includes commercial and industrial facilities, residential apartments, restaurants, a music hall, a shopping mall, and an abandoned gas station. The nearest residential properties are two apartment buildings located east and southeast of Hawkins Street.

The Site is located near the border of the Catawba and Yadkin River Basin. No surface water features are present on, or immediately adjacent to, the Site. The two closest surface water features are tributaries of Irwin Creek and Dairy Branch. Irwin Creek is located approximately 3,000 feet west of the Site. Irwin Creek flows southwest and joins with Sugar Creek which feeds into the Catawba River. Tributaries of Dairy Branch are located approximately 2,000 feet southeast of the Site. Dairy Branch flows southeast and joins with Little Sugar Creek which feeds into the Catawba River. The Catawba River ultimately discharges to the Atlantic Ocean. Due to the distance from the site to the nearest surface water bodies, potential exposure to surface water and sediment is not considered in this risk assessment.

Water is supplied to the area around the Site by Charlotte-Mecklenburg Utilities. Mountain Island Lake and Lake Norman supply the drinking water and are located approximately 10 miles and 15 miles northwest of the Site, respectively. There are no active public water supply wells in the vicinity of the Site (Environmental Data Resources [EDR] 2009 and personal communication with Jack Stutts of the Mecklenburg County Department of Groundwater and Wastewater in October 2010). Therefore, use of groundwater as a potable water supply is not expected to occur at the site and surrounding area.

The depth to groundwater was measured at seven locations (monitoring wells CH-MW-01 through CH-MW-07) during four separate gauging events conducted March 1, 2011, March 29, 2011, May 10, 2012, and October 3, 2012. The depth to groundwater at the Site varies from approximately 14 to 23 feet below ground surface (bgs).

Conceptual Site Model

The conceptual site model incorporated the site-specific analytical data with constituent-specific fate and transport information to identify migration pathways, and activity and use patterns to identify the unique receptors and exposure pathways. Land use around the Site is a mixture of commercial and industrial facilities and residential properties. The majority of the area is covered with buildings, asphalt, or other hardscape thereby reducing the likelihood of contact with the soil under current conditions. It is possible in the future that the pavement or buildings could be removed and contact with the soil could occur. In this instance, workers on the property or construction or utility workers could contact constituents in soil. There were no surface water bodies near the site so exposure to surface water and sediment was not considered in the development of HBGs. Finally, groundwater at the site is not used as a potable water supply and potable water is provided to the site and surrounding area by the municipal water system. Therefore, exposure to groundwater would occur only for a construction or utility worker contacting water seeping into an excavation area or trench should the excavation reach a depth of 14 feet bgs or deeper. The potential receptors and assumptions are discussed in more detail below.

Toxicity Assessment

There are two general categories of toxic effects (non-carcinogenic and carcinogenic) and constituent-specific toxicity values used to calculate potential risks for these two types of toxic effects. Toxicity values for potential non-carcinogenic and carcinogenic effects are available for arsenic from the United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) (USEPA 2012). Additionally, an inhalation reference concentration for arsenic used to evaluate non-cancer inhalation exposures is available from the California Environmental Protection Agency (CalEPA 2012) since one is not available on IRIS. The currently available toxicity values were compared to those used in the VCC Durham, North Carolina risk assessment and there were no changes.

Exposure to lead is evaluated differently from arsenic. Although exposures to lead are known to cause adverse effects, neither a cancer slope factor (CSF) nor a reference dose (RfD) has been developed for this constituent. In addition, many health authorities (e.g., CDC 1991; ATSDR 1991) believe that it may be inappropriate to develop and/or use a CSF or RfD for lead since that there may not be a true threshold for the effects of lead. As a result, the method used to evaluate the potential risks associated with exposure to lead in soil and groundwater is based on calculating lead concentrations in the blood, since chronic health effects associated with lead exposure have been related to chronic elevated blood lead levels (USEPA 2003).

Health-Based Goals for Arsenic

This section presents a summary of the assumptions and results of the derivation of the HBGs for arsenic by receptor.

Site Worker

The calculation of the health-based remediation goal for site worker exposure to soil was based on the USEPA (2002) *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. This guidance recommends evaluation of outdoor and indoor workers separately since these two groups should experience difference levels of exposure to the soil constituents. Indoor site workers were the most likely receptor at the Site, based on current land use at the site. If outdoor site workers were present on the site, they could be exposed to the surface soil through incidental ingestion of and dermal contact with the soil, and inhalation of particulates released from the soil. Exposure of indoor site workers are expected to be less than for outdoor workers. Therefore, a separate evaluation was not conducted for indoor site workers since outdoor worker exposure is protective of both potentially exposed populations. Standard exposure assumptions from the USEPA (2002) guidance were used to derive the HBGs for both indoor and outdoor site workers.

The HBGs were derived using the low end of the target risk range of 1×10^{-6} to 1×10^{-4} and a non-cancer hazard quotient (HQ) of 1. The minimum HBG for arsenic for an outdoor worker was calculated to be 2.1 milligrams per kilogram (mg/kg) corresponding to a target risk of 1×10^{-6}. However, if the entire target risk range is used, then the maximum HBG for an outdoor site worker would be 210 mg/kg, corresponding to a target risk of 1×10^{-4}. Similarly, for an indoor site worker, the HBG corresponding to a target risk of 1×10^{-4} is 380 mg/kg. The HBGs calculated for the non-cancer HQ of 1 were greater than the HBGs calculated for the cancer endpoints.

Construction Worker

The HBGs for construction workers exposed to soil were derived based on ingestion, dermal contact, and inhalation of particulates entrained in dust generated during construction activities. The HBG based on a target risk of 1×10^{-6} was calculated to be 25 mg/kg and the HBG based on a non-cancer HQ of 1 was calculated to be 55 mg/kg. Expanding the target risk to the entire target risk range, the HBGs would be 250 mg/kg and 2,500 mg/kg (for a target risk of 1×10^{-5} and 1×10^{-4}, respectively) and maintaining a HQ of 1, the resulting soil remediation goal would be 55 mg/kg because protection of construction workers at the non-cancer endpoint would be the limiting concentration.

HBGs for construction worker exposure to groundwater also were developed assuming a construction worker could contact groundwater seeping into an excavation area or trench, assuming that the depth of the excavation were 14 feet bgs or deeper. The HBG calculated based on a target risk of 1×10^{-6} corresponded to 0.79 milligrams per liter (mg/L) and an HBG based on an HQ of 1 was calculated to be 2.5 mg/L. The HBG protective of non-cancer effects is the limiting concentration and thus a groundwater HBG was set at 2.5 mg/L.

Summary of Arsenic HBGs

Potential Receptor	*Health-Based Remediation Goal*
Indoor Site Worker	380 mg/kg
Outdoor Site Worker	210 mg/kg
Construction Worker (soil)	55 mg/kg
Construction Worker (groundwater	2.5 mg/L

Health-Based Goals for Lead

Land use at the Site was assumed to remain nonresidential. Therefore, the HBGs for lead were derived using USEPA's adult lead model (ALM) (USEPA 2011) for both soil and groundwater. Using standard exposure assumptions, the lead HBG for a site worker was calculated to be 1,962 mg/kg and HBG for the construction worker was calculated to be 941 mg/kg. Assuming a construction worker contacts groundwater, an HBG for lead in groundwater was calculated to be 11.3 mg/L.

Soil Concentrations Protective of Groundwater

Protective soil concentrations were also derived based on potential leaching to groundwater and the relevant groundwater HBG, which in this case was protection of a construction worker exposed to shallow groundwater. Using the equations DENR used to derive their soil screening levels, the protective arsenic soil concentration is 460 mg/kg and that of lead is 200,000 mg/kg. Both of these soil concentrations were greater than the lowest calculated soil concentration for the protection of an individual through direct contact, and therefore remediation to the other levels discussed above would be protective of a construction worker exposed to groundwater.

Summary and Conclusions

HBGs were developed for an indoor and outdoor site worker and a construction worker exposed to soil at the site. Potential soil exposure pathways would include direct contact (oral and dermal exposure) with the soil and inhalation of particulates released from the soil. In addition, it is possible that the construction worker could come into contact with the groundwater and be exposed primarily through incidental ingestion of (oral exposure) and dermal contact with the groundwater. The lowest (most protective) of the calculated health-based remediation goals were:

Arsenic in soil: 55 mg/kg

Arsenic in groundwater 0.79 mg/L

Lead in soil: 941 mg/kg

Lead in groundwater: 11.3 mg/L

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1991. *Toxicological Profile for Lead*. Draft Update. October.

ARCADIS, 2012. Site Delineation Report and Removal Action Work Plan, Former Virginia-Carolina Chemical Corporation Site, Durham, North Carolina, Revised January 2012.

California Environmental Protection Agency (CalEPA). 2012. Office of Environmental Health Hazard Assessment (OEHHA). Online Toxicity Criteria Database. Available at: http://www.oehha.ca.gov/tcdb/.

Centers for Disease Control (CDC). 1991. Preventing Lead Poisoning in Young Children. A Statement by the Centers for Disease Control. October.

Environmental Data Resources (EDR), 2009. The EDR Radius Map™ with GeoCheck®, VCC-Charlotte, 301 West Tremont Avenue, Charlotte, NC 28203, Inquiry Number: 2662591.2s. December 18, 2009.

United States Environmental Protection Agency. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Emergency and Remedial Response, Washington, DC. OSWER 9355.4-24. December.

United States Environmental Protection Agency (USEPA). 2003. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. EPA-540-R-03-001. January.

United States Environmental Protection Agency. 2012. Integrated Risk Information System (IRIS), Office of Research and Development, National Center of Environmental Assessment. Internet access: [http://www.epa.gov/iris].

Appendix C

Development of Remediation Goals for the VCC Durham Site

September 2011

Table of Contents

1. Introduction **1**

2. Constituent Characterization **1**

2.1 Soil 1

2.2 Groundwater 2

2.3 Sediment 2

3. Toxicity Assessment **2**

3.1 Non-Carcinogenic Effects 2

3.2 Carcinogenic Effects 3

3.3 Dermal Toxicity Values and Dermal Absorption 4

3.4 Toxicity of Lead 5

4. Exposure Assessment **5**

4.1 Conceptual Site Model 6

4.1.1 Site Location and Surrounding Land Use 6

4.1.2 Potential Human Receptors 7

4.2 Receptor Exposure Pathways and Exposure Assumptions 7

4.2.1 Exposure Point Concentration 8

4.2.2 Site Worker 8

4.2.3 Construction Worker 9

4.2.4 Adolescent Trespasser 10

5. Development of Health-Based Remediation Goals **11**

5.1 General Concepts 11

5.1.1 Hazard Quotient for Non-Cancer Hazard 12

5.1.2 Excess Lifetime Cancer Risk 12

5.1.3 Lead 12

5.2 Arsenic Health-Based Remediation Goals 12

5.2.1 Site Worker Health-Based Remediation Goals 13

5.2.2 Construction Worker Health-Based Remediation Goals 14

5.2.3 Adolescent Trespasser Health-Based Remediation Goals 15

5.3 Lead Health-Based Remediation Goals 15

5.3.1 Lead in Soil 15

5.3.2 Lead in Groundwater 18

5.4 Soil Concentrations Protective of Groundwater 19

6. Summary and Conclusions 19

7. References 20

Tables

Table C-1 Summary of Arsenic and Lead Concentrations in Soil Samples

Table C-2 Permanent Groundwater Monitoring Well Sample Analytical Results and Field Parameter Measurements

Table C-3 Summary of Arsenic and Lead Concentrations in Sediment Samples

Table C-4 Toxicity Values

Table C-5 Dermal Absorption Parameters

Table C-6 Exposure Point Concentrations for Soil and Sediment Data

Table C-7 Health-Based Concentration Goal Equations for Site Worker and Trespasser Exposure to Soil

Table C-8 Health-Based Concentration Goal Equations for Construction Worker Exposure to Soil

Table C-9 Health-Based Concentration Goal Equations for Construction Worker Exposure to Groundwater

Table C-10 Receptor Exposure Parameters

Table C-11 Soil Particulate Emission Factors

Table C-12 Health-Based Concentration Goal Calculations for Exposure to Soil of an Outdoor Site Worker

Table C-13 Health-Based Concentration Goal Calculations for Exposure to Soil of an Intdoor Site Worker

Table C-14 Health-Based Concentration Goal Calculations for Exposure to Soil of a Construction Worker

Table C-15 Health-Based Concentration Goal Calculations for Exposure to Groundwater of a Construction Worker

Table C-16 Health-Based Concentration Goal Calculations for Exposure to Soil of an Adolescent Trespasser

Table C-17 Calculation of Health-Based Remediation Goals (HBGs) for Receptors Exposed to Lead in Soils

Table C-18 Calculation of Health-Based Remediation Goals (HBGs) for Receptors Exposed to Lead in Groundwater

Table C-19 Soil Screening Level Partitioning Equation for Migration to Groundwater – Arsenic

Table C-20 Soil Screening Level Partitioning Equation for Migration to Groundwater - Lead

1. Introduction

The purpose of this appendix is to present supporting documentation for the development of site-specific health-based remediation goals (HBGs) for the former Virginia-Carolina Chemical Corporation (VCC) site located in Durham, Durham County, North Carolina (the Site). The current street address that most closely matches the former acid chamber location is 2700 Angier Avenue.

The site-specific HBGs were derived to support the remedial approach for the VCC site. The health-based goals were derived for soil and groundwater for the two constituents of interest: arsenic and lead. Soil HBGs were derived for site worker, construction worker, and trespasser receptors, while groundwater HBGs were derived for a construction worker receptor from exposure to groundwater. The groundwater HBGs were then used to provide soil concentrations protective of the beneficial use of the groundwater on the property.

This appendix includes the following components: Constituent Characterization, Toxicity Assessment, Exposure Assessment, and the derivation of the HBGs.

2. Constituent Characterization

The focus of this evaluation is the presence of arsenic and lead in soil, groundwater and sediment above North Carolina Department of Environment and Natural Resources (NCDENR) screening levels as discussed in the main body of the report.

2.1 Soil

During the 2010 and 2011 site investigation and site delineation activities, 489 soil samples were collected from 153 soil borings advanced at the Site and analyzed for arsenic, lead, and pH. The maximum arsenic concentration of 339 mg/kg was present in a sample from soil boring DU-SB-28, located on Parcel 118830, at a depth of 0 to 0.5 feet bgs. The maximum lead concentration of 27,900 mg/kg was present in a sample from soil boring DU-SB-70, located on Parcel 118830, at a depth of 4 to 4.25 feet bgs. Soil pH levels varied between 3.5 and 10.9 standard units. Additional sampling details and results are provided in the main report (Site Delineation Report and Removal Action Work Plan [SDR/RAWP]). Table C-1 presents the soil data.

2.2 Groundwater

The groundwater data from the permanent monitoring wells are presented in Table C-2. Arsenic and lead concentrations in DU-MW-02 are the only ones to exceed the North Carolina 2L groundwater standards. DU-MW-02 is found within Parcel 118830.

2.3 Sediment

The sediment samples were collected from the dry drainage ditch located on Parcel 118814. Sediment data is presented in Table C-3. Because the drainage ditch is dry, and the samples are not characteristic of wet sediment, potential exposure to sediments is considered similar to soil exposures.

3. Toxicity Assessment

This section discusses the two general categories of toxic effects (non-carcinogenic and carcinogenic) and constituent-specific toxicity values used to calculate HBGs for these two types of toxic effects. Toxicity values for potential non-carcinogenic and carcinogenic effects are identified from available databases based on USEPA recommended hierarchy (UPEPA 2003a). Further, this section discusses dermal toxicity and toxicity of lead.

3.1 Non-Carcinogenic Effects

For many non-carcinogenic effects, protective mechanisms must be overcome before an effect is manifested. Therefore, a finite dose (threshold), below which adverse effects will not occur, exists for non-carcinogens. Depending on the dose, a single compound might elicit several adverse effects in the exposure route, the duration of exposure, and the susceptibility of the individual. Constituents may exhibit their toxic effects at the point of application or contact (local effect) or at other sites (systemic effects) after they have been absorbed into and distributed throughout the body. Most constituents can produce more than one type of toxic effect, depending on the dose and the susceptibility of the exposed individual or receptor. The goal of toxicity studies for application in risk assessment is to identify the most sensitive toxic effect and the exposure levels that are expected to be safe.

For a given constituent, the dose or concentration that elicits no adverse effect when evaluating the most sensitive response in the most sensitive species studied is referred to as the “no observed adverse effect level” (NOAEL). The NOAEL is used to establish

non-cancer toxicity values (called reference doses [RfDs] or reference concentrations [RfCs]). The RfD and RfC represent a daily exposure level that is not expected to cause adverse non-carcinogenic health effects. Chronic RfDs and RfCs are used to assess long-term exposures varying from 7 years to a lifetime. Subchronic RfDs and RfCs are typically used to evaluate the potential for adverse health effects associated with exposure to constituents over a shorter time period up to 7 years. However, subchronic toxicity values are not available for arsenic and therefore, only the chronic RfD and RfC for arsenic are presented in Table C-4.

3.2 Carcinogenic Effects

Cancer induction in humans and animals by chemicals proceeds through a complex series of reactions and processes. Carcinogenic constituents may produce tumors at the point of application or contact, or they may produce tumors in other tissues after they have been distributed throughout the body. Some constituents are associated only with one or two tumor types, while others may cause tumors at many different sites.

Constituents are classified as known, probable, or possible human carcinogens based on a USEPA weight-of-evidence scheme in which they are systematically evaluated for their ability to cause cancer in humans or laboratory animals. The USEPA classification scheme (USEPA 1989) contains five classes based on the weight of available evidence. Arsenic is considered to be a Class A or known human carcinogen. Lead is classified as a potential human carcinogen, but exposure to lead is evaluated differently than arsenic and is discussed in Section 3.4.

For carcinogens, USEPA's Cancer Guidelines (USEPA 2005) recommend a conservative default approach in which it is assumed that any level of exposure could cause cancer when data are not adequate to understand the mode of action. USEPA generally considers a linear dose-response model, and extrapolates from either the lowest dose or point of departure from laboratory animal data using a mathematical model that plots a line through the zero point and, based on the slope of this dose-response line, assigns a risk level for increasingly smaller doses of a particular compound . While constructing the linear extrapolation from animal or human data, USEPA uses values that are based on a 95 percent upper confidence limit (UCL) of the dose/response slope. Therefore, any risk estimates derived from the model are based on values higher than those reported in the underlying studies and not the most likely estimates generated by applying the mathematical model to the actual study data. The UCL for the slope of this line, called the cancer slope factor (CSF) if the units are risk per dose or the inhalation unit risk (IUR) if the units are risk per micrograms per

cubic meter (µg/m^3). CSFs and IURs are used to assess carcinogenic risk. The cumulative dose, regardless of the particular exposure period, determines the risk; therefore, separate CSFs are not derived for subchronic and chronic exposure periods. Table C-4 presents the carcinogenic toxicity values for oral, dermal, and inhalation exposure.

3.3 Dermal Toxicity Values and Dermal Absorption

Whenever possible, route-specific toxicity values have been used; however, the USEPA has not yet developed toxicity values for dermal exposures. For this reason, adjusted toxicity values (RfD_a and CSF_a) (adjusted to the absorbed dose) are derived from the oral toxicity values (RfD_o and CSF_o) and the oral (gastrointestinal) absorption efficiency (ABS_{GI}) for assessing dermal exposure (USEPA 1989):

$$RfD_a = RfD_o \times \text{Oral Absorption Efficiency}$$

$$CSF_a = CSF_o \,/\, \text{Oral Absorption Efficiency}$$

The adjusted toxicity values presented in Table C-4 represent the theoretical toxicity of the orally absorbed dose of the constituent. An oral absorption efficiency factor (or relative absorption factor) describes the ratio of the absorbed fraction of a constituent from a particular exposure medium to the fraction absorbed from the dosing vehicle used in the toxicity study for that constituent. Oral absorption efficiency values are used in the derivations of the risk-based soil and groundwater constituent concentrations to account for differences in the proportion of absorbed constituent in the soil and groundwater compared to the proportion absorbed in the toxicity studies forming the bases of the toxicity reference values. Oral absorption efficiencies are constituent-specific because they depend on unique physical-chemical properties of each constituent. As a conservative measure, the oral absorption efficiencies were assumed to be equal to 1 (i.e., 100 percent absorption) for all constituents. Uncertainty is associated with the adjusted toxicity values and with the dermal risks derived using these values, due to the uncertainty in the oral toxicity values combined with the uncertainty in the oral absorption efficiency default and constituent-specific values. However, the calculated dermal risks are expected to be very conservative and, therefore, will overestimate human health risks. The dermal toxicity values are presented in Table C-4.

Further, for the dermal exposure pathway, the dermal absorption efficiency is also used to estimate dermal uptake. The soil dermal absorption factor (ABS) is used to calculate dermal uptake through contact with soil and the permeability coefficient is used to

estimate dermal uptake from water. Dermal absorption parameters were obtained from USEPA sources (USEPA 2004) for the COPCs at the Site and are presented in Table C-5.

3.4 Toxicity of Lead

Although exposures to lead are known to cause adverse effects, neither a CSF nor an RfD has been developed for this constituent. In addition, many health authorities (e.g., CDC 1991; ATSDR 1991) believe that it may be inappropriate to develop and/or use a CSF or RfD for lead since that there may not be a true threshold for the effects of lead. As a result, the method used to evaluate the potential risks associated with exposure to lead in soil is based on calculating lead concentrations in the blood, since chronic health effects associated with lead exposure have been related to chronic elevated blood lead levels (USEPA 2003b).

4. Exposure Assessment

Exposure assessment is the process of measuring or estimating the intensity, frequency and duration of human exposure to substances present in the environment. The exposure assessment here includes: (1) identification of potentially exposed populations; (2) development of exposure scenarios; and (3) analysis of exposure pathways. Together, these elements are used to estimate HBGs under current and reasonably foreseeable future conditions. The exposure assessment is a critical component of the risk assessment process, as it qualitatively and quantitatively describes potential contact between COPCs and the receptors that may be affected by them.

The purpose of the exposure assessment is to estimate the ways a population may potentially be exposed to constituents at the Site. The exposure assessment includes characterization of the physical environment, identification of exposure pathways (including migration pathways, exposure points, and exposure routes), and identification of potentially exposed individuals and populations. The exposure assessment typically involves projecting concentrations along potential pathways between sources and receptors. The projection usually is accomplished using site-specific data and, when necessary, mathematical modeling. Exposure can occur only when the potential exists for a receptor to directly contact released constituents or when there is a mechanism for released constituents to be transported to a receptor. Without exposure there is no risk; thus, the exposure assessment is a key element of the risk assessment.

The following sections present a conceptual site model, detailing the potential receptor and exposure pathways and methods used to estimate constituent intakes.

4.1 Conceptual Site Model

The conceptual site model incorporates the site-specific conditions with constituent-specific fate and transport information to identify migration pathways, and activity and use patterns to identify the unique receptors and exposure pathways.

4.1.1 Site Location and Surrounding Land Use

Currently, the Site is comprised of three tax parcels. The eastern parcel (Parcel 118814) is undeveloped and heavily vegetated, while the southern parcel (Parcel 118830) consists of a vacant lot that is completely vegetated. The northwestern parcel (Parcel 118815) is occupied by industrial facilities including Magnetic Attractions and Portable On Demand Storage (PODS). The Magnetic Attractions facility and adjacent parking lot are located on the central portion of the property along Angier Avenue and are fenced off from the road. The PODS warehouse and parking lot are located on the western portion of the Site and are adjacent to the railroad tracks. Most of the area where the former VCC facility structures were located is currently paved as a parking lot or covered by the existing facility buildings (see Figure 1-3 of the main body of the report.)

Land use around the former Durham VCC Site includes commercial and industrial facilities, residential properties, a church, and undeveloped land. The nearest residential properties are approximately 150 feet to the north across the Norfolk Southern Railroad right-of-way. Additionally, Hoover Road Apartments are located approximately 200 feet to the northeast of the intersection of the railroad and Angier Avenue. Thomas Concrete of the Carolinas Inc. is adjacent to the vacant lots along Angier Avenue.

No surface water features are present on or immediately adjacent to the Site, other than the typically dry drainage ditch on Parcel 118814.

Shallow groundwater at the Site is not used as a potable water supply. Rather, municipal water is available for the site and surrounding area. Several residential properties located upgradient to the north of the site do not have public records indicating they are connected to the municipal water supply, therefore, groundwater use in the area cannot be ruled out. However, these properties are located upgradient

of the site, and monitor wells located at the northern site perimeter confirm that groundwater concentrations are below 2L standards in this area. Therefore, for this evaluation site groundwater was not considered to be a potential source of potable drinking water.

4.1.2 Potential Human Receptors

Several possible receptors have been identified for the Site. Potentially exposed receptors must be considered in light of current and likely future use of the Site and the nearby area, as well as access to the Site and impacted media.

Based on available information and site description, the most likely receptors are site workers, construction workers or utility workers, and adolescent trespassers who may access one of the parcels since they are not fenced and access is not restricted.

4.2 Receptor Exposure Pathways and Exposure Assumptions

Exposure pathways are identified in this section based on the site characterization information and the fate and transport properties of the COPCs to identify likely scenarios where human receptors might come in contact with constituents from affected media under current or potential future conditions at the Site. The principal pathways by which exposure could occur for human receptors are identified in each of the relevant exposure scenarios.

An exposure pathway is defined by the following four elements:

1. A source and mechanism of constituent release to the environment.

2. An environmental transport medium for the released constituent.

3. A point of potential contact by the receptor with the medium containing the constituent (the exposure point).

4. A route of exposure to the receptor at the exposure point (i.e., ingestion, inhalation, or dermal contact).

Exposure parameters are receptor- and scenario-specific values that are used in estimating the HBGs. They include, for example, such receptor-specific characteristics as body weight and ingestion rates and such scenario-specific items as the total period

a receptor is exposed to constituents of interest and the frequency with which exposure occurs. Receptor-specific exposure assumptions were obtained from the USEPA guidance (USEPA 1989, 1997, 2002, 2004, 2009a). Receptor exposure assumptions were selected so that HBGs are based on a reasonable maximum exposure (RME) scenario.

The exposure pathways and associated exposure medium identified for the receptors at the Site together with the exposure assumption used to evaluate that pathway are described below per receptor.

4.2.1 Exposure Point Concentration

The exposure point concentration (EPC) is the representative concentration of a constituent in an environmental medium that is potentially contacted by the receptor (USEPA 1989). The EPC is defined as “the arithmetic average of the concentration that is contacted over the exposure period” (USEPA 1989). Exposure to arsenic and lead is evaluated differently. Lead exposures are generally based on an average concentration. For arsenic, depending on the amount of data available, the 95 percent upper confidence level (UCL) on the mean (assuming an one-tailed distribution) can be calculated and used in the risk evaluation. The UCL is a statistical number calculated to represent the mean concentration with 95 percent confidence that the true arithmetic mean concentration will be less than the UCL. UCLs were calculated, where possible, using the ProUCL software available from USEPA (USEPA 2010).

The soil and sediment sampling data were evaluated to identify the EPC. Since there are three parcels under consideration, the data were segregated by parcel. Table C-6 presents the calculated EPCs.

4.2.2 Site Worker

The calculation of the HBGs for site worker exposure to soil was based on the USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA 2002). This guidance recommends evaluation of outdoor and indoor workers separately since these two groups should experience difference levels of exposure to the soil constituents. Indoor site workers are the most likely receptor at the Site, based on current land use at the Site. However, outdoor site workers were also evaluated in this report. Indoor site workers are assumed to be exposed to the surface soil only through incidental ingestion of indoor dust originating from the surface soil (USEPA 2002).

Outdoor site workers are assumed to be exposed to the surface soil through incidental ingestion of and dermal contact with the soil, and inhalation of particulates adhered to dust released from the soil. It should be noted that these exposure scenarios are unlikely to be present outdoors at the Site because there is very little uncovered soil. Indoor site workers are assumed to be exposed to the surface soil only through incidental ingestion of indoor dust originating from the surface soil (USEPA 2002). Because the site is predominately covered, the potential for exposure of indoor workers is limited. The equations used to evaluate site worker exposure to soil are presented in Table C-7 (USEPA 2002). The exposure assumptions for this potential receptor are included in Table C-10 and are summarized as follows:

- Averaging time of 25,550 days (70 years × 365 days per year) for cancer effects; and averaging time of 9,215 days (25 years × 365 days per year) for non-cancer effects (USEPA 1991)
- Adult body weight of 70 kg (USEPA 1991)
- Exposure duration of 25 years (USEPA 2002)
- Exposure frequency of 225 days/year (outdoor site worker) and 250 days/year (indoor site worker) (USEPA 2002)
- Incidental soil ingestion rate of 100 milligrams per day (mg/day) (outdoor site worker) and 50 mg/day (indoor site worker) (USEPA 2002)
- Exposed skin surface area of 3,300 cm^2, which is the sum of the mean values for hands, forearms, and face for an adult (USEPA 2002)
- Soil adherence rate of 0.2 milligrams per square centimeter (mg/cm^2).

4.2.3 Construction Worker

Hypothetical construction workers or utility workers at the Site could be exposed to soil through incidental ingestion of, and dermal contact with the soil and inhalation of particulates. Construction workers could use personal protective equipment (PPE) to minimize their exposure to site-related constituents in soil. While it is likely that construction workers would use PPE, the risk assessment was conducted conservatively assuming that PPE would not be used. The equations used to evaluate this potential exposure scenario are similar to those used for the site workers. The difference is that there may be more dust generated during construction activities at the

site and the additional dust generation was included in the equations, as seen in Table C-8. It was assumed that the construction worker might also come into contact with the shallow groundwater during this excavation work. The risk assessment assumes that, if the construction worker comes into contact with the groundwater, exposure would occur primarily through incidental ingestion of and dermal contact with the groundwater. The equations used to derive the HBGs for groundwater based on hypothetical construction worker exposure are presented in Table C-9. The exposure assumptions for this potential receptor are included in Table C-10 and are summarized as follows:

- Averaging time of 25,550 days (70 years × 365 days per year) for cancer effects; and averaging time of 180 days (26 weeks × 7 days per week) for non-cancer effects (USEPA 1991)
- Adult body weight of 70 kg (USEPA 1991)
- Exposure duration of 1 year (USEPA 2002)
- Exposure frequency of 130 days per year (5 workdays per week for 26 weeks) (USEPA 2002)
- Incidental soil ingestion rate of 330 mg/day (USEPA 2002)
- Soil adherence rate of 0.3 mg/cm^2 (USEPA 2002)
- Incidental groundwater ingestion rate of 0.005 liters per day (L/day) (professional judgment)
- Exposed skin surface area of 3,300 cm^2, which is the sum of the mean values for hands, forearms, and face for an adult (USEPA 2002).

4.2.4 Adolescent Trespasser

An older youth, age 7 to 16 years, could trespass onto the Site since it is not fenced and access is not restricted. This individual could contact soil or dry sediment while trespassing. It was assumed that this individual could access the Site on an occasional basis through an exposure period of 10 years. The exposure frequency was assumed to be 52 days/year assuming the individual accesses the site twice a week for six months of the year. The adolescent trespasser was assumed to contact the soil and/or dry sediments through incidental ingestion, dermal contact and inhalation of dust. The

equations used to evaluate this exposure scenario are presented in Table C-7. The exposure assumptions for the adolescent trespasser are included in Table C-10 are summarized as follows:

- Averaging time of 25,550 days (70 years × 365 days per year) for cancer effects; and averaging time of 3,650 days (10 years × 365 days per year) for non-cancer effects (USEPA 1991)
- Adult body weight of 45 kg (USEPA 1997)
- Exposure duration of 10 years (Professional judgment)
- Exposure frequency of 52 days/year, assuming 2 visits per week for 6 months of the year (USEPA 2002)
- Incidental soil ingestion rate of 50 mg/day (equivalent to a site worker) (USEPA 2002)
- Exposed skin surface area of 4,400 cm^2, which is the age averaged value for hands, forearms, legs, and face (USEPA 1997)
- Soil adherence rate of 0.2 milligrams per square centimeter (mg/cm^2).

5. Development of Health-Based Remediation Goals

Health-based remediation goals are derived in this section by combining exposure assumptions and toxicity values.

5.1 General Concepts

HBGs are derived by not only by combining exposure assumptions and toxicity values, but also by considering cancer and noncancer endpoints. A distinction is made between non-carcinogenic and carcinogenic endpoints, and two general criteria are used to describe the hazard quotient (HQ) for non-carcinogenic effects and excess lifetime cancer risk (ELCR) for constituents evaluated as human carcinogens.

5.1.1 Hazard Quotient for Non-Cancer Hazard

Exposure doses are averaged over the expected exposure period to evaluate non-carcinogenic effects. The HQ is the ratio of the estimated exposure dose and the RfD or RfC. Thus, an HQ greater than 1 indicates that the estimated exposure level for that constituent exceeds the RfD or RfC. This ratio does not provide the probability of an adverse effect. Although an HQ less than 1 indicates that health effects should not occur, an HQ that exceeds 1 does not imply that health effects will occur, but that health effects are possible. The USEPA and the NCDENR consider HQs at or equal to one as potentially acceptable noncancer risks (USEPA 2000; NCDENR 2010).

5.1.2 Excess Lifetime Cancer Risk

The ELCR is an estimate of the potential increased risk of cancer that results from lifetime exposure, at specified average daily dosages, to constituents detected in media at the site. Estimated doses or intakes for each constituent are averaged over the hypothesized lifetime of 70 years. It is assumed that a large dose received over a short period is equivalent to a smaller dose received over a longer period, as long as the total doses are equal. The ELCR is calculated as the product of the exposure dose and the CSF or IUR. The risk values provided in this risk assessment indicate the potential increased risk, above that applying to the general population, which may result from the exposure to vapors migrating into buildings on the property. The USEPA and the NCDENR consider ELCRs within and below the range of 10^{-6} to 10^{-4} as potentially acceptable cancer risks (USEPA 2000; NCDENR 2010).

5.1.3 Lead

Exposure to lead is typically evaluated by estimating the amount of lead that may reach the bloodstream following exposure. Blood lead level estimates are compared to a target blood lead level of 10 micrograms per deciliter (µg/dL) based on recommendation by the Center for Disease Control (CDC).

5.2 Arsenic Health-Based Remediation Goals

The HBGs for arsenic were calculated using site-specific exposure information for the exposure scenarios identified at the Site by combining the appropriate receptor exposure parameters with the toxicity values for each pathway.

As discussed above an HQ greater than one indicates that the estimated exposure for a constituent exceeds acceptable levels for protection against noncarcinogenic effects, however, it does not necessarily imply that adverse health effects will occur. Since arsenic is the only constituent evaluated in this assessment for noncancer endpoints, a target HQ of one was used which is consistent with NCDENR (2010) and USEPA Region 4 recommendations (USEPA 2000).

Moreover, the ELCR is an estimate of the increased risk of cancer that results from lifetime exposure at specified average daily dosages to constituents at specific levels. ELCR are compared to USEPA's target risk range of 1×10^{-4} to 1×10^{-6}. NCDENR bases initial regulatory decisions on an ELCR of 1×10^{-6} (one in 1,000,000), although variances may be allowed (NCDENR 2010). USEPA Region 4 recommends using 1×10^{-4} as a remediation trigger (USEPA 2000). Therefore, HBGs based on target ELCRs of 1×10^{-4} (one in 10,000), 1×10^{-5} (one in 100,000), and 1×10^{-6} (one in 1,000,000) were calculated.

The equations used to evaluate potential exposures of the site worker and adolescent trespasser to arsenic in soil are presented in Table C-7, and those used to evaluate potential exposures of construction workers to arsenic in soil are presented in Table C-8. Hypothetical future construction workers may contact groundwater during invasive activities at the site. The equations used to evaluate this exposure pathway are presented in Table C-9. The exposure parameters used to derive HBGs for each of these receptors are discussed below and are summarized in Table C-10. Results are presented below by receptor.

5.2.1 Site Worker Health-Based Remediation Goals

HBGs for outdoor and indoor site workers were derived using the toxicity values in Table C-4, the dermal parameters in Table C-5, together with the equations in Table C-7 and the exposure assumptions in Table C-10, and the results of the derivation of the particulate emission factor (PEF) which is used to evaluate inhalation exposures (Table C-11). Table C-12 presents the results of the calculations for the outdoor site worker. Using an ELCR of 1×10^{-6}, and an HQ of 1 as the starting point, the minimum HBG for arsenic was calculated to be 2.1 mg/kg. This concentration falls within a background concentration range of <0.1 mg/kg to 6.5 mg/kg obtained from the literature (Shacklette and Boerngen 1984). When the entire target risk range is used, then the maximum HBG for an outdoor site worker would be 210 mg/kg, corresponding to a target risk of 1×10^{-4}. Based on noncancer endpoints and using an HQ=1, the HBG was calculated to be 340 mg/kg. Similarly, for an indoor site worker (Table C-13), the HBG

corresponding to an ELCR of 1×10^{-4} and an HQ=1 were 380 mg/kg and 610 mg/kg, respectively.. Only two points (DU-SB-28 (0-0.5 ft) with arsenic at 339 mg/kg and DU-SB-117 (0-0.05 ft) with 236 mg/kg) exceed the HBG for an outdoor site worker corresponding to a target risk of 1×10^{-4} and a HQ=1. There were no exceedances of the HBG for the indoor worker corresponding to a target risk of 1×10^{-4} and a HQ=1. It should be noted that the EPCs for all three parcels and the entire site are well below the HBGs corresponding to either an ELCR of 1×10^{-4} or an HQ=1.

5.2.2 Construction Worker Health-Based Remediation Goals

Soil HBGs for construction workers were derived using the toxicity values in Table C-4, the dermal parameters in Table C-5, together with the equations in Table C-8 and the exposure assumptions in Table C-10, and the results of the derivation of the particulate emission factor (PEF) which is used to evaluate inhalation exposures (Table C-11) for exposure to soil. Table C-14 presents the results of the calculations for the construction worker. Using an ELCR of 1×10^{-6} and an HQ of 1 as the starting point, the minimum HBG for arsenic for a construction worker was calculated to be 25 mg/kg, All of the EPCs are less than or equal to this HBG indicating that exposure to the parcels individually or as a whole, the risks would be acceptable. Expanding the target risk to the entire target risk range, the maximum HBG for a construction worker would be 2,500 mg/kg, corresponding to a target risk of 1×10^{-4}. Based on the noncancer endpoint and using an HQ=1, the HBG was 55 mg/kg. The soil locations exceeding this construction worker HBG of 55 mg/kg, based on direct contact with soil are: DU-SB-27 (0-0.5 ft) – 91 mg/kg; DU-SB-27 (4-6 ft) – 130 mg/kg; DU-SB-28 (0-0.5 ft) – 339 mg/kg; DU-SB-28 (0.5-2 ft) – 131 mg/kg; DU-SB-57 (0-0.5 ft) – 108 mg/kg; DU-SB-60 (2-4 ft) – 167 mg/kg; DU-SB-75 (0-0.5 ft) – 119 mg/kg; DU-SB-82 (2-4 ft) – 63.3 mg/kg; DU-SB-117 (0-0.05 ft) – 236 mg/kg; DU-SB-121 (0-0.5 ft) – 92.0 mg/kg; DU-SB-127 (0-0.5 ft) – 176 mg/kg; DU-TW-02 (0-0.5 ft) – 93.2 mg/kg; and DU-TW-02 (0.5-2 ft) – 112 mg/kg.

HBGs for construction worker exposure to groundwater also were developed since DU-MW-02 had concentrations exceeding the North Carolina 2L groundwater standard. The HBGs were derived using the toxicity values in Table C-4, the dermal parameters in Table C-5, together with the equations presented in Table C-9 and the exposure assumptions are found in Table C-10. The results of the calculations are found on Table C-15. Using an ELCR of 1×10^{-6}, the HBG corresponds to 0.79 milligrams per liter (mg/L) and a HBG based on an HQ of 1 was calculated to be 2.5 mg/L. Expanding the target risk to the entire target risk range and maintaining an HQ of 1, the lower groundwater remediation goal would be 2.5 mg/L The maximum detected arsenic

groundwater concentration was 0.121 mg/L for the unfiltered sample collected on May 12, 2011. This concentration is below both the HBG that is protective of both cancer and noncancer endpoints corresponding to a target risk of 1×10^{-6} and a target hazard quotient of 1.

5.2.3 Adolescent Trespasser Health-Based Remediation Goals

HBGs for an adolescent trespasser were derived using the equations in Table C-7, the exposure assumptions in Table C-10, and the results of the derivation of the particulate emission factor (PEF) which is used to evaluate inhalation exposures (Table C-11). Table C-16 presents the results of the calculations for the adolescent trespasser. Using an ELCR of 1×10^{-6} and an HQ of 1 as the starting point, the minimum HBG for arsenic was calculated to be 29 mg/kg. All of the EPCs are below this HBG, indicating that exposure on a regular basis would not pose an adverse health effect. If the entire target risk range is used, then the maximum HBG for an adolescent trespasser would be 2,900 mg/kg, corresponding to a target risk of 1×10^{-4}. Based on noncancer end points and using an HQ=1, the HBG was 1,900 mg/kg. None of the detected soil concentrations exceed this concentration. Therefore, it is unlikely that adolescent trespassers would be at risk if they were to contact soil at the Site. The maximum concentration of arsenic detected in the dry sediments (Table C-3) was 82.8 mg/kg. This concentration is less than the HBG of 2,900 mg/kg which corresponds to a target risk of 1×10^{-4} and less than the HBG of 1,900 mg/kg based on noncancer end points and using an HQ=1.

5.3 Lead Health-Based Remediation Goals

USEPA's adult lead model (ALM) is used to evaluate risks to non-residential receptor populations (USEPA 2011b). HBGs were developed for lead in both soil and groundwater.

5.3.1 Lead in Soil

The following equation is used in the ALM to estimate quasi-steady state PbBs:

$$PbB_{GM} = PbB_0 + \frac{Pbs \times BKSF \times IRs \times AF \times EF}{AT}$$

Where:

PbB_{GM}	=	geometric mean (or 50th percentile) of the lognormal distribution of PbBs in adult workers (µg/dL)
PbB_0	=	baseline PbB due to exposure to non-site-related sources of lead (µg/dL)
Pbs	=	soil lead concentration (mg/kg)
BKSF	=	biokinetic slope factor (µg/dL per µg/day)
IRs	=	soil ingestion rate (g/day)
AF	=	gastrointestinal absorption fraction for lead in soil (unitless)
EF	=	exposure frequency (days/year)
AT	=	averaging time (years)

The receptor of concern in the ALM is the fetus of an adult worker. USEPA assumes a linear relationship between PbB in the adult woman and the fetus. Therefore, the geometric mean PbB in the fetus is equal to PbB_{GM} multiplied by a constant, R. This equation is manipulated to solve for an acceptable soil concentration.

The parameter values used in the ALM are discussed briefly below.

Baseline Blood Lead Concentration (PbB_0)

The baseline PbB is intended to represent the best estimate of a reasonable central value of PbB in women of child-bearing age who are not exposed to lead-contaminated non-residential soil or dust at the Site. USEPA recommends a default central tendency value of 1.0 µg/dL for all U.S. populations; this value was used in the ALM to evaluate potential lead risks at the Site (USEPA 2009b).

Geometric Standard Deviation (GSD)

USEPA recommends a GSD of 1.8 for all U.S. populations; this value was used in the ALM to evaluate potential lead risks (USEPA 2009b).

Biokinetic Slope Factor (BKSF)

The BKSF represents the increase in typical adult PbB due to average daily lead uptake. USEPA recommends a default value of 0.4 µg Pb/dL blood per µg Pb absorbed/day for the BKSF (USEPA 2003b). This value is based on empirical data on

the relationship between tap water lead concentrations and PbBs for a sample group of adult males. This default value was used for all exposure pathways in this evaluation.

Soil Ingestion Rate (IR_S)

Consistent with USEPA (2003b; 2011b) guidance, a soil ingestion rate of 50 mg/day was used to evaluate potential risks for the adult recreational user. This value represents the central tendency ingestion rate for soil non-contact-intensive activities (including soil-derived indoor dust) (USEPA 2011b). A soil ingestion rate of 100 mg/day was used to evaluate potential lead exposures for the utility worker and construction worker; this value represents “a reasonable default value that has commonly been used as a central tendency estimate for contact-intensive adult scenarios (such as an agricultural or construction worker)” (USEPA 2011b).

Exposure Frequency (EF) and Averaging Time (AT)

Exposure frequencies used in this lead evaluation were consistent with values used to evaluate potential exposure to arsenic. Specifically, the exposure frequency used for the site worker was 250 days per year. The exposure frequency used for the construction workers was 130 days per year. To avoid diluting exposures over the entire year, the averaging time was based on the exposure frequency for the construction worker.

Lead Absorption Fraction (AF)

This evaluation used a lead absorption fraction of 0.12, which is the default value recommended by USEPA (USEPA 2003b). This value is based on experimental studies of the bioavailability of ingested lead in adults with considerations for the following three major sources of variability: 1) effect of food on lead bioavailability; 2) nonlinearity in PbB; and 3) effect of lead form and particle size on bioavailability. The value assumes a relative bioavailability (RBA) of 0.6 for lead in site-related media as compared to soluble lead, and also assumes an absorption fraction of 0.2 for soluble lead. Thus the final AF is 0.12 (i.e., AF = 0.6 x 0.2 = 0.12).

Fetal/Maternal Blood Lead Concentration ($R_{fetal/maternal}$)

This evaluation used a fetal/maternal blood lead ratio of 0.9 for all receptors, which is the default value recommended by USEPA based on studies that have explored the relationship between umbilical cord and maternal PbBs (USEPA 2003b).

Table C-17 presents the results of the calculations used to derive the HBG for lead in soil. An HBG was not calculated for the adolescent trespasser for exposure to lead because the potential frequency of contact, exposure duration, and age of potential exposure are such that the HBG would be greater than that calculated for a site worker. The HBG for a site worker is 1,962 mg/kg and the HBG for the construction worker is 941 mg/kg. The average lead concentrations, as seen in Table C-6, for each parcel or the site as a whole are less than the calculated HBGs.

The soil locations exceeding the construction worker HBG based on direct contact with soil are: DU-SB-15 (0.5-2 ft) – 1,240 mg/kg; DU-SB-15 (2-4 ft) – 5,560 mg/kg; DU-SB-15 (4-6 ft) – 989 mg/kg; DU-SB-20 (2-4 ft) – 1,140 mg/kg; DU-SB-22 (0.5-2 ft) – 6,070 mg/kg; DU-SB-22 (4-6 ft) – 1,540 mg/kg; DU-SB-27 (0-0.5 ft) – 1,340 mg/kg; DU-SB-33 (0.5-2 ft) – 1,950 mg/kg; DU-SB-33 (2-2.5 ft) – 4,110 mg/kg; DU-SB-35 (2-4 ft) – 1,110 mg/kg; DU-SB-43 (0-0.5 ft) – 7,100 mg/kg; DU-SB-55 (0.5-2 ft) – 1,880 mg/kg; DU-SB-55 (2-4 ft) – 1,230 mg/kg; DU-SB-56 (0.5-2 ft) – 1,260 mg/kg; DU-SB-57 (0-0.5 ft) – 2,850 mg/kg; DU-SB-59 (0-0.5 ft) – 1,270 mg/kg; DU-SB-60 (2-4 ft) – 14,000 mg/kg; DU-SB-69 (0.5-2 ft) – 5,460 mg/kg; DU-SB-69 (2-2.5 ft) – 10,900 mg/kg; DU-SB-70 (2-4 ft) – 17,800 mg/kg; DU-SB-70 (4-4.25 ft) – 27,900 mg/kg; DU-SB-72 (0-0.5 ft) – 1,340 mg/kg; DU-SB-72 (0.5-2 ft) – 25,100 mg/kg; DU-SB-72 (2-2.5ft) – 8,790 mg/kg; DU-SB-76 (2-3.75 ft) – 9,440 mg/kg; DU-SB-78 (2-3.5 ft) – 3,350 mg/kg; DU-SB-82 (0-0.5 ft) – 956 mg/kg; DU-SB-82 (0.5-2 ft) – 1,030 mg/kg; DU-SB-82 (2-4 ft) – 2,580 mg/kg; DU-SB-82 (6-8 ft) – 1,140 mg/kg; DU-SB-83 (0-0.5 ft) – 1,260 mg/kg; DU-SB-83 (0.5-2 ft) – 1,780 mg/kg; DU-SB-84 (0.5-2 ft) – 964 mg/kg; DU-SB-96 (0.5-25 ft) – 7,160 mg/kg; DU-SB-96 (2-4 ft) – 10,200 mg/kg; DU-SB-99 (0-0.05 ft) – 991 mg/kg; DU-SB-104 (2-2.5 ft) – 1,430 mg/kg; DU-SB-110 (0- ft) – 1,110 mg/kg; and DU-SB-135 (2-4 ft) – 1,050 mg/kg.

5.3.2 Lead in Groundwater

The following equation is used in the ALM to estimate quasi-steady state PbBs:

$$PbB_{GM} = PbB_0 + \frac{Pbw \times BKSF \times IRw \times AF \times EF}{AT}$$

Where:

PbB_{GM} = geometric mean (or 50th percentile) of the lognormal distribution of PbBs in adult workers (µg/dL)

PbB_0 = baseline PbB due to exposure to non-site-related sources of lead (µg/dL)

Pbw	=	groundwater lead concentration (mg/L)
BKSF	=	biokinetic slope factor (µg/dL per µg/day)
IRw	=	water ingestion rate (g/day)
AF	=	gastrointestinal absorption fraction for lead in groundwater (unitless)
EF	=	exposure frequency (days/year)
AT	=	averaging time (years)

The two input parameters that differ from those derived for soil are the groundwater ingestion rate which is set at 0.005 L/day and the gastrointestinal absorption fraction (AF). The AF of 0.2 is that for soluble lead. All of the lead in groundwater was assumed to originate from this exposure scenario.

The health-based goal for the construction worker exposure to lead in groundwater is found in Table C-18 and is 11,300 µg/L or 11.3 mg/L. All of the detected lead concentrations in groundwater are below this level.

5.4 Soil Concentrations Protective of Groundwater

Protective soil concentrations were also derived based on potential leaching to groundwater and the relevant groundwater HBG which in this case was protection of a construction worker exposed to shallow groundwater. Using the equations NCDENR used to derive their soil screening levels, the protective arsenic soil concentration is 460 mg/kg (Table C-19) and that of lead is 200,000 mg/kg (Table C-20). Both of these soil concentrations are greater than the lowest calculated HBG for the protection of an individual through direct contact, and therefore remediation to the other levels discussed above would be protective of a construction worker exposed to groundwater.

6. Summary and Conclusions

HBGs were developed for a site worker, a construction worker, and an adolescent trespasser exposed to soil at the Site. Potential soil exposure pathways evaluated included direct contact (oral and dermal exposure) with the soil and inhalation of particulates released from the soil. In addition, since it is possible that the construction worker could come into contact with the shallow groundwater and be exposed primarily through incidental ingestion of (oral exposure) and dermal contact with the groundwater; HBGs for those pathways were calculated as well. The HBGs were selected by comparing the HBGs calculated at a target cancer risk within the target risk range of 1×10^{-4} to 1×10^{-6} and the HBG calculated for a target hazard quotient of 1. The

soil HBGs were compared to the EPCs for arsenic (based on the 95% UCL) and the EPC for lead (based on the average concentration) and none of the EPCs either by parcel or for the site as a whole exceeded the HBGs. The detected groundwater concentrations were below the HBGs. The selected HBGs were:

- Arsenic in soil: 55 mg/kg for a construction worker, 210 mg/kg for an outdoor worker, 380 mg/kg for an indoor worker, and 1,900 mg/kg for an adolescent trespasser.
- Arsenic in groundwater: 0.79 mg/L
- Lead in soil: 941 mg/kg for a construction worker and 1,962 mg/kg for a site worker
- Lead in groundwater: 11.3 mg/L

7. References

Agency for Toxic Substances and Disease Registry (ATSDR). 1991. *Toxicological Profile for Lead*. Draft Update. October.

Bowers, T. S., B. D. Beck, and H. S. Karam. 1994. "Assessing the Relationship between Environmental Lead Concentrations and Adult Blood Lead Levels. *Risk Analysis* 14(2).

Californian Environmental Protraction Agency (CalEPA). 2011. Office of Environmental Health Hazard Assessment (OEHHA). Online Toxicity Criteria Database. Available at: http://www.oehha.org/risk/ ChemicalDB/index.asp. California Environmental Protection Agency.

Centers for Disease Control (CDC). 1991. Preventing Lead Poisoning in Young Children. A Statement by the Centers for Disease Control. October.

National Climactic Data Center (NCDC), 2011. Web Climate Services, Version 2.0. Online. Internet access: http://www.sercc.com/climateinfo/historical/avgwind.html).

North Carolina Department of Environment and Natural Resources (NCDENR). 2010. Guidelines for Assessment and Cleanup. Hazardous Waste Site Branch.

Shacklette, H.T., and Boerngen, J.G. 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survery Professional Paper 1270. United States Government Printing Office, Washington, DC.

Superfund Chemical Database Matrix, Windows (SCDMWIN). 2004. Version 1.0. Office of Emergency and Remedial Response. Washington, DC. Internet access: http://www.epa.gov/superfund/resources/scdm/index.htm.

United States Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Volume 1, Part A. Interim Final. Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-89/002. December.

USEPA. 1991. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, Interim Final, OSWER Directive No. 9285.6-03, March 25.

USEPA. 1994. "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities." OSWER Directive 9355.4-12 by Elliott P. Laws, Assistant Administrator. 14 July.

USEPA. 1997. Exposure Factors Handbook. Exposure Assessment Group, Office of Research and Development, National Center for Environmental Assessment, Washington, DC. EPA 600/P-95-002. August.

USEPA. 2000. Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins, USEPA Region 4, originally published November 1995, Website version last updated May 2000: http://www.epa.gov/region4/waste/ots/healtbul.htm

USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Emergency and Remedial Response, Washington, DC. OSWER 9355.4-24. December.

USEPA. 2003a. Human Health Toxicity Values in Superfund Risk Assessments. Memo from Michael B. Cook. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. Office of Solid Waste and Emergency Response Directive (OSWER). Directive 9285.7-53. December. Available at: http://www.epa.gov/oswer/riskassessment/pdf/hhmemo.pdf

USEPA. 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. EPA-540-R-03-001. January.

USEPA. 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. Office of Superfund Remediation and Technology Innovation, Washington, DC. OSWER 9285.7-02EP. EPA/540/R/99/005. PB99-963312. July.

USEPA. 2005. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F. March.

USEPA . 2009a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part F, Supplemental Guidance for Inhalation Risk Assessment), Office of Superfund Remediation and Technology Innovation, Washington, DC. OSWER 9285.7-82. January.

USEPA. 2009b. Transmittal of Update of Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters. Memorandum from James E. Woolford, Office of Superfund Rememdiation and Technology Innovation to Superfund National Policy Managers, Regions 1-10. Office of Solid Waste and Response, Washington, DC. OSWER 9200.2-82. June 29.

USEPA. 2011a. Integrated Risk Information System (IRIS), Office of Research and Development, National Center of Environmental Assessment. Internet access: [http://www.epa.gov/iris].

USEPA. 2011b. Frequent Questions from Risk Assessors on the ALM. Available at http://www.epa.gov/superfund/health/contaminants/lead/almfaq.htm. Last updated 2/28/11.

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-1	0 - 0.5	6/7/2010	7.38	30.0 J
	0.5 - 2	6/7/2010	4.49	10.1 J
	2 - 4	6/7/2010	7.38	11.3 J
DU-SB-2	0 - 0.5	6/7/2010	2.44	58.0 J
	0.5 - 2	6/7/2010	13.4	232 J
	2 - 4	6/7/2010	3.25	120 J
DU-SB-3	0 - 0.5	6/7/2010	2.10	15.9 J
	0.5 - 2	6/7/2010	5.65	129 J
	2 - 4	6/7/2010	3.45	197 J
DU-SB-4	0 - 0.5	6/7/2010	4.69	36.5
	0.5 - 2	6/7/2010	6.09	36.8
	2 - 4	6/7/2010	2.14	19.9
DU-SB-5	0 - 0.5	6/7/2010	7.56	27.2
	0.5 - 2	6/7/2010	3.90	94.0
	2 - 4	6/7/2010	1.83	16.3
DU-SB-6	0 - 0.5	6/7/2010	3.05	37.2
	0.5 - 2	6/7/2010	3.65	49.6
	2 - 4	6/7/2010	2.26	16.4
DU-SB-7	0 - 0.5	6/8/2010	9.96	618
	0.5 - 2	6/8/2010	9.61	638
	2 - 4	6/8/2010	21.2	884
	4 - 6	6/8/2010	2.19	22.3
DU-SB-8	0 - 0.5	6/9/2010	4.35 [3.93]	375 [370]
	0.5 - 2	6/9/2010	28.9	922
	2 - 4	6/9/2010	2.63	61.6
DU-SB-9	0 - 0.5	6/9/2010	2.92	92.3
	0.5 - 2	6/9/2010	2.41	20.9
	2 - 4	6/9/2010	5.25	25.8
DU-SB-10	0 - 0.5	6/8/2010	2.00	15.0
	0.5 - 2	6/8/2010	2.35	16.0
	2 - 4	6/8/2010	3.12	15.0
DU-SB-11	0 - 0.5	6/8/2010	2.47	16.9
	0.5 - 2	6/8/2010	1.81	13.0
	2 - 2.5	6/8/2010	1.52	12.3
DU-SB-12	0 - 0.5	6/9/2010	5.14	15.8
	0.5 - 2	6/9/2010	5.75	12.2
	2 - 4	6/9/2010	4.58	33.3
DU-SB-13	0 - 0.5	6/9/2010	3.42	40.6
	0.5 - 2	6/9/2010	3.17	471
	2 - 4	6/9/2010	3.77	190
	4 - 6	6/9/2010	2.88	130
	6 - 8	6/9/2010	4.13	296
	8 - 10	6/10/2010	4.16	66.3

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-14	0 - 0.5	6/9/2010	4.64	60.6 J
	0.5 - 2	6/9/2010	2.89	10.4 J
	2 - 4	6/9/2010	16.9 [16.8]	606 J [178 J]
	4 - 6	6/10/2010	5.81	93.3
DU-SB-15	0 - 0.5	6/9/2010	4.40	376 J
	0.5 - 2	6/9/2010	4.91	1,240 J
	2 - 4	6/9/2010	6.50	5,560 J
	4 - 6	6/10/2010	19.8 [24.9]	989 [1,030]
	6 - 8	6/10/2010	4.38	22.6
DU-SB-16	0 - 0.5	6/9/2010	4.25	88.3
	0.5 - 2	6/9/2010	5.66	23.3
	2 - 4	6/9/2010	4.41	24.4
DU-SB-17	0 - 0.5	6/7/2010	3.24	55.1
	0.5 - 2	6/7/2010	4.56	123
	2 - 4	6/7/2010	2.19 [2.46]	12.9 [8.46]
DU-SB-18	0 - 0.5	6/7/2010	1.85	78.1 J
	0.5 - 2	6/7/2010	4.82 [4.27]	141 J [113 J]
	2 - 4	6/7/2010	5.65	193 J
DU-SB-19	0 - 0.5	6/7/2010	10.3	132 J
	0.5 - 2	6/7/2010	5.58	250 J
	2 - 4	6/7/2010	5.15	14.8 J
DU-SB-20	0 - 0.5	6/7/2010	0.835 J	10.6
	0.5 - 2	6/7/2010	14.0	424
	2 - 4	6/7/2010	52.6	1,140
	4 - 6	6/8/2010	6.10	10.3
DU-SB-21	0 - 0.5	6/9/2010	3.73	446
	0.5 - 2	6/9/2010	7.09	278
	2 - 4	6/9/2010	32.7	402
	4 - 6	6/10/2010	7.66	41.9 J
DU-SB-22	0 - 0.5	6/9/2010	3.25	60.5
	0.5 - 2	6/9/2010	14.4	6,070
	2 - 4	6/9/2010	4.47	612
	4 - 6	6/10/2010	10.0	1,540
	6 - 8	6/10/2010	28.8	80.6
	8 - 10	6/10/2010	3.67	10.6 J
DU-SB-23	0 - 0.5	6/9/2010	3.76	27.0
	0.5 - 2	6/9/2010	3.64	17.6
	2 - 4	6/9/2010	5.77	16.0
	4 - 6	6/9/2010	7.24	19.7
	6 - 8	6/9/2010	5.05	166
DU-SB-24	0 - 0.5	6/9/2010	3.03	14.5
	0.5 - 2	6/9/2010	3.64	18.2
	2 - 4	6/9/2010	3.92	16.1
	4 - 6	6/10/2010	7.37	16.0
	6 - 8	6/10/2010	2.88	36.6

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-25	0 - 0.5	6/9/2010	2.83	10.8 J
	0.5 - 2	6/9/2010	3.04	13.7 J
	2 - 4	6/9/2010	4.52	13.1 J
DU-SB-26	0 - 0.5	6/9/2010	4.24	12.6 J
	0.5 - 2	6/9/2010	3.02	55.4 J
	2 - 4	6/9/2010	4.62	13.8 J
	4 - 6	6/9/2010	2.30	18.9
	6 - 8	6/9/2010	1.01 J	12.7
DU-SB-27	0 - 0.5	6/9/2010	91.0	1,340 J
	0.5 - 2	6/9/2010	49.7	596
	2 - 4	6/9/2010	17.7	845
	4 - 6	6/10/2010	130	41.0
	6 - 8	6/10/2010	64.6	15.1
	8 - 9.5	6/10/2010	11.0	4.73 J
DU-SB-28	0 - 0.5	6/9/2010	339	13.0 J
	0.5 - 2	6/9/2010	131	18.3 J
	2 - 4	6/9/2010	3.50	8.80 J
DU-SB-29	0 - 0.5	6/7/2010	1.20 U	32.0
	0.5 - 2	6/7/2010	1.40 U	28.7 J
	2 - 4	6/7/2010	1.41 U	23.9 J
DU-SB-30	0 - 0.5	6/7/2010	8.24	51.6 J
	0.5 - 2	6/7/2010	8.52	60.2 J
	2 - 4	6/7/2010	5.30	179 J
DU-SB-31	0 - 0.5	6/7/2010	2.09	28.5 J
	0.5 - 2	6/7/2010	0.938 J	25.3 J
	2 - 4	6/7/2010	3.50	24.9 J
DU-SB-32	0 - 0.5	6/7/2010	1.29	15.9 J
	0.5 - 2	6/7/2010	2.14	55.7 J
	2 - 4	6/7/2010	1.87	23.6 J
DU-SB-33	0 - 0.5	6/7/2010	4.48	63.1 J
	0.5 - 2	6/7/2010	3.07	1,950 J
	2 - 2.5	6/7/2010	6.37	4,110 J
DU-SB-34	0 - 0.5	6/8/2010	1.14 U	9.71
	0.5 - 2	6/8/2010	1.23 U	8.14
	2 - 4	6/8/2010	1.54	11.3
DU-SB-35	0 - 0.5	6/8/2010	4.13	91.4
	0.5 - 2	6/8/2010	6.80	461
	2 - 4	6/8/2010	5.86 [8.28]	1,100 [1,520]
	4 - 6	6/9/2010	1.95	94.0
DU-SB-36	0 - 0.5	6/8/2010	3.21	18.1
	0.5 - 2	6/8/2010	4.52	14.7
	2 - 4	6/8/2010	1.58	12.8
DU-SB-37	0 - 0.5	6/8/2010	2.74	13.8
	0.5 - 2	6/8/2010	2.65	31.6
	2 - 4	6/8/2010	2.59	6.89

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-38	0 - 0.5	6/8/2010	1.76	9.47
	0.5 - 2	6/8/2010	1.91	9.92
	2 - 4	6/8/2010	1.24	12.4
DU-SB-39	0 - 0.5	6/8/2010	0.790 J	15.0
	0.5 - 2	6/8/2010	1.75	9.64
	2 - 4	6/8/2010	1.88	9.88
DU-SB-40	0 - 0.5	6/8/2010	3.53	85.6
	0.5 - 2	6/8/2010	5.53	123
	2 - 4	6/8/2010	3.37	73.5
DU-SB-41	0 - 0.5	6/7/2010	2.41 [1.21]	65.7 J [46.4 J]
	0.5 - 2	6/7/2010	11.8	75.3 J
DU-SB-42	0 - 0.5	6/7/2010	4.23	19.6 J
	0.5 - 2	6/7/2010	5.68	95.3 J
	2 - 4	6/7/2010	6.00	42.3 J
DU-SB-43	0 - 0.5	6/8/2010	2.04	7,100
	0.5 - 2	6/8/2010	2.10	14.2
	2 - 4	6/8/2010	1.39	6.87
DU-SB-44	0 - 0.5	6/10/2010	5.27	125
	0.5 - 2	6/10/2010	1.71	12.9
	2 - 4	6/10/2010	1.53	13.6
DU-SB-45	0 - 0.5	6/9/2010	2.01	34.0
	0.5 - 2	6/9/2010	2.32	18.6
	2 - 4	6/9/2010	1.36	13.2
DU-SB-46	0 - 0.5	6/10/2010	2.71	11.5
	0.5 - 2	6/10/2010	4.14	12.5
	2 - 4	6/10/2010	2.59	11.7
DU-SB-47	0 - 0.5	6/9/2010	2.21	14.2
	0.5 - 2	6/9/2010	2.34	23.8
	2 - 4	6/9/2010	1.59	10.5
DU-SB-48	0 - 0.5	6/9/2010	2.60	27.0
	0.5 - 2	6/9/2010	2.68	13.7
	2 - 4	6/9/2010	2.16 [1.52]	20.7 [13.5]
DU-SB-49	0 - 0.5	6/8/2010	5.14	284
	0.5 - 2	6/8/2010	2.79	56.2
	2 - 4	6/8/2010	2.94 [3.42]	20.7 [24.3]
DU-SB-50	0 - 0.5	6/9/2010	12.9	16.9
	0.5 - 2	6/9/2010	5.35	13.0
	2 - 4	6/9/2010	8.11	25.8
DU-SB-51	0 - 0.5	6/9/2010	11.4	47.7
	0.5 - 2	6/9/2010	3.75	11.7
	2 - 4	6/9/2010	20.7	5.66
DU-SB-52	0 - 0.5	6/9/2010	15.6	298
	0.5 - 2	6/9/2010	2.95	17.3
	2 - 4	6/9/2010	1.31	15.5

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-53	0 - 0.5	12/6/2010	4.11 J [4.31]	38.6 [69.8]
	0.5 - 2	12/6/2010	26.6 J	223
	2 - 4	12/6/2010	1.30 UJ	45.9
DU-SB-54	0 - 0.5	12/6/2010	8.31 J	151
	0.5 - 2	12/6/2010	1.35 UJ	18.1
	2 - 4	12/6/2010	1.24 UJ	2.43
DU-SB-55	0 - 0.5	12/6/2010	1.57 J	52.7
	0.5 - 2	12/6/2010	18.2 J	1,880
	2 - 4	12/6/2010	22.6 J	1,230
DU-SB-56	0 - 0.5	12/6/2010	6.00 J	146
	0.5 - 2	12/6/2010	21.6 J	1,260
	2 - 4	12/6/2010	13.6 J	503
	4 - 6	12/6/2010	1.11 UJ	45.3
DU-SB-57	0 - 0.5	12/7/2010	108	2,850
	0.5 - 2	12/7/2010	13.7	380
	2 - 4	12/7/2010	3.54	86.1
DU-SB-58	0 - 0.5	12/6/2010	3.63 J	184
	0.5 - 2	12/6/2010	6.60 J	208
	2 - 4	12/6/2010	10.7 J	592
DU-SB-59	0 - 0.5	12/6/2010	32.5 J	1,270
	0.5 - 2	12/6/2010	12.0 J	508
	2 - 4	12/6/2010	4.23 J	40.1
DU-SB-60	0 - 0.5	12/7/2010	2.95	162
	0.5 - 2	12/7/2010	10.6	161
	2 - 4	12/7/2010	167	14,000
	4 - 6	12/7/2010	3.54	93.5
DU-SB-61	0 - 0.5	12/7/2010	1.51	13.6
	0.5 - 2	12/7/2010	0.836 J	14.2
	2 - 4	12/7/2010	1.46	8.28
DU-SB-62	0 - 0.5	12/7/2010	2.91	19.8
	0.5 - 2	12/7/2010	5.76	104
	2 - 3	12/7/2010	19.2	268
DU-SB-63	0 - 0.5	12/7/2010	2.69 [2.13]	27.0 [17.2]
	0.5 - 2	12/7/2010	7.23	208
	2 - 4	12/7/2010	8.65	684
	4 - 6	12/7/2010	7.34	257
DU-SB-64	0 - 0.5	12/7/2010	3.09	31.9
	0.5 - 2	12/7/2010	2.33	14.8
	2 - 4	12/7/2010	1.60	16.9
DU-SB-65	0 - 0.5	12/8/2010	3.46	31.2 J
	0.5 - 2	12/8/2010	4.25	220 J
DU-SB-66	0 - 0.5	12/7/2010	2.93	43.2
	0.5 - 2	12/7/2010	2.13	20.4
	2 - 4	12/7/2010	4.68	252

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-67	0 - 0.5	12/8/2010	2.64	17.3
	0.5 - 2	12/8/2010	4.23	377
	2 - 4	12/8/2010	7.81	218
DU-SB-68	0 - 0.5	12/7/2010	4.50 [4.44]	38.8 [32.5]
	0.5 - 2	12/7/2010	7.04	49.3
	2 - 4	12/7/2010	3.88	67.5
DU-SB-69	0 - 0.5	12/8/2010	5.84	107 J
	0.5 - 2	12/8/2010	8.29 [5.41 J]	5,460 J [1,490 J]
	2 - 2.5	12/8/2010	17.8 J	10,900 J
DU-SB-70	0 - 0.5	12/8/2010	3.97	75.8
	0.5 - 2	12/8/2010	2.37	608
	2 - 4	12/8/2010	5.93	17,800
	4 - 4.25	12/10/2010	2.48	27,900
DU-SB-71	0 - 0.5	12/8/2010	2.77	27.0
	0.5 - 2	12/8/2010	2.01	18.9
	2 - 4	12/8/2010	3.80	25.5
DU-SB-72	0 - 0.5	12/8/2010	34.8	1,340
	0.5 - 2	12/8/2010	24.9 J	25,100
	2 - 2.5	12/8/2010	26.8 J	8,790
DU-SB-73	0 - 0.5	12/9/2010	1.23	14.4
	0.5 - 2	12/9/2010	4.00	95.3
	2 - 3.5	12/9/2010	6.18	259
DU-SB-74	0 - 0.5	12/9/2010	6.55	88.5 J
	0.5 - 2	12/9/2010	5.01 [8.06]	215 J [223 J]
	2 - 4	12/9/2010	8.51	176 J
DU-SB-75	0 - 0.5	12/9/2010	119	443
	0.5 - 2	12/9/2010	1.92	11.4
	2 - 4	12/9/2010	2.57	8.54 J
DU-SB-76	0 - 0.5	12/9/2010	2.49	30.3
	0.5 - 2	12/9/2010	2.37	14.9
	2 - 3.75	12/9/2010	7.35	9,440
DU-SB-77	0 - 0.5	12/9/2010	4.53	461
	0.5 - 2	12/9/2010	3.35 J	14.7
	2 - 4	12/9/2010	11.4 J	454
	4 - 6	12/10/2010	6.60	91.3
	6 - 8	12/10/2010	1.83	12.4
DU-SB-78	0 - 0.5	12/9/2010	2.86	24.0 J
	0.5 - 2	12/9/2010	4.93	663 J
	2 - 3.5	12/9/2010	12.0 J [10.7 J]	3,350 J [2,370 J]
DU-SB-79	0 - 0.5	12/9/2010	13.0 J	62.2 J
	0.5 - 2	12/9/2010	2.88	60.9 J
	2 - 4	12/9/2010	28.6 J	103 J
	4 - 6	12/10/2010	6.44	60.7
	6 - 8	12/10/2010	3.09	20.5

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-80	0 - 0.5	12/9/2010	4.02 J	62.0
	0.5 - 2	12/9/2010	7.63 J	206
	2 - 4	12/9/2010	18.5 J	94.4
	4 - 6	12/10/2010	13.2	20.0
DU-SB-81	0 - 0.5	12/14/2010	6.80	38.6 J
	0.5 - 2	12/14/2010	1.94	15.8 J
	2 - 4	12/14/2010	1.05 J	6.65 J
DU-SB-82	0 - 0.5	12/9/2010	47.9 J	956
	0.5 - 2	12/9/2010	13.6 J	1,030
	2 - 4	12/9/2010	63.3 J	2,580
	4 - 6	12/10/2010	29.5	2,230
	6 - 8	12/10/2010	27.1	1,140
DU-SB-83	0 - 0.5	12/9/2010	47.5 J	1,260
	0.5 - 2	12/9/2010	42.5 J	1,780
DU-SB-84	0 - 0.5	12/9/2010	13.2 J	452
	0.5 - 2	12/9/2010	35.5 J [46.8 J]	964 [849]
	2 - 4	12/9/2010	23.2 J	504
	4 - 6	12/10/2010	27.0	49.3
	6 - 8	12/10/2010	26.8	34.8
DU-SB-85	0 - 0.5	12/17/2010	51.2 [55.0]	687 J [1,470 J]
	0.5 - 2	12/17/2010	39.0	386 J
	2 - 3	12/17/2010	5.04	16.7 J
DU-SB-86	0 - 0.5	12/10/2010	24.6	696
	0.5 - 2	12/10/2010	17.4	429
	2 - 3.75	12/10/2010	8.48	149
DU-SB-87	0 - 0.5	12/10/2010	5.21	276
	0.5 - 2	12/10/2010	4.95	18.1
	2 - 4	12/10/2010	3.19	21.9
DU-SB-88	0 - 0.5	12/10/2010	2.14	17.1
	0.5 - 2	12/10/2010	3.42	101
	2 - 3	12/10/2010	6.19	321
DU-SB-89	0 - 0.5	12/10/2010	3.42	18.6
	0.5 - 2	12/10/2010	5.85	166
	2 - 4	12/10/2010	10.7 [6.74]	678 [862]
DU-SB-90	0 - 0.5	12/17/2010	6.95	88.6 J
	0.5 - 2	12/17/2010	2.94	32.4 J
	2 - 4	12/17/2010	3.52	14.2 J
DU-SB-91	0 - 0.5	12/17/2010	2.82	20.0 J
	0.5 - 2	12/17/2010	4.64	22.7 J
	2 - 3	12/17/2010	3.63	34.5 J
DU-SB-92	0 - 0.5	12/10/2010	1.54	20.7
	0.5 - 2	12/10/2010	1.14 J	93.5
DU-SB-93	0 - 0.5	12/13/2010	1.54	25.0
	0.5 - 2	12/13/2010	1.83	16.1
	2 - 4	12/13/2010	1.25	6.22

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-94	0 - 0.5	12/13/2010	3.19	52.9
	0.5 - 2	12/13/2010	1.16 J	25.7
	2 - 4	12/13/2010	1.16 J	21.2
DU-SB-95	0 - 0.5	12/13/2010	2.70	498
	0.5 - 2	12/13/2010	1.88	16.9
	2 - 4	12/13/2010	1.40	10.6
DU-SB-96	0 - 0.5	12/13/2010	0.857 J	93.4
	0.5 - 2	12/13/2010	9.63	7,160
	2 - 4	12/13/2010	19.4	10,200
DU-SB-97	0 - 0.5	12/13/2010	2.78	63.2
	0.5 - 2	12/13/2010	2.41	9.63
	24	12/13/2010	1.47	9.36
DU-SB-98	0 - 0.5	12/13/2010	3.17	9.51
	0.5 - 2	12/13/2010	4.60	8.66
	2 - 4	12/13/2010	7.22	9.67
DU-SB-99	0 - 0.5	12/14/2010	7.28	991
	0.5 - 2	12/14/2010	5.90	559
	2 - 4	12/14/2010	2.01	21.0
DU-SB-100	0 - 0.5	12/14/2010	12.8 [10.3]	339 [412]
	0.5 - 2	12/14/2010	3.26	25.2
	2 - 3.75	12/14/2010	3.79	152
DU-SB-101	0 - 0.5	12/14/2010	7.11	456 J
	0.5 - 2	12/14/2010	4.11	146 J
	2 - 4	12/14/2010	2.57	75.4 J
DU-SB-102	0 - 0.5	12/14/2010	2.77	18.8 J
	0.5 - 2	12/14/2010	3.19	19.2 J
	2 - 4	12/14/2010	1.34	16.2 J
DU-SB-103	0 - 0.5	12/14/2010	5.75	97.0
	0.5 - 2	12/14/2010	6.75	15.8
	2 - 4	12/14/2010	3.58	11.4 J
DU-SB-104	0 - 0.5	12/14/2010	2.53	64.0 J
	0.5 - 2	12/14/2010	2.74	302 J
	2 - 2.5	12/14/2010	2.42 [4.20]	1,430 J [9,670 J]
DU-SB-105	0 - 0.5	12/14/2010	1.15 U	4.59 J
	0.5 - 2	12/14/2010	4.80	582
	2 - 4	12/14/2010	1.23 J	29.4
DU-SB-106	0 - 0.5	12/15/2010	1.15 UJ	10.4 J
	0.5 - 2	12/15/2010	1.20 UJ	17.2 J
	2 - 4	12/15/2010	1.24 UJ	10.6 J
DU-SB-107	0 - 0.5	12/15/2010	1.14 UJ	3.78 J
	0.5 - 2	12/15/2010	1.79 J	66.7 J
	2 - 3.5	12/15/2010	3.14 J	26.5 J
DU-SB-108	0 - 0.5	12/15/2010	0.733 J	11.3 J
	0.5 - 2	12/15/2010	1.29 UJ	13.5 J
	2 - 2.5	12/15/2010	1.34 UJ	23.5 J

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-109	0 - 0.5	12/15/2010	1.17 UJ	2.69 J
	0.5 - 2	12/15/2010	3.85 J	177 J
DU-SB-110	0 - 2	12/15/2010	13.4 J	1,110 J
DU-SB-111	0 - 0.5	12/15/2010	1.53 J	20.7 J
	0.5 - 2	12/15/2010	1.77 J [4.40 J]	14.6 J [15.1 J]
	2 - 4	12/15/2010	1.72 J	16.4 J
DU-SB-112	0 - 0.5	12/15/2010	1.10 UJ	2.11 J
	0.5 - 2	12/15/2010	1.23 UJ	1.13 J
	2 - 4	12/15/2010	1.34 UJ	1.18 J
DU-SB-113	0 - 0.5	12/15/2010	1.07 U	3.69 J
	0.5 - 2	12/15/2010	4.39	55.0 J
	2 - 2.5	12/15/2010	1.28 U	6.12 J
DU-SB-114	0 - 0.5	12/15/2010	5.81	50.0 J
	0.5 - 2	12/15/2010	2.19	9.97 J
	2 - 4	12/15/2010	2.20	11.3 J
DU-SB-115	0 - 0.5	12/15/2010	2.74	19.3 J
	0.5 - 2	12/15/2010	2.57	16.6 J
	2 - 4	12/15/2010	2.08	9.78 J
DU-SB-116	0 - 0.5	12/17/2010	29.5	310 J
	0.5 - 2	12/17/2010	5.48	14.1 J
	2 - 4	12/17/2010	8.92	16.7 J
DU-SB-117	0 - 0.5	12/17/2010	236 [149]	540 [440]
	0.5 - 2	12/17/2010	15.4	99.8
	2 - 4	12/17/2010	2.72	12.8
DU-SB-118	0 - 0.5	12/17/2010	2.39	50.1 J
	0.5 - 2	12/17/2010	1.04 U	10.2 J
	2 - 4	12/17/2010	1.02 J	6.49
DU-SB-119	0 - 0.5	12/17/2010	2.91	30.9 J
	0.5 - 2	12/17/2010	14.6	25.8 J
	2 - 4	12/17/2010	5.76	8.46 J
DU-SB-120	0 - 0.5	12/17/2010	7.04	250 J
	0.5 - 2	12/17/2010	22.1	107 J
	2 - 3	12/17/2010	26.6	223 J
DU-SB-121	0 - 0.5	12/17/2010	92.0	36.8
	0.5 - 2	12/17/2010	4.06	17.6
	2 - 4	12/17/2010	2.84	22.1
DU-SB-122	0 - 0.5	2/21/2011	3.79	14.9
	0.5 - 2	2/21/2011	2.90	10.5
	2 - 4	2/21/2011	2.58	10.0
DU-SB-123	0 - 0.5	2/24/2011	4.00	14.6 J
	0.5 - 2	2/24/2011	1.98	7.68 J
	2 - 4	2/24/2011	2.24	13.7 J
DU-SB-124	0 - 0.5	2/21/2011	9.74 [15.0]	46.6 [56.2]
	0.5 - 2	2/21/2011	1.82	10.1
	2 - 4	2/21/2011	1.78	10.5

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-125	0 - 0.5	2/21/2011	5.29	60.1
	0.5 - 2	2/21/2011	1.67 J	18.1
	2 - 4	2/21/2011	2.33 J	24.4
DU-SB-126	0 - 0.5	2/21/2011	2.57	40.1
	0.5 - 2	2/21/2011	1.36 J	23.4
	2 - 4	2/21/2011	1.24 J	28.1
DU-SB-127	0 - 0.5	2/24/2011	176	59.8 J
	0.5 - 2	2/24/2011	22.1	314 J
	2 - 4	2/24/2011	5.37 J	22.5 J
DU-SB-128	0 - 0.5	2/21/2011	3.59	138
	0.5 - 2	2/21/2011	1.96 J	15.7
	2 - 4	2/21/2011	1.14 J	6.06
DU-SB-129	0 - 0.5	2/22/2011	2.39	15.5
	0.5 - 2	2/22/2011	2.39	24.0
	2 - 4	2/22/2011	1.20 J	7.07
DU-SB-130	0 - 0.5	2/22/2011	6.61	42.9
	0.5 - 2	2/22/2011	9.78 [7.81]	28.9 [23.0]
	2 - 4	2/22/2011	3.37	14.6
DU-SB-131	0 - 0.5	2/22/2011	7.25	162
	0.5 - 2	2/22/2011	3.45	20.1
	2 - 4	2/22/2011	1.67	11.9
DU-SB-132	0 - 0.5	2/22/2011	5.18	27.9
	0.5 - 2	2/22/2011	5.75	17.8
	2 - 4	2/22/2011	6.66	23.0
DU-SB-133	0 - 0.5	2/22/2011	3.04	21.3
	0.5 - 2	2/22/2011	5.27	16.5
	2 - 4	2/22/2011	1.64	11.6
DU-SB-134	0 - 0.5	2/22/2011	4.95	16.9
	0.5 - 2	2/22/2011	5.72	78.3
	2 - 4	2/22/2011	1.54 J	8.23
DU-SB-135	0 - 0.5	2/22/2011	3.56	36.7
	0.5 - 2	2/22/2011	5.13	88.6
	2 - 4	2/22/2011	2.53 J	1,050
DU-SB-136	0 - 0.5	2/22/2011	1.79 J	12.7
	0.5 - 2	2/22/2011	1.35 J	20.3
	2 - 4	2/22/2011	9.35	40.1
DU-SB-137	0 - 0.5	2/22/2011	2.28	15.4
	0.5 - 2	2/22/2011	4.37	17.4
	2 - 4	2/22/2011	4.36	258
DU-SB-138	0 - 0.5	2/22/2011	3.03 [3.03]	461 [552]
	0.5 - 2	2/22/2011	2.17	187
	2 - 4	2/22/2011	3.08	115
DU-SB-139	0 - 0.5	2/23/2011	11.7	176
	0.5 - 2	2/23/2011	14.7	115
	2 - 4	2/23/2011	22.3 [15.7]	121 [361]

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-SB-140	0 - 0.5	2/23/2011	1.19	15.6
	0.5 - 2	2/23/2011	6.48	17.2
	2 - 4	2/23/2011	4.93	14.3
DU-SB-141	0 - 0.5	2/24/2011	3.07 J	32.6 J
	0.5 - 2	2/24/2011	1.09 UJ	6.31 J
	2 - 3	2/24/2011	4.13 J	9.21 J
DU-SB-142	0 - 0.5	2/23/2011	1.11 J	38.6
	0.5 - 2	2/23/2011	1.27	11.7
	2 - 4	2/23/2011	20.2 [25.0]	212 [249]
	4 - 6	2/24/2011	15.4	14.4 J
DU-SB-143	0 - 0.5	2/23/2011	5.14	171
	0.5 - 2	2/23/2011	7.42	68.8
	2 - 4	2/24/2011	7.44	43.9
DU-SB-145	0 - 0.5	2/24/2011	2.48 J	27.9 J
	0.5 - 2	2/24/2011	13.6 J	138 J
	2 - 4	2/24/2011	6.66	79.7 J
DU-SB-146	0 - 0.5	2/24/2011	2.97	14.5
	0.5 - 2	2/24/2011	3.89	46.6
	2 - 4	2/24/2011	3.34	12.1
DU-TW-01	0 - 0.5	12/7/2010	3.09	107
	0.5 - 2	12/7/2010	1.82	443
	2 - 4	12/7/2010	2.04	289
	4 - 6	12/7/2010	1.15 U	25.6
DU-TW-02	0 - 0.5	12/7/2010	93.2	50.1
	0.5 - 2	12/7/2010	112	38.9
	2 - 4	12/7/2010	1.27 U	11.4
DU-TW-03	0 - 0.5	12/7/2010	1.70	14.1
	0.5 - 2	12/7/2010	2.96	19.2
	2 - 4	12/7/2010	2.07	9.09
DU-TW-04	0 - 0.5	12/7/2010	1.55	13.6
	0.5 - 2	12/7/2010	2.48	13.5
	2 - 4	12/7/2010	2.51	13.2
DU-TW-05	0 - 0.5	12/7/2010	3.05	34.1
	0.5 - 2	12/7/2010	2.25	23.7
	2 - 4	12/7/2010	4.98	37.9
DU-TW-06	0 - 0.5	12/6/2010	1.41 UJ	13.6
	0.5 - 2	12/6/2010	2.66	10.6
	2 - 4	12/6/2010	0.933 J	7.49
DU-TW-07	0 - 0.5	12/6/2010	1.52	10.5
	0.5 - 2	12/6/2010	4.10	147
	2 - 4	12/6/2010	1.39 U	16.5

Table C-1
Summary of Arsenic and Lead Concentrations in Soil Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Location ID:	Depth (ft bgs)	Date Collected	Arsenic (mg/kg)	Lead (mg/kg)
DU-TW-08	0 - 0.5	12/8/2010	1.93	62.0
	0.5 - 2	12/8/2010	1.89	31.3 J
	2 - 4	12/8/2010	1.90	15.9 J

Notes:

mg/kg - milligrams per kilogram

ft bgs - feet below ground surface

J - estimated value

U - not detected

Duplicate sample concentrations are in brackets

Table C-2
Permanent Groundwater Monitoring Well Sample Analytical Results and Field Parameter Measurements
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Analyte	NCDENR 2L Groundwater Standards [a]	Units	Concentration in Sample:					
			DU-MW-01	DU-MW-01	DU-MW-02	DU-MW-02[1]	DU-MW-02	DU-MW-03
			12/20/2010	3/8/2011	12/20/2010	3/8/2011	5/12/2011	3/8/2011
Inorganics - Unfiltered								
Arsenic	10	µg/L	10 U [10 U]	10 U	19.3	1,000 U [1,000 U]	121	10 U
Lead	15	µg/L	5.0 U [5.0 U]	5.0 U	183	500 U [500 U]	330	5.0 U
Inorganics - Filtered								
Arsenic	10	µg/L	10 U	10 U	17.4	400 J [1,000 U]	104	10 U
Lead	15	µg/L	3.2 J	5.0 U	175	500 U [500 U]	230	5.0 U
Field Parameters								
Dissolved Oxygen	--	mg/L	7.3	6.20	4.3	2.37	1.6	1.52
ORP	--	mV	170	133	131	285	309	114
pH	--	SU	6.79	6.90	4.16	4.02	3.75	6.56
Specific Conductivity	--	mS/cm	0.406	0.490	10.99	20.10	15.98	0.990
Temperature	--	°C	14.04	16.31	13.24	13.77	15.29	13.19
Turbidity	--	NTU	6.63	2	123	9.90	2.10	2

Notes:

"- -" - not applicable

U - not detected

J - estimated value

µg/L - micrograms per liter

mg/L - milligrams per liter

mV - millivolt

SU - standard units

mS/cm - millisiemens per centimeter

°C - degrees Celsius

NTU - nephelometric turbidity units

Duplicate sample concentrations are in brackets

[1] - Sample was analyzed at 100 times the detection limit due to interference.

[a] North Carolina Department of Environment and Natural Resources (NCDENR) standards.

Shaded values exceed the NC 2L Groundwater Standards.

Table C-2
Permanent Groundwater Monitoring Well Sample Analytical Results and Field Parameter Measurements
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Analyte	NCDENR 2L Groundwater Standards [a]	Units	Concentration in Sample:					
			DU-MW-04	DU-MW-04	DU-MW-05	DU-MW-06	DU-MW-MA8	DU-MW-MA8
			12/21/2010	3/8/2011	3/8/2011	3/8/2011	12/20/2010	3/8/2011
Inorganics - Unfiltered								
Arsenic	10	µg/L	6.4 J	10 U	10 U	10 U	4.6 J	10 U
Lead	15	µg/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Inorganics - Filtered								
Arsenic	10	µg/L	10 U	4.6 J	10 U	10 U	10 U	10 U
Lead	15	µg/L	5.2	5.0 U	5.0 U	5.0 U	11.3	5.0 U
Field Parameters								
Dissolved Oxygen	--	mg/L	4.85	4.76	1.28	5.36	4.2	3.82
ORP	--	mV	165	146	157	140	202.5	280
pH	--	SU	6.57	6.53	5.89	7.07	4.68	4.81
Specific Conductivity	--	mS/cm	3.916	4.563	3.700	1.840	2.353	2.196
Temperature	--	°C	13.12	14.01	15.15	18.75	16.57	18.23
Turbidity	--	NTU	8.1	7	5	5	4.23	2

Notes:

"- -" - not applicable

U - not detected

J - estimated value

µg/L - micrograms per liter

mg/L - milligrams per liter

mV - millivolt

SU - standard units

mS/cm - millisiemens per centimeter

°C - degrees Celsius

NTU - nephelometric turbidity units

Duplicate sample concentrations are in brackets

[1] - Sample was analyzed at 100 times the detection limit due to interference.

[a] North Carolina Department of Environment and Natural Resources (NCDENR) standards.

Shaded values exceed the NC 2L Groundwater Standards.

Table C-3
Summary of Arsenic and Lead Concentrations in Sediment Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Analyte	Units	Concentration in Sample:						
		DU-SD-1	DU-SD-1	DU-SD-1	DU-SD-2	DU-SD-2	DU-SD-2	DU-SD-3
		0 - 0.5 ft bgs	0.5 - 2 ft bgs	2 - 4 ft bgs	0 - 0.5 ft bgs	0.5 - 2 ft bgs	2 - 4 ft bgs	0 - 0.5 ft bgs
		6/8/2010	12/15/2010	12/15/2010	12/13/2010	12/15/2010	12/15/2010	12/13/2010
Inorganics								
Arsenic	mg/kg	40.9 J [18.7 J]	5.09	9.79	50.0 [58.5]	9.03	5.95	7.19
Lead	mg/kg	89.5 J [55.9 J]	14.8 J	16.2 J	134 [141]	11.4 J	14.8 J	27.2

Notes:

"- -" - not applicable

mg/kg - milligrams per kilogram

ft bgs - feet below ground surface

J - estimated value

Duplicate sample concentrations are in brackets.

Table C-3
Summary of Arsenic and Lead Concentrations in Sediment Samples
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Analyte	Units	Concentration in Sample:					
		DU-SD-4	DU-SD-4	DU-SD-4	DU-SD-5	DU-SD-5	DU-SD-5
		0 - 0.5 ft bgs	0.5 - 2 ft bgs	2 - 4 ft bgs	0 - 0.5 ft bgs	0.5 - 2 ft bgs	2 - 4 ft bgs
		12/15/2010	12/15/2010	12/15/2010	12/17/2010	12/17/2010	12/17/2010
Inorganics							
Arsenic	mg/kg	72.9	67.5	3.29	82.8	60.8	5.69
Lead	mg/kg	92.4 J	27.3 J	9.04 J	84.3	101	11.9

Notes:

"- -" - not applicable

mg/kg - milligrams per kilogram

ft bgs - feet below ground surface

J - estimated value

Duplicate sample concentrations are in brackets.

Table C-4
Toxicity Values
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	Oral RfD (mg/kg/day) [a]		Dermal RfD (mg/kg/day) [b]	Inhalation RfC (mg/m^3) [a]		Oral CSF $(mg/kg/day)^{-1}$ [a]		Dermal CSF (mg/kg/day) [b]	Inhalation Unit Risk $(mg/m^3)^{-1}$ [a]		ABS_{GI} [b]
	value	[ref]	value	value	[ref]	value	[ref]	value	value	[ref]	
Inorganics											
Arsenic	3.0E-04	I	3.0E-04	1.5E-05	C	1.5E+00	I	1.5E+00	4.3E+00	I	1
Lead	NA		NA	NA		NA		NA	NA		1

References [ref]:

C CalEPA, Toxicity Criteria database (CalEPA 2011).

I USEPA, Integrated Risk Information System (IRIS; USEPA 2011a).

[a] Toxicity values were obtained per USEPA hierarchy (USEPA, 2003a).

[b] The oral-to-dermal adjustment factor (oral absorption efficiency (ABS_{GI})) was used to calculate the dermal RfD values.
RfD (dermal) = RfD (oral) × Adjustment Factor (oral absorption efficiency).

Table C-5
Dermal Absorption Parameters
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent of Potential Concern	Soil Dermal Absorption Factor (ABSd) [a]	Water Permeability Constant Kp (cm/hour) [b]		DA_1hr [c] (mg/cm²/event)
		Value	[Ref]	
Inorganics				
Arsenic	0.03	1.0E-03	W	1.00E-06
Lead	0	1.0E-04	DRA	1.00E-07

References [ref]:

calc	Calculated value (USEPA 2004).
DRA	Dermal Risk Assessment Guidance (USEPA 2004).
W	Assumed to be equal to the value for water (USEPA 2004).

cm	Centimeter.
mg	milligram.

[a]	Dermal absorption efficiency for uptake of constituents from a soil matrix (unitless) (USEPA 2004).
[b]	Permeability coefficient for dermal contact with constituents in water (centimeters per hour).
[c]	Dermal Absoprotion Factor (DA) calculated according to equations presented in USEPA 2004 (as indicated in Table C-8 based on exposure time (ET) = 1 hour.

Table C-6
Exposure Point Concentrations for Soil and Sediment Data
Development of Remediation Health-Based Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

	Exposure Point Concentration							
Constituent (mg/kg)	Parcel 118814		Parcel 118815		Parcel 118830		All Parcels	
Arsenic	25	[a,b]	5.0	[a,d]	19	[a,b]	16	[a,b]
Lead	300	[c]	187	[c]	659	[c]	490	[c]

[a] The exposure point concentration for arsenic was the upper confidence level on the mean (UCL).
The UCLs were calculated using ProUCL 4.1.00 (USEPA, 2010). The UCL used is the one recommended by ProUCL 4.1.00.
[b] 95% Kaplan Meier (KM) (Chebyshev) UCL.
[c] Exposure to lead is evaluated by predicting resultant blood lead levels using the arithmetic average (avg).
[d] 95% Kaplan Meier (KM) bias-corrected accelerated bootstrap method (BCA) UCL.

Table C-7
Health-Based Concentration Goal Equations for Site Worker and Trespasser Exposure to Soil
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

ROUTE-SPECIFIC CONCENTRATION GOALS:

Oral:

$$(HBG_o)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC}) \times (10^6\ mg/kg)}{IRs \times FI \times EF \times ED \times (CSF_o\ or\ [1/RfD_o])}$$

Dermal:

$$(HBG_d)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC}) \times (10^6\ mg/kg)}{SSAs \times SAR \times ABSd \times EF \times ED \times (CSF_a\ or\ [1/RfD_a])}$$

Inhalation: (non-volatiles)

$$(HBG_i)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times PEF \times (AT_C\ or\ AT_{NC})}{ET \times CF \times EF \times ED \times (IUR\ or\ [1/RfC])}$$

$$PEF_{wind} = \frac{Q/C_{wind} \times (3{,}600\ sec/hr)}{RPF \times (1-V) \times (Um/Ut)^3 \times Fx}$$

CONCENTRATION GOAL BASED ON CANCER EFFECTS: (combining all exposure routes)

$$HBG_C = \frac{1}{[1/(HBG_o)_C] + [1/(HBG_d)_C] + [1/(HBG_i)_C]}$$

CONCENTRATION GOAL BASED ON NON-CANCER EFFECTS: (combining all exposure routes)

$$HBG_{NC} = \frac{1}{[1/(HBG_o)_{NC}] + [1/(HBG_d)_{NC}] + [1/(HBG_i)_{NC}]}$$

HBG = MINIMUM of HBG_C and HBG_{NC}

Variable Definitions:

ABSd	Dermal absorption efficiency (unitless) (Table C-5).
AT_C	Averaging time for cancer effects (days) (Table C-9).
AT_{NC}	Averaging time for non-cancer effects (days) (Table C-9).
BW	Body weight (kg) (Table C-9).
CF	Conversion Factor 0.042 day/hour.
CSF	Cancer slope factor for oral (CSF_o) and dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg [inverse mg/kg/day]) (Table C-4).
ED	Exposure duration (years) (Table C-9).
EF	Exposure frequency (days/year) (Table C-9).
ET	Exposure Time (hours/day).
FI	Fraction ingested from area of concern (unitless) (Table C-9).
Fx	Function of Ut/Um (unitless); $Fx = 0.18 \times (8x^3 + 12x) \times \exp[-(x^2)]$, where $x = 0.886 \times (Ut/Um)$.
HBG	Health-based goal for soil (mg/kg).
IUR	Inhalation Unit Risk (m^3/mg), (Table C-4).
IRs	Ingestion rate of soil (mg/day) (Table C-9).
PEF_{wind}	Particulate emission factor for wind blown dust (m^3/kg).
Q/C_{wind}	Particulate emission flux per unit concentration [$(g/m^2/sec)/(kg/m^3)$].

Table C-7
Health-Based Concentration Goal Equations for Site Worker and Trespasser Exposure to Soil
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

RfC	Reference concentration (mg/m^3), (Table C-4).
RfD	Reference dose for oral (RfDo), or dermal (adjusted to an absorbed dose, RfDa), exposure (mg/kg/day) (Table C-4).
RPF	Respirable particle fraction (0.036 $g/m^2/hr$).
SAR	Soil-to-skin adherence rate ($mg/cm^2/day$) (Table C-9).
SSAs	Exposed skin surface area for soil contact (cm^2) (Table C-9).
T	Exposure interval (sec).
TCR	Target cancer risk (unitless).
THQ	Target hazard quotient for non-cancer effects (unitless).
Um	Mean annual wind speed (m/sec).
Ut	Equivalent threshold value of windspeed at 7 meters (11.32 m/sec).
V	Fraction of vegetative cover (unitless).
x	Intermediate value in the calculation of PEF; $x = 0.886 \times (Ut/Um)$.

Table C-8
Health-Based Concentration Goal Equations for Construction Worker Exposure to Soil
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

ROUTE-SPECIFIC CONCENTRATION GOALS:

Oral:

$$(HBG_o)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC}) \times (10^6\ mg/kg)}{IRs \times FI \times EF \times ED \times (CSF_o\ or\ [1/RfD_o])}$$

Dermal:

$$(HBG_d)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC}) \times (10^6\ mg/kg)}{SSAs \times SAR \times ABSd \times EF \times ED \times (CSF_a\ or\ [1/RfD_a])}$$

Inhalation: (non-volatiles)

$$(HBG_i)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times PEF_{SC} \times (AT_C\ or\ AT_{NC})}{ET \times CF \times EF \times ED \times (IUR\ or\ [1/RfC])}$$

$$PEF_{SC} = \frac{Q/C_{sr} \times (1/F_D) \times T \times A_R}{556 \times (W/3)^{0.4} \times [(365 - p)/365] \times SVKT}$$

CONCENTRATION GOAL BASED ON CANCER EFFECTS: (combining all exposure routes)

$$HBG_C = \frac{1}{[1/(HBG_o)_C] + [1/(HBG_d)_C] + [1/(HBG_i)_C]}$$

CONCENTRATION GOAL BASED ON NON-CANCER EFFECTS: (combining all exposure routes)

$$HBG_{NC} = \frac{1}{[1/(HBG_o)_{NC}] + [1/(HBG_d)_{NC}] + [1/(HBG_i)_{NC}]}$$

HBG = MINIMUM of HBG_C and HBG_{NC}

Variable Definitions:

ABSd	Dermal absorption efficiency (unitless) (Table C-5).
A_R	Surface area of contaminated road segment (m^2).
AT_C	Averaging time for cancer effects (days) (Table C-9).
AT_{NC}	Averaging time for non-cancer effects (days) (Table C-9).
BW	Body weight (kg) (Table C-9).
CF	Conversion Factor 0.042 day/hour.
CSF	Cancer slope factor for oral (CSF_o) and dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg [inverse mg/kg/day]) (Table C-4).
ED	Exposure duration (years) (Table C-9).
EF	Exposure frequency (days/year) (Table C-9).
ET	Exposure Time (hours/day).
FI	Fraction ingested from area of concern (unitless) (Table C-9).
F_D	Dispersion correction factor (unitless) (0.185) (USEPA 2002).
HBG	Health-based concentration goal for soil (mg/kg).
IRs	Ingestion rate of soil (mg/day) (Table C-9).
IUR	Inhalation Unit Risk (m^3/mg), (Table C-4).
p	Number of days with at least 0.01 inches of precipitation (days/year)

Table C-8
Health-Based Concentration Goal Equations for Construction Worker Exposure to Soil
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

PEF_{SC}	Subchronic road particulate emission factor (m^3/kg); used for non-VOCs.
Q/C_{sr}	Particulate emission flux per unit concentration for construction scenario [$(g/m^2/sec)/(kg/m^3)$].
RfC	Reference concentration (mg/m^3), (Table C-4).
RfD	Reference dose for oral (RfDo), or dermal (adjusted to an absorbed dose, RfDa), exposure (mg/kg/day) (Table C-4).
SAR	Soil-to-skin adherence rate ($mg/cm^2/day$) (Table C-9).
SSAs	Exposed skin surface area for soil contact (cm^2) (Table C-9).
T	Exposure interval (sec).
TCR	Target cancer risk (unitless).
THQ	Target hazard quotient for non-cancer effects (unitless).
SVKT	Sum of vehicle kilometers traveled during the exposure duration (km).
W	Mean vehicle weight (tons).

Table C-9
Health-Based Concentration Goal Equations for Construction Worker Exposure to Groundwater
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

ROUTE-SPECIFIC CONCENTRATION GOALS:

Oral: $$(HBG_o)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC})}{IRgw \times EF \times ED \times [\ CSF_o\ or\ (1/RfD_o)\ ]}$$

Dermal: $$(HBG_d)_{C\ or\ NC} = \frac{(TCR\ or\ THQ) \times BW \times (AT_C\ or\ AT_{NC})}{SSAgw \times DA \times EF \times ED \times [\ CSF_a\ or\ (1/RfD_a)\ ]}$$

Inorganics: $$DA\ [0] = \frac{K_p \times ETsw}{1000\ cm^3/L}$$

CONCENTRATION GOAL BASED ON CANCER EFFECTS: (combining all exposure routes)

$$HBG_C = \frac{1}{[\ 1 / (HBG_o)_C\ ] + [\ 1 / (HBG_d)_C\ ]}$$

CONCENTRATION GOAL BASED ON NON-CANCER EFFECTS: (combining all exposure routes)

$$HBG_{NC} = \frac{1}{[\ 1 / (HBG_o)_{NC}\ ] + [\ 1 / (HBG_d)_{NC}\ ]}$$

HBG = MINIMUM of HBG_C and HBG_{NC}

Variable Definitions:

AT_C	Averaging time for cancer effects (days) (Table C-9).
AT_{NC}	Averaging time for noncancer effects (days) (Table C-9).
BW	Body weight (kg) (Table C-9).
CSF	Cancer slope factor for oral (CSFo), dermal (adjusted to an absorbed dose, CSFa), (Tables C-4).
DA	Dermal absorption factor (L/cm²/day).
ED	Exposure duration (years) (Table C-9).
EF	Exposure frequency (days/year) (Table C-9).
ETgw	Exposure time for water contact (hours/day) (Table C-9).
HBG	Health-based concentration goal for groundwater (mg/L).
IRgw	Incidental ingestion rate of groundwater (L/day) (Table C-9).
K_p	Permeability coefficient (cm/hour) (Table C-5).
RfD	Reference dose for oral (RfDo), or dermal (adjusted to an absorbed dose, RfDa), exposure (mg/kg/day) (Table C-4).
SSAgw	Exposed skin surface area for groundwater water contact (cm²) (Table C-9).
TCR	Target cancer risk (unitless).
THQ	Target hazard quotient for noncancer effects (unitless).

Table C-10
Receptor Exposure Parameters
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Parameter	Symbol	units	Site Worker Outdoor		Site Worker Indoor		Construction Worker		Adolescent Trespasser	
General Factors										
Averaging Time (cancer)	ATc	days	25,550	[a]	25,550	[a]	25,550	[a]	25,550	[a]
Averaging Time (noncancer)	ATnc	days	9,125	[a]	9,125	[a]	182	[a]	3,650	[a]
Body Weight	BW	kg	70	[1,2]	70	[1,2]	70	[1,2]	45	[5]
Exposure Frequency	EF	weeks/year	52	PJ	52	PJ	26	PJ	52	PJ
Exposure Frequency	EF	days/year	225	[1,2]	250	[1,2]	130	PJ [b]	52	PJ [c]
Exposure Duration	ED	years	25	[1,2]	25	[1,2]	1	PJ	10	PJ
Inhalation										
Exposure Time	ET	hour/day	8	PJ	–		8	PJ	1	PJ
Conversion Factor	CF	day/hour	0.042		–		0.042		0.042	
Groundwater - Ingestion (Oral)										
Groundwater Ingestion Rate	IRgw	L/day	–		–		0.005	PJ	–	
Groundwater - Dermal Contact										
Exposed Skin Surface Area	SSAgw	cm^2	–		–		3,300	[3]	–	
Exposure Time; groundwater contact	ETgw	hours/day	–		–		2	PJ	–	
Soil - Ingestion (Oral)										
Incidental Soil Ingestion Rate	IRs	mg/day	100	[4]	50	[2]	330	[4]	50	[5]
Soil - Dermal Contact										
Exposed Skin Surface Area	SSAs	cm^2	3,300	[3]	–		3,300	[3]	4,400	[d]
Soil-to-Skin Adherence Rate	SAR	$mg/cm^2/day$	0.2	[3]	–		0.3	[4]	0.2	[3]
Sediment - Ingestion (Oral)										
Incidental Sediment Ingestion Rate	IRsed	mg/day	–		–		–		50	PJ
Sediment - Dermal Contact										
Exposed Skin Surface Area	SSAsed	cm^2	–		–		–		4,400	[d]
Exposure Frequency	EFsed	days/year	–		–		–			
Sediment-to-Skin Adherence Rate	SedAR	$mg/cm^2/day$	–		–		–		0.2	[3]

Table C-10
Receptor Exposure Parameters
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

References:

[1]	USEPA 1989
[2]	USEPA 1991
[3]	USEPA 2004
[4]	USEPA 2002
[5]	USEPA 1997
[a]	The averaging time for cancer risk is the expected lifespan of 70 years expressed in days. The averaging time for non-cancer hazard is the total exposure duration (ED) expressed in days.
[b]	EF for the construction worker is assumed to be 5 days a week for 26 weeks (6 months).
[c]	EF for the trespasser is assumed to be twice a week during the warm months (6 months) of the year.
[d]	SSAs assumes that a 6-16 year old trespasser receptor is wearing a short-sleeved shirt, shorts, and shoes therefore the SSAs is the average surface area for the hands, forearms, face, and legs.

cm	Centimeter.
kg	Kilogram.
L	Liter.
mg	Milligram.
PJ	Professional judgment (see text).
–	Not applicable.

Table C-11
Soil Particulate Emission Factors
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Particulate Emission Factor:

PEF_{wind}	=	1.10E+09	m^3/kg	Particulate emission factor (m^3/kg) under passive conditions; Site specific using USEPA 2002 model.
PEF_{sc}	=	2.29E+06	m^3/kg	Particulate emission factor (m^3/kg) during soil invasive actvities scenarios; Site specific using USEPA 2002 model.

Particulate Emission Factor for Wind-Blown Fugitive Dust (PEF_{wind})

$$PEF_{wind} = Q/C_{wind} \times \left[\frac{3600}{0.036 \times (1-V) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)} \right]$$

x	=	2.089	unitless	Function of Ut/Um; x = 0.886 × (Ut/Um)
Fx	=	0.2245	unitless	Function of x; Fx = 0.18 × ($8x^3 + 12x$) × exp($-x^2$)
Q/Cwind	=	93.77	$(g/m^2/sec)/(kg/m^3)$	Wind-related particulate emission flux per unit concentration (USEPA 2002, default)
RPF	=	0.036	$g/m^2/hour$	Respirable particle fraction (USEPA 2002).
Um	=	4.8	m/sec	Mean annual wind speed for Raleigh-Durham, North Carolina (National Climatic Data Center 2011)
Ut	=	11.32	m/sec	Equivalent threshold value of windspeed at 7 meters (USEPA 2002)
V	=	0.5	unitless	Fraction vegetative cover (USEPA 2002, default)

Table C-11
Soil Particulate Emission Factors
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Particulate Emission Factor for Subchronic Road Particulate Emission (PEF_{sc})

$$PEF_{sc} = Q/C_{sr} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left(\frac{W}{3}\right)^{0.4} \times \frac{365-p}{365} \times \sum VKT} \right]$$

Q/C_{sr}	=	17.62	(g/m^2-s per kg/m^3)	Inverse of 1-hr avg. air concentration at center of the square emission source
				where $Q/C_{sr} = A * \exp[(\ln A_c - B)^2/C]$
A	=	14.0111		Constant (USEPA, 2002)
B	=	19.6154		Constant (USEPA, 2002)
C	=	225.3397		Constant (USEPA, 2002)
A_c	=	2.8	acres	Areal extent of site soil impacts (excavation area)
F_D	=	1.90E-01	unitless	Dispersion correction factor
				where $FD = 0.1852+(5.3537/t_c)+(-9.6318/t_c^2)$
t_c	=	1040	hour	Duration of construction
	where:	130	days	Number of days per construction event
T	=	3.74E+06	seconds	Construction time
A_R	=	610	m^2	Surface area of contaminated road (AR = LR x WR)
	LR	100		$L_R = (A_c \text{ acres} \times 4047\ m^2/\text{acre})^{0.5}$
	WR	6.1		W_R = (meters)
W	=	12	tons	Mean vehicle weight
p	=	121	days/year	Number of days with 0.01 inces of precipitation
ΣVKT	=	143	km	Sum of fleet vehicle kilometers traveled during construction (Number of vehicles x LR x Number of Construction Days per yr)
	where:	11	unitless	Number of vehicles

g	gram	m	meters
kg	kilogram	sec	second
km	kilometer		

Table C-12
Health-Based Concentration Goal Calculations for Exposure to Soil of an Outdoor Site Worker
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	PEF_{wind} [a] (m^3/kg)	CANCER EFFECTS: Route-Specific HBG (mg/kg) ($TCR = 10^{-6}$) Oral $(HBG_o)_C$	Dermal $(HBG_d)_C$	Inhalation $(HBG_i)_C$	HBG_C (mg/kg) TCR = 1E-06	TCR = 1E-05	TCR = 1E-04	NON-CANCER EFFECTS: Route-Specific HBG (mg/kg) (THQ = 1) Oral $(HBG_o)_{NC}$	Dermal $(HBG_d)_{NC}$	Inhalation $(HBG_i)_{NC}$	HBG_{NC} (mg/kg) THQ = 1	Minimum HBG [b] (mg/kg)
Inorganics												
Arsenic	1.10E+09	2.1E+00	3.2E+02	3.4E+03	2.1E+00	2.1E+01	2.1E+02	3.4E+02	5.2E+04	7.9E+04	3.4E+02	2.1E+00 C
Lead	1.10E+09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] The particulate emission factor (PEFwind) derived on Table C-10.
[b] Minimum of the HBG_C (identified by "C") and HBG_{NC} (identified by "N") for TCR = 10-6 and HBG for THQ = 1.

HBG	Heath-based goal.	PEF	Particulate emission factor.
NA	Not available.	TCR	Target cancer risk.
m^3/kg	Cubic meters per kilogram.	THQ	Target hazard quotient for non-cancer effects.
mg/kg	Milligrams per kilogram.		

Equations:

(HBGo)c = (TCR × 70 × 25,550 × 1,000,000) / (100 × 1 × 225 × 25 × CSFo)
(HBGd)c = (TCR × 70 × 25,550 × 1,000,000) / (3,300 × 0.2 × ABSd × 225 × 25 × CSFa)
(HBGi)c = (TCR × PEF × 25,550) / (0.042 × 8 × 225 × 25 × IUR)

(HBGo)nc = (THQ × 70 × 9,125× 1,000,000) / (100 × 1 × 225 × 25 × [1/RfDo])
(HBGd)nc = (THQ × 70 × 9,125 × 1,000,000) / (3,300 × 0.2 × ABSd × 225 × 25 × [1/RfDa])
(HBGi)nc = (THQ × PEF × 9,125) / (0.042 × 8 × 225 × 25 × [1/RfC])

Table C-13
Health-Based Concentration Goal Calculations for Exposure to Soil of an Indoor Site Worker
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	CANCER EFFECTS				NON-CANCER EFFECTS		Minimum HBG [a] (mg/kg)
	Route-Specific HBG (mg/kg) (TCR = 10^{-6})	HBG_C (mg/kg)			Route-Specific HBG (mg/kg) (THQ = 1)	HBG_{NC} (mg/kg)	
	Oral $(HBG_o)_C$	TCR = 1E-06	TCR = 1E-05	TCR = 1E-04	Oral $(HBG_o)_{NC}$	THQ = 1	
Inorganics							
Arsenic	3.8E+00	3.8E+00	3.8E+01	3.8E+02	6.1E+02	6.1E+02	3.8E+00 C
Lead	NA	NA	NA	NA	NA	NA	NA

[a] Minimum of the HBG_C (identified by "C") and HBG_{NC} (identified by "N") for TCR = 10-6 and HBG for THQ = 1.

HBG	Heath-based goal.		
NA	Not available.	TCR	Target cancer risk.
mg/kg	Milligrams per kilogram.	THQ	Target hazard quotient for non-cancer effects.

Equations:

(HBGo)c = (TCR × 70 × 25,550 × 1,000,000) / (50 × 1 × 250 × 25 × CSFo) (HBGo)nc = (THQ × 70 × 9,125× 1,000,000) / (50 × 1 × 250 × 25 × [1/RfDo])

Table C-14
Health-Based Concentration Goal Calculations for Exposure to Soil of a Construction Worker
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	PEF_{sc} [a] (m^3/kg)	CANCER EFFECTS: Route-Specific HBG (mg/kg) (TCR = 10^{-6}) Oral $(HBG_o)_C$	Dermal $(HBG_d)_C$	Inhalation $(HBG_i)_C$	HBG_C (mg/kg) TCR = 1E-06	TCR = 1E-05	TCR = 1E-04	NON-CANCER EFFECTS: Route-Specific HBG (mg/kg) (THQ = 1) Oral $(HBG_o)_{NC}$	Dermal $(HBG_d)_{NC}$	Inhalation $(HBG_i)_{NC}$	HBG_{NC} (mg/kg) THQ = 1	Minimum HBG [b] (mg/kg)	
Inorganics													
Arsenic	2.29E+06	2.8E+01	9.3E+03	3.1E+02	2.5E+01	2.5E+02	2.5E+03	8.9E+01	3.0E+04	1.4E+02	5.5E+01	2.5E+01	C
Lead	2.29E+06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

[a] The particulate emission factor (PEFsc) derived on Table C-10.
[b] Minimum of the HBG_C (identified by "C") and HBG_{NC} (identified by "N") for TCR = 10-6 and HBG for THQ = 1.

HBG	Heath-based goal.	PEF	Particulate emission factor.
NA	Not available.	TCR	Target cancer risk.
m^3/kg	Cubic meters per kilogram.	THQ	Target hazard quotient for non-cancer effects.
mg/kg	Milligrams per kilogram.		

Equations:

(HBGo)c = (TCR × 70 × 25,550 × 1,000,000) / (330 × 1 × 130 × 1 × CSFo)
(HBGd)c = (TCR × 70 × 25,550 × 1,000,000) / (3,300 × 0.3 × ABSd × 130 × 1 × CSFa)
(HBGi)c = (TCR × PEF × 25,550) / (0.042 × 8 × 130 × 1 × IUR)

(HBGo)nc = (THQ × 70 × 182× 1,000,000) / (330 × 1 × 130 × 1 × [1/RfDo])
(HBGd)nc = (THQ × 70 × 182 × 1,000,000) / (3,300 × 0.3 × ABSd × 130 × 1 × [1/RfDa])
(HBGi)nc = (THQ × PEF × 182) / (0.042 × 8 × 130 × 1 × [1/RfC])

Table C-15
Health-Based Concentration Goal Calculations for Exposure to Groundwater of a Construction Worker Receptor
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	DA [a] (L/cm²/day)	CANCER EFFECTS: Route-Specific HBG (mg/L) (TCR = 10^{-6}) Oral $(HBG_o)_C$	Dermal $(HBG_d)_C$	HBG_C (mg/L) TCR = 1E-06	TCR = 1E-05	TCR = 1E-04	NON-CANCER EFFECTS: Route-Specific HBG (mg/L) (THQ = 1) Oral $(HBG_o)_{NC}$	Dermal $(HBG_d)_{NC}$	HBG_{NC} (mg/L) THQ = 1	Minimum HBG [b] (mg/L)	
Inorganics											
Arsenic	2.00E-06 [0]	1.8E+00	1.4E+00	7.9E-01	7.9E+00	7.9E+01	5.9E+00	4.5E+00	2.5E+00	7.9E-01	C
Lead	2.00E-07 [0]	NA	NA	NA	NA	NA	NA	NA	NA	NA	

[a] The particulate emission factor (PEFwind) derived on Table C-10.

[b] Minimum of the HBG_C (identified by "C") and HBG_{NC} (identified by "N") for TCR = 10-6 and HBG for THQ = 1.

—	Not applicable.
HBG	Heath-based goal.
mg/L	Milligrams per liter.
NA	Not available.
TCR	Target cancer risk.
THQ	Target hazard quotient for noncancer effects.
L/cm²/day	Liter per cubic centimer per day

Equations:

(HBGo)c = (TCR × 70 × 25,550) / (0.005 × 130 × 1 × CSFo)

(HBGd)c = (TCR × 70 × 25,550) / (3,300 × DA × 130 × 1 × CSFa)

(HBGo)nc = (THQ × 70 × 182) / (0.005 × 130 × 1 × [1/RfDo])

(HBGd)nc = (THQ × 70 × 182) / (3,300 × DA × 130 × 1 × [1/RfDa])

Table C-16
Health-Based Concentration Goal Calculations for Exposure to Soil of an Adolescent Trespasser
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Constituent	PEF_{wind} [a] (m^3/kg)	CANCER EFFECTS: Route-Specific HBG (mg/kg) (TCR = 10^{-6}) Oral $(HBG_o)_C$	Dermal $(HBG_d)_C$	Inhalation $(HBG_i)_C$	HBG_C (mg/kg) TCR = 1E-06	TCR = 1E-05	TCR = 1E-04	NON-CANCER EFFECTS: Route-Specific HBG (mg/kg) (THQ = 1) Oral $(HBG_o)_{NC}$	Dermal $(HBG_d)_{NC}$	Inhalation $(HBG_i)_{NC}$	HBG_{NC} (mg/kg) THQ = 1	Minimum HBG [b] (mg/kg)	
Inorganics													
Arsenic	1.10E+09	2.9E+01	1.7E+03	3.0E+05	2.9E+01	2.9E+02	2.9E+03	1.9E+03	1.1E+05	2.7E+06	1.9E+03	2.9E+01	C
Lead	1.10E+09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

[a] The particulate emission factor (PEFwind) derived on Table C-10.
[b] Minimum of the HBG_C (identified by "C") and HBG_{NC} (identified by "N") for TCR = 10-6 and HBG for THQ = 1.

HBG	Heath-based goal.	PEF	Particulate emission factor.
NA	Not available; insufficient data.	TCR	Target cancer risk.
m^3/kg	Cubic meters per kilogram.	THQ	Target hazard quotient for non-cancer effects.
mg/kg	Milligrams per kilogram.		

Equations:

(HBGo)c = (TCR × 45 × 25,550 × 1,000,000) / (50 × 1 × 52 × 10 × CSFo)
(HBGd)c = (TCR × 45 × 25,550 × 1,000,000) / (4,400 × 0.2 × ABSd × 52 × 10 × CSFa)
(HBGi)c = (TCR × [PEF] × 25,550) / (0.042 × 1 × 52 × 10 × IUR)

(HBGo)nc = (THQ × 45 × 3,650× 1,000,000) / (50 × 1 × 52 × 10 × [1/RfDo])
(HBGd)nc = (THQ × 45 × 3,650 × 1,000,000) / (4,400 × 0.2 × ABSd × 52 × 10 × [1/RfDa])
(HBGi)nc = (THQ × [PEF] × 3,650) / (0.042 × 1 × 52 × 10 × [1/RfC])

Table C-17
Calculation of Health-Based Remediation Goals (HBGs) for Receptors Exposed to Lead in Soils
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Variable	Description of Variable	Units	Site Worker	Construction Worker
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	µg/dL	10	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.05	0.10
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	250	130
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	365	182
HBG		**mg/kg**	**1,962**	**941**

Notes:
ALM Version date 6/21/09
µg/dL = micrograms per deciliter
g/day = grams per day
µg/day = micrograms per day
mg/kg = milligrams per kilogram

Table C-18

Calculation of Health-Based Remediation Goals (HBGs) for Construction Workers Exposed to Lead in Groundwater

Development of Remediation Goals

Former Virginia-Carolina Chemical Corporation (VCC) Site

Durham, North Carolina

Variable	Description of Variable	Units	Construction Worker
$PbB_{fetal, 0.95}$	95th percentile PbB in fetus	µg/dL	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1
IRw	Water ingestion rate	L/day	0.005
AFw	Absorption fraction	--	0.2
EFw	Exposure frequency	days/yr	130
ATw	Averaging time	days/yr	182
HBG		**µg/L**	**11,300**

Notes:

ALM Version date 6/21/09

µg/dL = micrograms per deciliter

g/day = grams per day

µg/day = micrograms per day

mg/L = milligrams per liter

Table C-19
Soil Screening Level Partitioning Equation for Migration to Groundwater - Arsenic
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Soil - Water Partition Equation:

$$\text{Soil Screening Level (mg/kg)} = C_w \left(K_d + \frac{(\Theta_w + \Theta_a H')}{P_b} \right)$$

where:

$$C_w = HBG \times DAF$$

$$\Theta_a = n - \Theta_w$$

$$n = 1 - (P_b / P_s)$$

Parameter / Definition	*Values*	*Units*	*Source*
C_w - target soil leachate concentration	15.8	mg/L	
HBG - Health-based goal for protection of construction workers	0.79	mg/L	1
DAF - Dilution Attenuation Factor	20	unitless	2
K_d - soil-water partitioning coefficient	29	L/kg	2
Θ_w - water filled soil porosity (subsurface soil)	0.30	L_{water}/L_{soil}	
Θ_a - air filled soil porosity (subsurface soil)	0.13	L_{air}/L_{soil}	
n - soil porosity	0.43	L_{pore}/L_{soil}	
P_s - soil particle density	2.65	kg/L	2
P_b - dry soil bulk density	1.5	kg/L	2
H - Henry's law constant	-	(atm-m³/mol)	
H' - nondimensional Henry's law constant convert (H x 41)	-	unitless	
RT - Product of the ideal gas constant and the absolute temperature	0.02447	(atm-m³/mol)	

$$\text{Soil Screening Level (mg/kg)} = 15.8 \left(29 + \frac{(0.30 + (0.13 \times 0))}{1.5} \right)$$

$$SSL_{arsenic} = 460 \text{ mg/kg}$$

Notes:

mg/kg	Milligrams per kilogram.
mg/L	Milligrams per liter.
L/kg	Liters per kilogram.
atm-m³/mol	Atmospheres × cubic meters per mole.

Sources:

1 National Primary Drinking Water Standards. Internet access: http://www.epa.gov/safewater/mcl.html#mcls.

2 USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. December. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24.

Table C-20
Soil Screening Level Partitioning Equation for Migration to Groundwater - Lead
Development of Remediation Goals
Former Virginia-Carolina Chemical Corporation (VCC) Site
Durham, North Carolina

Soil - Water Partition Equation:

$$\text{Soil Screening Level (mg/kg)} = C_w \left(K_d + \frac{(\Theta_w + \Theta_a H')}{P_b} \right)$$

where:

$$C_w = HBG \times DAF$$

$$\Theta_a = n - \Theta_w$$

$$n = 1 - (P_b / P_s)$$

Parameter / Definition	*Values*	*Units*	*Source*
C_w - target soil leachate concentration	226	mg/L	
HBG - Health-based goal for protection of construction workers	11.3	mg/L	1
DAF - Dilution Attenuation Factor	20	unitless	2
K_d - soil-water partitioning coefficient	900	L/kg	3
Θ_w - water filled soil porosity (subsurface soil)	0.30	L_{water}/L_{soil}	
Θ_a - air filled soil porosity (subsurface soil)	0.13	L_{air}/L_{soil}	
n - soil porosity	0.43	L_{pore}/L_{soil}	
P_s - soil particle density	2.65	kg/L	2
P_b - dry soil bulk density	1.5	kg/L	2
H - Henry's law constant	-	(atm-m³/mol)	
H' - nondimensional Henry's law constant convert (H x 41)	-	unitless	
RT - Product of the ideal gas constant and the absolute temperature	0.02447	(atm-m³/mol)	

$$\text{Soil Screening Level (mg/kg)} = 226 \left(900 + \frac{(0.30 + (0.13 \times 0))}{1.5} \right)$$

$$SSL_{lead} = 200{,}000 \text{ mg/kg}$$

Notes:

mg/kg	Milligrams per kilogram.
mg/L	Milligrams per liter.
L/kg	Liters per kilogram.
atm-m³/mol	Atmospheres × cubic meters per mole.

Sources:

1 Federal action level for residential tap water Internet Access: http://www.epa.gov/safewater/contaminants/index.html#mcls

2 USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. December. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24.

3 Superfund Chemical Database Matrix, Windows (SCDMWIN). 2004. Version 1.0. Office of Emergency and Remedial Response. Washington, DC. Internet access: http://www.epa.gov/superfund/resources/scdm/index.htm.

Appendix D

Hydraulic Conductivity Memorandum

ARCADIS U.S., Inc.
630 Plaza Drive
Suite 200
Highlands Ranch
Colorado 80129
Tel 720.344.3500
Fax 720.344.3535
www.arcadis-us.com

MEMO

To:
Kirstyn White

Copies:

From:
Aaron Kempf
Michael Kladias

Date:
April 20, 2010

ARCADIS Project No.:
B0085793.0031

Subject:
Slug Test Analysis: ExxonMobil - Virginia Chemical Company, Charlotte, NC

This technical memorandum summarizes the results of hydraulic conductivity values derived from slug test data using the parameter estimation program AQTESOLV™ (Version 4.50) at the ExxonMobil - Virginia Chemical Company, Charlotte, NC site (Site). ARCADIS performed falling- and rising-head slug tests at monitoring wells CH-MW-01, CH-MW-02, CH-MW-03, CH-MW-04, CH-MW-05, CH-MW-06, and CH-MW-07 on March 2, 2011. Water levels were allowed to recover to static conditions after the slug was inserted and removed, and the recovery data were analyzed. The water levels were recorded using a pressure transducer In-situ Troll Model 700.

Six monitoring wells have a screen length of ten feet, while one (CH-MW-02) has a screen length of 15 feet. All wells have a casing diameter of 2 inches, and a borehole diameter of 8 inches. The solid slug used for the test had a length of 5 feet with an outside diameter of 1.32 inches.

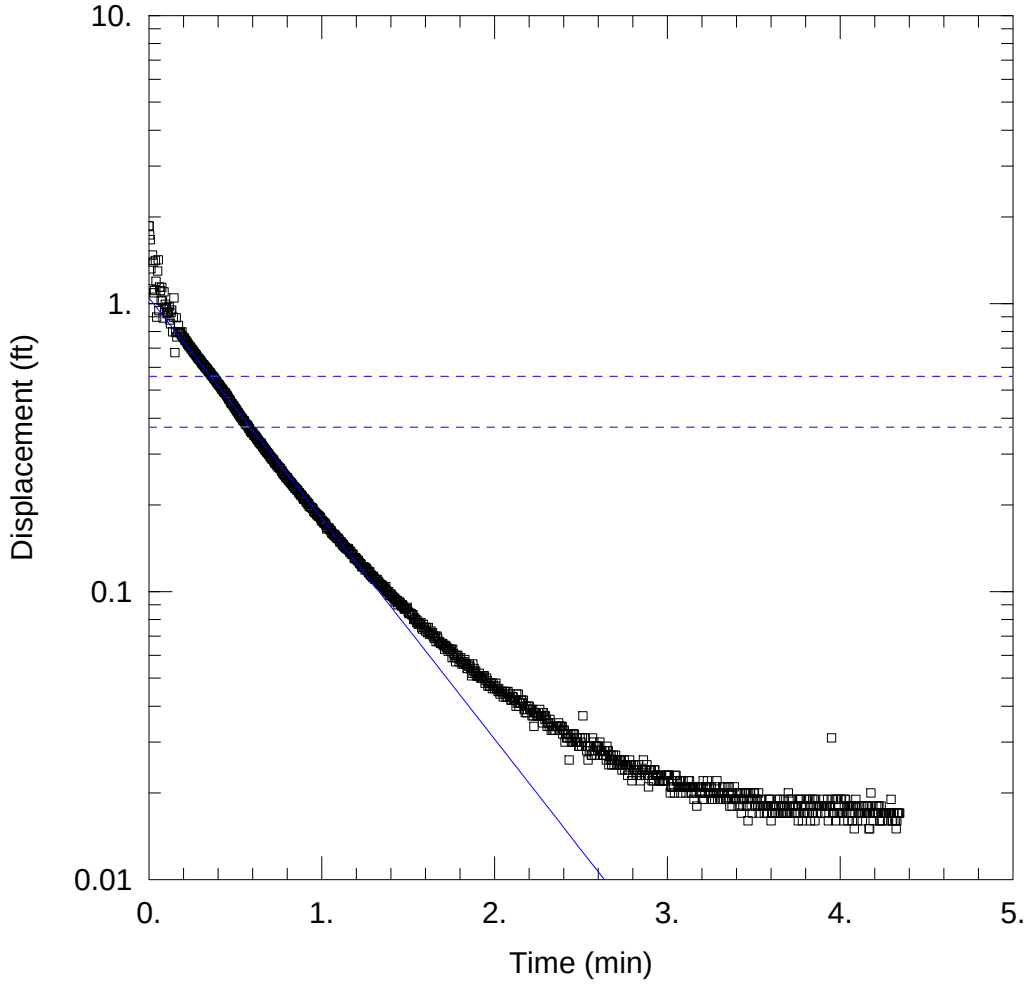
Model input parameters included well recovery results from the down-well pressure transducers and dataloggers, and well construction variables such as radius and screen depth. Using the Bouwer-Rice solution for unconfined aquifers, reasonable values for hydraulic conductivity were estimated for all wells. Additionally, a correction factor was applied to the analysis of falling- and rising-head tests at each well. This correction accounts for the difference between theoretical and observed initial displacements. The correction factor applied (Butler, 1998) was selected based on the well/aquifer configuration, where the analysis was not influenced by drainage of the filter pack. Results are presented in Figures 1 through 14, and summarized in Table 1.

Hydraulic conductivity values were consistent at a given well for falling- and rising-head tests, as well as at different locations across the Site. Hydraulic conductivity ranged from 0.3 to 2.8 feet per day (ft/d), and averaged 1.0 ft/d. The results of each analysis are generally consistent with expected hydraulic conductivities based on lithology described in each boring log, if not slightly higher. All tested wells were set in silty aquifer material, with some clay identified at CH-MW-02.

Table 1
Slug Test Results
ExxonMobil - VCC
Charlotte, NC

Well ID	Slug Test Type	Hydraulic Conductivity (ft/d)	Hydraulic Conductivity (cm/s)	Solution
CH-MW-01	Falling Head	2.7	9.5E-04	Bouwer - Rice
	Rising Head	2.8	9.9E-04	Bouwer - Rice
CH-MW-02	Falling Head	0.3	1.1E-04	Bouwer - Rice
	Rising Head	0.5	1.6E-04	Bouwer - Rice
CH-MW-03	Falling Head	1.5	5.3E-04	Bouwer - Rice
	Rising Head	1.8	6.4E-04	Bouwer - Rice
CH-MW-04	Falling Head	0.3	1.2E-04	Bouwer - Rice
	Rising Head	0.3	9.6E-05	Bouwer - Rice
CH-MW-05	Falling Head	0.5	1.7E-04	Bouwer - Rice
	Rising Head	0.3	1.2E-04	Bouwer - Rice
CH-MW-06	Falling Head	0.6	2.0E-04	Bouwer - Rice
	Rising Head	0.7	2.4E-04	Bouwer - Rice
CH-MW-07	Falling Head	1.2	4.1E-04	Bouwer - Rice
	Rising Head	1.2	4.2E-04	Bouwer - Rice

Notes:
ft/d = feet per day
cm/s = centimeters per second



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-01_falling.aqt
Date: 04/20/11 Time: 16:01:10

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-01
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 9.9 ft
Anisotropy Ratio (Kz/Kr): 0.1

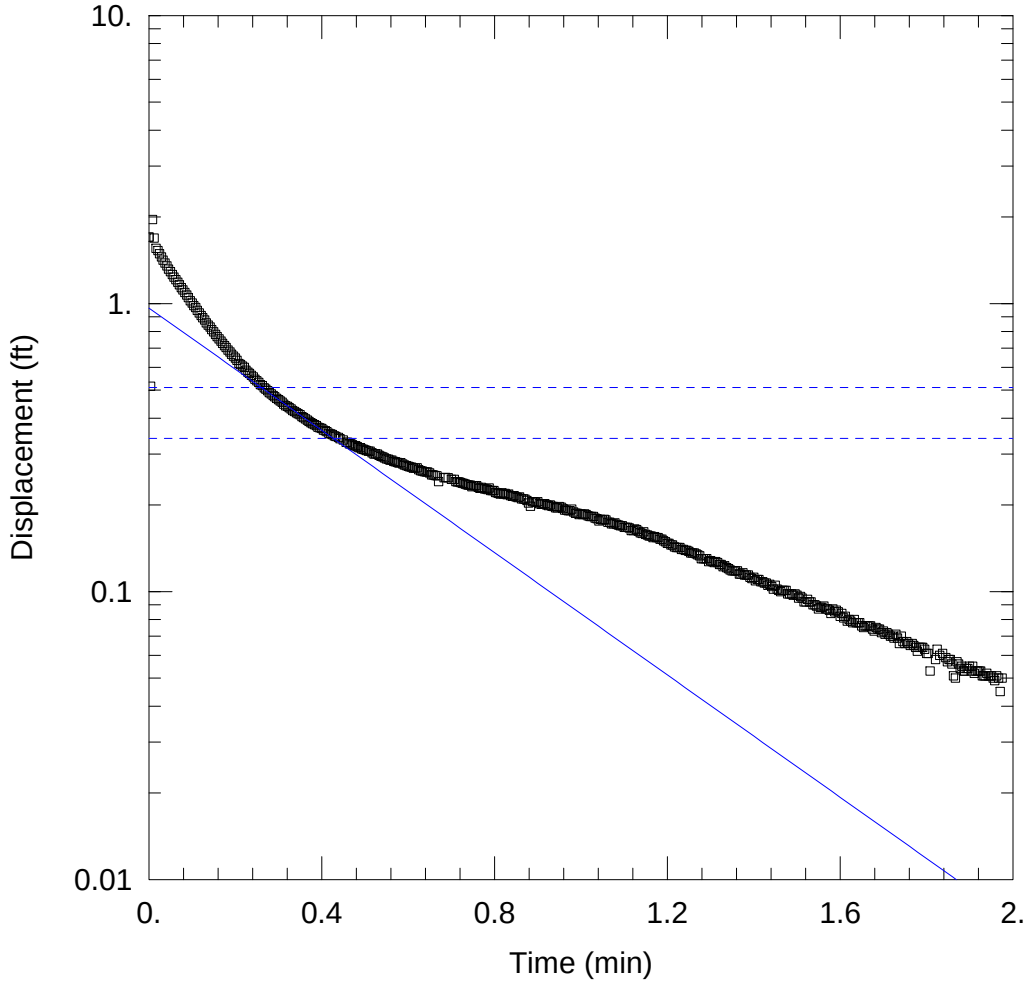
WELL DATA (CH-MW-01)

Initial Displacement: 1.862 ft
Total Well Penetration Depth: 9.9 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 9.9 ft
Screen Length: 9.9 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.704 ft/day
y0 = 1.046 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-01_rising.aqt
Date: 04/20/11 Time: 16:00:40

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-01
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 9.9 ft
Anisotropy Ratio (Kz/Kr): 0.1

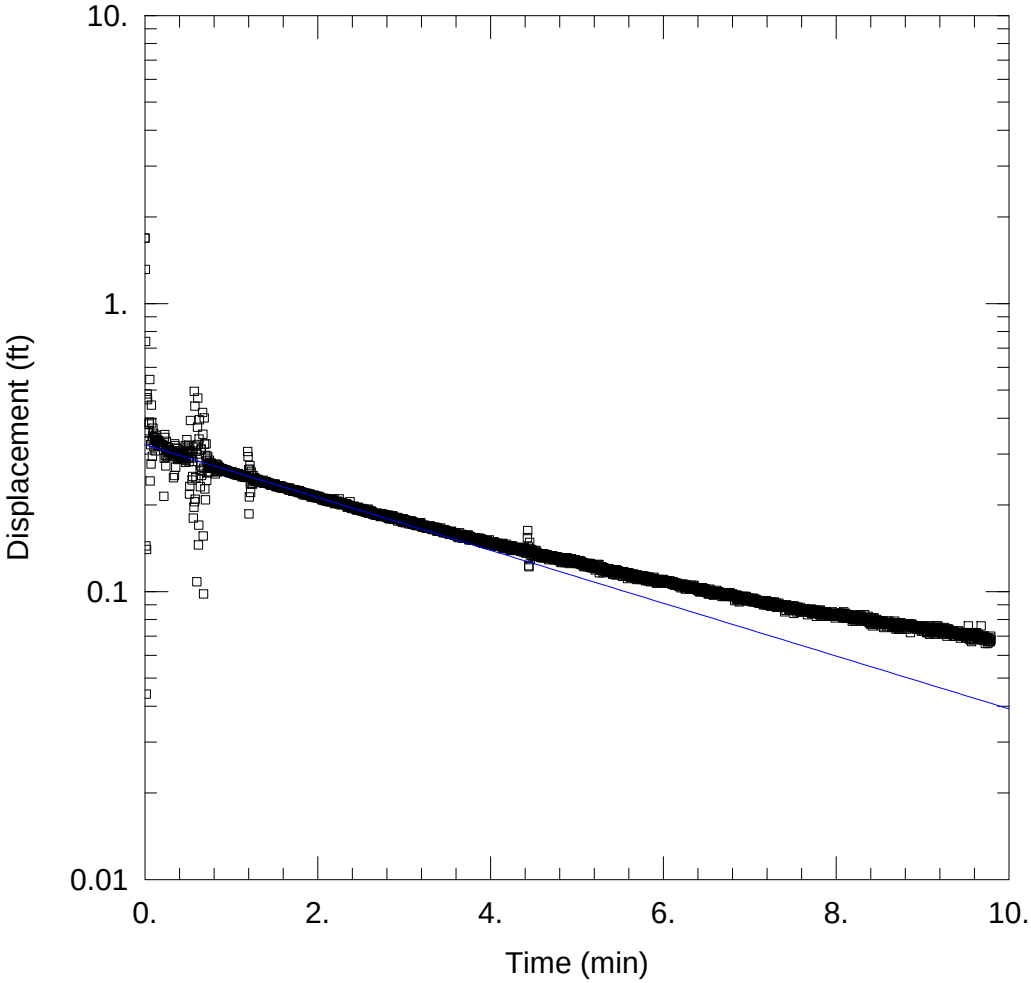
WELL DATA (CH-MW-01)

Initial Displacement: 1.701 ft
Total Well Penetration Depth: 9.9 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 9.9 ft
Screen Length: 9.9 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 4.101 ft/day
y0 = 0.9645 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-02_falling.aqt
Date: 04/20/11 Time: 16:05:22

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-02
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 12.37 ft
Anisotropy Ratio (Kz/Kr): 0.1

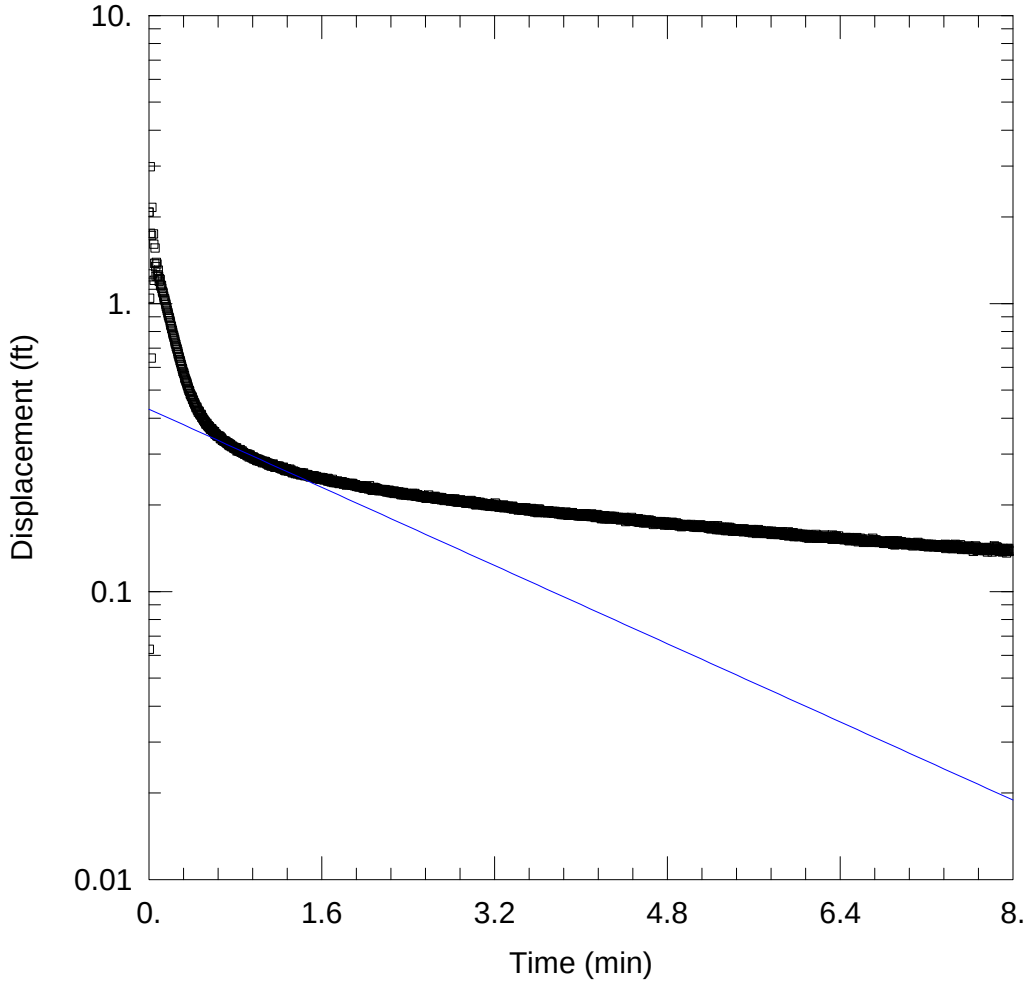
WELL DATA (CH-MW-02)

Initial Displacement: 1.686 ft
Total Well Penetration Depth: 12.37 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 12.37 ft
Screen Length: 12.37 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.3069 ft/day
y0 = 0.3233 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-02_rising.aqt
Date: 04/20/11 Time: 16:05:08

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-02
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 12.37 ft
Anisotropy Ratio (Kz/Kr): 0.1

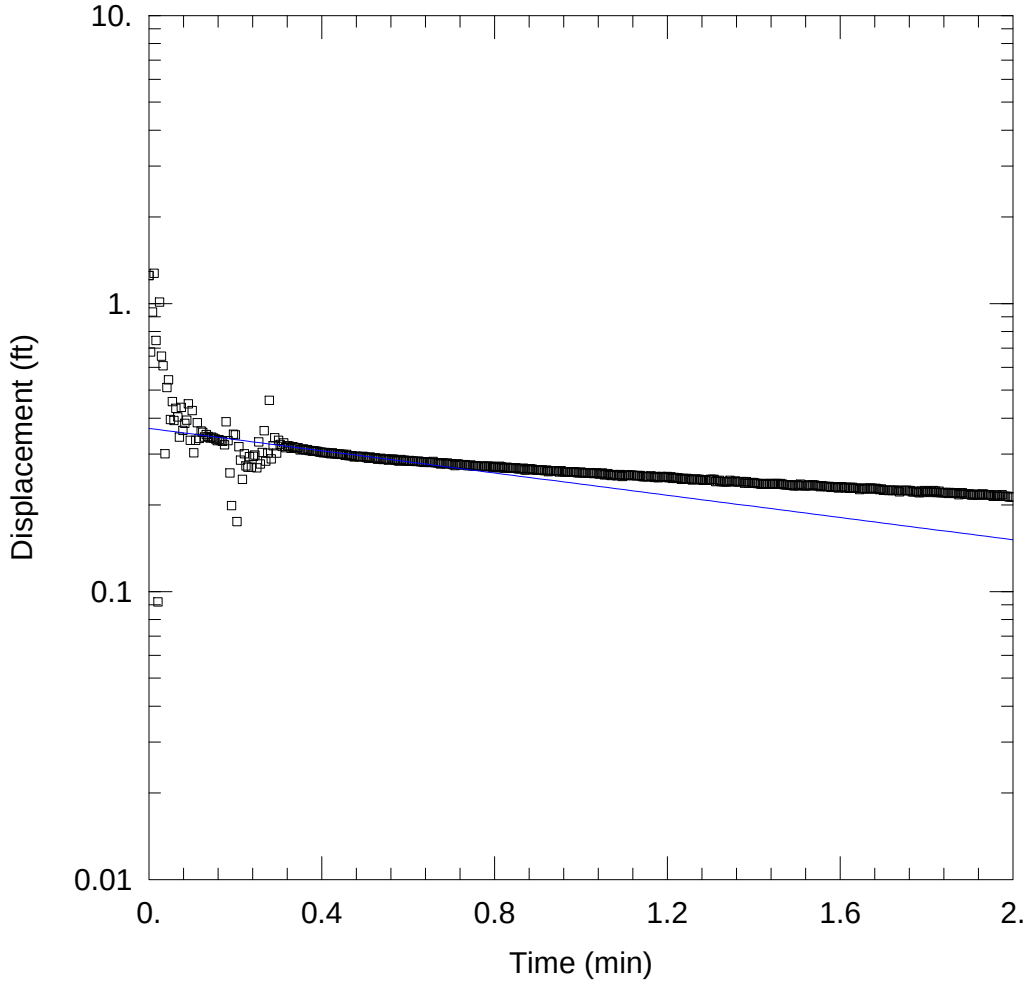
WELL DATA (CH-MW-02)

Initial Displacement: 2.078 ft
Total Well Penetration Depth: 12.37 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 12.37 ft
Screen Length: 12.37 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.4608 ft/day
y0 = 0.4298 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-03_falling.aqt
Date: 04/20/11 Time: 16:04:36

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-03
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 5.35 ft
Anisotropy Ratio (Kz/Kr): 0.1

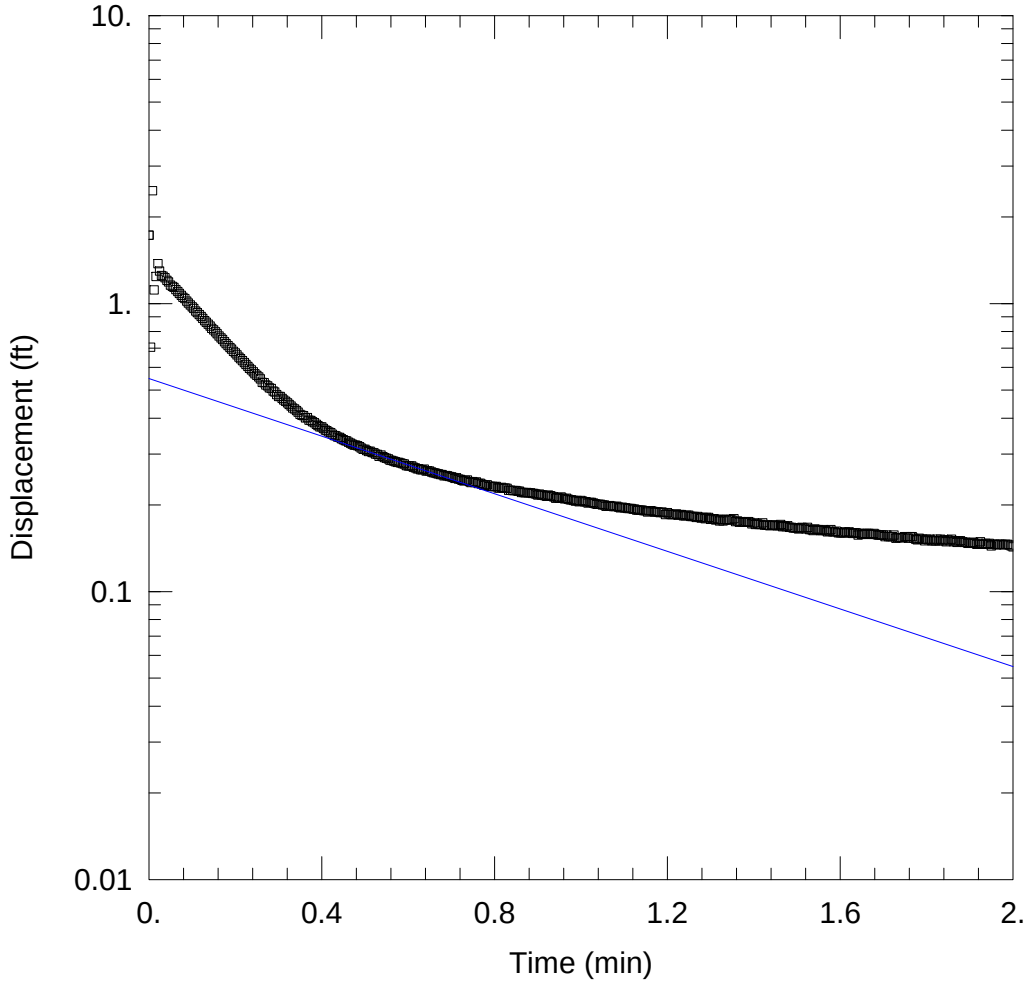
WELL DATA (CH-MW-03)

Initial Displacement: 1.25 ft
Total Well Penetration Depth: 5.35 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 5.35 ft
Screen Length: 5.35 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.493 ft/day
y0 = 0.3682 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-03_rising.aqt
Date: 04/20/11 Time: 16:15:49

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-03
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 5.35 ft
Anisotropy Ratio (Kz/Kr): 0.1

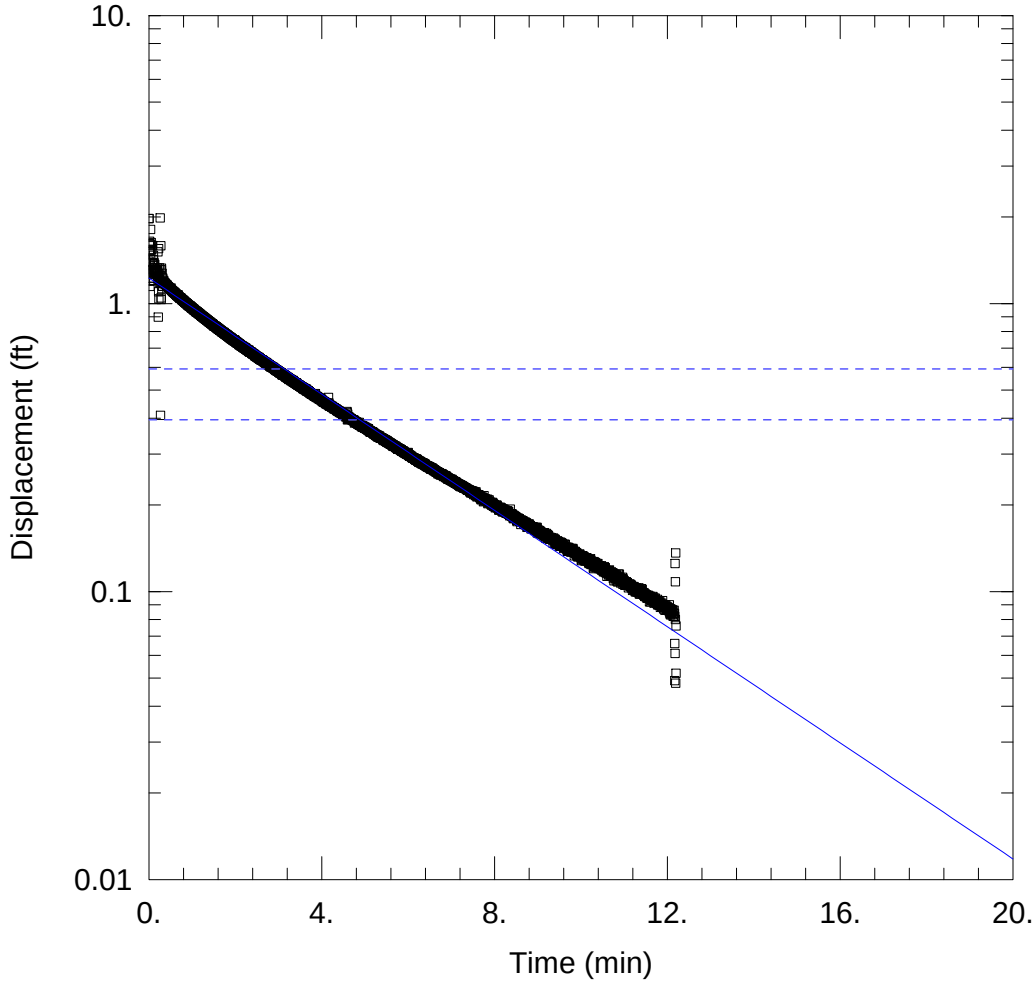
WELL DATA (CH-MW-03)

Initial Displacement: 1.727 ft
Total Well Penetration Depth: 5.35 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 5.35 ft
Screen Length: 5.35 ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.796 ft/day
y0 = 0.5488 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-04_falling.aqt
Date: 04/20/11 Time: 16:03:37

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-04
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

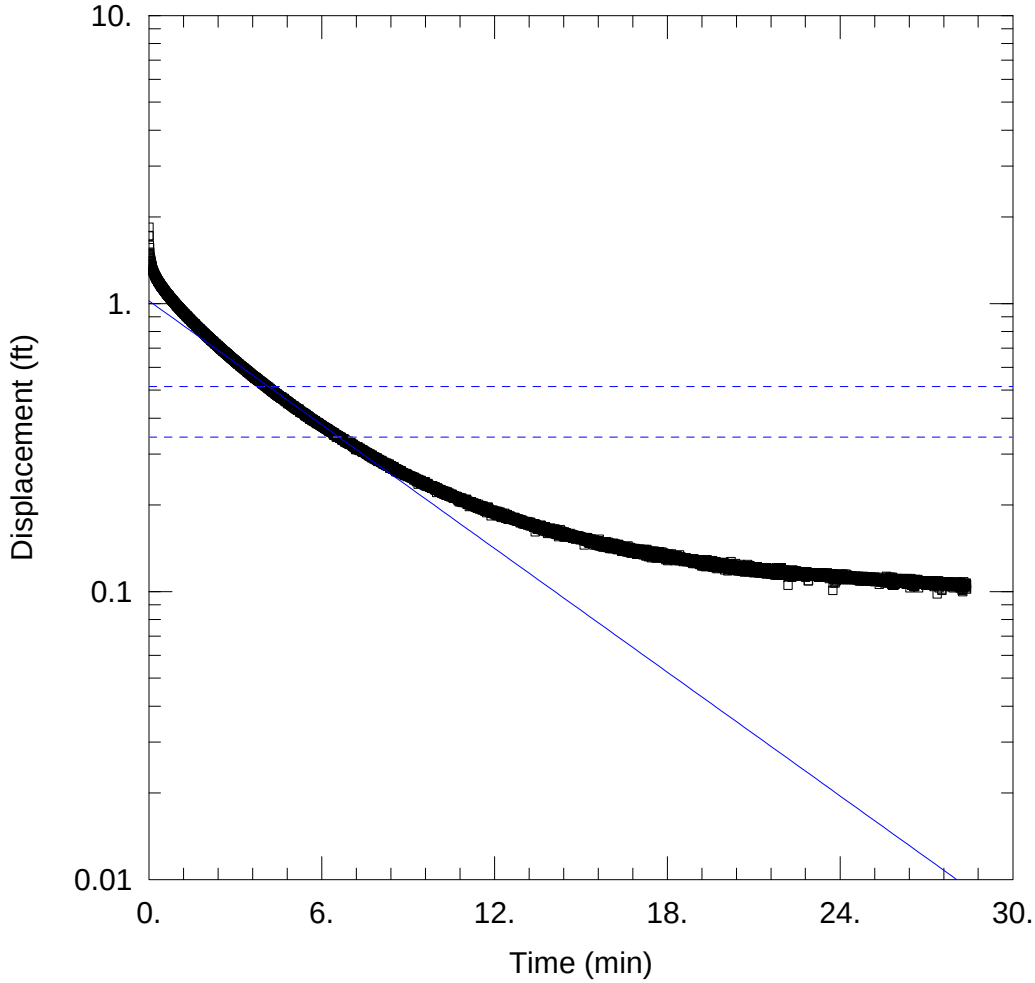
WELL DATA (CH-MW-04)

Initial Displacement: 1.974 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.3333 ft/day
y0 = 1.225 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-04_rising.aqt
Date: 04/20/11 Time: 16:03:21

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-04
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

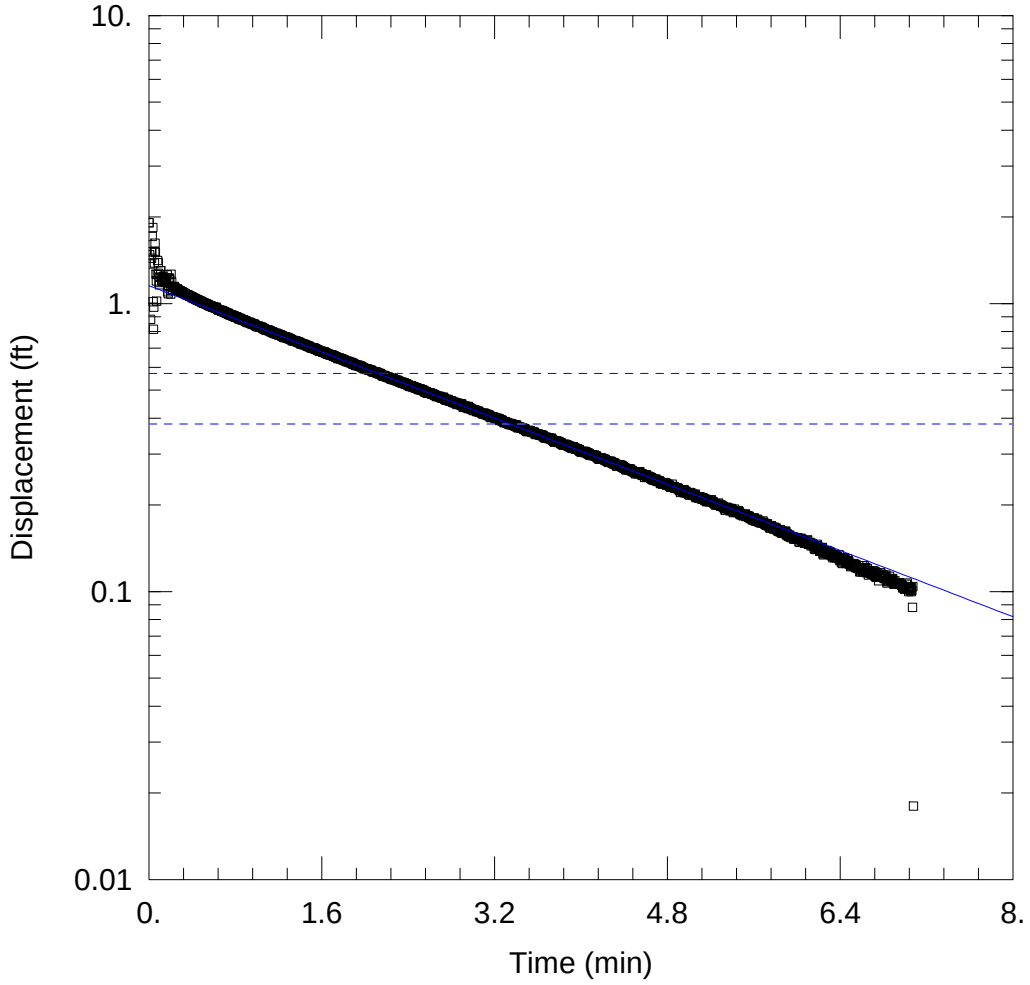
WELL DATA (CH-MW-04)

Initial Displacement: 1.718 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.2721 ft/day
y0 = 1.021 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-05_falling.aqt
Date: 04/20/11 Time: 16:03:05

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-05
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

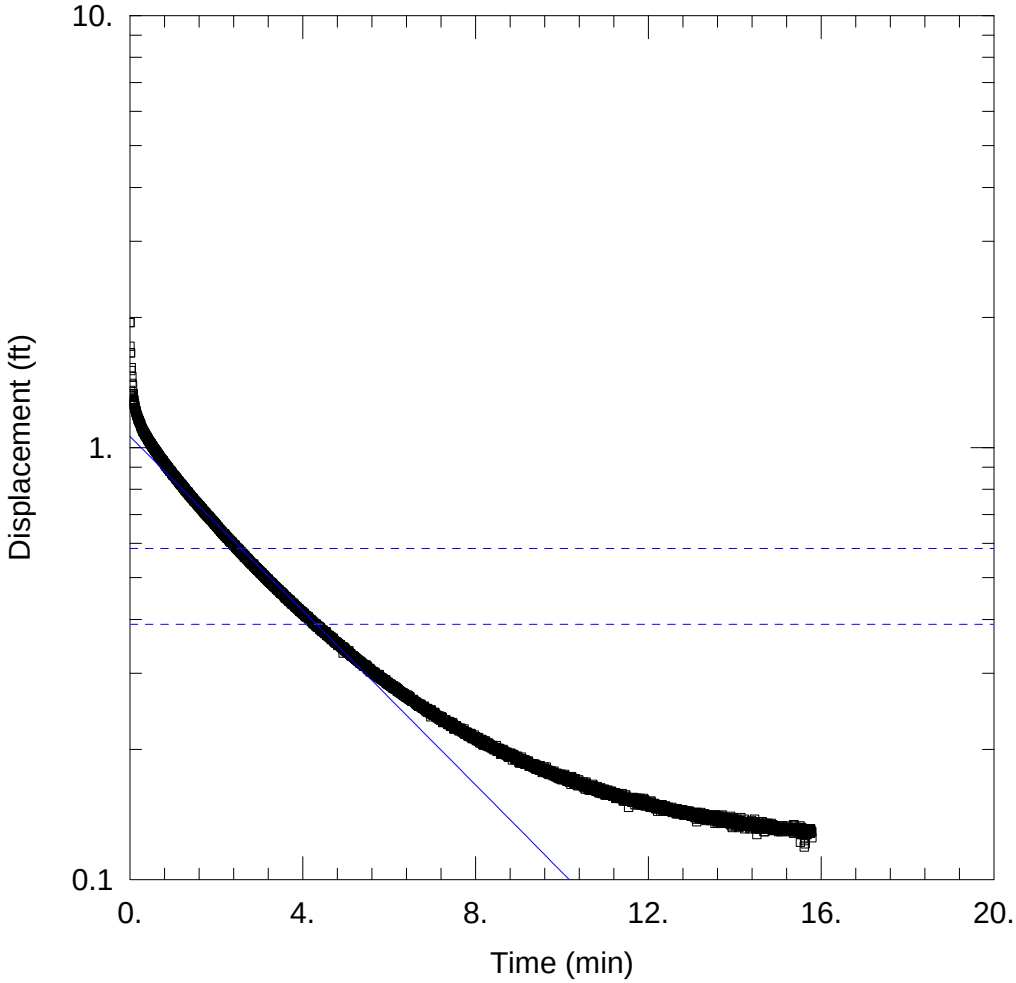
WELL DATA (CH-MW-05)

Initial Displacement: 1.906 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.4919 ft/day
y0 = 1.153 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-05_rising.aqt
Date: 04/20/11 Time: 16:02:50

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-05
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

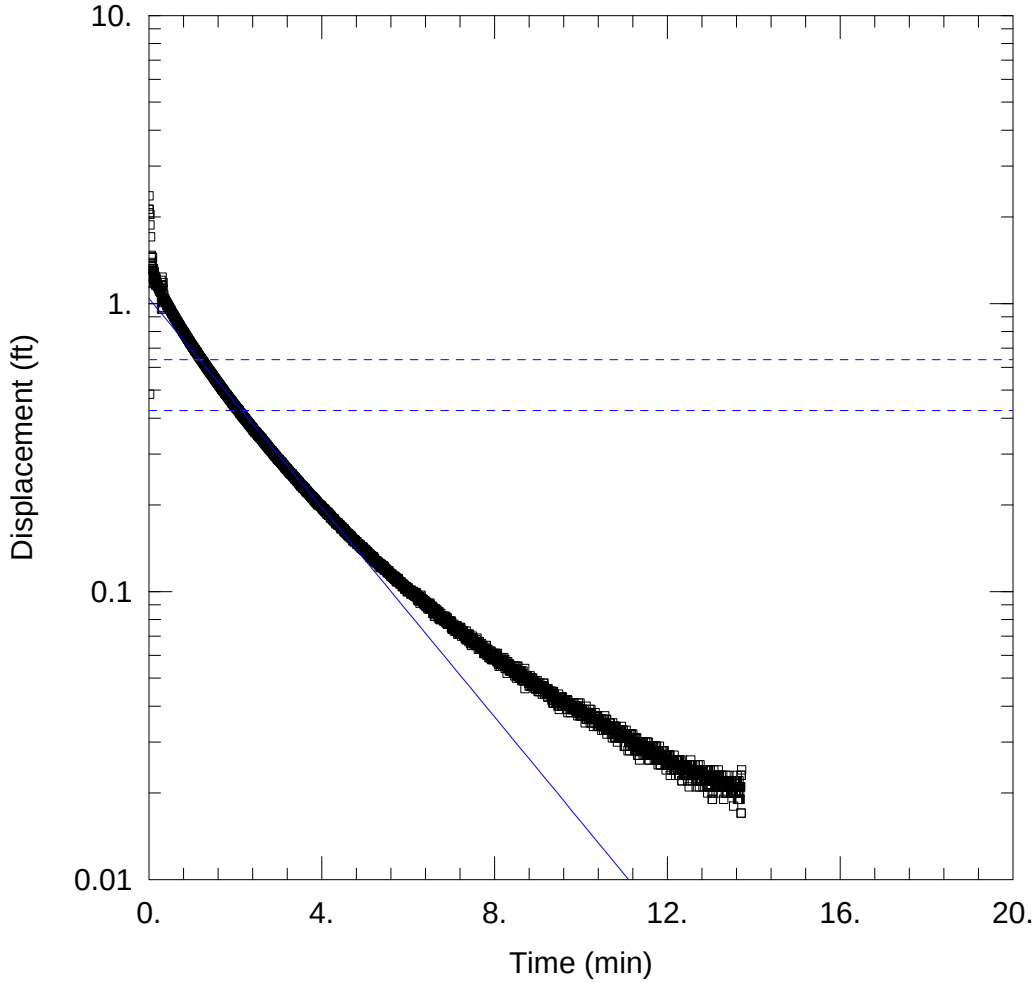
WELL DATA (CH-MW-05)

Initial Displacement: 1.947 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.3381 ft/day
y0 = 1.061 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-06_falling.aqt
Date: 04/20/11 Time: 16:02:27

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-06
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

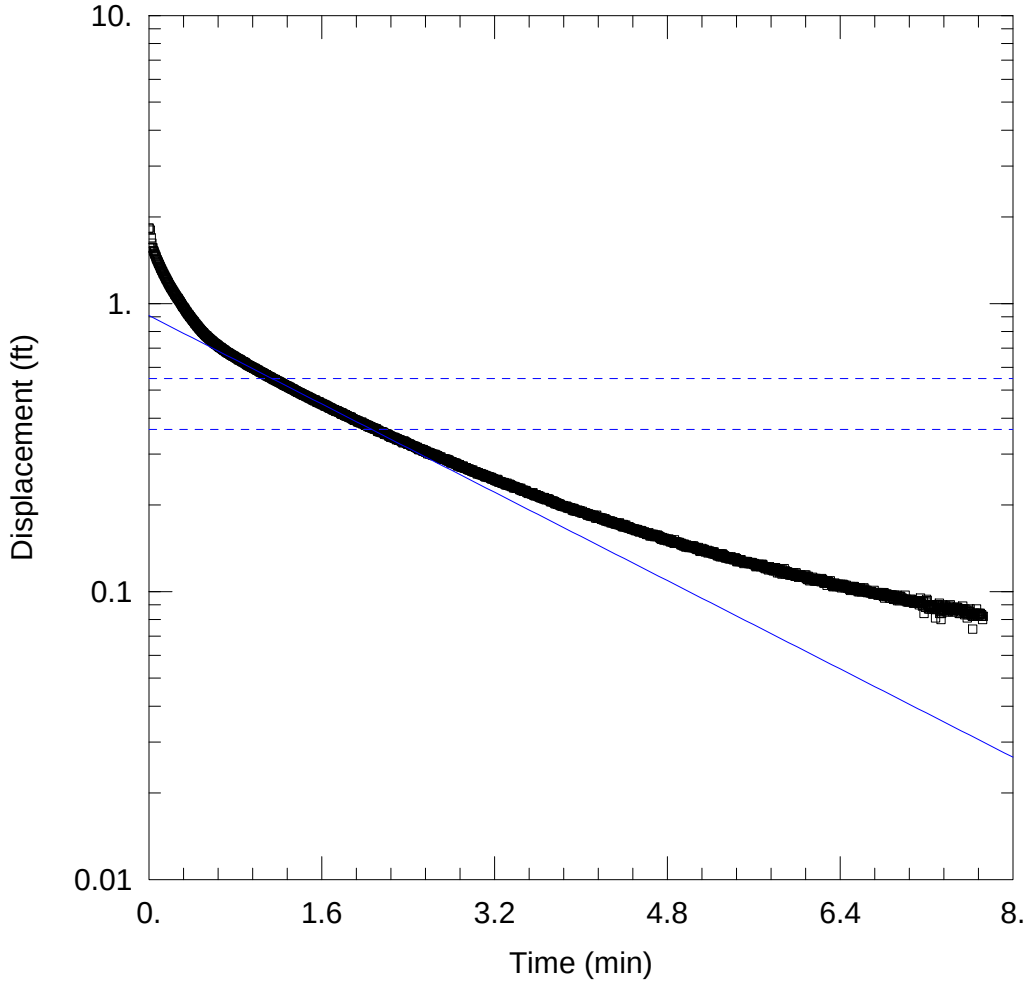
WELL DATA (CH-MW-06)

Initial Displacement: 2.126 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.5576 ft/day
y0 = 1.041 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-06_rising.aqt
Date: 04/20/11 Time: 16:02:12

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-06
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

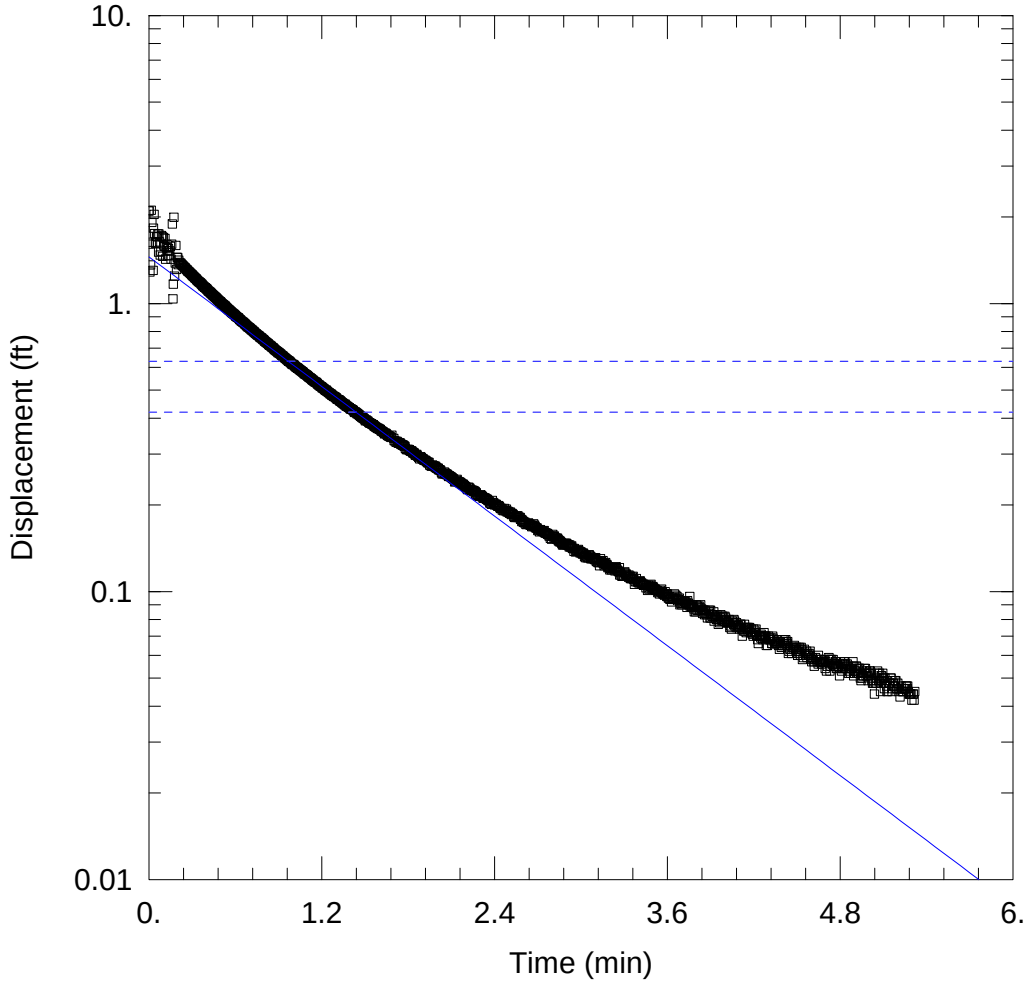
WELL DATA (CH-MW-06)

Initial Displacement: 1.829 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.6839 ft/day
y0 = 0.9076 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-07_falling.aqt
Date: 04/20/11 Time: 16:01:43

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-07
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

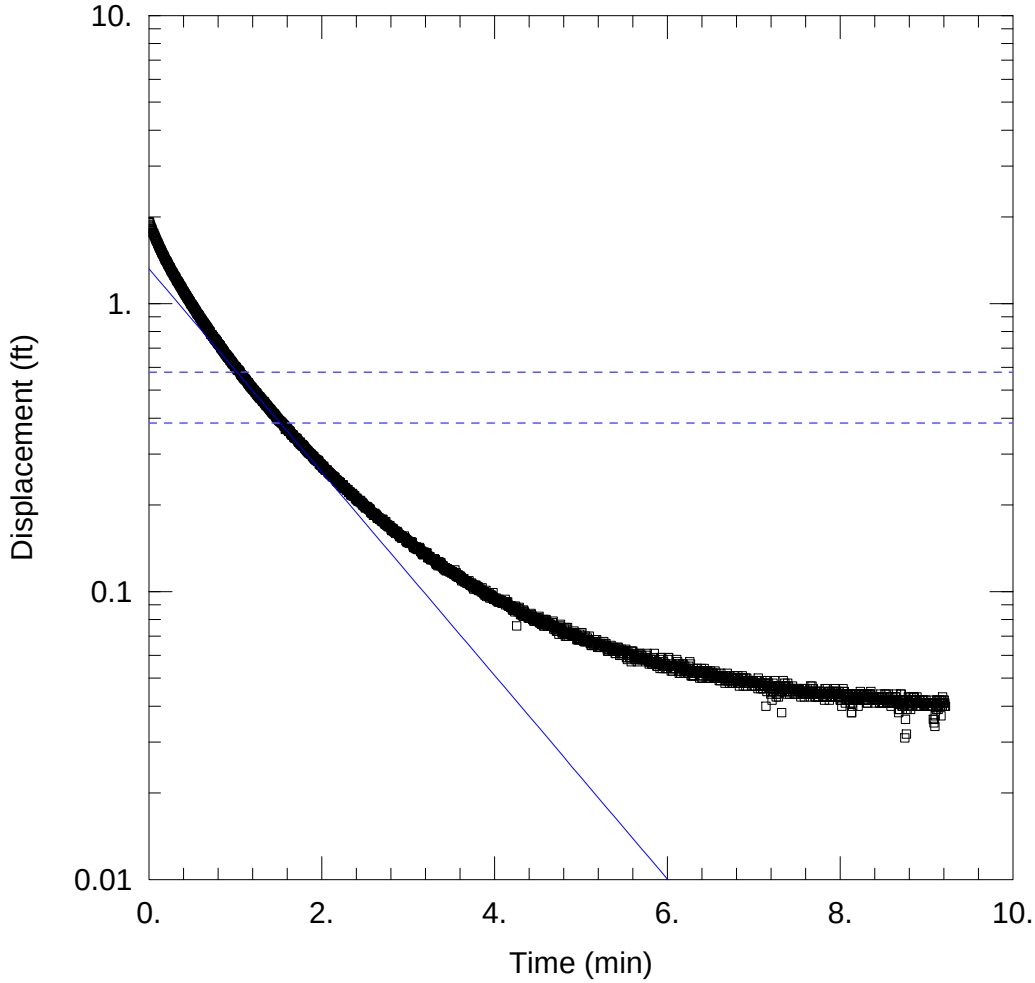
WELL DATA (CH-MW-07)

Initial Displacement: 2.099 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.166 ft/day
y0 = 1.452 ft



WELL TEST ANALYSIS

Data Set: G:\Common\Aaron Kempf\VCC Charlotte\CH-MW-07_rising.aqt
Date: 04/20/11 Time: 16:01:29

PROJECT INFORMATION

Company: ARCADIS
Client: ExxonMobil - VCC Charlotte
Project: B0085793.0031
Location: Charlotte, NC
Test Well: CH_MW-07
Test Date: 03/02/2011

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CH-MW-07)

Initial Displacement: 1.924 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.198 ft/day
y0 = 1.321 ft

Appendix E

Waste Manifests

HAZ~MAT

ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237
(704) 332-5600
FAX (704) 375-7183

Manifest No. 47019

P.O. No.

Job No.

NON-HAZARDOUS SPECIAL WASTE

Section I. GENERATOR (Generator complete all of Section I)

GENERATOR LOCATION

NAME: EXXONMOBIL OIL CORP
ORIGINATING ADDRESS: 307 W. TREMONT AVENUE
MAILING ADDRESS:
CITY: CHARLOTTE STATE: NC ZIP:
PHONE NO.: ~~919-415-2261~~ 2308
CONTACT NAME: ~~KRISTIN WHITE~~ Matt PeHon
DES. OF WASTE: NON-DOT REGULATED MATERIAL

WORK CONTRACTED BY
Bill To (If different from information at left)

NAME: ARCADIS
ADDRESS: 11000 REGENCY PKWY W. TOWER 205
CITY: CARY STATE: NC ZIP: 27518
PHONE NO.: 919-415-2286
CONTACT NAME: CORRIE CHWALEK

No. | Type | Units | Quantity

Section II. INVOICE INFORMATION — GALLONS | DRUMS

DESCRIPTION	QUANTITY		LINE TOTAL	
1. PETROLEUM CONTACT WATER PUMPED FROM TANKS, DRUMS OR AFVR				
2. OFF-SPEC LIGHT OIL, DIESEL OR GAS PUMPED FROM TANKS OR DRUMS				
3. SOLUBLE OILS OR COOLANTS PUMPED FROM STORAGE				
4. SEDIMENT OR SOLIDS VACUUMED FROM CONTAINMENT AREA				
5. 55-GALLON DRUM REMOVED - SOLID OR EMPTY				
6. 55-GALLON DRUM REMOVED - LIQUID DECON WATER		1		
7.				
8.				
9.				
10. ARRIVAL TIME: DEPARTURE TIME:				

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR Part 261.

X Tommy Darby "on behalf of Exxon Mobil" — Generator Authorized Agent Name
X Thomas H Darby — Signature
Shipment Date: 06/15/10

Section III. TRANSPORTER (TRANSPORTER (Generator complete a-d; Transporter I complete e-g; Transporter II complete h-m)

HAZ~MAT
ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237

a. Driver Name/Title: Greg Harris
b. Phone No.:
c. Truck No.: CT-3

Hazardous Waste Transporter Permits
EPA NCR 000003186
EPA NCD048461370

d. Driver Signature: Greg Harris
Shipment Date: 06/15/10

TRANSPORTER II

e. Name:
f. Address:
g. Driver Name/Title:
h. Phone No.:
i. Truck No.:
j. Transporter II Permit Nos.

Driver Signature
Shipment Date

Section IV. FACILITY INFORMATION AND CERTIFICATE OF DISPOSAL

Site Name: Haz-Mat Environmental Services
Physical Address: 210 Dalton Avenue, Charlotte, N.C. 28206
a. Phone No.: 704-332-5600
b. Mailing Address: P.O. Box 37392, Charlotte, N.C. 28237

e: Discrepancy Indication Space

This is to certify that all non-hazardous material removed from above location has been received and will be disposed of in accordance with applicable local, state and federal regulations in the following manner: (1) Petroleum products are blended into a beneficial reusable fuel for use in large industrial burners. (2) Waste waters are to be treated with polymers, pH adjusters, and a flocculant, then flows through a dissolved air flotation system for pretreatment separation, then into the CMUD sanitation sewer system under permit IUP#5012. (3) Sludges from treatment systems are hauled to E.P.A. approved facilities for proper disposal. Manifest and certificate of disposal are on file. (4) Our treatment system operates on a first in, first out basis and product should be processed within seven days.

SIGNATURE OF FACILITY AGENT	DATE	MONTH	DAY	YEAR

ORIGINAL - FINAL T.S.D. • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: NCP051210086
2. Page 1 of 1
3. Emergency Response Phone: 704-332-5600
4. Manifest Tracking Number: 001298279 FLE

GENERATOR

5. Generator's Name and Mailing Address: AMSADIS
11000 REGENCY PKWY STE. 205
CARY, NC 27518
Generator's Phone: 919 415-2261

Generator's Site Address (if different than mailing address): EXXONMOBIL OIL CORP
307 W. TREMONT AVENUE
CHARLOTTE, NC 28203

6. Transporter 1 Company Name: HAZ-MAT TRANSPORTATION & DISPOSAL 704-332-5600
U.S. EPA ID Number: ~~NCD003154~~ NCD048461370 DG

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address: CLEAN HARBORS DEER PARK
202 INDEPENDENCE PARKWAY SOUTH
LAPORTE, TX 77571
Facility's Phone: 281-930-2300
U.S. EPA ID Number: TXD055141378

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. NA3077, HAZARDOUS WASTE SOLID, N.O.S. (LEAD), 9, PG III (SOIL & PPE)	02	DM	600	P	~~D008~~ OUT5	319H	DG
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information

1) ERG#171 CH440475 DC2926815

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Thomas Darby II "on behalf of Exxon Mobil" Signature: [signature] Month 06 Day 15 Year 10

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: ALEX HARRIS / HAZMAT CL 3 Signature: [signature] Month 6 Day 15 Year 10

Transporter 2 Printed/Typed Name: Michael Berkhead Signature: [signature] Month 6 Day 25 Year 10

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H040	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: TERRY STEARNS Signature: [signature] Month 7 Day 12 Year 10

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. **DESIGNATED FACILITY TO GENERATOR**

Generator Copy

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC.
LAND DISPOSAL RESTRICTION FORM LDR-1

MANIFEST NO 001298279FLE

THE HAZARDOUS WASTES IDENTIFIED ON THE HAZARDOUS WASTE MANIFEST IDENTIFIED ABOVE AND BEARING THE EPA HAZARDOUS WASTE CODES LISTED BELOW ARE RESTRICTED WASTES WHICH ARE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT UNDER THE LAND DISPOSAL RESTRICTIONS, 40 CFR PART 268 .7 (a)(2), AND RCRA SECTION 3004(D). IN ACCORDANCE WITH 40 CFR 268.7(a), THE EPA WASTE CODE, WASTE SUBCATEGORY, AND TREATABILITY GROUPS, AS APPLICABLE, ARE INCLUDED BELOW.

INSTRUCTIONS -- COMPLETE ALL SECTIONS. REFER TO PAGE 3 OF THIS FORM FOR KEY TERMS/DEFINITIONS.

Column 1 - Line Item: Enter the manifest line item number (e.g., 11a) that corresponds to the waste code(s).
Column 2 - Waste Codes/Subcategory: Check off all applicable waste codes. For D001 through D043, also check applicable subcategory; for F001 through F005, check applicable constituents.
Column 3 - Wastewater/Non-wastewater: Check off "WW" for wastewater and "Non-WW" for non-wastewaters.
Column 4 - LDR Handling Code: Circle the appropriate handling code, as follows:

1 = The waste is a characteristic hazardous waste D001, D002, D003, D004-D011, or D018-43 which is intended for treatment/disposal in a CWA system, CWA-equivalent system, or Class I SDWA system. Underlying Hazardous Constituents (UHC's) are NOT required to be identified.

1A = The waste is a characteristic hazardous waste D001 High TOC Ignitable Liquids Subcategory (i.e., greater than or equal to 10% TOC). Pursuant to 40 CFR 268.40, the waste must be treated using organic recovery (RORGS) or combustion (CMBST) technology. UHC's are NOT required to be identified.

2 = The waste is a characteristic hazardous waste D001 (other than High TOC Ignitable Liquids), D002, D003 Explosive, Water Reactive or Other Reactive subcategory, D004-D011, D012-17 non-wastewater, or D018-43 which is intended for treatment/disposal in a non-CWA system, non-CWA-equivalent system, or non-Class I SDWA system located in the United States. All UHC's which are reasonably expected to be present must be identified, except for D001 waste that is intended to be treated using organic recovery (RORGS) or combustion (CMBST) technologies. Identify UHC's by completing Sections I and IV of CHI Form LDR-1 Addendum and attach completed Addendum to this form.

3 = The waste is a characteristic (i.e., D-code) or listed (i.e., F-, K-, U-, or P-code) hazardous waste which is intended for export and treatment/disposal at a facility located outside the United States. LDR treatment standards do not apply to hazardous waste treated/disposed in a foreign country, and per USEPA guidance, the identification of UHC's (if applicable) is not required for hazardous waste that is intended to be exported. Note however that if the exported waste is subsequently returned for treatment/disposal in the United States, all applicable LDR regulations would apply and a revised LDR notification would be required.

4 = The waste meets the definition of hazardous debris pursuant to 40 CFR 268.2(h) and is intended for treatment/ disposal in compliance with the alternate debris treatment technologies of 40 CFR 268.45. In accordance with the requirements of 40 CFR 268.7(a)(2) : the contaminants subject to treatment (CSTT's) must be identified as part of this notification. Identify CSTT's by completing Section III and IV of the CHI Form LDR-1 Addendum and attach completed Addendum to this form. These constituents are being treated to comply with 40 CFR 268.45.

5 = The waste is a characteristic waste D003 Reactive Sulfide, Reactive Cyanide, or Unexploded Ordnance subcategory, a characteristic waste D012- 17 wastewater, or a listed (i.e., F-, K-, U-, or P-code) hazardous waste. UHC's are NOT required to be identified.

6 = The waste is a lab pack that is intended for incineration using the alternative lab pack treatment standard under 40 CFR 268.42(c). UHC's are NOT required to be identified; however, the generator must complete and attach the lab pack certification statement on CHI Form LDR-LP. Note that in accordance with 40 CFR Part 268 Appendix IV, lab packs which contain waste codes D009, F019, K003, K004, K005, K006, K062, K071, K100, K106, P010, P011, P012, P076, P078, U134, and U151 are not eligible for alternative lab pack treatment standard.

*** **NOTE: IF THE WASTE IS A SOIL CONTAMINATED WITH A LISTED OR CHARACTERISTIC WASTE AND THE GENERATOR WANTS TO USE THE ALTERNATE TREATMENT STANDARD FOR SOILS, CONTACT CORPORATE COMPLIANCE FOR THE APPROPRIATE LDR NOTIFICATION FORM.**

SECTION I. CHARACTERISTIC WASTES D001 THROUGH D043

COLUMN 1: LINE ITEM SEE MANIFEST	COLUMN 2: WASTE CODE / SUBCATEGORY	COLUMN 3: WASTEWATER/ NON-WASTEWATER	COLUMN 4: HANDLING CODE
_____	[ ] D001 Ignitables, except High TOC subcategory	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D001 High TOC Ignitable Liquids Subcategory (Greater than or equal to 10% TOC)	[ ] Non-WW only	1A 3 6
_____	[ ] D002 Corrosives	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D003		
	[ ] Reactive Sulfide, per 261.23 (a)(5)	[ ] WW [ ] Non-WW	1 3 4 5 6
	[ ] Reactive Cyanide, per 261.23(a)(5)	[ ] WW [ ] Non-WW	1 3 4 5 6
	[ ] Explosive, per 261.23(a)(6), (7) & (8)	[ ] WW [ ] Non-WW	1 2 3 4 6
	[ ] Water Reactive, per 261.23(a)(2), (3) & (4)	[ ] Non-WW only	1 2 3 4 6
	[ ] Other Reactive, per 261.23(a)(1)	[ ] WW [ ] Non-WW	1 2 3 4 6
	[ ] Unexploded Ordnance, Emergency Response	[ ] WW [ ] Non-WW	1 3 4 5 6
_____	[ ] D004 Arsenic	[ ] WW [ ] Non-WW	1 3 4 5 6
_____	[ ] D005 Barium	[ ] WW [ ] Non-WW	1 3 4 5 6
_____	[ ] D006		
	[ ] Cadmium	[ ] WW [ ] Non-WW	1 2 3 4 6
	[ ] Cadmium Containing Batteries	[ ] Non-WW only	2 3 6
_____	[ ] D007 Chromium	[ ] WW [ ] Non-WW	1 2 3 4 6
961	[ ] D008		
	[K] Lead	[ ] WW [A] Non-WW	1 (2) 3 4 6
	[ ] Lead Acid Batteries	[ ] Non-WW only	2 3 6

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC.
LAND DISPOSAL RESTRICTION FORM LDR-1

MANIFEST NO 001298279 FLE

SECTION I. CHARACTERISTIC WASTES D001-43 (CONTINUED)

COLUMN 1: LINE ITEM SEE MANIFEST	COLUMN 2: WASTE CODE / SUBCATEGORY	COLUMN 3: WASTEWATER/ NON-WASTEWATER	COLUMN 4: HANDLING CODE
_____	[ ] D009		
	[ ] Low Mercury, less than 260 mg/kg Mercury	[ ] WW [ ] Non-WW	1 2 3 4
	[ ] High Mercury Organic Subcategory	[ ] Non-WW only	2 3 4
	[ ] High Mercury Inorganic Subcategory	[ ] Non-WW only	2 3 4
_____	[ ] D010 Selenium	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D011 Silver	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D012 Endrin	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D013 Lindane	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D014 Methoxychlor	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D015 Toxaphene	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D016 2,4-D	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D017 2,4,5-TP (Silvex)	[ ] WW [ ] Non-WW	2 3 4 5 6
_____	[ ] D018 Benzene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D019 Carbon tetrachloride	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D020 Chlordane	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D021 Chlorobenzene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D022 Chloroform	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D023 o-Cresol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D024 m-Cresol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D025 p-Cresol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D026 Cresol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D027 1,4-Dichlorobenzene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D028 1,2-Dichloroethane	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D029 1,1-Dichloroethylene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D030 2,4-Dinitrotoluene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D031 Heptachlor (and its epoxide)	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D032 Hexachlorobenzene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D033 Hexachlorobutadiene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D034 Hexachloroethane	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D035 Methyl ethyl ketone	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D036 Nitrobenzene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D037 Pentachlorophenol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D038 Pyridine	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D039 Tetrachloroethylene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D040 Trichloroethylene	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D041 2,4,5-Trichlorophenol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D042 2,4,6-Trichlorophenol	[ ] WW [ ] Non-WW	1 2 3 4 6
_____	[ ] D043 Vinyl Chloride	[ ] WW [ ] Non-WW	1 2 3 4 6

SECTION II. SPENT SOLVENT WASTES F001 THROUGH F005

COLUMN 1: LINE ITEM SEE MANIFEST	COLUMN 2: WASTE CODE / SUBCATEGORY	COLUMN 3: WASTEWATER/ NON-WASTEWATER	COLUMN 4: HANDLING CODE
_____	[ ] F001 [ ] F002 [ ] F003 [ ] F004 [ ] F005	[ ] WW [ ] Non-WW	3 4 5 6

_____ [ ] 1. ALL F001-F005
_____ [ ] 2. Acetone
_____ [ ] 3. Benzene
_____ [ ] 4. n-Butyl alcohol
_____ [ ] 5. Carbon disulfide
_____ [ ] 6. Carbon tetrachloride
_____ [ ] 7. Chlorobenzene
_____ [ ] 8. o-Cresol
_____ [ ] 9. m-Cresol (difficult to distinguish from p-cresol)
_____ [ ] 10. p-Cresol (difficult to distinguish from m-cresol)
_____ [ ] 11. Cresol - mixed isomers (sum of o-, m- and p-cresol)

_____ [ ] 12. Cyclohexanone
_____ [ ] 13. o-Dichlorobenzene
_____ [ ] 14. 2-Ethoxyethanol (F005 only)
_____ [ ] 15. Ethyl acetate
_____ [ ] 16. Ethyl benzene
_____ [ ] 17. Ethyl ether
_____ [ ] 18. Isobutyl alcohol
_____ [ ] 19. Methanol
_____ [ ] 20. Methylene chloride
_____ [ ] 21. Methyl ethyl ketone
_____ [ ] 22. Methyl isobutyl ketone
_____ [ ] 23. Nitrobenzene
_____ [ ] 24. 2-Nitropropane (F005 only)

_____ [ ] 25. Pyridine
_____ [ ] 26. Tetrachloroethylene
_____ [ ] 27. Toluene
_____ [ ] 28. 1,1,1-Trichloroethane
_____ [ ] 29. 1,1,2-Trichloroethane
_____ [ ] 30. Trichloroethylene
_____ [ ] 31. 1,1,2-Trichloro-1,2,2-trifluoroethane
_____ [ ] 32. Trichloromonofluoromethane
_____ [ ] 33. Xylene - mixed isomers (sum of o-, m-, and p-xylene)

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC.
LAND DISPOSAL RESTRICTION FORM LDR-1

MANIFEST NO 001298279FLE

SECTION III. CALIFORNIA LIST WASTES

COLUMN 1: LINE ITEM SEE MANIFEST	COLUMN 2: WASTE CODE / SUBCATEGORY	COLUMN 3: WASTEWATER/ NON-WASTEWATER	COLUMN 4: HANDLING CODE
_____	Hazardous waste containing one or more of the following California List constituents:	[ ] WW [ ] Non-WW	1 2 3 4 6

[ ] ALL CALIFORNIA LIST CONSTITUENTS
[ ] Liquids with nickel greater than or equal to 134 mg/l
[ ] Liquids with thallium greater than or equal to 130 mg/l
[ ] Liquids with PCB's > or = 50 ppm
[ ] Waste containing HOC's > or = 1,000 mg/kg

SECTION IV. OTHER LISTED WASTES (F006-12, F019-F028, F037-38, F039, K-, U-, AND P-CODES)

COLUMN 1: LINE ITEM SEE MANIFEST	COLUMN 2: WASTE CODE / SUBCATEGORY	COLUMN 3: WASTEWATER/ NON-WASTEWATER	COLUMN 4: HANDLING CODE
_____	_____	[ ] WW [ ] Non-WW	3 4 5 6
_____	_____	[ ] WW [ ] Non-WW	3 4 5 6
_____	_____	[ ] WW [ ] Non-WW	3 4 5 6
_____	_____	[ ] WW [ ] Non-WW	3 4 5 6
_____	_____	[ ] WW [ ] Non-WW	3 4 5 6

[ ] CHECK HERE IF ADDITIONAL LISTED WASTE CODES ARE PRESENT. COMPLETE AND ATTACH LDR-1 CONTINUATION SHEET.
[ ] CHECK HERE IF WASTE CODE F039 (MULTISOURCE LEACHATE) IS PRESENT. IDENTIFY F039 CONSTITUENTS BY COMPLETING SECTIONS II AND IV OF CHI FORM LDR-1 ADDENDUM AND ATTACH COMPLETED ADDENDUM TO THIS FORM.

SECTION V. CONTACT NAME AND DATE

Print Name: Thomas Dachy "on behalf of Exxon Mobil" Date: 6/15/10

KEY TERMS/DEFINITIONS

CLASS I SDWA SYSTEM means a Class I deep well facility regulated under the Safe Drinking Water Act (SDWA).

CWA SYSTEM means a centralized wastewater treatment facility discharging under a Clean Water Act (CWA) permit. For example, a CWA facility would treat organic or inorganic aqueous wastes and discharge the treated effluent to the local sewer system. Examples of CWA treatment systems owned and operated by Clean Harbors include the wastewater treatment operations at Baltimore (including the CES system), Bristol, Chicago, Cincinnati and Cleveland.

CWA-EQUIVALENT SYSTEM means a "zero discharge system" that engages in "CWA-equivalent" treatment before land disposal. Zero-discharge facilities treat hazardous wastes using "CWA-equivalent" treatment methods, but do not discharge the treatment effluent to a sewer or water body (e.g., spray irrigation land farm). "CWA-equivalent" treatment methods means biological treatment for organics, alkaline chlorination, or ferrous sulfate precipitation for cyanide, precipitation/ sedimentation for metals, reduction of hexavalent chromium, or other treatment technology that can be demonstrated to perform equally or greater than these technologies.

HIGH TOC IGNITABLE LIQUIDS SUBCATEGORY means an ignitable liquid hazardous waste (waste code D001) which contains greater than or equal to 10% total organic carbon (TOC). Pursuant to 40 CFR 268.40, such wastes must be treated using organic recovery (RORGS) or combustion (CMBST) technology. Examples of RORGS technologies include the CES unit at Clean Harbors of Baltimore. Examples of CMBST technologies include hazardous waste fuel blending and subsequent reuse at a cement kiln, or destruction at a RCRA incinerator.

WASTEWATERS are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS). [See 40 CFR 268.2(f)]

HAZ~MAT

ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237
(704) 332-5600
FAX (704) 375-7183

Manifest No. 50175

P.O. No.

Job No.

NON-HAZARDOUS SPECIAL WASTE

Section I. GENERATOR (Generator complete all of Section I)

GENERATOR LOCATION

NAME: EXXONMOBIL OIL CORP
ORIGINATING ADDRESS: 307 W. TREMONT AVENUE
MAILING ADDRESS:
CITY: CHARLOTTE STATE: NC ZIP:
PHONE NO.: 919-415-2261
CONTACT NAME: KIRSTYN WHITE
DES. OF WASTE: NON-DOT REGULATED MATERIAL

WORK CONTRACTED BY
Bill To (If different from information at left)

NAME: ARCADIS
ADDRESS: 11000 REGENCY PKWY W. TOWER 205
CITY: CARY STATE: NC ZIP: 27518
PHONE NO.: 919-415-2286
CONTACT NAME: CORRIE CHWALEK

No. | Type | Units | Quantity

Section II. INVOICE INFORMATION

DESCRIPTION	GALLONS QUANTITY	DRUMS QUANTITY	GALLONS LINE TOTAL	DRUMS LINE TOTAL
1. PETROLEUM CONTACT WATER PUMPED FROM TANKS, DRUMS OR AFVR				
2. OFF-SPEC LIGHT OIL, DIESEL OR GAS PUMPED FROM TANKS OR DRUMS				
3. SOLUBLE OILS OR COOLANTS PUMPED FROM STORAGE				
4. SEDIMENT OR SOLIDS VACUUMED FROM CONTAINMENT AREA				
5. 55-GALLON DRUM REMOVED - SOLID OR EMPTY SOIL CUTTINGS/PPE		26		
6. 55-GALLON DRUM REMOVED - LIQUID DECON WATER		8		
7.				
8.				
9.				
10. ARRIVAL TIME: DEPARTURE TIME:				

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR Part 261.

Shannon Self "on behalf of Exxon Mobil" — Generator Authorized Agent Name
Shannon R Self — Signature
040511 — Shipment Date

Section III. TRANSPORTER

TRANSPORTER (Generator complete a-d; Transporter I complete e-g; Transporter II complete h-n)

HAZ~MAT
ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237

a. Driver Name/Title: DALLAS FRANKLIN / DRIVER
b. Phone No.: (704) 332-5600 c. Truck No.: LT-1

Hazardous Waste Transporter Permits
EPA NCR 000003186
EPA NCD048461370

d. Dallas Franklin — Driver Signature
040511 — Shipment Date

TRANSPORTER II

e. Name
f. Address
g. Driver Name/Title
h. Phone No. i. Truck No.
j. Transporter II Permit Nos.

Driver Signature
Shipment Date

Section IV. FACILITY INFORMATION AND CERTIFICATE OF DISPOSAL

Site Name: Haz-Mat Environmental Services
Physical Address: 210 Dalton Avenue, Charlotte, N.C. 28206
a. Phone No.: 704-332-5600
b. Mailing Address: P.O. Box 37392, Charlotte, N.C. 28237

e: Discrepancy Indication Space

This is to certify that all non-hazardous material removed from above location has been received and will be disposed of in accordance with applicable local, state and federal regulations in the following manner: (1) Petroleum products are blended into a beneficial reusable fuel for use in large industrial burners. (2) Waste waters are to be treated with polymers, pH adjusters, and a flocculant, then flows through a dissolved air flotation system for pretreatment separation, then into the CMUD sanitation sewer system under permit IUP#5012. (3) Sludges from treatment systems are hauled to E.P.A. approved facilities for proper disposal. Manifest and certificate of disposal are on file. (4) Our treatment system operates on a first in, first out basis and product should be processed within seven days.

SIGNATURE OF FACILITY AGENT	DATE	MONTH	DAY	YEAR
Mike Hinds		4	5	11

ORIGINAL - FINAL T.S.D. • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR

HAZ~MAT

ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237
(704) 332-5600
FAX (704) 375-7183

Manifest No. 53171

P.O. No.

Job No.

NON-HAZARDOUS SPECIAL WASTE

Section I. GENERATOR (Generator complete all of Section I)

GENERATOR LOCATION

NAME: EXXONMOBIL OIL CORP
ORIGINATING ADDRESS: 307 W. TREMONT AVENUE
MAILING ADDRESS:
CITY: CHARLOTTE STATE: NC ZIP: 28203
PHONE NO.: 919-415-2261
CONTACT NAME: KIRSTYN WHITE / LAUREN GORDON
DES. OF WASTE: NON-DOT REGULATED MATERIAL

WORK CONTRACTED BY
Bill To (If different from information at left)

NAME: ARCADIS
ADDRESS: 801 CORPORATE CENTER DR. STE. 300
CITY: RALEIGH STATE: NC ZIP: 27607
PHONE NO.: 919-415-2308
CONTACT NAME: MATT PELTON

No.	Type	Units	Quantity

Section II. INVOICE INFORMATION

DESCRIPTION	GALLONS	DRUMS	LINE TOTAL
1. PETROLEUM CONTACT WATER PUMPED FROM TANKS, DRUMS OR AFVR			
2. OFF-SPEC LIGHT OIL, DIESEL OR GAS PUMPED FROM TANKS OR DRUMS			
3. SOLUBLE OILS OR COOLANTS PUMPED FROM STORAGE			
4. SEDIMENT OR SOLIDS VACUUMED FROM CONTAINMENT AREA			
5. 55-GALLON DRUM REMOVED - SOLID OR EMPTY SOIL CUTTINGS/PPE		1	
6. 55-GALLON DRUM REMOVED - LIQUID DECON WATER		1	
7.			
8.			
9.			
10. ARRIVAL TIME: 0900 DEPARTURE TIME: 0910			

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR Part 261.

X RYAN HABERSANG
Generator Authorized Agent Name

X
Signature

Shipment Date: 01 24 12

Section III. TRANSPORTER

TRANSPORTER (Generator complete a-d; Transporter I complete e-g; Transporter II complete h-n)

HAZ~MAT
ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237

a. Driver Name/Title: JOHNATHAN S SMITH / DRIVER
b. Phone No.: 704 332-5600 c. Truck No.: ST-6

Hazardous Waste Transporter Permits
EPA NCR 000003186
EPA NCD048461370

d. Driver Signature

Shipment Date: 01 24 12

TRANSPORTER II

e. Name
f. Address
g. Driver Name/Title
h. Phone No. i. Truck No.
j. Transporter II Permit Nos.

Driver Signature

Shipment Date

Section IV. FACILITY INFORMATION AND CERTIFICATE OF DISPOSAL

Site Name: Haz-Mat Environmental Services
Physical Address: 210 Dalton Avenue, Charlotte, N.C. 28206

a. Phone No. 704-332-5600
b. Mailing Address: P.O. Box 37392, Charlotte, N.C. 28237

e: Discrepancy Indication Space

This is to certify that all non-hazardous material removed from above location has been received and will be disposed of in accordance with applicable local, state and federal regulations in the following manner: (1) Petroleum products are blended into a beneficial reusable fuel for use in large industrial burners. (2) Waste waters are to be treated with polymers, pH adjusters, and a flocculant, then flows through a dissolved air flotation system for pretreatment separation, then into the CMUD sanitation sewer system under permit IUP#5012. (3) Sludges from treatment systems are hauled to E.P.A. approved facilities for proper disposal. Manifest and certificate of disposal are on file. (4) Our treatment system operates on a first in, first out basis and product should be processed within seven days.

SIGNATURE OF FACILITY AGENT	DATE	MONTH 1	DAY 24	YEAR 12

ORIGINAL - FINAL T.S.D. • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR

HAZ~MAT

ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237
(704) 332-5600
FAX (704) 375-7183

Manifest No. 56383

P.O. No.

Job No. 12-4730 / 42030

NON-HAZARDOUS SPECIAL WASTE

Section I. GENERATOR (Generator complete all of Section I)

GENERATOR LOCATION

NAME Exxon Mobil Oil Corp
ORIGINATING ADDRESS 207 W Tremont Ave.
MAILING ADDRESS
CITY Charlotte STATE NC 28203
PHONE NO. 919-415-2261
CONTACT NAME Lauren Gordon / Kirstyn White
DES. OF WASTE Non-DOT regulated material

WORK CONTRACTED BY
Bill To (If different from information at left)

NAME Arcadis
ADDRESS 801 Corporate Center Drive Ste. 300
CITY Raleigh STATE NC 27607
PHONE NO. 919-415-2308
CONTACT NAME Matt Pelton

No.	Type	Units	Quantity
01	BT	D	00002

Section II. INVOICE INFORMATION

DESCRIPTION	GALLONS	DRUMS	LINE TOTAL
1. PETROLEUM CONTACT WATER PUMPED FROM TANKS, DRUMS OR AFVR			
2. OFF-SPEC LIGHT OIL, DIESEL OR GAS PUMPED FROM TANKS OR DRUMS			
3. SOLUBLE OILS OR COOLANTS PUMPED FROM STORAGE			
4. SEDIMENT OR SOLIDS VACUUMED FROM CONTAINMENT AREA			
5. 55-GALLON DRUM REMOVED - SOLID OR EMPTY			
6. 55-GALLON DRUM REMOVED - LIQUID			
7. Soil cuttings / PPE		1	
8. Decon water		1	
9.			
10. ARRIVAL TIME: DEPARTURE TIME:			

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR Part 261.

RYAN HABERSANG "ON BEHALF OF EXXONMOBIL" — Generator Authorized Agent Name
Signature
Shipment Date: 062912

Section III. TRANSPORTER

TRANSPORTER (Generator complete a-d; Transporter I complete e-g; Transporter II complete h-n)

HAZ~MAT
ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237

a. Driver Name / Title Dustin Chastain
b. Phone No. 704 332 5600 c. Truck No. ST-6
Hazardous Waste Transporter Permits
EPA NCR 000003186
EPA NCD048461370
d. Driver Signature
Shipment Date: 062912

TRANSPORTER II

e. Name
f. Address
g. Driver Name / Title
h. Phone No. i. Truck No.
j. Transporter II Permit Nos.
Driver Signature
Shipment Date

Section IV. FACILITY INFORMATION AND CERTIFICATE OF DISPOSAL

Site Name: Haz-Mat Environmental Services
Physical Address: 210 Dalton Avenue, Charlotte, N.C. 28206
a. Phone No. 704-332-5600
b. Mailing Address: P.O. Box 37392, Charlotte, N.C. 28237

e: Discrepancy Indication Space

This is to certify that all non-hazardous material removed from above location has been received and will be disposed of in accordance with applicable local, state and federal regulations in the following manner: (1) Petroleum products are blended into a beneficial reusable fuel for use in large industrial burners. (2) Waste waters are to be treated with polymers, pH adjusters, and a flocculant, then flows through a dissolved air flotation system for pretreatment separation, then into the CMUD sanitation sewer system under permit !UP#5012. (3) Sludges from treatment systems are hauled to E.P.A. approved facilities for proper disposal. Manifest and certificate of disposal are on file. (4) Our treatment system operates on a first in, first out basis and product should be processed within seven days.

SIGNATURE OF FACILITY AGENT	DATE	MONTH 6	DAY 29	YEAR 7

ORIGINAL - FINAL T.S.D. • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR

HAZ~MAT

ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237
(704) 332-5600
FAX (704) 375-7183

Manifest No. 57381

P.O. No.

Job No.

NON-HAZARDOUS SPECIAL WASTE

Section I. GENERATOR (Generator complete all of Section I)

GENERATOR LOCATION

NAME EXXONMOBIL OIL CORP
ORIGINATING ADDRESS 307 W. TREMONT AVENUE
MAILING ADDRESS
CITY CHARLOTTE STATE NC ZIP 28203
PHONE NO. 919-415-2261
CONTACT NAME KIRSTYN WHITE / LAUREN GORDON
DES. OF WASTE NON-DOT REGULATED MATERIAL

WORK CONTRACTED BY
Bill To (If different from information at left)

NAME ARCADIS
ADDRESS 801 CORPORATE CENTER DR. STE. 300
CITY RALEIGH STATE NC ZIP 27607
PHONE NO. 919-415-2308
CONTACT NAME MATT PELTON

No.	Type	Units	Quantity

Section II. INVOICE INFORMATION

DESCRIPTION	QUANTITY GALLONS	QUANTITY DRUMS	LINE TOTAL
1. PETROLEUM CONTACT WATER PUMPED FROM TANKS, DRUMS OR AFVR			
2. OFF-SPEC LIGHT OIL, DIESEL OR GAS PUMPED FROM TANKS OR DRUMS			
3. SOLUBLE OILS OR COOLANTS PUMPED FROM STORAGE			
4. SEDIMENT OR SOLIDS VACUUMED FROM CONTAINMENT AREA			
5. 55-GALLON DRUM REMOVED - SOLID OR EMPTY			
6. 55-GALLON DRUM REMOVED - LIQUID ~~SOIL CUTTINGS/PPE~~		~~1~~	
7. DECON WATER		1	
8.			
9.			
10. ARRIVAL TIME: DEPARTURE TIME:			

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if the waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions, I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR Part 268 and is no longer a hazardous waste as defined by 40 CFR Part 261.

RYAN HABERSANG "ON BEHALF OF EXXON MOBIL" — Generator Authorized Agent Name
Signature
Shipment Date 102412

Section III. TRANSPORTER

TRANSPORTER (Generator complete a-d; Transporter I complete e-g; Transporter II complete h-n)

HAZ~MAT
ENVIRONMENTAL SERVICES
P.O. BOX 37392 • CHARLOTTE, N.C. 28237

a. Driver Name / Title James Hunter
b. Phone No. 704-507 8328 c. Truck No. CT-3

Hazardous Waste Transporter Permits
EPA NCR 000003186
EPA NCD048461370

d. Driver Signature
Shipment Date 102412

TRANSPORTER II

e. Name
f. Address
g. Driver Name / Title
h. Phone No. i. Truck No.
j. Transporter II Permit Nos.

Driver Signature
Shipment Date

Section IV. FACILITY INFORMATION AND CERTIFICATE OF DISPOSAL

Site Name: Haz-Mat Environmental Services
Physical Address: 210 Dalton Avenue, Charlotte, N.C. 28206
a. Phone No. 704-332-5600
b. Mailing Address: P.O. Box 37392, Charlotte, N.C. 28237

e: Discrepancy Indication Space

This is to certify that all non-hazardous material removed from above location has been received and will be disposed of in accordance with applicable local, state and federal regulations in the following manner: (1) Petroleum products are blended into a beneficial reusable fuel for use in large industrial burners. (2) Waste waters are to be treated with polymers, pH adjusters, and a flocculant, then flows through a dissolved air flotation system for pretreatment separation, then into the CMUD sanitation sewer system under permit IUP#5012. (3) Sludges from treatment systems are hauled to E.P.A. approved facilities for proper disposal. Manifest and certificate of disposal are on file. (4) Our treatment system operates on a first in, first out basis and product should be processed within seven days.

SIGNATURE OF FACILITY AGENT	DATE	MONTH	DAY	YEAR
Mike Lewis		10	24	12

ORIGINAL - FINAL T.S.D. • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR