PRELIMINARY SITE ASSESSMENT

PARCEL 214
ENT WORSLEY REAL ESTATE, LLC PROPERTY
7158 MARKET STREET
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA

TIP NO.: U-4751
STATE PROJECT: 25381
WBS ELEMENT: 40191.1.2
DESCRIPTION: SR 1409 (MILITARY CUTOFF ROAD EXTENSION)
FROM SR 1409 TO US 17 IN WILMINGTON

CATLIN PROJECT NO. 215050

PREPARED FOR:

NCDOT GEOTECHNICAL ENGINEERING UNIT-GEOENVIRONMENTAL SECTION
1589 MSC
RALEIGH, NORTH CAROLINA 27699-1589

JULY 28, 2015

PREPARED BY:

CATLIN ENGINEERS AND SCIENTISTS
P. O. BOX 10279
WILMINGTON, NORTH CAROLINA 28404-0279
(910) 452-5861

CORPORATE GEOLOGY LICENSE CERTIFICATION NO. C-118
CORPORATE LICENSURE NO. FOR ENGINEERING SERVICES C-0585

TABLE OF CONTENTS

PRELIMINARY SITE ASSESSMENT

PARCEL 214
ENT WORSLEY REAL ESTATE, LLC PROPERTY
7158 MARKET STREET
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA

TIP NO.: U-4751
STATE PROJECT: 25381
WBS ELEMENT: 40191.1.2
DESCRIPTION: SR 1409 (MILITARY CUTOFF ROAD EXTENSION)
FROM SR 1409 TO US 17 IN WILMINGTON

JULY 28, 2015

1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) is planning construction activities and acquisition of the right-of-way (ROW) and property is necessary for the construction of Military Cutoff Road Extension in Wilmington, North Carolina (WBS Element 40191.1.2). NCDOT has indicated a site investigation is necessary to determine the presence underground storage tanks and/or contaminated soils.

2.0 PURPOSE OF INVESTIGATION AND DESCRIPTION

CATLIN Engineers and Scientists (CATLIN) was retained by the NCDOT Geotechnical Engineering Unit to provide field investigations concluding with a Preliminary Site Assessment (PSA) report for one (1) area associated with WBS Element 40191.1.2. In response to a Request for Technical and Cost Proposal (RFP) dated April 22, 2015, CATLIN submitted a proposal for conducting a PSA at 7158 Market Street in Wilmington, North Carolina. This report documents the investigation at site, Parcel 214, ENT Worsley Real Estate, LLC (Worsley) Property. The site is located in the southeast corner of the US 17 (Market Street) and Middle Sound Loop Road intersection. The facility currently operates as a convenience store and gas station. The general location is illustrated on Sheet 1. CATLIN personnel conducted a field investigation at the site concluding on June 18, 2015. This PSA report documents activities and findings at the Worsley Property.

According to the RFP and information gathered during CATLIN's review of information at the North Carolina Department of Environment and Natural Resources (NCDENR) Underground Storage Tank (UST) Section Wilmington Regional Office (see Appendix A), the site had/has Facility ID Numbers 0-020168, 0-020180 and has a historical UST groundwater incident (32152) on

record.

The requested area of investigation is the entire parcel. Borings/samples were proposed from near/around the historical and active UST system(s). The geophysical investigation was conducted across the entire parcel. The NCDOT conventional plan sheet symbols are provided on Sheet 2 and the site layout including proposed features are illustrated on Sheet 3.

The NCDOT has requested an investigation to determine if contamination is present at the site. The purpose of this investigation was to:

- Perform a PSA at the current Worsley Property.
- Locate all USTs and determine approximate size and contents (if any).
- Determine if contaminated soils are present.
- If contamination is evident, estimate the quantity of impacted soils and indicate the approximate area of soil contamination on a site map.
- Provide a MicroStation® file with the location of UST(s) (if any) and soil contamination.
- Prepare a report including field activities, findings, and recommendations for this site and submit in triplicate.

3.0 METHODS

Proposed boring/sample locations were discussed and agreed upon before boring advancement.

CATLIN coordinated geophysical activities with Pyramid Environmental and Engineering (Pyramid). The geophysical investigation methods are detailed in the Pyramid geophysical report provided in Appendix B.

CATLIN proposed utilizing QROS On-Site Rapid Measurement Techniques and Tools (QED™ Analyzer) to evaluate potential for petroleum impacts to soil in a cost effective manner. Soil samples collected from above the approximate water table depth with total petroleum hydrocarbon (TPH) concentrations greater than 10 milligrams per kilogram (mg/kg) diesel range organics (DRO) or gasoline range organics (GRO) will be considered contaminated for estimated contaminated vadose soil volume calculations. Contaminated soil volume is estimated from the surface to the water table and/or the midpoint distance between a clean sample location and dirty sample location or the property line along with consideration given to historical results gleaned from the NCDENR file review information.

Borings advanced during this investigation are identified with “DPT” (direct push technology) and numbered sequentially “##”. Soil samples for analysis per QROS QED™ Analyzer were identified by boring number and depth [example: DPT-01 (3-4’)].

The NCDENR Wilmington Regional Office was contacted, a UST groundwater incident file review was requested, arranged, and conducted.

3.1 FIELD METHODS

All field work was conducted in general accordance with state and federal guidelines and industry standards.

Underground utility locating was coordinated by CATLIN personnel. The North Carolina One Call Center (NC-1-Call) was contacted for underground utility location. The areas around the proposed boring locations were checked and underground utilities were indicated by NC-1-Call personnel.

CATLIN personnel gathered subsurface soil data by Direct Push Technology boring advancement using an AMS PowerProbe™ 9600D (PowerProbe). When using the PowerProbe, the borings are advanced to depth by static force and a 90-pound hydraulic percussion hammer. Two and one-quarter inch diameter by four-foot length steel is used as casing. Soil samples are continuously collected in one and one-half inch clear liners. Liners are removed from the casing and then cut in half longitudinally to allow for visual/manual classification utilizing the Unified Soil Classification System (USCS). Boring information was recorded on field logs and transferred to Boring Logs (see Appendix C). Soil samples were collected and packed in appropriate glassware for analysis.

New disposable nitrile gloves were worn during sampling activities. Soils selected for QROS QED™ analysis were placed into new glassware provided by QROS. All samples were placed on ice in an insulated cooler for transportation to the laboratory. Sample integrity was maintained by following proper Chain of Custody procedures. A copy of the Chain of Custody is provided following the analytical report in Appendix D.

Boreholes were abandoned to the surface in grassy areas and just below existing asphalt in asphalt areas using three-eighth inch bentonite chips. Bentonite and water were poured into the borehole simultaneously to facilitate hydration. Boreholes in asphalt were finished with asphalt patch to the surface.

3.2 ANALYTICAL TESTING

The QROS QED™ Analyzer methods have been approved by the NCDENR for petroleum contamination determination. Complete QROS QED™ procedures are on file with the NCDENR and are

available upon request. The QROS QED™ analysis was conducted by QROS personnel at their laboratory in Wilmington, North Carolina.

QROS QED™ analysis provides total Benzene, Toluene, Ethylbenzene, and Toluene (BTEX), DRO, GRO, TPH, total aromatics (C10-C35) and (total) 16 Environmental Protection Agency (EPA) Poly Aromatic Hydrocarbons (PAHs) concentrations. Soil sample DRO and GRO results greater than 10 mg/kg are considered contaminated for this investigation.

4.0 FIELD ACTIVITIES

4.1 CURRENT SITE CONDITIONS AND FIELD OBSERVATIONS

As previously mentioned, The Worsley facility at this location operates as a convenience store and gas station. A total of three known USTs were observed on the property. Photographs taken during the geophysical investigation are included in the geophysical report provided in Appendix B.

The site vicinity is illustrated on Sheet 1 and Sheet 3 illustrates the current site map with soil boring and sample locations.

4.2 SOIL SAMPLING

A total of 11 borings were installed as part of the investigation. One (1) soil sample interval was collected from each boring and submitted for analysis. Boring/sample locations are illustrated on Sheet 3. Boring logs are included in Appendix C.

Most borings were advanced to 8 feet below land surface (BLS) and terminated in dry to moist sandy soils. Borings DPT-03, 04, 05 and 06 were terminated at 4 feet BLS in dry to moist sandy soil. Soils were collected continuously to boring termination. After retrieving the drive, soil was visually/manually classified for USCS classification. Soil samples collected from each boring for analysis were packed in the appropriate glassware, labeled, and placed in a cooler on ice. Borings were located at/near former and current UST system locations. A total of 11 soil samples were submitted to QROS for QED™ analysis. Chain of Custody documentation is included in Appendix D.

4.3 SURVEYING

Boring/sample locations were recorded utilizing a Trimble® global positioning survey instrument and data collector. The boring DPT-11 location was not recorded with the survey grade GPS due to the dispenser canopy covering the sample location. Boring coordinates

are shown on the Boring Logs provided in Appendix C. Boring locations are indicated on plan sheets provided by NCDOT and are included as Sheet 3.

5.0 RESULTS

NCDENR UST Groundwater Incident File Review

Portions of the information obtained at the NCDENR Wilmington Regional Office including the June 2004 Tank Closure Report, May 2008 Comprehensive Site Assessment, May 2009 Corrective Action Plan, and Monitoring Reports are include in Appendix A.

According to the Tank Closure Report, a 1,000 gallon diesel UST was abandoned in place on April 25, 2004. The approximate tank location is illustrated on figures included in historical file review information and in the Pyramid geophysical report. Total Petroleum Hydrocarbon (TPH) soil contamination was detected in soil samples collected around the abandoned tank.

The historical documents indicate a Facility ID: 0-020168 and UST Incident Number: 32152. Risk assessment conducted during the Comprehensive Site Assessment resulted in a High Risk Ranking based on soil and groundwater contamination and water supply wells within 1,000 feet of the site.

A Corrective Action Plan was implemented that included soil vapor extraction, air sparging and periodic groundwater monitoring. The January 8, 2013 Active Remediation Monitoring Report indicates the remediation system had not been operational since November 2011. Groundwater sample results from December 2011 and June 2012 did not reveal target petroleum compounds above the 2L Groundwater Quality Standards (2L GWQS) and no further action was requested. NCDENR subsequently required additional sampling.

As documented in the January 2013 report, soil samples revealed contamination concentrations above the Soil-to-Groundwater and Residential Maximum Soil Contaminant Concentrations (MSCCs) and groundwater sample results were above the 2L GWQS. The approximate groundwater contamination plumes from the January 2013 report are illustrated on Sheet 3. Depth to water has been reported to range from approximately seven (7) to 15 feet BLS.

No other documents were on file since the January 2013 report. According to the NCDENR UST Incident database, the treatment system was to be restarted. (The treatment system was not operational during CATLIN's site activities.)

Geophysical Investigation

The complete geophysical investigation report is included in Appendix B. As indicated in the Pyramid report, the investigation revealed and confirmed three known USTs and one probable UST. Two of the USTs are approximately nine (9) feet wide and 17 feet long and the third UST is approximately eight (8) feet wide and 22 feet long. The probable UST is likely the diesel tank identified in file review information as abandoned in place. The dimensions of this probable tank are approximately eight (8) feet wide by 13 feet long. All of the USTs were approximately (4) feet below the ground surface. The remaining Ground Penetrating Radar (GPR) scans verified the presence of utilities and conduits crossing the site, and possible debris but no evidence of additional USTs was observed.

Soil

Soil sample results from the recent assessment activities utilizing QROS QED™ analysis are provided on Table 1. Soil boring and sample locations are illustrated on Sheet 3. The QROS QED™ fingerprint graphs and chain of custody are provided in Appendix D.

Soils encountered across the site were predominately sands with varying colors. Dry soils were encountered across the site and to a maximum depth of 8 feet at DPT-01, 02, 07, 08, 09, 10 and 11. DPT-03, 04, 05, and 06 were pushed to a maximum depth of 4 feet.

DRO or GRO soil concentrations were not reported above 10 mg/kg in 8 of the 11 soil samples submitted for analysis. The highest DRO and/or GRO concentration revealed was 44.2 mg/kg in soil sample DPT-11 (3'). Soil sample DPT-06 (2.5') indicated DRO and/or GRO concentrations at 18.9 mg/kg and DPT-09 (3') results were 10.4 mg/kg.

The estimated area of petroleum impacted soils (1,657 feet^2) is illustrated on Sheet 3. This estimated area is based on the recent CATLIN soil sample results and historical soil data collected by others and on file at NCDENR. Potentially contaminated soil that may extend beyond the existing property line and under Market Street is not considered in the estimated area. The estimated volume of contaminated soil is 368 yards^3. This contaminated soil volume assumes soil contamination exists in the entire contaminated area from approximately one (1) foot deep to and the estimated season high water table at seven (7) feet BLS.

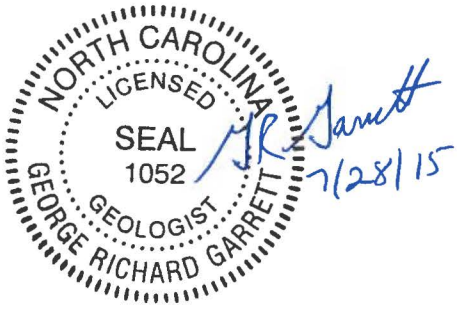
6.0 SUMMARY AND CONCLUSIONS

The site is currently a Scotchman convenience store with retail gasoline sales. The geophysical investigation confirmed the presence of USTs identified during the NCDENR Groundwater Incident file review. No other USTs were revealed. Eleven borings were advanced for soil sample collection around/near the historical and active UST system(s). Contaminated soils were revealed in soil samples collected from three (3) of the 11 borings. Historical assessments conducted by others and on file at NCDENR indicate impacted soil and groundwater from a previous UST system. Active soil and groundwater remediation has occurred at the site. There are a number of existing groundwater monitoring wells and treatment system components across the site. According to the NCDENR UST Incident database, the treatment system was to be turned back on as of 2013 but the system was not operation during CATLIN's field activities.

Groundwater was not encountered during boring advancement and soil sample collection to eight (8) feet BLS. However, historical groundwater measurements by others reported depth to groundwater as shallow as seven (7) feet BLS. Approximately 368 yards^3 of petroleum impacted soil are suspected at the site.

7.0 SIGNATURES

Benjamin J. Ashba, P.G.
Project Manager



G. Richard Garrett, P.G.
Contract Manager

TABLES

TABLE 1
SUMMARY OF SOIL RESULTS

QED

QROS

Hydrocarbon Analysis Results

Client: CATLIN Engineers and Scientists
Site: Parcel 214, Worsley, LLC Property
7158 Market St. Wilmington, NC
Facility ID: 0-020180
Groundwater Incident: 32152
Contact: Ben Ashba

Samples taken Thursday, June 18, 2015
Samples extracted Thursday, June 18, 2015
Samples analysed Friday, June 19, 2015
Operator KING

Project: WBS Element: 40191.1.2 TIP: U-4751

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios			HC Fingerprint Match
										% light	% mid	% heavy	
s	DPT-01 (6') 0945	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	Background Organics
s	DPT-02 (5') 1005	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	V.Deg.PHC (FCM) (P)
s	DPT-03 (3') 1015	26.5	<1.3	<0.66	1.9	1.9	1.7	0.19	0.007	0	81	19	V.Deg.PHC (FCM) 78.1%
s	DPT-04 (2.5') 1025	24.5	3.9	3.9	0.65	4.55	0.62	0.07	0.005	86.4	8.7	4.9	Deg.Gas (FCM)
s	DPT-05 (2.5') 1030	26.3	<1.3	<0.66	0.43	0.43	0.41	0.05	<0.013	0	60.3	39.7	V.Deg.PHC (FCM)
s	DPT-06 (2.5') 1045	24.3	<1.2	<0.61	**18.9**	18.9	18	2.1	0.27	0	74.6	25.4	Pyrogenic HC (FCM) 60.5%
s	DPT-07 (3') 1120	24.1	<1.2	<0.6	3.8	3.8	3.6	0.39	0.018	0	82.7	17.3	V.Deg.PHC (FCM) 89.3%
s	DPT-08 (5') 1130	24.3	<0.61	<0.61	0.5	0.5	0.47	0.04	<0.012	0	0	100	Background Organics (FCM)
s	DPT-09 (3') 1150	23.6	<1.2	<0.59	**10.4**	10.4	10.2	1.2	0.12	0	81.1	18.9	Pyrogenic HC (FCM) 73.9%
s	DPT-10 (5') 1245	23.6	<1.2	<0.59	4.3	4.3	4.2	0.47	0.024	0	79.8	20.2	V.Deg.PHC (FCM) 69.6%
s	DPT-11 (3') 1300	23.4	<1.2	<0.59	**44.2**	44.2	42.1	4.8	0.34	0	79.6	20.4	V.Deg.PHC (FCM) 63.6%
	Initial Calibrator QC check			**OK**					**Final FCM QC Check**		**OK**		**103.6 %**

Results in **bold** are greater than the 10 milligrams per kilogram (mg/kg) GRO and/or DRO State Action Level.

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples. Soil values are not corrected for moisture or stone content

Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:FCM = Results calculated using Fundamental Calibration Mode : % =confidence for sample fingerprint match to library (SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present

SHEETS

PROJECT REFERENCE NO.	SHEET
40191.1.2 (U-4751)	1

GENERAL LOCATION

0 4000 8000

FEET

SITE LOCATION

I-40

US-17

MILITARY CUTOFF RD.

NEW HANOVER CO

PENDER CO

Town Creek

Sunset

Murraysville

Ogden

Scotts Hill

WT

Cem

Pages Creek

Howe Creek

Rich Inlet

SOUND

Island

Bight

Figure

MIDDLE

WATERWAY

INTRACOASTAL

Mason Inlet

DATA SOURCE: MAP ADAPTED FROM TERRAIN NAVIGATION PRO

04/06/15

PROJECT REFERENCE NO.	SHEET NO.
40912.2 (U-4751)	2

STATE OF NORTH CAROLINA, DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin
- Property Corner
- Property Monument
- Parcel/Sequence Number
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary
- Proposed Wetland Boundary
- Existing Endangered Animal Boundary
- Existing Endangered Plant Boundary
- Existing Historic Property Boundary
- Known Contamination Area: Soil
- Potential Contamination Area: Soil
- Known Contamination Area: Water
- Potential Contamination Area: Water
- Contaminated Site: Known or Potential

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign
- Well
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream
- Buffer Zone 1
- Buffer Zone 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch
- False Sump

RAILROADS:

- Standard Gauge
- RR Signal Milepost
- Switch
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line
- Proposed Right of Way Line with Iron Pin and Cap Marker
- Proposed Right of Way Line with Concrete or Granite R/W Marker
- Proposed Control of Access Line with Concrete C/A Marker
- Existing Control of Access
- Proposed Control of Access
- Existing Easement Line
- Proposed Temporary Construction Easement
- Proposed Temporary Drainage Easement
- Proposed Permanent Drainage Easement
- Proposed Permanent Drainage / Utility Easement
- Proposed Permanent Utility Easement
- Proposed Temporary Utility Easement
- Proposed Aerial Utility Easement
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut
- Proposed Slope Stakes Fill
- Proposed Curb Ramp
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert
- Bridge Wing Wall, Head Wall and End Wall

MINOR:

- Head and End Wall
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB
- Paved Ditch Gutter
- Storm Sewer Manhole
- Storm Sewer

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*)
- U/G Power Line LOS C (S.U.E.*)
- U/G Power Line LOS D (S.U.E.*)

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole
- Telephone Pedestal
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole
- U/G Telephone Cable LOS B (S.U.E.*)
- U/G Telephone Cable LOS C (S.U.E.*)
- U/G Telephone Cable LOS D (S.U.E.*)
- U/G Telephone Conduit LOS B (S.U.E.*)
- U/G Telephone Conduit LOS C (S.U.E.*)
- U/G Telephone Conduit LOS D (S.U.E.*)
- U/G Fiber Optics Cable LOS B (S.U.E.*)
- U/G Fiber Optics Cable LOS C (S.U.E.*)
- U/G Fiber Optics Cable LOS D (S.U.E.*)

WATER:

- Water Manhole
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*)
- U/G Water Line LOS C (S.U.E*)
- U/G Water Line LOS D (S.U.E*)
- Above Ground Water Line

TV:

- TV Pedestal
- TV Tower
- U/G TV Cable Hand Hole
- U/G TV Cable LOS B (S.U.E.*)
- U/G TV Cable LOS C (S.U.E.*)
- U/G TV Cable LOS D (S.U.E.*)
- U/G Fiber Optic Cable LOS B (S.U.E.*)
- U/G Fiber Optic Cable LOS C (S.U.E.*)
- U/G Fiber Optic Cable LOS D (S.U.E.*)

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*)
- U/G Gas Line LOS C (S.U.E.*)
- U/G Gas Line LOS D (S.U.E.*)
- Above Ground Gas Line

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line
- Above Ground Sanitary Sewer
- SS Forced Main Line LOS B (S.U.E.*)
- SS Forced Main Line LOS C (S.U.E.*)
- SS Forced Main Line LOS D (S.U.E.*)

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box
- Utility Unknown U/G Line LOS B (S.U.E.*)
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc.
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

PROJECT REFERENCE NO.	SHEET NO.
40191.1.2 (U-4751)	3

SITE PLAN

0 10 20
FEET

DPT-03
DPT-04
DPT-02
DPT-01
DPT-10
DPT-05
DPT-06 (18.9)
DPT-11 (44.2)
DPT-08
DPT-09 (10.4)
DPT-07

ESTIMATED EXTENT OF SOIL CONTAMINATION

7158 Market St.

APPROXIMATE GROUNDWATER CONTAMINATION PLUMES (REPORTED BY OTHERS)

MARKET STREET
US HWY 17
MIDDLE SOUND LOOP ROAD
SR 1403
77+00
25+00
-Y1-
-Y13-

QED QROS

Hydrocarbon Analysis Results

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios % light	Ratios % mid	Ratios % heavy	HC Fingerprint Match
s	DPT-01 (6') 0945	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	Background Organics
s	DPT-02 (5') 1005	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	V.Deg.PHC (FCM) (P)
s	DPT-03 (3') 1015	26.5	<1.3	<0.66	1.9	1.9	1.7	0.19	0.007	0	81	19	V.Deg.PHC (FCM) 78.1%
s	DPT-04 (2.5') 1025	24.5	3.9	3.9	0.65	4.55	0.62	0.07	0.005	86.4	8.7	4.9	Deg.Gas (FCM)
s	DPT-05 (2.5') 1030	26.3	<1.3	<0.66	0.43	0.43	0.41	0.05	<0.013	0	60.3	39.7	V.Deg.PHC (FCM)
s	DPT-06 (2.5') 1045	24.3	<1.2	<0.61	**18.9**	18.9	18	2.1	0.27	0	74.6	25.4	Pyrogenic HC (FCM) 60.5%
s	DPT-07 (3') 1120	24.1	<1.2	<0.6	3.8	3.8	3.6	0.39	0.018	0	82.7	17.3	V.Deg.PHC (FCM) 89.3%
s	DPT-08 (5') 1130	24.3	<0.61	<0.61	0.5	0.5	0.47	0.04	<0.012	0	0	100	Background Organics (FCM)
s	DPT-09 (3') 1150	23.6	<1.2	<0.59	**10.4**	10.4	10.2	1.2	0.12	0	81.1	18.9	Pyrogenic HC (FCM) 73.9%
s	DPT-10 (5') 1245	23.6	<1.2	<0.59	4.3	4.3	4.2	0.47	0.024	0	79.8	20.2	V.Deg.PHC (FCM) 69.6%
s	DPT-11 (3') 1300	23.4	<1.2	<0.59	**44.2**	44.2	42.1	4.8	0.34	0	79.6	20.4	V.Deg.PHC (FCM) 63.6%

Results in **bold** are greater than the 10 milligrams per kilogram (mg/kg) GRO and/or DRO State Action Level. Results generated by a QED HC-1 analyser.
Concentration values in mg/kg for soil samples. Soil values are not corrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.
The abbreviations are:FCM = Results calculated using Fundamental Calibration Mode : % =confidence for sample fingerprint match to library
(SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present

NOTE: 1. BASE DRAWING PROVIDED BY NCDOT.
2. ALL BORINGS, WELLS, & TREATMENT SYSTEM COMPONENTS ARE APPROXIMATE.
3. SLOPE STAKE LINE IS REFERENCED FROM SHT. 29, DATED 5/14/2015, AND IS APPROXIMATE.
* = UST ABANDONED IN PLACE.

LEGEND

(#) DIESEL RANGE ORGANICS RESULTS GREATER THAN 10 MG/KG

RENT WORSLEY REAL ESTATE, LLC DB 5305 PG 924

214

60" CMP

APPENDIX A

NCDENR GROUNDWATER INCIDENT FILE REVIEW INFORMATION

UNDERGROUND STORAGE TANK CLOSURE REPORT

The closure report should contain, at a minimum, the following information. Any other information that is pertinent to the site should be included.

I. General Information

LAT: 34°16'16"
LONG: 77° 49'56"

A. Ownership of UST(s)

1. Name of UST owner:

Worsley Companies, Inc.

2. Owner address and telephone number:

P. O. Box 3227
Wilmington, North Carolina 28406
(910) 395-5300

B. Facility Information

1. Facility name:

Scotchman #35

2. Facility ID #:

0-020168

3. Facility address, telephone number and county:

7158 Market Street
Wilmington, North Carolina 28405
(910) 686-4789
New Hanover County

C. Contacts

1. **Name, address, telephone number and job title of primary contact person:**

   Mr. Mitch Rose
   Environmental Manager
   Worsley Companies, Inc.
   P. O. Box 3227
   Wilmington, North Carolina 28406
   (910) 395-5300

2. **Name, address and telephone number of closure contractor:**

   Donald S. Bright II
   SEI Environmental, Inc.
   130 Penmarc Drive
   Suite 108
   Raleigh, North Carolina 27603
   (919) 832-2535

3. **Name, address and telephone number of primary consultant:**

   Donald S. Bright II, P.E.
   SEI Engineering and Geological Services, P.C.
   5100 N. I-85 Service Road, Suite 7A
   Charlotte, North Carolina 28206
   (704) 596-8624

4. **Name, address, telephone number, and State certification number of laboratory:**

   Environmental Science Corporation
   12065 Lebanon Road
   Mt. Juliet, Tennessee 37122
   (800) 767-5859
   Certification Number: 375

D. UST Information

Tank no.	Installation dates	Size in Gallons	Tank Dimensions	Last Contents	Previous Contents (if any)
1	1961	1,000	4' x 10.5'	Diesel	None known

E. Site Characteristics

1. **Describe any past releases at this site:**

   No past releases at the site.

2. **Is the facility active or inactive at this time? If the facility is inactive note the last time the USTs were in operation:**

   The facility is active although the diesel UST was inactive. The site is currently a convenience store which has three active UST's. Premium, mid-grade, and regular gasoline are sold at the site.

3. **Describe surrounding property use (for example, residential, commercial, farming, etc.)**

   The site is located at the southeastern corner of the intersection of Market Street and Middle Sound Loop Road, inside Wilmington city limits, in an area of mixed residential and commercial use.

4. **Describe site geology/hydrogeology:**

   The site is located in the Comfort and New Hanover Members of the Castle Hayne Formation of the Coastal Plain Physiographic Province. According to the Geologic Map of North Carolina (Brown, et al., 1985), the New Hanover Member is characterized by micritic and thin phosphate-pebble conglomerates. It is restricted to the basal part of the Castle Hayne Formation in southeastern counties of the state. The Comfort Member is characterized by bryozoen-echinoid skeletal limestone which is locally dolomitized and solution cavities are common

5. **Describe the results of the receptor survey (water wells, basements, etc. within 1,500 feet of the facility).**

   City of Wilmington Water Service reports that water is supplied to the area and residents are required to connect. A detailed receptor survey will be performed during the Limited Site Assessment if deemed necessary by NCDENR. Major water tributaries were not noted within 1,500 feet of the subject property. Subsurface structures with potential to contain explosive vapors were not located near the facility.

II. Closure Procedures

A. Describe preparations for closure including the steps taken to notify authorities, permits obtained and the steps taken to clean and purge the tanks.

Prior to the abandonment of the USTs, Notifications for Permanent Closure (GW/UST-3) were filed with the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management (DWM), Wilmington Regional Office by SEI (Appendix A). Verbal 24 hour notification was also provided to the DWM by SEI Environmental, Inc. (SEI). The local Fire Marshall was also notified and all proper fire permits were obtained. The USTs were emptied and purged with dry ice prior to abandonment procedures.

The USTs were purged of residual fumes and oxygen with dry ice. Once an oxygen level lower than 5% was obtained in a tank, the dry ice and any water remaining in the USTs were pumped out. The diesel UST was then filled with a concrete slurry to complete the abandonment. The diesel UST was abandoned in place on April 25, 2004.

B. Note the amount of residual material pumped from the tank(s):

Southeast Response & Remediation, Inc. removed a total of 136 gallons of residual diesel/water mixture prior to abandonment and removal.

C. Describe the storage, sampling and disposal of the residual material:

The residual diesel/water mixture was transported by Southeast Response & Remediation, Inc. to a recycling facility located in Wilmington, North Carolina. A material manifest is included in Appendix E.

D. Excavation

Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" on limiting excavations. The Trust Fund will not pay for excessive excavation unless it is justified and verified by laboratory results.

1. Describe excavation procedures noting the condition of the soils the dimensions of the excavation in relation to the tanks, piping and/or pumps:

The diesel UST was abandoned in place, therefore, no soil were excavated.

2. **Note the depth of tank burial(s) (from land surface to top of tank):**

   The diesel UST was buried approximately two feet below land surface (bls).

3. **Quantity of soil removed:**

   The diesel UST was abandoned in place, therefore, no soils were excavated or removed.

4. **Describe soil type(s):**

   Soil encountered while performing the soil borings was primarily tan to brown fine sand.

5. **Type and source of backfill used:**

   The USTs were abandoned in place, therefore, no backfill was needed.

E. Contaminated Soil

Note: Suspected contaminated soil should be segregated from soil that appears to be uncontaminated and should be treated as contaminated until proven otherwise. It should <u>not</u> be used as backfill.

1. **Describe how it was determined to what extent to excavate the soil:**

   No soil was excavated during the UST closure activities.

2. **Describe method of temporary storage, sampling and treatment/disposal of soil:**

   No soil was excavated or removed during the UST closure activities.

III. Site investigation

A. Provide information on field screening and observations, include methods used to calibrate field screening instrument(s):

Soil samples were collected and divided into two representative portions. The first portion of each sample was placed in a polyethylene bag for a minimum of five minutes to allow any petroleum hydrocarbons to volatilize. An flame ionization detection (FID) was used to screen the headspace of the bagged sample for volatile hydrocarbons. FID readings and depths of soil samples collected are presented in Table 1. The second portion of each sample was used to submit to the laboratory for analysis.

B. Describe soil sampling points and sampling procedures used, including:
Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" for information about sampling requirements.

On May 13, 2004, six soil samples (SB-1(6-7'), SB-2(6-7'), SB-3(6-7'), SB-4(6-7'), SB-5(6-7'), SB-6(6-7') were collected surrounding the UST pit. Additionally, soil samples SB-7(2-3'), SB-8(1-2')) were collected along the product line and the diesel dispenser respectively. The soil samples were collected utilizing direct push technology. On May 14, 2004, the samples were sent out for laboratory analysis.

Groundwater was encountered approximately eight feet bls during soil samples collection activities. Soil samples SB-1(6-7') through SB-6(6-7') were collected from the walls surrounding the UST pit at depths ranging from approximately six to seven feet bls. Soil sample SB-7(2-3') was collected underneath the product line at a depth between two to three feet bls. Soil sample SB-8(1-2') was collected underneath beneath the dispenser at a depth between one to two feet bls. Figure 3 shows the locations of these soil samples.

All soil samples were submitted for laboratory analysis by EPA method 8015 with both sample preparation 5030 (TPH as gasoline) and sample preparation 3550 (TPH as diesel).

C. Describe groundwater or surface water sampling procedures used, including:
Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" for information about sampling requirements.

Groundwater was encountered approximately eight feet bls during soil collection activities on May 13, 2004. No groundwater samples were collected.

D. Quality control measures

Soil samples were immediately placed in laboratory supplied glass containers, sealed with Teflon lined caps, and placed in an iced cooler. Samples were maintained at 4°C and submitted under chain-of-custody procedures to Environmental Science Corp. in Mt. Juliet, Tennessee, for laboratory analysis. Six soil samples surrounding the UST system and two samples along the product line and dispenser were collected on May 13, 2004, and submitted for laboratory analysis on May 14, 2004.

E. Investigation results

Analytical results indicate TPH as diesel was detected at concentrations above the DWM Reportable Concentration in three (SB-1(6-7), SB-2(6-7), and SB-8(1-2) of the eight soil samples collected at concentrations ranging from 210 milligrams per kilogram (mg/kg) to 2,500 mg/kg.

Analytical results indicate TPH as gasoline was detected at concentrations above the Division of Waste Management (DWM) Reportable Concentration in SB-1(6-7) and SB-2(6-7) of the eight soil samples collected at concentrations of 380 mg/kg and 13 mg/kg respectively. Analytical results are presented in Table 1 and shown in Figures 4. A copy of the laboratory analytical report and chain-of-custody form is included in Appendix F.

IV. Conclusions

Analytical results indicate TPH as diesel was detected at concentrations above the NCDWM Reportable Concentration in three of eight soil samples collected from around the UST system at Scotchman #35 in Wilmington, North Carolina, during the UST closure activities. Analytical results indicate TPH as gasoline was detected at concentrations above the NCDWM Reportable Concentration in two of eight soil samples collected during the UST closure activities. A 24-hour Release and UST Leak Reporting Form #61 was faxed on May 24, 2004. A Limited Site Assessment will be required to assess the groundwater quality at this site.

V. Signature of Professional Engineer or Licensed Geologist

Professional Engineer Registration #: 029421
Licensed Geologist License #:

Donald S. Bright II 6/15/04

Donald S. Bright II, P.E. Date
SEI Engineering and
Geological Services, P.C.
5100 N. I-85 Service Road, Suite 7A
Charlotte, North Carolina 28206

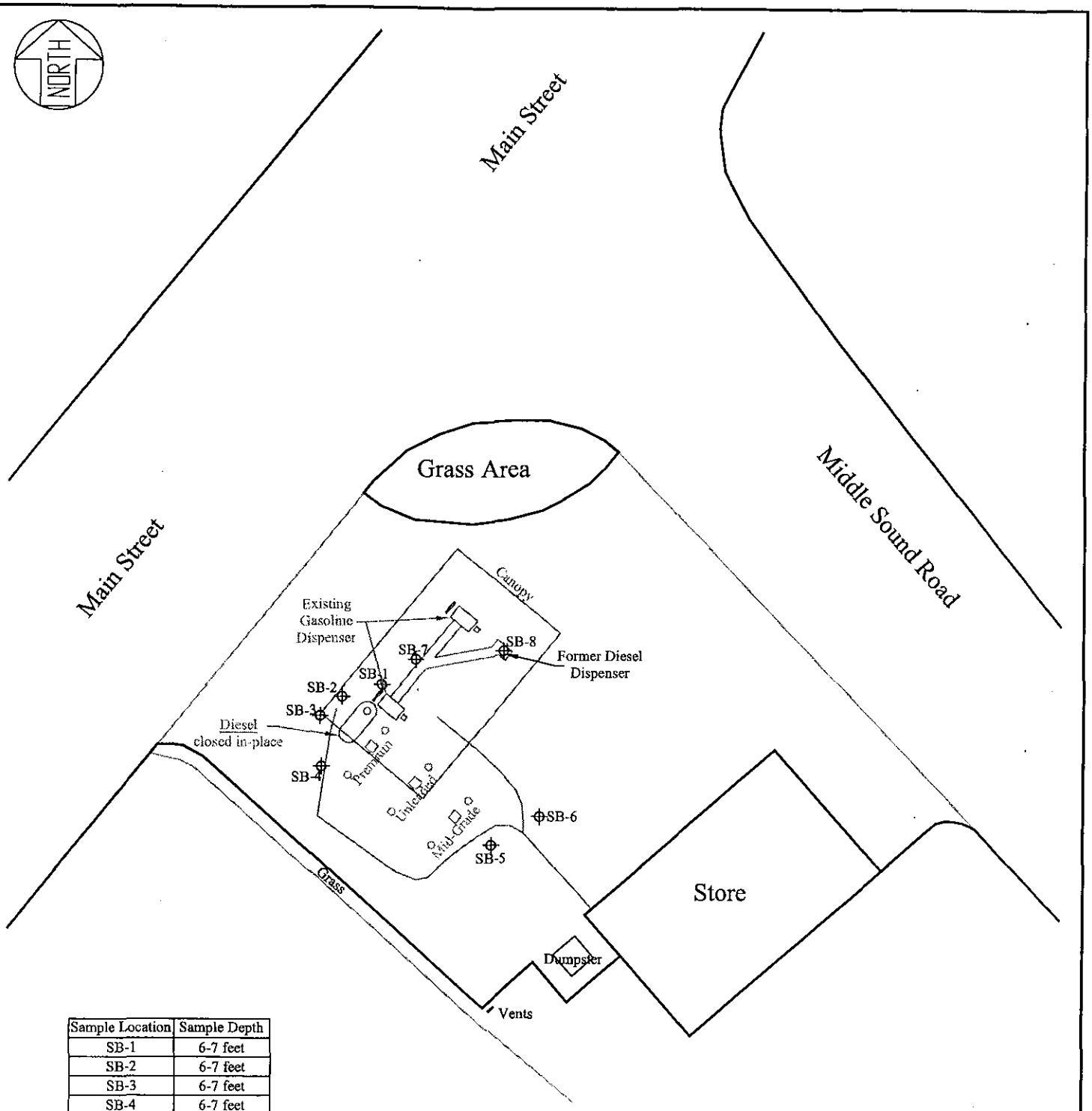
TABLE 1

Soil Sample Field Screening and Analytical Results

Scotchman #35
5158 Market Street
Wilmington, North Carolina 28405
Project Number 504745
Date Sampled: May 13, 2004

Sample Location	Sample Depth (feet)	FID Reading (ppm)	TPH as Gasoline (Method 5030) (mg/kg)	TPH as Diesel (Method 3550) (mg/kg)	Notes
SB-1	6-7	850	**380**	**2,500**	Pit Sidewall
SB-2	6-7	200	**13**	**210**	Pit Sidewall
SB-3	6-7	0	<0.53	<4.2	Pit Sidewall
SB-4	6-7	0	<0.54	<11	Pit Sidewall
SB-5	6-7	0	<0.52	7.9	Pit Sidewall
SB-6	6-7	5	<0.55	<4.4	Pit Sidewall
SB-7	2-3	2	<0.53	<10	Product Line
SB-8	1-2	18	<0.56	**980**	Dispense
NCDWM Reportable Concentrations			**10**	**10**	-----

ppm - parts per million
mg/kg - milligrams per kilogram
BDL – Below Detection Limit
NA – Not Analyzed
Bold denotes concentrations above the NCDWM Reportable Concentrations



Sample Location	Sample Depth
SB-1	6-7 feet
SB-2	6-7 feet
SB-3	6-7 feet
SB-4	6-7 feet
SB-5	6-7 feet
SB-6	6-7 feet
SB-7	2-3 feet
SB-8	1-2 feet

Scale: 1" = 30'

0 5 10 15 30 45 60

Legend:

SB-6 ⊕ Soil Sample Location

Pump Island and Canopy Support

Cathodic Lines

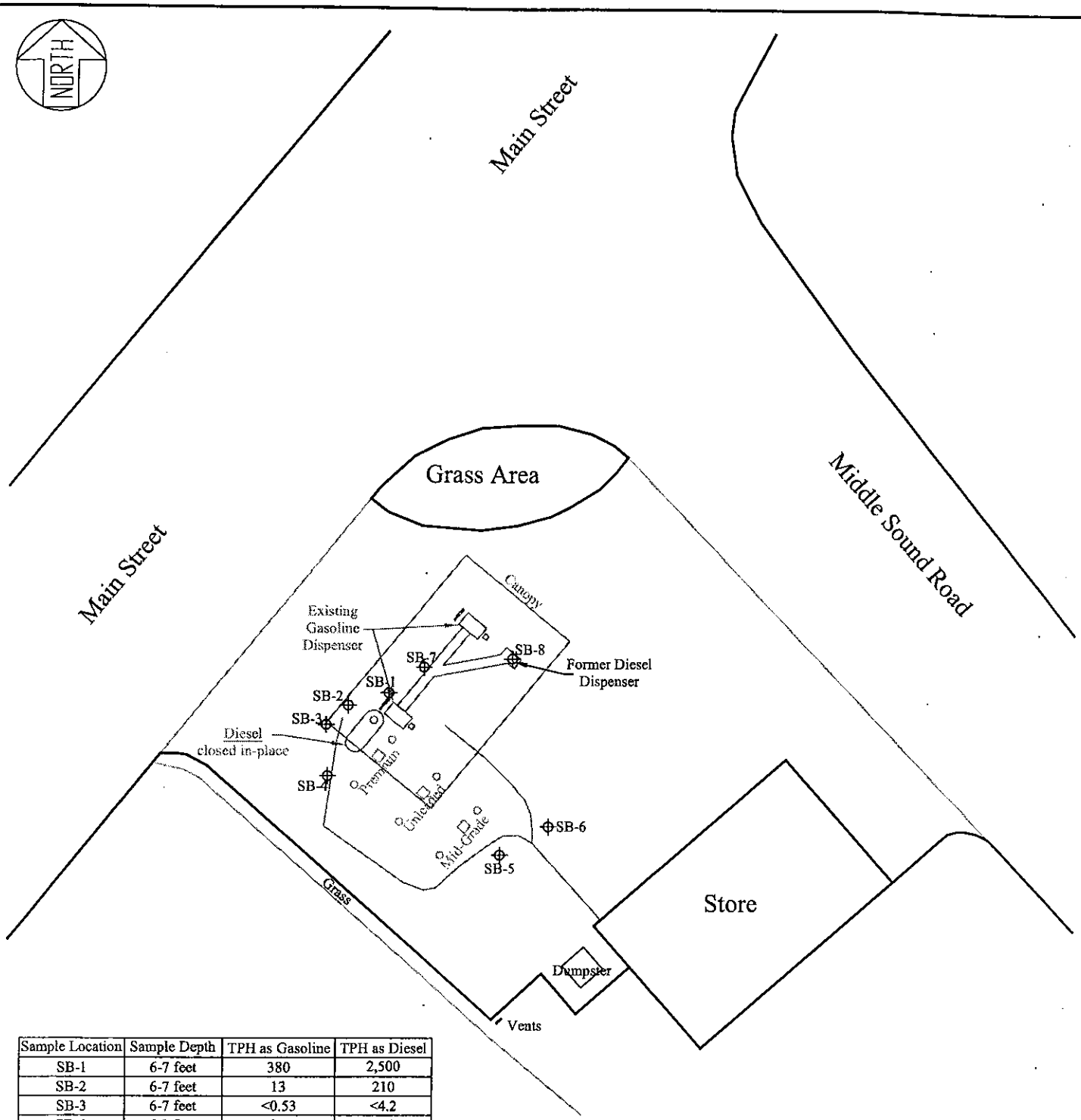
Property Lines

SEI Engineering & Geological Services, P.C.

5100 Reagan Dr., Suite 7A, Charlotte, NC 28206, Ph# 704-597-4022

FIGURE 3: SOIL SAMPLE LOCATION MAP
SCOTCHMAN #35
7158 MARKET STREET
WILMINGTON, NORTH CAROLINA

WO # 504745	DATE: 5/18/04
DWG # 4745-F4.dwg	DRAWN BY: DSB



Sample Location	Sample Depth	TPH as Gasoline	TPH as Diesel
SB-1	6-7 feet	380	2,500
SB-2	6-7 feet	13	210
SB-3	6-7 feet	<0.53	<4.2
SB-4	6-7 feet	<0.54	<11
SB-5	6-7 feet	<0.52	7.9
SB-6	6-7 feet	<0.55	<4.4
SB-7	2-3 feet	<0.53	<10
SB-8	1-2 feet	<0.56	980

Scale: 1" = 30'

0 5 10 15 30 45 60

Legend:

SB-6 ⊕ Soil Sample Location

Pump Island and Canopy Support

Cathodic Lines

Property Lines

SEI Engineering & Geological Services, P.C.

5100 Reagan Dr., Suite 7A, Charlotte, NC 28206, Ph# 704-597-4022

FIGURE 4: ANALYTICAL RESULTS MAP
SCOTCHMAN #35
7158 MARKET STREET
WILMINGTON, NORTH CAROLINA

WO # 504745
DWG # 4745-F4.dwg

DATE: 5/18/04
DRAWN BY: DSB

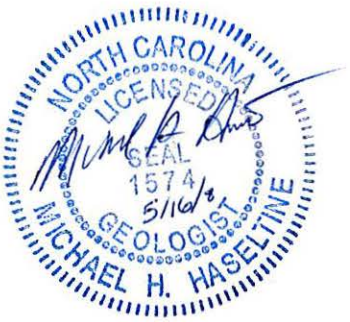
COMPREHENSIVE SITE ASSESSMENT REPORT

MAY 16, 2008

Site Name: Scotchman #35
Site Address: 7160 Market Street
Wilmington, New Hanover County, North Carolina
Facility I.D.: 0-020168
UST Incident Number: 32152
Site Priority Ranking and Reason: High – 287A
Water supply wells with 1000 feet of site
Land Use Category: Zoned B-2

UST Owner: Worsley Operating Corporation
Address: P.O. Box 3227
Wilmington, North Carolina 28406
Property Owner: Entrepreneur, Inc.
Address: P.O. Box 3227
Wilmington, North Carolina 28406

Consultant: Environmental Services & Solutions, PLLC
Address: P.O. Box 12055
Wilmington, North Carolina 28406
Telephone: (910) 343-1991



Release Information
Date Discovered: March 24, 2004
Latitude: 34.271944 North
Longitude: 77.818889 West
Estimated Quantity of Release: Unknown
Cause of Release: Unknown

UST Information:

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	1961	N/A
2	Gasoline	6,000	1961	N/A
3	Gasoline	4,000	1961	N/A
4	Diesel	6,000	1961	4/25/04

I, Michael Haseltine a Professional Geologist for Environmental Services & Solutions, PLLC, do certify that the information in this report is correct and accurate to the best of my knowledge.

EXECUTIVE SUMMARY

Environmental Services & Solutions, PLLC (ESS) was retained by Worsley Operating Corporation to prepare this Comprehensive Site Assessment Report (CSA) for the Scotchman #35 facility. This CSA was requested by the North Carolina Department of Environment and Natural Resources in a Notice of Regulatory Requirements (NORR) dated January 3, 2007.

Petroleum has been released through activities related to the facility's underground storage tank systems. The amount, exact source and duration of the petroleum release(s) is undetermined at this time. However, free product has not been encountered.

Noteworthy site assessment activities have included the following; the installation and sampling of ten Type II and one Type III monitoring wells, the advancement of 22 soil borings and the collection of samples from each, aquifer slug tests and evaluations from three monitoring wells, a receptor survey and revised receptor survey, a subsurface utility survey and, a fate and transport evaluation. This work is summarized in this report as well as the *Underground Storage Tank Closure Report* and *Limited Site Assessment Report*, both of which were prepared by SEI Engineering & Geological Services, P.C.

Petroleum impacted soil above Soil-to-Groundwater MSCCs appears to be limited to the dispenser area. Dissolved BTEX compounds, VPH, and EPH concentrations, exceeding 2L Standards, are the predominant petroleum-related constituents in groundwater at the subject facility. The highest contaminant concentrations were identified in monitoring wells MW-1 and MW-3. The absence of contaminants above 2L Standards in the Type III well (MW-2) and the close proximity and location of MW-2 to MW-1 indicates the vertical extent is defined. The absence of contaminants above 2L Standards in monitoring wells MW-6 through MW-11 indicate the horizontal extent is defined.

Dissolved petroleum impacted groundwater is defined within the surficial geology of the Coastal Plain province. The surficial aquifer is underlain by the Castle Hayne aquifer. The lithology of the site is defined by a silty fine to medium-grained sand. The hydraulic conductivity (3.14×10^{-4} cm/sec) as determined through aquifer tests, is consistent with the site material. Two anomalies exist within the site area. The first is an apparent dramatic change in both hydraulic gradient and potential groundwater flow direction beneath the Market Street right-of-way. The second anomaly is the current drought that has lowered groundwater elevations approximately 2 to 8 feet based upon comparison of the 2004 and 2007 site data. Both anomalies will affect contaminant fate and transport.

The site is not located within a state sanctioned Wellhead Protection Area. However, nine water supply wells were identified within 1,500 feet of the subject facility. The closest well is approximately 175 feet from the site. According to the City of Wilmington Engineer's Office, connection to the municipal water supply line is possible.

Significant pathways, such as underground utilities that intercept groundwater, have not been identified. At least four storm water retention ponds are located to the northwest and occur within a 1500-foot radius of the site. In addition, an unnamed tributary of the Howe Creek lies approximately 1,000 feet south of the site. The site is located in the New Hanover County business planning zone B-2 .

Fate and transport modeling and natural attenuation evaluation results provide strong evidence that biological degradation of the impacted groundwater at the site is a plausible remedial alternative. Therefore, a corrective action should be considered that includes periodic groundwater monitoring, active remediation of the source areas and impacted soil and active enhanced natural attenuation/bioremediation of the impacted groundwater.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLES

FIGURES

APPENDICES

COMPREHENSIVE SITE ASSESSMENT REPORT
FOR THE
SCOTCHMAN #35
7160 MARKET STREET
WILMINGTON, NORTH CAROLINA

Environmental Services and Solutions, PLLC (ESS) has prepared the following *Comprehensive Site Assessment Report* for the site referenced above on behalf of our client, Worsley Operating Corporation. This report has been prepared pursuant to Title 15A of the North Carolina Administrative Code (NCAC), Chapter 2, Subchapter 2L and in accordance with the *Guidelines for Assessment and Corrective Action*, provided by the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management (DWM), Underground Storage Tank (UST) Section, dated July 2001.

1.0 BACKGROUND INFORMATION

1.1 SITE HISTORY

The Scotchman #35 (herein referred to as the Site) is located at 7160 Market Street in Wilmington, New Hanover County, North Carolina. The topographic vicinity map of the surrounding area is provided as **Figure 1** and **Figure 2** is a site map depicting pertinent structures.

Presently, the site is an active retail motor fuel outlet and convenience store. There are presently three active USTs located on the property. The property is owned by Entrepreneur Inc., of Wilmington, North Carolina. Available data on the facility's UST systems are tabulated below.

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	4/16/1961	N/A
2	Gasoline	6,000	4/16/1961	N/A
3	Gasoline	4,000	4/16/1961	N/A
4	Diesel	1,000	4/16/1961	4/25/2004

On and around May 24, 2004, impacted soil was documented through laboratory analysis during activities related to the closure-in-place of the diesel UST system. The consultant at the time, SEI Engineering & Geological Services, P.C. (SEI) , completed and submitted the UST form *24-Hour Release and UST Leak Reporting Form* to the NCDENR office.

Documentation of the closure-in-place was provided in a *Underground Storage Tank Closure Report,* dated June 15, 2004 and submitted to the NCDENR Wilmington Regional Office (WiRO) by SEI.

SEI submitted a *Limited Site Assessment (LSA) Report*, dated December 29, 2004, to NCDENR, WiRO. In response to the findings presented in the *LSA Report*, the NCDENR classified the site as High Risk - H287A and issued a NORR (January 3, 2007) requiring WCI to conduct a Comprehensive Site Assessment (CSA). The *high-risk* classification was assigned due to the presence of a water supply wells located within 1000 feet of the confirmed release area. Additionally, the levels of groundwater contamination for benzene exceeded the Title 15A of the North Carolina Administrative Code, Chapter 2, Subchapter 2L, Section .0202 (2L Standards) Groundwater Quality Standards.

Free product has not been encountered on the site.

A copy of the referenced Division correspondence requesting a CSA is provided in **Appendix A**. The costs for completing CSA activities were approved in Task Authorization Numbers 32152-1, 32152-2, and 32152-3, copies of which are also included in Appendix A.

1.2 SOURCE CHARACTERIZATION

Source characterization has been defined through the advancement of soil borings and installation of groundwater wells and subsequent sampling activities as reported in the UST closure report and the LSA report. The former and current UST locations are depicted in **Figure 2**.

UST closure activities conducted in 2004 included the advancement of eight soil borings and the concurrent collection of eight soil samples, SB-1 through SB-8.

In 2004 SEI provided oversight of the installation of four shallow groundwater monitoring wells (MW-1, MW-3, MW-4, MW-5) and one telescoping monitoring well (MW-2). Additionally, after well installation, a groundwater sample was collected from each monitoring well. The groundwater samples were submitted to a North Carolina certified laboratory for analyses. One soil sample (SS-1) was collected for laboratory analysis.

As part of CSA activities in September 2007, Environmental Science and Solutions, PLLC (ESS) supervised and/or advanced over fourteen soil borings (SB-1, SB-1B, SB-2, SB-3, SB-3B, SB-4 through SB-14, and SB-14B) and subsequently collected samples from 14 locations. In addition, ESS directed the installation of six Type II monitoring wells (MW-6 through MW-11). A comprehensive groundwater sampling event was conducted in September 2007 that included field measurements and laboratory analysis of some natural attenuation parameters. A water sample was collected for laboratory analysis at the Jones Seafood restaurant in November 2007.

Laboratory analyses of soil samples collected during UST closure activities identified the presence of petroleum-related compounds in soil at SB-1, SB-2 and SB-8. Laboratory analyses of soil samples collected from the borings SS-1, SB-1B, SB-2, SB-4, SB-5, SB-6, SB-9, and SB-13 identified the presence of petroleum-related compounds in excess of Soil-to-Groundwater Maximum Soil Contamination Concentrations (STGW-MSCCs).

Laboratory analyses of groundwater sampled from monitoring wells MW-1, MW-3, MW-4, and MW-5 identified dissolved petroleum-related compounds above their respective 2L Standards.

2.0 RECEPTOR AND CONTAMINANT PATHWAY INFORMATION

SEI conducted a receptor survey in 2004 during LSA activities. ESS conducted an updated field survey and enhanced the detail of the survey during CSA activities.

2.1 WATER SUPPLY WELLS

In 2004, SEI conducted a survey to determine the location of water supplies located within a 1,500-foot radius of the subject facility. ESS conducted a survey update in 2007. Information was gathered through mail questionnaires, site reconnaissance and contacts with City of Wilmington and New Hanover County personnel.

Information collected during the mail-survey process is detailed below. Based on the responses received, the survey data have been summarized and are presented in **Table 1**. A water supply well location map is presented in **Figure 3** and is cross-referenced with **Table 1.**

- A total of 9 water supply wells were identified within a 1,500-foot radius of the subject site, eight of which occur within a 1000-foot radius.
- All properties can be connected to the City of Wilmington water supply or the New Hanover County water supply.
- Five of the nine wells are reportedly used for potable purposes.
- The subject facility is also connected to the municipal water system.

2.2 PUBLIC WATER SUPPLIES

Per conversations with the New Hanover County Engineers Office, public water in the vicinity of the site is furnished by New Hanover County and the City of Wilmington. The county water is furnished to residential developments to the west of Market Street. According to a telephone conversation with Mr. Jim Bonser of the City of Wilmington Public Utility Office and information obtained from that office, the City of Wilmington provides water north on Market Street to the approximate limits of the 1500-foot radius and the majority of properties east of Market Street. Mr. Bonser also indicated that connection to the municipal system is not mandatory but is currently available.

2.3 SURFACE WATER BODIES

At least four storm water retention ponds are located to the northwest and occur within a 1500-foot radius of the site. In addition, an unnamed tributary of the Howe Creek lies approximately 1,000 feet south of the site. Howe Creek is tidally influenced and drains into the Intercoastal Waterway.

2.4 WELLHEAD PROTECTION AREAS

At the time of this assessment, a designated wellhead protection area, as defined in 42 USC 300h-7(e), was not found to exist within 1,500 feet of the source area.

2.5 DEEP AQUIFERS AND REGIONAL GEOLOGY/HYDROGEOLOGY

The subject facility is located within the Atlantic Coastal Plain province. Overall, the Atlantic Coastal Plain slopes eastward at an average rate of less than three feet per mile. The coastal plain is basically flat in interstream areas, but is broken by low escarpments adjacent to stream valleys. New Hanover County is a relatively flat sandy plain with a relief ranging from mean sea level (MSL) to approximately 50 feet above MSL. The subject facility lies approximately 25 feet above mean sea level.

The Atlantic Coastal Plain province consists of two natural subdivisions, the Outer Coastal Plain (Tidewater Region) and the Inner Coastal Plain. The Tidewater Region is defined by land surface being less than 40 to 50 feet above mean sea level and its proximity to the coastline. The surficial aquifer within the Tidewater Region is composed of fine sand, silt, clay, shell, peat beds, and scattered deposits of coarser-grained material. West of the Tidewater Region, within the Inner Coastal Plain, the unconsolidated sediments of the surficial aquifer become coarser-grained and more poorly sorted. The subject facility lies within the Inner Coastal Plain.

Names of the North Carolina aquifers, located within the coastal plain, are generally taken from the predominant geologic formation with which an aquifer is associated. The lithology of each formation is significant with respect to the manner in which it will influence aquifer properties such as groundwater chemistry, hydraulic conductivity, groundwater velocity, and vertical movement.

The formations capable of yielding good water quality (potable water) are those not older than late Cretaceous. The deep, older formations generally contain water too salty for potable use. The potable water aquifers, lying within the late Cretaceous and younger sediments, are generally comprised of

imperfectly connected sand beds, limestone, to unconsolidated sediments of the surficial sands. Confining units also may be present, which separate the major aquifers. These confining units consist of clay beds or groups of clay beds and silt with varying amounts of sand. The lithology of a confining unit tends to retard the vertical exchange (movement) of groundwater between upper and lower aquifer systems.

As part of the Atlantic Coastal Plain province, New Hanover County has four predominant aquifer systems in the vicinity of the site. In descending order these include:

- Surficial aquifer comprised of Pleistocene and Pliocene age sediments;
- Castle Hayne aquifer with sediments generally of Eocene age;
- Pedee aquifer which is comprised of Late Cretaceous age sediments; and,
- Black Creek aquifer.

Specific aquifer information was obtained from the publication, *Hydrogeologic Framework of the North Carolina Atlantic Coastal Plain* (U.S. Geological Survey Professional Paper 1404-I. M.D. Winner, Jr. and R.W. Coble, 1996). The geological profiles were obtained from Borings #91 and #111 along cross-section L-L' of the publication. The site occurs between the borings.

The surficial aquifer and Castle Hayne aquifer are separated by the Castle Hayne confining unit and the Castle Hayne aquifer and Pedee aquifer are separated by the Pedee confining unit.

Generally, the surficial aquifer is of major importance due to its extended coverage throughout the Coastal Plain. Precipitation infiltrating this aquifer is responsible for the bulk of water recharging the Coastal Plain aquifer system. The surficial aquifer transmits water laterally to streams and serves as a source bed holding the water that moves down gradient to the deeper aquifers. The surficial aquifer occurs within approximately 5 to 20 feet below ground surface (bgs) in most areas of the county and yields sufficient water for domestic use.

Surficial aquifer sediments in the Tidewater Region were deposited under shallow marine or estuarine conditions. These consist of fine sand, silt, clay, shell, and peat beds, plus scattered deposits of coarser-grained material in the form of relic beach ridges and floodplain alluvium. The average thickness of the surficial aquifer in the Tidewater Region is approximately 38 feet. The aquifer is composed of 79 percent permeable material and has an estimated hydraulic conductivity of 35 feet per day.

The underlying Castle Hayne confining unit is composed of beds of clay, sandy clay, and clay with sandy streaks. Throughout much of the area, the Castle Hayne confining unit is thin, with an average thickness of about 14 feet, and contains enough sand to allow significant vertical movement between the surficial aquifer and the underlying Castle Hayne aquifer. The Castle Hayne confining unit contact was not defined in the borings.

The Castle Hayne aquifer is predominantly composed of limestone (including shell, dolomitic, and sandy limestone ranging from loosely consolidated to hard/crystallized) and sand with minor amounts of clay and was deposited under marine conditions. Sand bed intervals have varying carbonate content and range from fine to coarse grains, but are typically composed of fine to medium sand. Clay occurs as marl beds less than 10 feet thick or as a matrix in both sand and limestone beds. Typically, the upper portion of the Castle Hayne aquifer consists of limestone, while the lower portion is mainly sand.

The Castle Hayne aquifer is the most productive in North Carolina. Along its western margin, it occurs near land surface in New Hanover County and is exposed in many streams in the area. The aquifer is greater than 52 feet thick and contains approximately 64 percent permeable material. The estimated hydraulic conductivity is 65 feet per day.

The Peedee confining unit is overlain by the Castle Hayne aquifer in the area. The Peedee confining unit is approximately 28 feet in thickness and contains sediments with less than 15 percent permeability. The Peedee confining unit is composed of clay, silty clay and sandy clay and represents the Cenozoic-Mesozoic geological boundary.

The Peedee aquifer primarily occurs within the Peedee Formation. The Peedee Formation consists of fine to medium-grained sand interbedded with gray to black marine clay and silt. Glauconitic sand beds and thin beds of consolidated calcareous sandstone and impure limestone are interlayered in the sands in places. The Peedee aquifer is approximately 300 feet thick in the vicinity of the site and has an estimated hydraulic conductivity of 34 feet per day.

The Black Creek confining unit is overlain by the Peedee aquifer. The Black Creek confining unit is approximately 42 feet thick in the Wilmington area and contains sediments having less than 12 percent permeability. The Black Creek aquifer, overlain by the Black Creek confining unit, has a thickness of approximately 334 feet, and the estimated hydraulic conductivity is 25 feet per day.

In general, potable water is not captured from the aquifers located at depths beyond the Black Creek aquifer. These include the Upper Cape Fear and Lower Cape Fear Aquifers.

2.6 SUBSURFACE STRUCTURES

Information gathered by ESS personnel identified the presence several underground utilities in the vicinity of the site. These include water supply lines, sanitary sewer lines, and storm water lines.

The City of Wilmington has an 8-inch PVC water supply line, which services the vicinity of the site and is present on the east side of the Market Street right-of-way extending north through the 1500-foot radius. A branch of that line extends from Market Street to the southern side of the right-of-way of Middle Sound Loop Road. The depth of this line is reportedly at least 2 feet bgs.

Two eight-inch diameter sanitary sewer lines are present in the vicinity of the site with one with one line on each side of Market Street. Both lines are reportedly present in the North Carolina Department of Transportation right-of-way for Market Street but both reportedly terminate south of the site. The sanitary sewer lines are reportedly constructed to a depth ranging from approximately seven to 10 feet bgs.

A reinforced concrete storm water pipe is located approximately 500 hundred feet south of the site and provides storm water control southward. The pipe ranges in diameter from 15 to 24-inches and is constructed with an invert depth of approximately 6 feet below ground surface.

2.7 LAND USE

The Market Street business corridor is primarily zoned by New Hanover County as B-2. The B-2 Highway Business District is a heavy commercial zoning. Its purpose is to provide for the proper grouping and development of business uses which best accommodate the needs of the motoring public with a regional orientation. Residential developments to the west of Market Street business corridor are

zoned residential R-10 and R-15 and to the east are zoned residential R-15 and R-20. The zoning boundaries are provided in **Figure 3**.

2.8 ADJACENT PROPERTY OWNERS AND OCCUPANTS

The names and addresses of owners having properties located adjacent or contiguous to the subject facility are presented in **Table 2**. The property locations can be cross-referenced with **Table 1** and **Table 2** and the map presented in **Figure 3**.

3.0 COMPREHENSIVE SITE ASSESSMENT METHODOLOGY

The Comprehensive Site Assessment (CSA) activities, performed to collect data for this report, included researching site-specific, local and regional data, UST closure activities, monitoring wells installation, soil and groundwater sampling, and aquifer evaluations. The following sections discuss specific methodologies used in performance of the CSA activities.

3.1 SOIL SAMPLING

On May 13, 2004, as part of the UST closure activities, soil sampling was performed by SEI with respect to the former diesel UST system. Samples SB-1 through SB-6 were collected at six to seven feet below ground surface (bgs). Samples SB-7 (2-3 feet bgs) and SB-8 (1-2 feet bgs) were collected along the product line and dispenser, respectively. All soil samples were submitted for laboratory analysis by EPA Method 8015, Total Petroleum Hydrocarbons (TPH) with both sample preparation 5030 (gasoline) and 3550 (diesel). The soil samples were collected using direct push technology.

Soil sampling during LSA activities in September 2004 included the collection of sample SS-1 (MW-1) at a depth of five to seven feet bgs. The sample was submitted to a laboratory for analysis by EPA Method 8260B and 8270C and Massachusetts Department of Environmental Protection Methods for volatile and extractable petroleum hydrocarbons (MADEP VPH and EPH, respectively).

During CSA activities, on September 20, 2007, Geologic Exploration, Inc. of Statesville, North Carolina, on behalf of ESS advanced 11 soil borings (SB-1 through SB-9, SB-1B and SB-3B). ESS personnel obtained nine soil samples (i.e. SB-1B, SB-2, SB-3B, and SB-4 through SB-9) at depths of six to seven feet bgs. It should be noted that refusal was encountered at boring locations SB-1 and SB-3 at shallow depths so additional borings were installed in the vicinity of prior sampling locations. All soil samples were obtained using Geoprobe direct push sampling equipment including a three feet long split spoon sampler with a clear plastic liner. Prior to each location, the split spoon sampling equipment was properly deconned to prevent cross contamination.

Based on the results of soil samples collected from prior CSA soil sampling activities, ESS personnel advanced five additional soil borings (i.e. SB-10 through SB-14) on February 29, 2008. These soil samples were obtained utilizing a hand auger which was deconned prior to each sampling location.

All soil samples were placed in laboratory-supplied jars, sealed, labeled, and set on ice for delivery to Environmental Science Corp. of Mt. Juliet, Tennessee, NC Laboratory Certificate Number ENV375. The soil samples were inventoried on the chain-of-custody documents and delivered to the project laboratory for analyses by EPA Methods 8260B and 8270C as well as MADEP Methods for VPH and EPH. In addition, samples collected at SB-8, MW-6 and MW-7 were analyzed for Fraction of Organic Carbon by method D2974.

The boring logs are provided in **Appendix B**. The soil sample locations are depicted in **Figure 4**. Analytical results for the CSA soil samples are discussed in Section 5.1.

3.2 MONITORING WELL INSTALLATION

In 2004, SEI provided oversight of the installation of four shallow groundwater monitoring wells (MW-1, MW-3, MW-4, MW-5) and one Type III telescoping monitoring well (MW-2) at the subject facility. The shallow wells were constructed to a depth of 20 feet bgs. The screened interval of monitoring well MW-2 is 25 to 30 feet bgs.

As part of CSA activities in September 2007, ESS provided oversight for the installation of six Type II monitoring wells, MW-6 through MW-11. These wells were installed as part of the CSA activities to assist in delineating the dissolved petroleum hydrocarbon plume identified earlier during the LSA. These shallow wells were constructed to a depth ranging from 14 to 20 feet bgs.

The Type II monitoring wells installed during CSA activities were constructed in accordance with well construction standards, as specified in 15A NCAC 2C. All shallow monitoring wells were installed using hollow-stem auger drilling equipment. The wells were constructed with two-inch diameter well casings made of flush-joint, threaded schedule-40 PVC. The PVC well screens are 0.010-inch slot with screened intervals of 10 to 15 feet. A coarse sand pack (filter pack) was used to backfill the well annuli to a depth averaging approximately one-foot to two feet above the shallow well screens. A six-inch to one-foot thick bentonite seal was placed above the filter packs, and neat cement was used to fill the remainder of the well annuli to ground surface.

Construction of the Type III well was conducted by SEI. The construction included the installation of a six-inch diameter, schedule 40 PVC outer casing using the hollow-stem auger drilling method. The casing was set at 20 feet bgs. A two-inch diameter, schedule 40 PVC inner well casing and 0.010-inch slot PVC well screen were installed using the mud rotary drilling method. The total well depth is 30 feet bgs with a five-foot screened interval from 25 to 30 feet bgs.

The filter pack for the deep well was placed in the well annulus to seven feet above the well screen. A three-foot-thick bentonite seal was placed above the filter pack, and neat cement was used to fill the remaining 19 feet of well annulus to ground surface.

All wells were installed as flush-mounted and were provided with sealing and locking caps. Protective manhole-type covers were placed over each well upon completion. The well construction records, as-built details, and boring logs are provided in **Appendix B**.

3.3 GROUNDWATER SAMPLING

As part of the LSA field activities, groundwater samples were collected by SEI from monitoring wells MW-1 through MW-5 on October 4, 2004.

ESS personnel collected groundwater samples from wells MW-1 through MW-11 on September 24, 2007. At the time of sample collection, the water levels were recorded for each well utilizing an oil/water interface probe. Prior to sample collection, the respective well volumes were calculated, and a minimum of three well volumes was purged from each well column to ensure replacement of stagnant water with representative formation water. A water sample was also collected from the water supply well at Jones' Seafood Restaurant in November 2007.

The samples from the monitoring wells were collected using a disposable, high-density polyethylene (HDPE) bailer and nylon chord. The samples were slowly poured from the bailers into laboratory-supplied containers, and the containers were sealed, labeled, and immediately placed on ice for delivery to Environmental Science Corp. of Mt. Juliet, Tennessee, NC Laboratory, Certificate Number ENV375. The groundwater samples from monitoring wells MW-6 through MW-11 were inventoried on the chain-of-custody documents and submitted to the laboratory for analyses EPA Method 602 with methyl tertiary butyl ether (MTBE) and isopropyl ether (IPE), EPA Method 625 plus ten most prominently identifiable peaks, as well as MADEP Methods for VPH and EPH. The groundwater samples from monitoring wells MW-1 through MW-5 were inventoried on the chain-of-custody documents and submitted to the laboratory for analyses EPA Method 602 with MTBE, IPE, and naphthalene. The analytical results are discussed in Section 5.2.

Samples from monitoring wells MW-1, MW-3, MW-6, MW-7, MW-8, and MW-9 were also submitted for analysis of natural attenuation parameters including nitrate and sulfate by Method 9056. Natural attenuation parameters were also measured from all monitoring wells using a Horiba Water Quality monitor. Natural attenuation parameters included pH, specific conductivity, dissolved oxygen (DO), temperature and oxidation reduction potential (ORP).

The sample from the water supply well inventoried on the chain-of-custody documents and submitted to the laboratory for analyses EPA Methods 602 with MTBE and IPE, 625 plus ten most prominently identifiable peaks, and MADEP Methods for VPH and EPH. The results are provided in Section 7.1.

3.4 FREE PRODUCT ASSESSMENT

Free product was not encountered during assessment activities at the subject facility. ESS personnel utilize oil/water interface probes to measure depth to groundwater.

3.5 HYDROGEOLOGIC AND AQUIFER EVALUATION

On April 29, 2008, ESS personnel performed aquifer slug tests in shallow monitoring wells MW-5, MW-7, and MW-10. The equipment employed during these tests included an In-Situ, Inc. Level Troll 700 pressure transducer and data logger accompanied with the In-Situ, Inc. RuggedReader (Personal Digital Assistant - PDA), and an electronic water level meter.

The tests were generally performed in accordance with standard industrial practices as provided in ASTM D4404-96. An initial water level reading was gained from each test well using an electronic water level meter. To ensure atmospheric equilibration, a follow-up reading of the test well provided an identical water level reading following a period of time. The Level Troll was connected to the transducer line and lowered into the monitoring well intersecting the lower portion of the test well's screened interval. A clean disposable bailer was then lowered into the well. Prior to activating the PDA a water level was collected to ensure water displaced by both the transducer and bailer had recharged the aquifer. The initial start-up water level was typically within a couple of hundredths of a foot from the original water level readings. The bailer was quickly removed and the logging was initiated through the PDA. The PDA allowed real time observation of water level data and the test was terminated following the collection of sufficient data. Data was typically collected at 1 second intervals. Three wells were evaluated at this site with two to three trials per well.

Details and analysis of the slug test results and the aquifer characteristics evaluation are presented in Section 4.4. The data is provided in **Appendix C**.

4.0 SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

Field assessment methodologies performed for the CSA were initiated, in part, to obtain information useful in evaluating the relationship between the area's geology/hydrogeology and the potential for migration of petroleum-related contaminants. The following discussion represents the results of the CSA activities performed to obtain data for this purpose. It is important to note that the information provided in the U.S. Geological Survey, Professional Paper 1401-I, *Hydrogeologic Framework of the North Carolina Coastal Plain*, 1996) regarding the area in the vicinity of the site did not define the Castle Hayne confining unit. Therefore, the surficial aquifer may be directly underlain by the Castle Hayne aquifer.

4.1 SHALLOW SUBSURFACE GEOLOGY

The site occurs on the boundary of the Leon Sand (LE) and Kureb (Kr) sand as defined by the Department of Agriculture (now Natural Resources Conservation Service). The Leon Sand occurs on level elevations and it is typically poorly drained soil found on rims of depressions, on smooth flats and occurs as indefinite patterns on uplands and stream terraces. The profile, in descending order, consists of the following; 3-inches of dark gray sand, 13-inches of light gray sand, 24-inches of dark reddish brown sand, and 64-inches of light gray sand.

The Kureb Sand (Kr) occurs on slopes of 1 to 8 percent. It is excessively drained soil is on long broad undulating ridges and uplands. Permeability is high and available water capacity is very low. Additionally, infiltration is moderate and runoff is slow. The profile for this sand, in descending order, consists of the following; 3-inches of dark gray sand, 23-inches of light gray sand, and 89-inches of brownish yellow sand in the upper portion and pale brown sand in the lower portion. (*U.S. Department of Agriculture: Soil Conservation Service, Soil Survey of New Hanover County, North Carolina, 1997).*

Based upon the soil boring data reported SEI and observations by ESS during the monitoring well and soil boring advancements, the surficial geology generally of a fine to medium-grained silty sand ranging in color from light gray to dark brown. Boring logs are presented in **Appendix B**. Based upon the site specific data collected by SEI during the monitoring well installations all monitoring wells, including well MW-2, the Type III well did not penetrate the surficial aquifer.

4.2 GROUNDWATER OCCURRENCE AND FLOW DIRECTION

On October 4, 2004 SEI reported the depth to water in the range of approximately 7 to 10 feet bgs. On September 24, 2007 ESS measured groundwater at depths ranging from approximately 8 to 15 feet bgs. The effect of the regional drought on the surficial aquifer is observed in the difference in the occurrence of depth to water measurements. The Type III well, MW-2, also exhibited a lower groundwater elevation, however, this well is screened in the same water bearing zone as the Type II wells.

Upon review of the Scotts Hill Quadrangle topographic map (7.5 minute series topographic map, U.S. Geological Survey –USGS), the surficial groundwater in the vicinity of the site would be expected to flow in a south-southeasterly direction and mimic surface topography. Contrary to expectations, data reported in the LSA by SEI in October 2004 and data obtained by ESS in during September 2007 reflect potential groundwater flow toward the north and west. Monitoring wells MW-8 and MW-9 were installed on the west side of the Market Street right-of-way and approximately 75 feet from the site boundary. The groundwater elevations of these wells are slightly higher than those wells (MW-1, MW-2, MW-3, MW-5, and MW-11) along the western site boundary. This is consistent with expected regional groundwater flow toward the south and southeast. A summary of water table elevation data is presented in **Table 3**. Groundwater elevations have been derived from the water table elevation data collected during the comprehensive sampling event of September 2007 and are presented on **Figure 5**.

4.3 VERTICAL MOVEMENT

Water table elevations of the Type III well, MW-2, and the other shallow Type II wells do not indicate a significant potential head difference. In fact, comparison of the groundwater elevation of MW-1 with MW-2, located only a few feet away, indicate a difference in head of only 0.01 feet. This provides evidence that the surficial aquifer is not recharging deeper water bearing zones.

4.4 AQUIFER CHARACTERISTICS

On April 29, 2008, ESS personnel performed slug tests in shallow monitoring wells MW-5, MW-7, and MW-10. The slug test field data were combined with the Bouwer and Rice equation using the Super Slug™ aquifer slug test analysis for Windows™. The Bouwer and Rice equation is expressed as:

$$K = \frac{r_c^2 \, ln\,(R_e / r_w)}{2 L_e} \frac{1}{t} ln \frac{h_0}{h_t}$$

Where:

K= Hydraulic Conductivity (ft/day)
r_c = well radius (inside blank casing)
R_e = effective radial distance over which the head difference y is dissipated
r_w = borehole radius, including filter pack
L_e = saturated screen length
h_0 = head at time 0
h_t = head at time t
t = time since h_0

The resulting hydraulic conductivity values (K) for the tested shallow wells are:

MW-5 = 5.13×10^{-5} cm/sec (mean)
MW-7 = 2.28×10^{-4} cm/sec (mean)
MW-10 = 5.76×10^{-4} cm/sec (mean)

Range of hydraulic conductivity = 3.19×10^{-5} cm/sec to 1.30×10^{-3} cm/sec
Mean hydraulic conductivity = 3.14×10^{-4} cm/sec
Median of hydraulic conductivity = 2.05×10^{-4} cm/sec

Transmissivity for the water table aquifer (shallow wells) was calculated according to:

$T = Kb$

Where :

T = Transmissivity (ft^2/day)
K = Average Hydraulic Conductivity (3.14×10^{-4} cm/sec or 0.89 ft/day)
b = Average Aquifer Thickness (30 ft)

The transmissivity value (T) is: 26.7 ft^2/day

The groundwater seepage velocity (water table aquifer) at the subject facility was calculated according to Darcy's Law, defined as:

$$V = K \bullet \underline{i} \ / \ n_e$$

Where:

V = Groundwater Velocity (ft/day)
K = Average Hydraulic Conductivity (0.89 ft/day)
i = Hydraulic Gradient (0.11 ft/ft)
n_e = Effective Porosity (0.401, dimensionless)

The hydraulic gradient (i) of the facility's surficial aquifer was determined from the water table contour map presented in **Figure 5**. The hydraulic gradient is the difference in head between contour lines, divided by the distance between them. The surficial aquifer (screened interval) at the facility is predominantly silty sand, having an approximate effective porosity (n_e) of 0.401 (*Transactions of the ASCE Soil & Water Division Paper*, Rawls, Brakensiek, Saxton, 1982 and *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, Freeze and Cherry, 1979). Having obtained the hydraulic conductivity, hydraulic gradient, and effective porosity, the groundwater seepage velocity is estimated at:

V = 0.25 ft/day

The calculated hydraulic properties for monitoring wells MW-5, MW-7, and MW-10 are indicative of the area immediately adjacent to the tested wells and may not reflect conditions throughout the surficial aquifer in the region.

These calculations only represent on-site conditions. The groundwater characteristics off-site and to the west are largely undefined. An apparent dramatic change in hydraulic gradient and potential groundwater flow direction lies beneath Market Street and has not been defined. This anomaly will affect the fate and transport of the fugitive petroleum.

4.5 EFFECTS OF SUBSURFACE STRUCTURES ON GROUNDWATER FLOW

The effects of subsurface structures on local hydrogeology are anticipated to be minimal based on their reported depths of burial in proximity to the source area observed depth to groundwater measurements.

5.0 ANALYTICAL RESULTS

The following sections discuss results of the analytical data as related to site-specific conditions encountered during the assessment.

5.1 SOIL SAMPLING RESULTS

Eight soil samples, SB1 through SB-8, were collected during the UST closure activities from the vicinity of the closed-in-place diesel UST. Petroleum hydrocarbon concentrations as TPH gasoline exceeded the Reportable Concentrations (10 mg/kg) in samples SB-1 and SB-2. Petroleum hydrocarbon concentrations as TPH diesel exceeded the Reportable Concentrations (10 mg/kg) in samples SB-1, SB-2, and SB-8. A summary of analytical results for soil samples collected during UST closure activities is presented in **Table 4.**

One sample collected during LSA activities, SS-1 exceeded the Soil-to-Groundwater MSCCs for benzo(a)anthracene, benzo(b)fluoranthene, and benzo(a)pyrene.

The laboratory results of the fourteen soil samples collected during CSA activities indicated the presence of benzene, toluene, ethyl benzene and total xylenes (collectively referred to as BTEX), specific Method 8260 compounds, and MADEP VPH aromatics and aliphatic compounds above Soil-to-Groundwater MSCCs in samples SB-1B, SB-2, SB-4, SB-6, SB-9, and SB-13. In addition, MADEP EPH aliphatic compounds were detected above Soil-to-Groundwater MSCCs in sample SB-1B. Trichloroethene was detected above Soil-to-Groundwater MSCCs in samples SB-1B, SB-2, SB-4, SB-6, and SB-13.

Concentration contours for petroleum-related compounds in the unsaturated soil are presented in **Figure 4**. A summary of analytical results for soil samples collected during the Comprehensive Site Assessment activities is presented in **Table 5**. The laboratory report is provided in **Appendix D**.

5.2 GROUNDWATER SAMPLING RESULTS

Laboratory results of groundwater samples collected identified the presence of dissolved petroleum-related compounds at concentrations which exceeded respective 2L Standards, in monitoring wells MW-1 MW-3, MW-4, MW-5. The identified compounds included BTEX, lead, and VPH and EPH aliphatic and aromatic compounds. Dissolved petroleum hydrocarbons in groundwater samples collected from the remaining wells were either below 2L Standards or below their respective method detection limits (MDL). Lead was detected above its 2L Standard in monitoring well MW-1. MTBE was detected above its 2L Standard in monitoring well MW-5.

An order of magnitude decrease can be observed in the Method 602 compounds between the 2004 and 2007 sampling event. This could be the result of the removal of a former source (former diesel UST system). However, the regional drought condition likely caused a dramatic lowering of the surficial water table. Coincidentally, the physical and chemical interaction of the water table with the substantially impacted soil would cease and result in lower contaminant concentrations in the groundwater.

The vertical extent of impacted groundwater is defined by the absence of contaminants above standards in the Type III monitoring well, MW-2. It should be noted that this well is constructed in the same water bearing zone as the shallow wells.

A tabulated summary of the analytical results is presented in **Table 6** and **Table 7**. Results of the sample collected from the water supply well at Jones' Seafood Restaurant did not indicated the presence of detectable levels of petroleum contamination and these results are provided in **Table 8**. The estimated horizontal extents of benzene, total BTEX compounds, and combined VPH and EPH compounds and are depicted in **Figure 6, Figure 7, and Figure 8**, respectively. The laboratory reports are provided in **Appendix D**.

6.0 GEOLOGIC CROSS-SECTIONS

Cross-sections were developed to assist the interpretation of the site geology and approximate extent of the impacted soil and groundwater. The specific geologic interpretation noted by each individual was directly transferred to the cross-sections. Some variation in interpretation likely occurred between the consultants and their subcontractors. The immediate surficial aquifer generally consists primarily of a silty, fine to medium-grained sand. A continuous confining unit or other prominent feature was not observed. The cross-section locations are provided in **Figure 9**. Cross-section A-A' is provided as **Figure 10** and B-B' is provided as **Figure 11.**

7.0 CONTAMINANT FATE AND TRANSPORT MODELING

The prediction of contaminant fate and transport is an integral part of any risk-based corrective action or natural attenuation evaluation. Natural attenuation, or intrinsic remediation, involves the passive reduction of contaminant concentrations by physical and intrinsic microbial processes. Physical attenuation of contaminants includes the processes of volatilization, dispersion, and sorption onto aquifer matrix materials. These processes tend to reduce or "attenuate" the concentrations of petroleum contaminants in ground water but do not affect their chemical composition and toxicity. It is reasonable to believe that dispersion is ongoing at the site because it is a process inherent to the flow of a solute through a porous medium. Additionally, ground water isoconcentration maps illustrate a plume that is indicative of groundwater flow processes.

Biological processes also have the capacity to degrade BTEX compounds. Aerobic microbial growth utilizes oxygen for an electron source and the organic carbon (contaminant) as a food source. However, a longer time frame may be required before contaminant concentrations are reduced to below ground water standards via natural attenuation.

Fate and transport prediction involves the following four basic steps: 1) data compilation and evaluation, 2) model selection and set-up, 3) calibration and sensitivity analysis, and 4) prediction.

7.1 DATA COMPILATION AND EVALUATION

The data used for modeling purposes was taken directly from the CSA, previous reports, and various published sources for the ground water parameters. The field measured, site-specific parameters include hydraulic conductivity, hydraulic gradient, source contaminant concentrations, plume dimensions and natural biodegradation indicators.

Uncertain parameters (those not measured directly) include effective porosity, soil bulk density, partition coefficient, diffusivity, and solute half-life. Certain and uncertain parameter values and ranges of typical values used as the model conditions are summarized in **Table 9**.

In September 2007, natural attenuation indicators including field measurements and ground water samples for laboratory analysis were collected. The field measurements included dissolved oxygen (DO), pH, temperature, specific conductivity, and oxidation/reduction potential (ORP). Laboratory analyses included nitrate-N, total sulfate, and fraction of organic carbon.

Natural Attenuation field measurements and laboratory results were evaluated by comparison of the background wells and the plume wells. The plume area was defined by monitoring wells MW-1, MW-3, MW-4, and MW-5. The background area was defined by wells MW-2, MW-6, MW-7, MW-8, MW-9, MW-10, and MW-11. Evidence of natural attenuation through biological activity is highlighted by the significant difference of DO readings between the background mean (3.29 mg/l) and plume (1.22 mg/l). Confirmation of biological activity is the striking difference between the plume area mean ORP (-226.5 mV) and the background area mean of 76.29 mV. Nitrate occurs below the method detection limits (MDL) of 0.10 milligrams per liter (mg/L) within the plume area wells and a mean of 1.12 mg/L occurs within the background area wells. The greatly depressed ORP, DO, and absence of nitrate, relative to the background wells, provide clear evidence of a biologically induced anaerobic and anoxic environment within area of impacted groundwater.

A summary of the results are provided in **Table 10.** The results of the comparison are summarized in **Table 11**. The laboratory analyses are included in **Appendix D**.

7.2 MODEL SELECTION AND SETUP

An attempt to employ the two dimensional groundwater model *BIOPLUME III* was unsuccessful due to problems with the software which could not be resolved in a timely manner by the software provider. Consequently, the model selected was *BIOSCREEN, Natural Attenuation Decision Support System, Version 1.4. BIOSCREEN* is a Domenico-based, one-dimensional analytical solute transport model developed for the Air Force Center for Environmental Excellence (AFCEE). The model was designed to simulate advection, dispersion, adsorption, as well as aerobic and anaerobic decay at petroleum release sites.

Model output can be generated for three different fate and transport scenarios: 1) solute transport without decay, 2) solute transport with first order decay, and 3) solute transport with instantaneous biodegradation reaction. The solute transport without decay is a conservative estimation of the contaminant transport based upon dispersion, advection, and adsorption. The first order decay simulation is a conservative estimation method that assumes a constant decay rate throughout the plume without consideration of the availability of electron acceptors. The instantaneous biodegradation reaction simulation incorporates the availability of electron acceptors as well as dispersion, advection, adsorption, and decay.

7.3 ASSUMPTIONS AND LIMITATIONS

The applicability of this type of model to varying hydraulic conditions is limited. A one-dimensional model cannot approximate the flow or transport effect of aquifer boundary conditions from recharge, impermeable barriers, or surface water. In addition, this model cannot anticipate vertical flow or transport.

The simulations presented herein utilized the first order decay. Benzene was selected for the model simulations. Benzene was applied to the simulations because of its inherent toxic characteristics and consistent occurrence above 2L standards. In addition, benzene exhibits a propensity to migrate within the subsurface environment. Based upon current information, the horizontal extent of the impacted ground water is no greater than 120 feet from the source area(s).

A dramatic change of hydraulic gradient that occurs between the western perimeter site wells, MW-3, MW-2, MW-1, MW-5, and MW-11 and across Market Street to monitoring wells MW-8 and MW-9. This modeling does not include simulation beneath Market Street and locations further west due to insufficient data.

For the purpose of this modeling effort, the source of the dissolved-phase petroleum was assumed around the northern end of the dispenser area. Review of the historical laboratory results indicated possible release areas from beneath the western side of the dispenser area that includes part of the former diesel UST and current USTs. The laboratory results and subsequent interpretation of the comprehensive sampling event of September 2007 were employed for the initial simulation concentrations and final calibration concentrations.

The volume of petroleum released and the date and duration of the release is unknown. The three currently registered USTs storing gasoline were installed in 1961. The presence of MTBE indicates a release has occurred since its introduction in the late 1970's. Impacted soil has been documented within the dispenser area. The mass and duration of petroleum released to the environment is unknown. For the purpose of this modeling, the residual soluble mass within the soil source area was estimated as 100 kilograms (kg). The source concentration in groundwater was estimated at 500 ug/L.

As provided in the *BIOSCREEN* program, the dispersivity coefficients were calculated by the model from established algorithms that associate the plume length to longitudinal dispersivity, ratio of longitudinal to transverse dispersivity, and ratio of transverse to vertical dispersivity. Please note the Center for Subsurface Modeling Support (CSMoS) comments regarding limitations of *BIOSCREEN* (**Appendix E).** Based upon the CSMoS guidance, dispersivity coefficients may add error to the predictions within relatively impermeable aquifers and should not affect this simulation.

7.4 CALIBRATION

The goal of the calibration step is to refine the model through the modification of uncertain parameters to best simulate site-specific conditions. Those parameters were varied within an established range of values provided in published technical sources. Typical calibration of three-dimensional models include variation of parameters such that the results occur within an acceptable residual value and residual standard deviation.

The model calibration involved the adjustment of benzene solute half-lives using *BIOSCREEN.* The calibration was conducted by comparison of the estimated and measured benzene concentrations to the First Order Decay Model. Using a source mass of 100 kg and a source area concentration of 0.500 mg/L, the benzene half-life was varied from 0.2, 0.4, 0.6, and 0.9 years. In addition, the average laboratory reported concentration of FOC was 0.83 percent. However, the simulations could not provide mobility of benzene at such a high FOC value. Therefore, an FOC percent of 0.0083 was used in the simulations. This value is consistent with typical values presented in the *BIOSCREEN Users Manual.* Calibration of the Instantaneous Reaction Model was not conducted because this model simulated the complete degradation of the source and plume within 2 years which does not seem realistic. Calibration of the No Degradation Model was also not conducted because it simulated significant benzene concentrations outside of the model domain, which also do not appear to represent actual site conditions.

7.5 PREDICTION

A simulation was performed for a period up to 100 years with 100 kg of source mass. The First Order Decay results indicated benzene would not exceed 2L standards beyond 130 feet from the source area. However, after 100 years the site source concentration in groundwater was only reduced to 0.347 mg/L from the initial 0.500 mg/L.

Another simulation was performed without any source mass (less than 0.5 kg). The First Order Decay results indicated benzene would not exceed 2L standards beyond 130 feet from the source area and would decay to below 0.001 mg/L at the former source area after 10 years.

The First Order Decay Model likely projects the physical dimensions of the groundwater benzene plume and presents plume decay without the influence of natural attenuation. Strong evidence of natural attenuation through biological activity has been presented in this report. Therefore, this model provides a conservative prediction of the fate of the benzene. The results are included in **Appendix E**.

7.6 POTENTIAL RECEPTOR PATHWAYS AND RECEPTORS

Based upon available data, the current and historical groundwater elevations will not likely intercept potential receptor pathways such as storm and sanitary sewer lines and other underground utility lines. In addition, the conservative modeling effort precludes interception of benzene with the nearest down-gradient water supply wells (#8 and #5). However, drawdown of those wells and closer water supply wells (#2 and #4) could influence groundwater flow to the extent of interception with benzene.

7.7 CORRECTIVE ACTION CONSIDERATIONS

Information provided in this report, particularly the modeling effort and potential receptor pathways, should be considered in the proposal of a corrective action. The First Order Decay simulations provided a 10-year resolution of the groundwater benzene plume following removal of the source area and provided essentially no resolution with the source area intact.

Strong evidence of microbial decay is observed within the petroleum plume. The decay rates of petroleum within an aerobic environment will typically exceed the decay rates in an anoxic or anaerobic environment (Howard, et al., 1991).

Consequently, the removal of the source area would greatly excel attenuation of benzene and other petroleum constituents. Natural attenuation can be actively enhanced through supplementation with an electron acceptor, such as oxygen, and the appropriate ratio of nutrients.

8.0 CONCLUSIONS

Based on the findings of this Comprehensive Site Assessment and all assessment work, it appears the extent of the petroleum release has been reasonably defined.

- This site is an active retail gasoline facility. Additional releases could change assessment, modeling, and remediation requirements.
- Petroleum-related impacts to soil, exceeding STGW-MSCCs, were identified at the subject facility. The extent of impacted soil appears limited to dispenser and UST system area.
- Free product was not encountered during the assessment activities.
- Dissolved BTEX, VPH, and EPH concentrations, exceeding 2L Standards, are the predominant petroleum-related constituents in groundwater at the subject facility. The highest contaminant concentrations were identified in monitoring wells MW-1 and MW-3. These offsite wells are located immediately down gradient from the source area.
- The absence of contaminants above 2L Standards and the close proximity and location of the Type III well, MW-2, to MW-1 indicate the vertical extent is defined.
- The absence of contaminants above 2L Standards in monitoring wells MW-6 through MW-11 indicate the horizontal extent is defined.
- The apparent dramatic change in hydraulic gradient and potential groundwater flow direction that occurs beneath Market Street is not completely understood at this time. In addition, drought conditions likely caused a significantly lower water table since the 2004 assessment work. Both of these conditions will affect the fate and transport of the fugitive petroleum.
- Nine water supply wells were identified within 1,500 feet of the subject facility. According to the City of Wilmington Engineer's Office, connection to their water supply line could be achieved at all properties.

9.0 RECOMMENDATIONS

In consideration of the data obtained during the assessment activities, the cleanup of impacted soil and groundwater at this site should be addressed through the preparation of a Corrective Action Plan (CAP). Additionally, periodic pre-CAP monitoring should be conducted due to the close proximity of the source area to water supply wells. Additional monitoring information will elucidate the groundwater characteristics of the area beneath the Market Street right-of-way as well as groundwater elevations due to drought conditions. The CAP may include active remediation of the source areas and impacted soil and active enhanced natural attenuation/bioremediation of the impacted groundwater.

10.0 LIMITATIONS

This report has been prepared for the exclusive use of Worsley Operating Company. The opinions included herein are based on information obtained during the study, on our experience in accordance with currently accepted hydrogeologic and engineering practices, and relevant regulatory guidelines at this time and location. Other than this, no warranty is implied or intended.

TABLES

TABLE 1
WATER SUPPLY WELL INFORMATION
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Map ID/ Well Number	Well Owner/User	Owner/User Address	Owner/User Phone Number	Well Use	Well Depth (ft BGS)	Type of Well	Well Casing Depth (ft BGS)	Well Screen Interval (x to y ft BGS)	Distance from Source area of release (ft)
2	Cecil Covil Etal & Richard Covil Estate	7158 Market St. Wilmington, NC 28411	(910) 686-7783	not used	unknown	unknown	unknown	unknown	175
4	Cecil Covil T, Et Ux Etal & Richard Covil Estate	7148 Market St. Wilmington, NC 28411	(910) 686-7783	cleaning	unknown	unknown	unknown	unknown	300
5	Atrium at Middle Sound Land Wilmington, NC 28402	7155 Market St. Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	300
8	Pearl L Rochelle C/O Jones' Seafood	7201 Market St. Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	300
9	Deloris Ryals	906 Bayshore Dr. Wilmington, NC 28405	(910) 686-4559	not used irrigation	180	unknown	60	unknown	550
10	Troy T. & Bertha R. Martin C/O B&T Imports	7222 Market St. Wilmington, NC 28411	(910) 686-0338	drinking	100	unknown	unknown	unknown	550
12	Tammy C. Winslow Kernersville, NC 27284	125 Middle Sound Loop Rd Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	475
13	Cecil & Shirley Covil	129 Middle Sound Loop Wilmington, NC 28411	(910) 686-7783	drinking irrigation	80	unknown	unknown	unknown	550
15	Mark Francolini	7100 Ragland Court Wilmington, NC 28411	(910) 686-3536	irrigation	unknown	unknown	unknown	unknown	1,450

NOTES:

- Well Numbers correspond to Figure 3
- Pearl L Rochelle resides at;
  18 Euguene Place
  St. Augustine, FL 32080

TABLE 2
ADJACENT AND CONTIGUOUS PROPERY INFORMATION
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Map ID	Owner/Occupant Name Mailing Address	Address
1	**Entrepreneur, Inc.** **Wilmington, NC 28406**	7160 Market St. Wilmington, NC 28411
2	Cecil Covil Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7158 Market St. Wilmington, NC 28411
3	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7154 Market St. Wilmington, NC 28411
4	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7148 Market St. Wilmington, NC 28411
5	Atrium at Middle Sound Land Wilmington, NC 28402	7155 Market St. Wilmington, NC 28411
6	CDA Properties, LLC Southern Pines, NC 28387	7161 Market St. Wilmington, NC 28411
7	Atrium at Middle Sound Land Wilmington, NC 28402	7167 Market St. Wilmington, NC 28411
8	Pearl L Rochelle C/O Jones' Seafood	7201 Market St. Wilmington, NC 28411
9	Deloris Ryals	906 Bayshore Dr. Wilmington, NC 28405
10	Troy T. & Bertha R. Martin C/O B&T Imports	7222 Market St. Wilmington, NC 28411
11	Covil J W Mamie L C/O Atlantic Coast Foods, Inc. 112 Queens Creek Rd #1 Swansboro, NC 28584	7208 Market St. Wilmington, NC 28411
12	Tammy C. Winslow Kernersville, NC 27284	125 Middle Sound Loop Road Wilmington, NC 28411
13	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	129 Middle Sound Loop Rd. Wilmington, NC 28411
14	Covil J W Mamie L 7158 Market St. Wilmington, NC 28405	106 Middle Sound Loop Rd. Wilmington, NC 28411
15	Mark Francolini	7100 Ragland Court Wilmington, NC 28411

TABLE 3
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas Depth to water has been adjusted due to presence of free product using th following formula's: DTW-DTP=X_0 ; (78%)(X_0) = X_1 ; DTW-X_1 = DTW_{ADJ}
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 4
SUMMARY OF TPH LABORATORY RESULTS FOR SOIL SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample Location	Sampling Date	Sample Depth (ft, bgs)	TPH GRO (mg/kg)	TPH DRO (mg/kg)	Sample Reasoning
NC DWM Action Levels			*10*	*10*	
SB-1	5/13/2004	6 - 7	**380**	**2,500**	Pit Sidewall
SB-2	5/13/2004	6 - 7	**13**	**210**	Pit Sidewall
SB-3	5/13/2004	6 - 7	<0.53	<4.2	Pit Sidewall
SB-4	5/13/2004	6 - 7	<0.54	<11	Pit Sidewall
SB-5	5/13/2004	6 - 7	<0.52	7.9	Pit Sidewall
SB-6	5/13/2004	6 - 7	<0.55	<4.4	Pit Sidewall
SB-7	5/13/2004	2 - 3	<0.53	<10	Product Line
SB-8	5/13/2004	1 - 2	<0.56	**980**	Dispenser

Notes: 1.) TPH GRO - Total petroleum hydrocarbons, gasoline range organics by EPA Method 8015 with 5035 preparation
2.) TPH DRO - Total petroleum hydrocarbons, diesel range organics by EPA Method 8015 with 3550 preparation
3.) **Bold** numbers exceed DWM Action Levels
4.) ft, bgs - feet, below ground surface
5.) mg/kg - milligrams per kilogram
6.) Samples obtained by others

TABLE 5
SUMMARY OF LABORATORY RESULTS FOR SOIL SAMPLES BY RISK-BASED METHODS
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	SS-1	SB-1B	SB-2	SB-3B	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	SB-13	SB-14B	SOIL-TO-WATER MSCCs	RESIDENTIAL MSCCs	INDUSTRIAL/ COMMERCIAL MSCCs
Sample Depth (ft.) →	5 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7			
Sample Date →	9/20/2004	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	2/29/2008	2/29/2008	2/29/2008	2/29/2008	2/29/2008			
Analyses →	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH			
Detected Compounds ↓	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
EPA METHOD 8260																		
Acetone	<0.028	<26	<26	<0.051	<15	0.077	<66	<0.052	<0.053	<0.058	<0.060	<0.060	<0.060	<150	<0.054	3	1,564	40,880
Benzene	<0.0011	<0.52	<0.53	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.012	<0.012	<0.012	<2.9	<0.0011	0.0056	22	200
n-Butylbenzene	<0.0011	**7.9**	**5.7**	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	4	156	4,088
sec-Butyl benzene	<0.0011	2.8	2.6	<0.0010	1.0	0.0024	<1.3	<0.0010	<0.0011	0.011	<0.0012	<0.0012	<0.0012	**3.3**	<0.0011	3	156	4,088
1,2-Dichloropropane	<0.0011	**1.3**	<0.53	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	0.0029	9	84
Ethylbenzene	<0.0011	**5.8**	**3.4**	<0.0010	**7.0**	0.010	**8.6**	<0.0010	<0.0011	0.026	<0.0012	<0.0012	<0.0012	**33**	<0.0011	0.24	1,560	40,000
Isopropyl benzene	<0.0011	**2.7**	1.6	<0.0010	1.6	0.0026	2.0	<0.0010	<0.0011	0.0084	<0.0012	<0.0012	<0.0012	**7.3**	<0.0011	2	1,564	40,880
4-Isopropyl toluene	<0.0011	<0.52	<0.53	<0.0010	2.8	0.0058	3.4	<0.0010	<0.0011	0.031	<0.0012	<0.0012	<0.0012	7.2	<0.0011	NA	NA	NA
Naphthalene	<0.0057	**19**	**19**	<0.0051	**7.4**	0.019	**16.0**	<0.0052	<0.0053	**0.62**	<0.0060	<0.0060	<0.0060	**41**	<0.0054	0.58	63	1,635
n-Propylbenzene	<0.0011	**12**	**6.1**	<0.0010	**6.4**	0.0098	**8.2**	<0.0010	<0.0011	0.041	<0.0012	<0.0012	<0.0012	**24**	<0.0011	2	156	4,088
Toluene	<0.0057	<2.6	<2.6	<0.0051	<1.5	0.0064	<6.6	<0.0052	<0.0053	0.022	<0.0060	<0.0060	<0.0060	**25**	<0.0054	7	3,200	82,000
Trichloroethene	<0.0011	**0.91**	**0.89**	<0.0010	**0.49**	<0.0012	**2.2**	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	0.0183	58	520
1,2,4-Trimethylbenzene	<0.0011	<0.52	<0.53	<0.0010	**56**	0.081	**75**	<0.0010	0.0020	1.0	<0.0012	<0.0012	<0.0012	**230**	<0.0011	8	782	20,440
1,2,3-Trimethylbenzene	NA	0.59	0.56	<0.0010	11	0.025	18	<0.0010	<0.0011	0.34	<0.0012	<0.0012	<0.0012	52	<0.0011	NA	NA	NA
1,3,5-Trimethylbenzene	<0.0011	<0.52	<0.53	<0.0010	**14**	0.025	**20**	<0.0010	<0.0011	0.18	<0.0012	<0.0012	<0.0012	**64**	<0.0011	7	782	20,440
Total Xylenes	<0.0034	<1.6	<1.6	< 0.0031	**30**	0.067	**57**	<0.0031	<0.0032	0.32	<0.0036	<0.0036	<0.0036	**210**	<0.0032	5	32,000	200,000
EPA METHOD 8270																		
Acenaphthene	<0.38	0.27	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	8	940	24,000
Benzo (a) anthracene	**1.1**	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	0.34	0.88	8
Benzo (b) fluoranthene	**1.2**	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	1	0.88	8
Benzo (g,h,i) perylene	0.50	<0.038	<0.039	58	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	6,720	469	12,264
Benzo (k) fluoranthene	0.51	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	12	9	78
Benzo (a) pyrene	**1.2**	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	0.091	0.088	0.78
Chrysene	1.2	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	38	88	780
Fluoranthene	2.2	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	276	620	16,400
Fluorene	<0.38	0.46	<0.039	<0.034	<0.039	<0.040	0.046	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	44	620	16,400
Ideno (1,2,3-cd) pyrene	0.48	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	3	0.88	8
Naphthalene	<0.38	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	**15**	<0.36	0.58	63	1,635
Phenanthrene	0.97	0.76	<0.039	<0.034	<0.039	<0.040	0.051	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	60	469	12,264
Pyrene	1.8	0.089	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	286	469	12,264
MADEP METHODS FOR VPH & EPH																		
C_9-C_{10} Aromatics	<5.7	**370**	**330**	<15	**350**	<15	**390**	<12	<13	<15	<15	<17	<15	**870**	<5.4	34	469	12,264
C_{11}-C_{22} Aromatics	<6.2	**1,600**	**1,200**	<6.7	8.8	**51**	23	27	12	16	<7.8	<7.9	<7.8	**300**	<7.0			
C_5-C_8 Aliphatics	<5.7	**260**	**74**	<15	**190**	<15	**300**	<12	<13	<15	<15	<17	<15	**510**	<5.4	72	939	24,528
C_9-C_{12} Aliphatics	<5.7	**950**	740	<15	760	20	880	<12	<13	<15	<15	<17	<15	2,000	<5.4	3,255	9,386	245,280
C_9-C_{18} Aliphatics	<6.2	**2,900**	2,500	<6.7	<7.6	24	47	<6.7	<6.9	<7.5	<7.8	<7.9	<7.8	140	<7.0			
C_{19}-C_{36} Aliphatics	<6.2	790	740	<6.7	<7.6	30	11	8.6	<6.9	<7.5	<7.8	<7.9	<7.8	70	<7.0	#	93,860	##

Notes:
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is method detection limit.
- Analytical results are presented in milligrams per kilogram (mg/kg).
- Analytical results exceeding Soil-to-Water Maximum Soil Contaminant Concentrations (MSCCs) are in *italic* type.
- Analytical results exceeding the most stringent MSCCs are in **bold** type.
- Analytical results exceeding Industrial/Commercial MSCCs are shaded.
- No other compounds were detected at levels above laboratory quantitation limits
- # Considered immobile
- ## Health based level >100%
- NA information is not available

TABLE 6
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*1,000*	*550*	*530*	*200*	*70*	*21*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	12
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 7
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES BY RISK-BASED METHODS
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11		
Sample Date →	10/4/2004	10/4/2004	10/4/2004	10/4/2004	10/4/2004	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007		
Analyses →	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**NCAC 2L Groundwater Quality Standards**	**Gross Contaminant Levels (GCLs)**
Detected Compounds ↓	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**(ug/L)**	**(ug/L)**
Benzene	**30**	<1.0	**260**	**23**	**12**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5,000
Toluene	<100	<5.0	**1,900**	220	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1,000	257,500
Ethylbenzene	**760**	<1.0	490	65	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	550	29,000
Total Xylenes	**830**	<3.0	**2,600**	**750**	<30	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	530	87,500
MTBE	<20	<1.0	<100	<10	**270**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	200	200,000
IPE	<20	<1.0	<70	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	70	70,000
Lead	**34**	<5.0	6.3	7.6	7.0	NA	NA	NA	NA	NA	NA	15	15,000
EDB	<0.010	<0.010	<0.010	<0.010	<0.010	NA	NA	NA	NA	NA	NA	0.0004	50
1-Methylnaphthalene	88	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	**140**	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	14.0	NA
Naphthalene	**270**	<10	**120**	12	<10	<5	<5	<5	<5	<5	<5	21	15,500
C_5-C_8 Aliphatics (VPH)	**1,300**	<100	**6,100**	**570**	370	<100	<100	<100	<100	<100	<100	420	NE
C_9-C_{12} Aliphatics (VPH)	**6,100**	280	**12,000**	670	210	<100	<100	<100	<100	<100	<100	4,200	NE
C_9-C_{18} Aliphatics (EPH)	<100	260	130	<100	<100	<100	<100	<100	<100	<100	<100		
C_{19}-C_{36} Aliphatics (EPH)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	42,000	NE
C_9-C_{10} Aromatics (VPH)	**4,700**	150	**5,800**	**280**	<100	<100	<100	<100	<100	<100	<100	210	NE
C_{11}-C_{22} Aromatics (EPH)	**330**	<100	120	<100	<100	<100	<100	<100	<100	<100	<100		

NOTES:
- MW-1 to MW-5 sampled and analyzed by others during Phase II LSA activities
- Analytical results presented in micrograms per liter (ug/L).
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is the method detection limit.
- NE denotes narrative standard has not been established for compound.
- NA denotes that this sample was not analyzed for this compound
- Analytical results exceeding NCAC 2L Groundwater Quality Standards are in **Bold** type.
- All other compounds were below quantitation limits.

TABLE 9
SUMMARY OF MODEL PARAMETERS
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

PARAMETER	VALUE	SOURCE	EXPLANATION
Hydraulic Conductivity (cm/sec)	3.14E-04	Slug Test Analysis from MW-5, MW-7, MW-10	Rising head slug analyses by Bower and Rice Graphical Solution. Also characteristic of silty/clayey sand, Freeze and Cherry, 1979 (10^{-5} to 10^{-1} cm/sec).
Effective Porosity (%)	40	Spitz & Moreno, 1996 and Domenico and Schwartz, 1990	characteristic of fine sand 0.26 - 0.53%
Mean Hydraulic Gradient (ft/ft)	0.11	Ground water elevation data (2007)	change in head (MW-6 to MW-1)/horizontal distance (MW-6 to MW-1)
Seepage Velocity (ft/day)	0.25	V = Ki/ne	Based upon calculated conductivity, gradient, and estimated effective porosity
Zone of contaminated saturated thickness (ft)	20	CSA activities (2007)	Based upon depth of Type III well, MW-2 and absence of Benzene above 2L Standards
Soil Bulk Dry Density (gm/cc)	1.5	Rawls & Brackensiek (1989)	bulk density of silty,clayey, sand

TABLE 10
SUMMARY OF NATURAL ATTENUATION PARAMETERS FOR GROUNDWATER AND SOIL
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Location No.	Date	pH (S.U.)	Specific Conductivity (mS/m)	Dissolved Oxygen (mg/L)	Temperature (°C)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)	Foc (percent)
MW-1	9/24/2007	6.78	76.4	1.29	25.0	-210	<0.10	32	NA
MW-3	9/24/2007	6.88	46.6	1.27	26.3	-277	<0.10	15	NA
MW-4	9/24/2007	6.59	29.2	1.26	27.6	-235	NA	NA	NA
MW-5	9/24/2007	6.84	54.4	1.07	25.8	-184	NA	NA	NA
MW-6	9/24/2007	7.24	48.2	3.62	24.7	164	0.33	7.5	NA
MW-7	9/24/2007	7.63	61.9	5.33	28.9	183	1.90	38	NA
MW-8	9/24/2007	6.95	0.1	5.41	26.3	100	<0.10	18	NA
MW-9	9/24/2007	6.52	23.0	2.77	23.1	36	<0.10	24	NA
MW-10	9/24/2007	6.70	40.8	2.21	27.2	-70	NA	NA	NA
MW-11	9/24/2007	6.90	32.7	1.26	24.5	70	NA	NA	NA
MW-2	9/24/2007	5.80	22.8	2.45	24.7	51	NA	NA	NA
SB-8	9/20/2007	NA	NA	NA	NA	NA	NA	NA	0.66
MW-6	9/20/2007	NA	NA	NA	NA	NA	NA	NA	0.53
MW-7	9/20/2007	NA	NA	NA	NA	NA	NA	NA	1.3
Average									**0.830**

Notes:
- S.U. is an abbreviation for Standard Units
- mS/m is an abbreviation for milliSiemens per meter
- mg/L is an abbreviation for milligrams per liter
- °C is an abbreviation for degrees Celcius
-ORP is an abbreviation for oxygen reduction potential
- mV is an abbreviation for millivolts
- NA indicates that this information is not available
- Foc is an abbreviation for naturally occurring carbon

TABLE 11
COMPARISON OF NATURAL ATTENUATION PARAMETERS: PLUME WELLS TO BACKGROUND WELLS
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

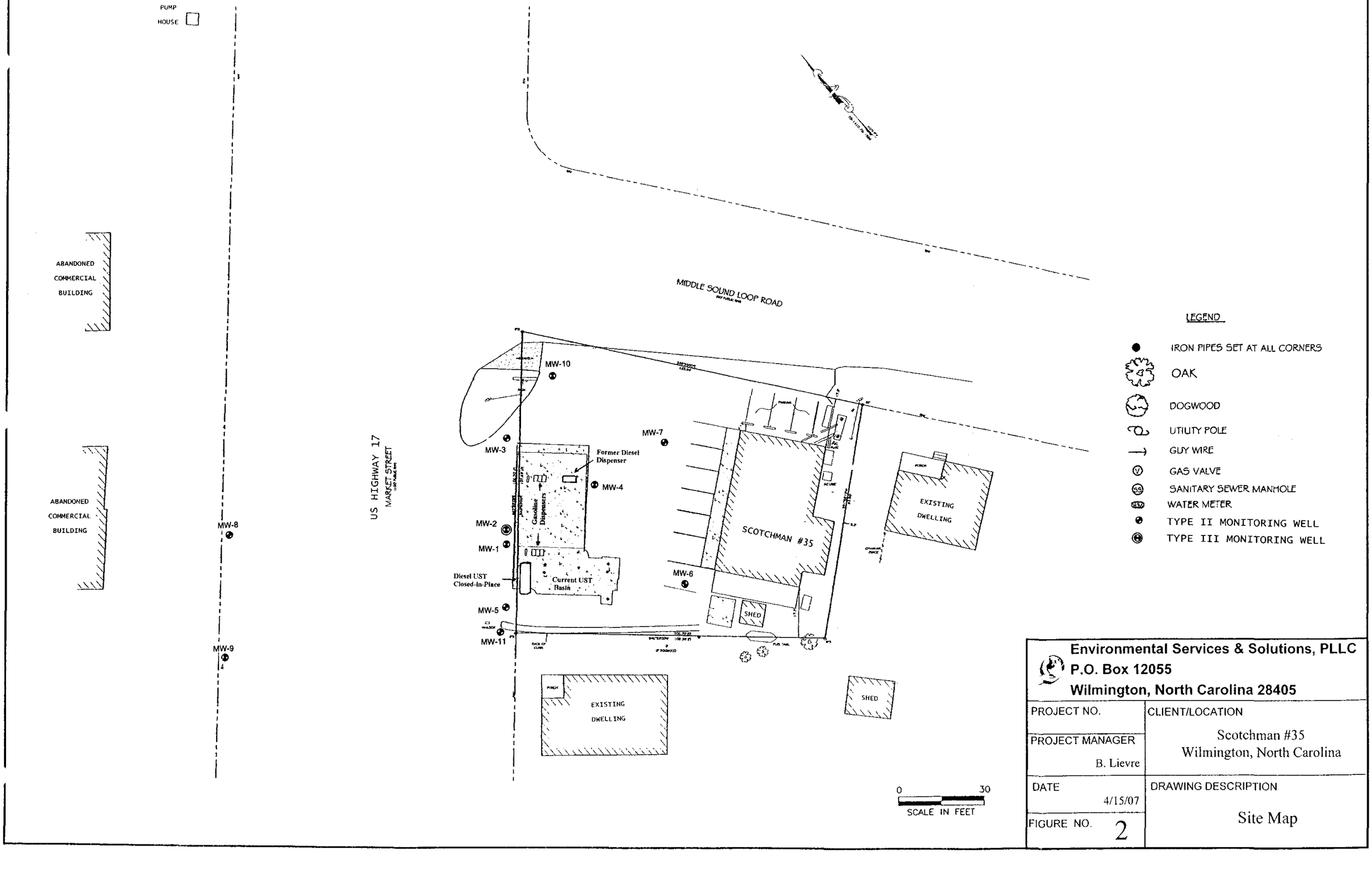
	pH (S.U.)	Specific Conductivity (mS/m)	Dissolved Oxygen (mg/L)	Temperature (°C)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)
Plume Wells (MW-1,MW-2, MW-3, MW-4, MW-5)							
mean	6.77	51.65	1.22	26.18	-226.50	<0.10	23.50
median	6.81	50.50	1.27	26.05	-222.50	<0.10	23.50
Background Wells (MW-6, MW-7, MW-8, MW-9, MW-10, MW-11)							
mean	6.82	32.79	3.29	25.63	76.29	1.12	21.88
median	6.90	32.70	2.77	24.70	70.00	1.12	21.00
Absolute Difference (plume mean - background mean)	0.05	18.86	2.07	0.55	302.79	1.12	1.63

Notes:
- S.U. is an abbreviation for Standard Units
- mS/m is an abbreviation for milliSiemens per meter
- mg/L is an abbreviation for milligrams per liter
- °C is an abbreviation for degrees Celcius
-ORP is an abbreviation for oxygen reduction potential
- mV is an abbreviation for millivolts

FIGURES

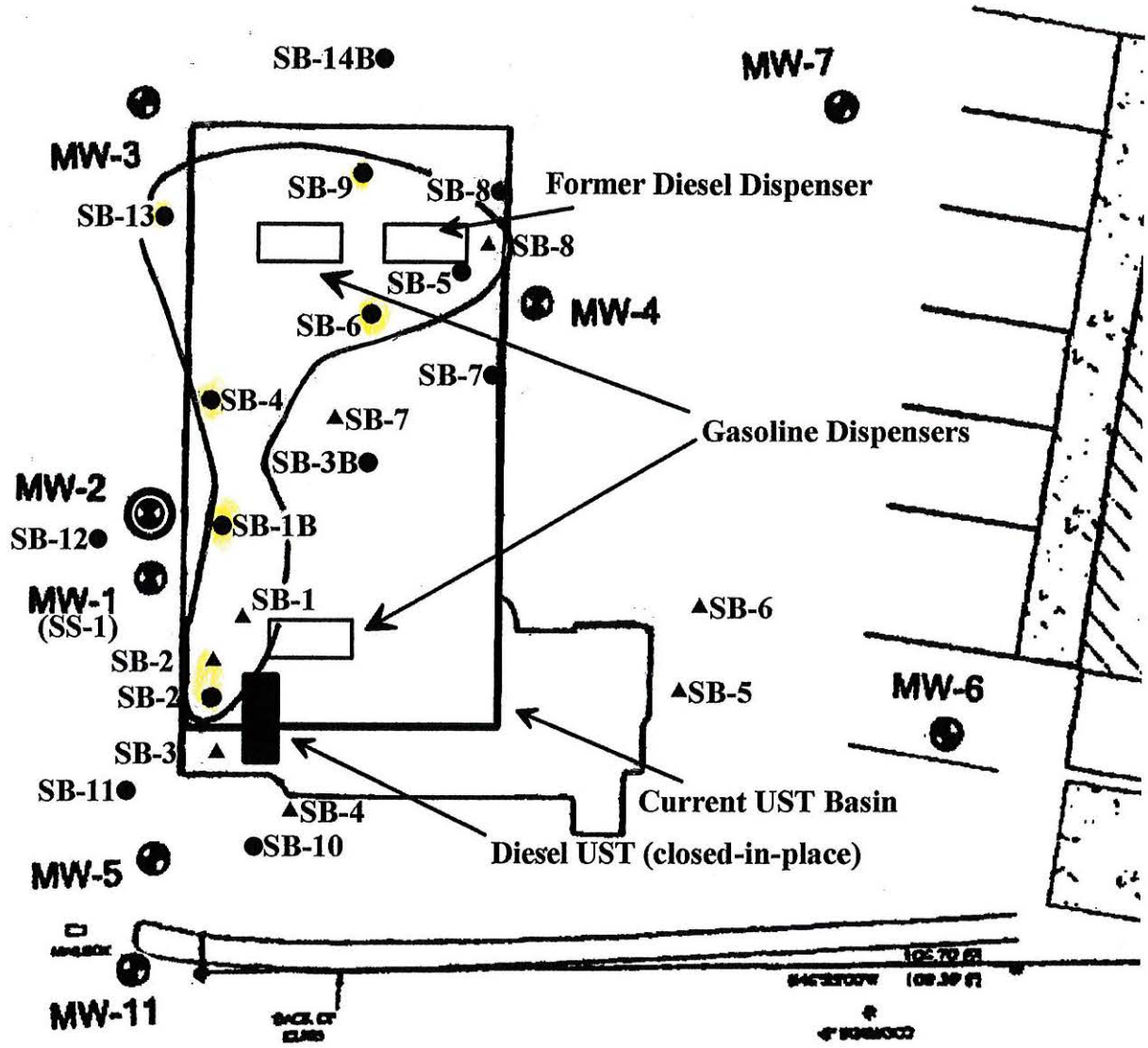
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)

Environmental Services & Solutions, PLLC P.O. Box 12055, Wilmington, NC 28405 Telephone: (910) 392-3050		Title: Topographic Vicinity Map	Figure No. 1
Drawn By: BKL	Date: 5-5-08	Location: Scotchman #35 Wilminmgton, NC	
Checked By: FP	Date: 5-5-08		



Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION Scotchman #35 Wilmington, North Carolina
PROJECT MANAGER B. Lievre	
DATE 4/15/07	DRAWING DESCRIPTION Site Map
FIGURE NO. 2	



Extent of impacted soil above Residential MSCCs

SB-2 ● Boring conducted during CSA activities

SB-2 ▲ Boring conducted during UST activities

Note -
UST activity sample SB-7 collected at 2-3 feet bgs
UST activity sample SB-8 collected at 1-2 feet bgs
LSA activity sample SS-1 (MW-1) collected at 5-7 feet bgs
All other samples collected at 6-7 feet bgs
bgs - below ground surface

0 15

SCALE IN FEET

Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**		Title: Soil Boring and Sample Locations	Figure No. 4
Drawn By: MHH	Date: 5/7/8	Location: Scotchman #35 Wilmington, NC	
Checked By: BKL	Date: 5/7/8		

PUMP HOUSE

SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA

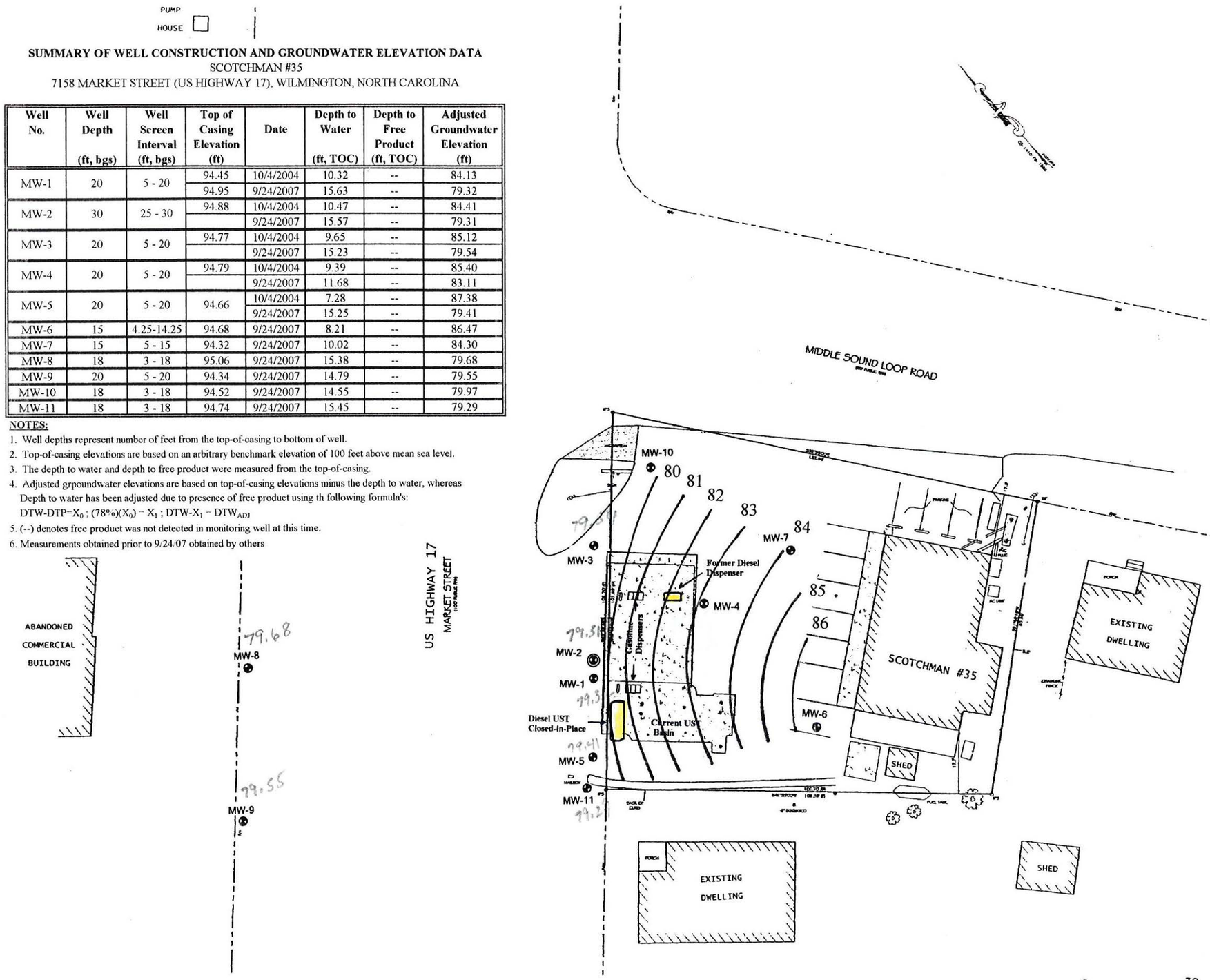
SCOTCHMAN #35

7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas Depth to water has been adjusted due to presence of free product using th following formula's: DTW-DTP=X_0 ; (78%)(X_0) = X_1 ; DTW-X_1 = DTW_{ADJ}
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements obtained prior to 9/24/07 obtained by others



LEGEND

- IRON PIPES SET AT ALL CORNERS
- OAK
- DOGWOOD
- UTILITY POLE
- GUY WIRE
- GAS VALVE
- SANITARY SEWER MANHOLE
- WATER METER
- TYPE II MONITORING WELL
- TYPE III MONITORING WELL

84 — Groundwater elevation and contour (relative to site datum)

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION: Scotchman #35, Wilmington, North Carolina
PROJECT MANAGER: B. Lievre	
DATE: 5/7/8	DRAWING DESCRIPTION: Groundwater Elevation Map
FIGURE NO.: 5	

PUMP HOUSE

SUMMARY OF RISK BASED LABORATORY RESULTS FOR GROUNDWATER

SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11		
Sample Date →	10/4/2004	10/4/2004	10/4/2004	10/4/2004	10/4/2004	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007		
Analyses →	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 602 & 625, MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	NCAC 2L Groundwater Quality Standards	Gross Contaminant Levels (GCLs)
Detected Compounds ↓	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	(ug/L)	(ug/L)
Benzene	**30**	<1.0	**260**	**23**	**12**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5,000
Toluene	<100	<5.0	**1,900**	220	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1,000	257,500
Ethylbenzene	**760**	<1.0	**590**	65	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	550	29,000
Total Xylenes	**830**	<3.0	**2,600**	**750**	<30	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	530	87,500
MTBE	<20	<1.0	<100	<10	**270**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	200	200,000
IPE	<20	<1.0	<70	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	70	70,000
Lead	**34**	<5.0	6.3	7.6	7.0	NA	NA	NA	NA	NA	NA	15	15,000
EDB	<0.010	<0.010	<0.010	<0.010	<0.010	NA	NA	NA	NA	NA	NA	0.0004	50
1-Methylnaphthalene	**88**	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	**140**	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	14.0	NA
Naphthalene	**270**	<10	**120**	12	<10	<5	<5	<5	<5	<5	<5	21	15,500
C_5-C_8 Aliphatics (VPH)	**1,300**	<100	**6,100**	**570**	300	<100	<100	<100	<100	<100	<100	420	NE
C_9-C_{12} Aliphatics (VPH)	**6,100**	280	**12,000**	670	210	<100	<100	<100	<100	<100	<100	4,200	NE
C_9-C_{18} Aliphatics (EPH)	<100	260	130	<100	<100	<100	<100	<100	<100	<100	<100		
C_{19}-C_{36} Aliphatics (EPH)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	42,000	NE
C_9-C_{12} Aromatics (VPH)	**4,700**	150	**5,800**	**280**	<100	<100	<100	<100	<100	<100	<100	210	NE
C_{11}-C_{22} Aromatics (EPH)	**330**	<100	120	<100	<100	<100	<100	<100	<100	<100	<100		

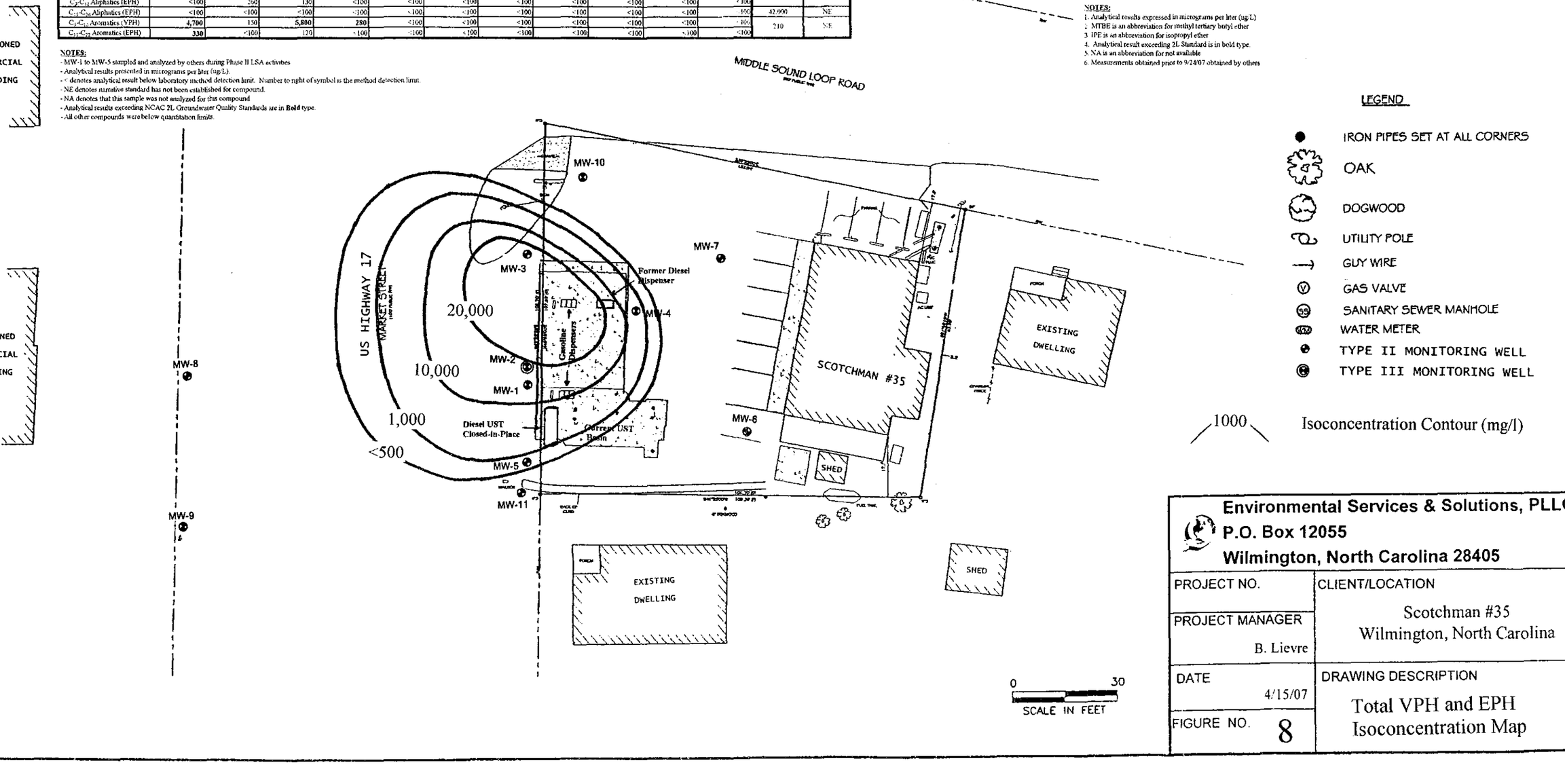
NOTES:
- MW-1 to MW-5 sampled and analyzed by others during Phase II LSA activities
- Analytical results presented in micrograms per liter (ug/L).
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is the method detection limit.
- NE denotes narrative standard has not been established for compound.
- NA denotes that this sample was not analyzed for this compound
- Analytical results exceeding NCAC 2L Groundwater Quality Standards are in **Bold** type.
- All other compounds were below quantitation limits.

SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES

SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*1,000*	*550*	*530*	*200*	*70*	*21*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	**18**	<3.0	<1.0	<1.0	<5.0
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<15
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-3	10/4/2004	**260**	**1,900**	**590**	**2,600**	<100	<70	120
	9/24/2007	**18**	<50	190	220	<10	<10	<50
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	12
	9/24/2007	**3.7**	5.9	58	67	<1.0	<1.0	3.2
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	**18**	<3.0	<1.0	<1.0	<5.0
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available.
6. Measurements obtained prior to 9/24/07 obtained by others

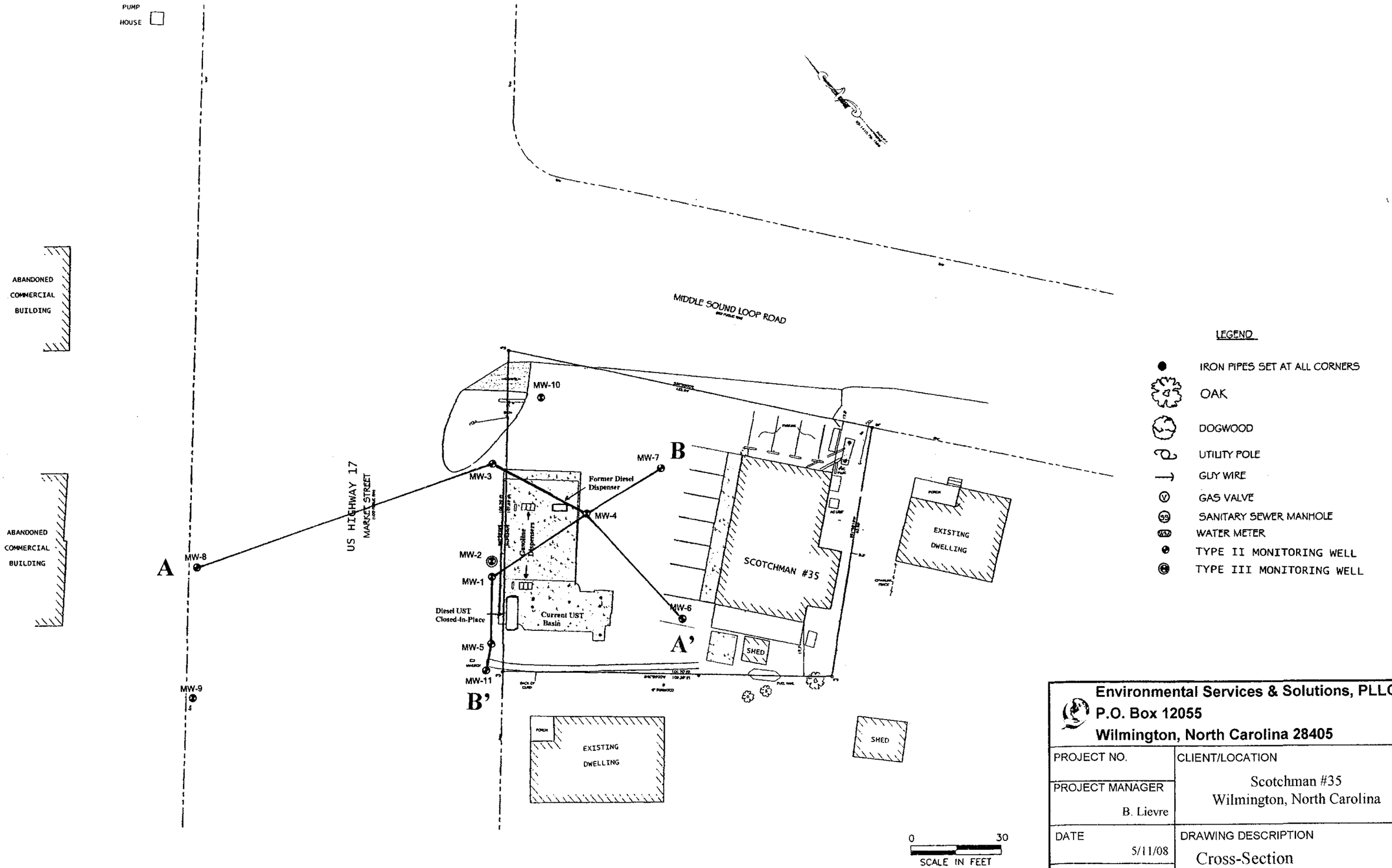


LEGEND

- IRON PIPES SET AT ALL CORNERS
- OAK
- DOGWOOD
- UTILITY POLE
- GUY WIRE
- GAS VALVE
- SANITARY SEWER MANHOLE
- WATER METER
- TYPE II MONITORING WELL
- TYPE III MONITORING WELL
- 1000 Isoconcentration Contour (mg/l)

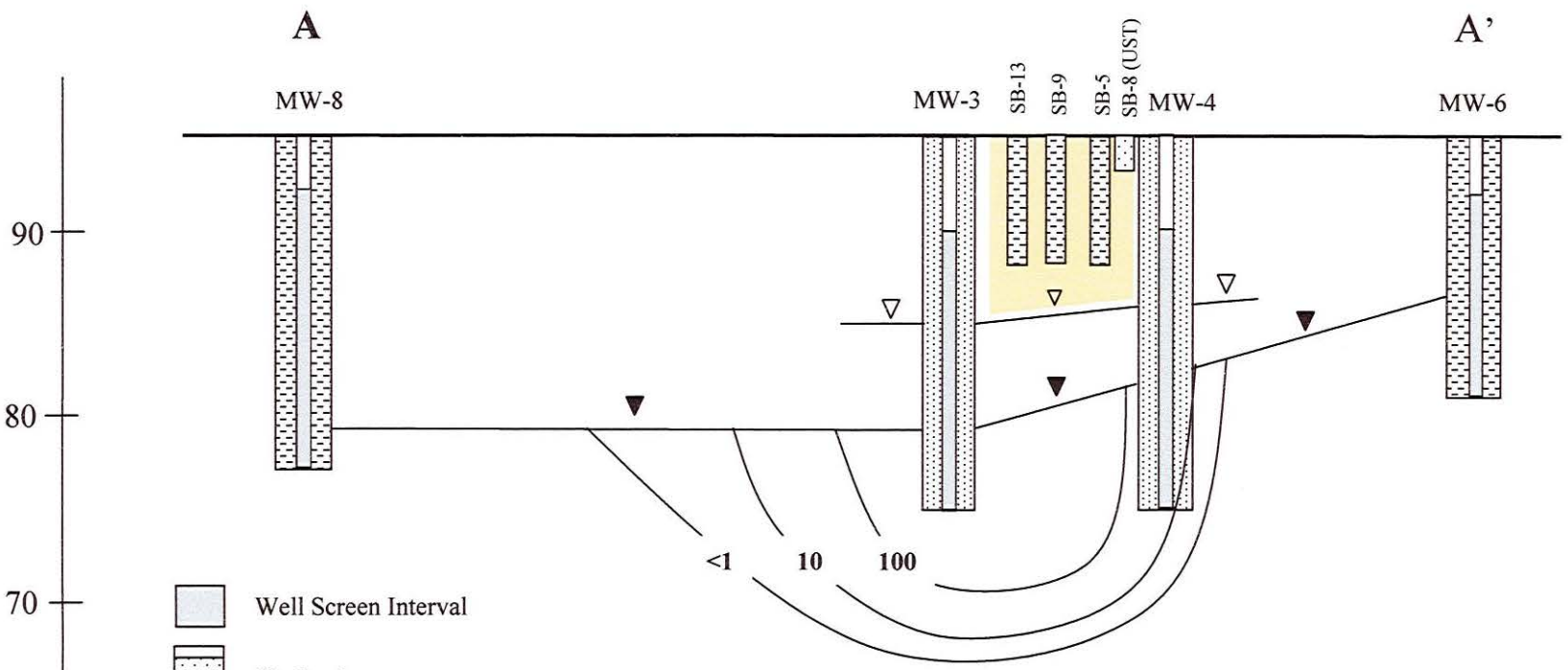
Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION: Scotchman #35, Wilmington, North Carolina
PROJECT MANAGER: B. Lievre	
DATE: 4/15/07	DRAWING DESCRIPTION: Total VPH and EPH Isoconcentration Map
FIGURE NO. 8	



Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION Scotchman #35 Wilmington, North Carolina
PROJECT MANAGER B. Lievre	
DATE 5/11/08	DRAWING DESCRIPTION Cross-Section Location Map
FIGURE NO. 9	



Well Screen Interval

SP: Sand

SP: Fine Sand

SM: Silty Sand

SC: Clayey Sand

ML: Clayey Silt

ML: Sandy Silt

CL: Sandy Clay

Impacted Soil Above Soil-to-Groundwater MSCCs (mg/kg)

— 100 — Benzene Isoconcentration Contour (mg/l)

Groundwater Elevation (September 2007)

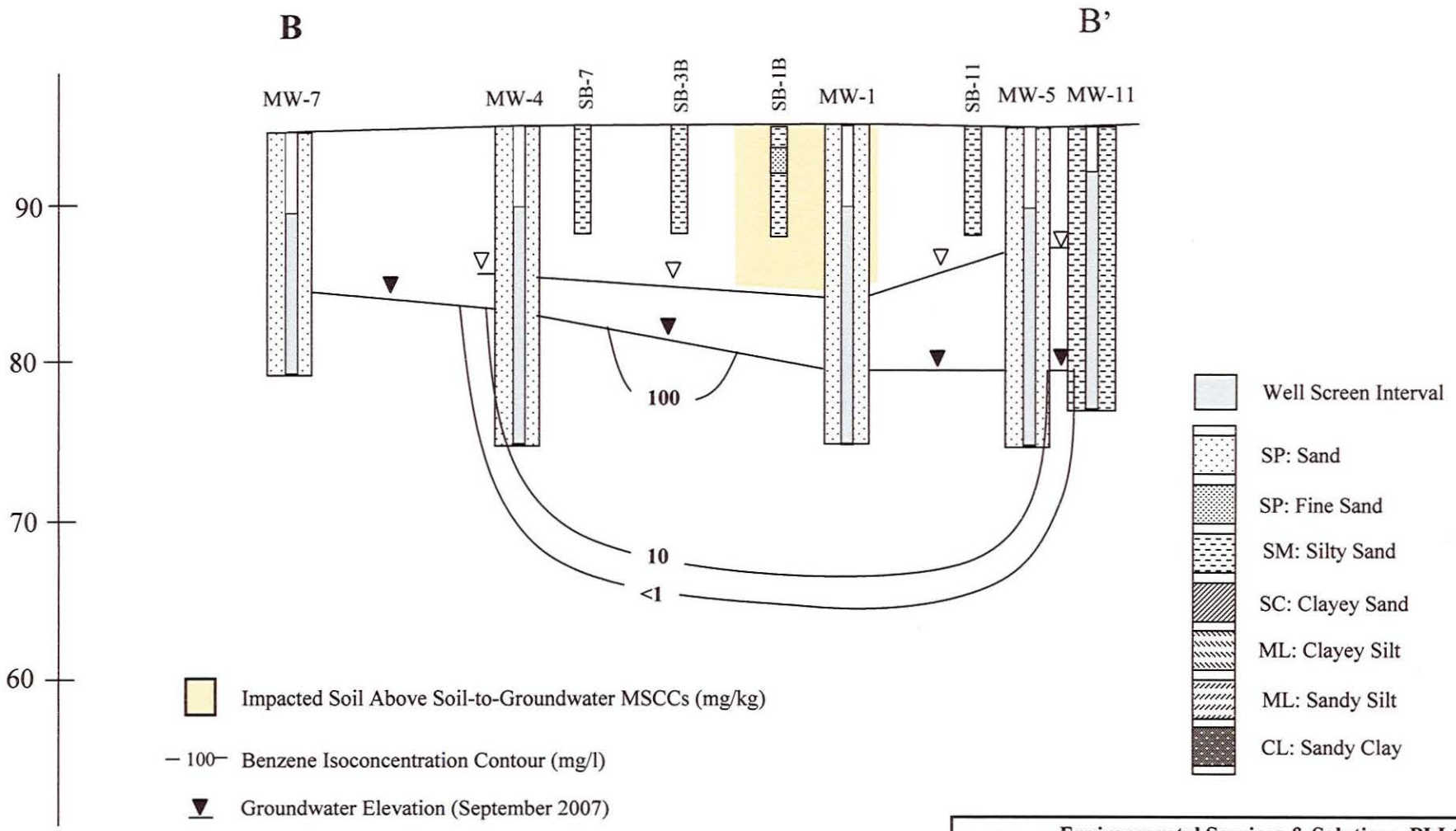
Groundwater Elevation (October 2004.)

Horizontal 1 inch = 30 feet
Vertical 1 inch = 10 feet

Note: well and boring diameters are not to scale

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
5/9/08	Cross-Section A-A'	10

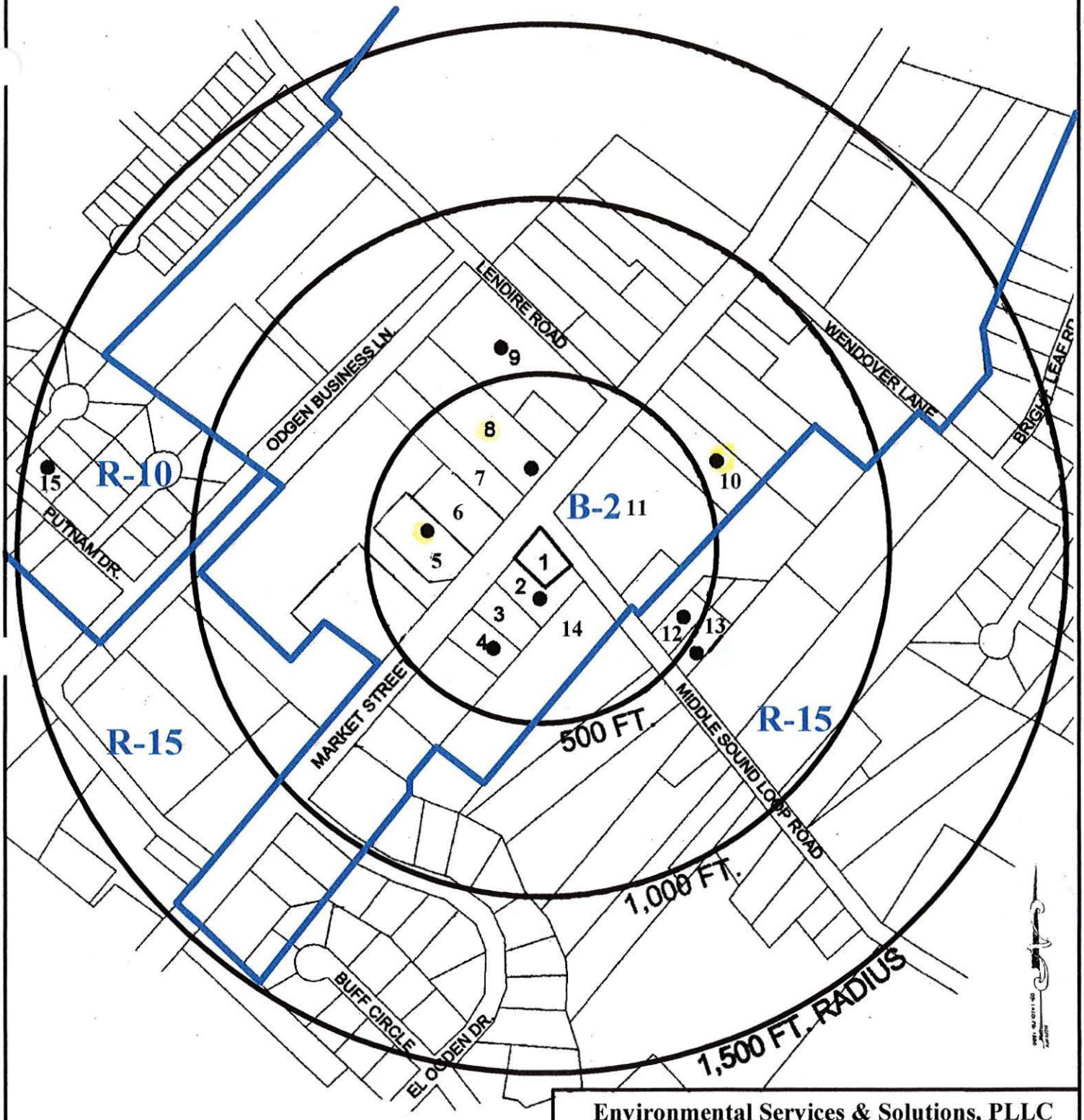


Horizontal 1 inch = 20 feet
Vertical 1 inch = 10 feet

Note: well and boring diameters are not to scale

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
5/9/08	Cross-Section B-B'	11



4 ● Water Supply Well
note - Property number corresponds to Table

R-15 New Hanover County Zoning Code

0 500

SCALE IN FEET

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION Scotchman #35 Wilmington, North Carolina
PROJECT MANAGER B. Lievre	
DATE 5/5/08	DRAWING DESCRIPTION **Water Supply Well Location and Parcel Map**
FIGURE NO. **3**	

APPENDIX B

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-1

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING 30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
4'					Tan to Brown Fine Sand	
6'	6-7				Brown Fine Sand	
8'					Dark Brown Fine Sand (Moisture 7.5' to 8')	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-2

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING
30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
4'					Tan to Brown Fine Sand	
7'	6-7				Brown Fine Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-3

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING
30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
7'	6-7				Tan to Brown Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-4

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING
30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
7'	6-7				Tan to Brown Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-5

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING
30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
3'					Fill	
7'	6-7				Brown to Tan Fine Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-6

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING 30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
3'					Fill	
7'	6-7				Brown to Tan Fine Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-7

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING 30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
3'	2-3				Brown to Tan Fine Sand	

TEST BORING LOG

PROJECT Scotchman #35 HOLE NO. SB-8

LOCATION 7158 Market Street, Wilmington, NC SURF. EL. 0.0

DATE STARTED 05/13/04 DATE COMPLETED 05/13/04 JOB NO. 504745

GROUNDWATER DEPTH
WHILE DRILLING Not Established

N-NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING 30" - ASTM D. 1586, STANDARD PENETRATION TEST

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SMP#	SAMPLE DRIVE RECORD PER6'	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
4"					Concrete	
2.5'	1-2				Brown Sand	
3.0					Tan Sand	

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-1
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/20/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Earthprobe 200
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
	2.0						6" - 4' Brown silty SAND. Refusal at 4'
EOB @ 4 feet bgs	4.0						
	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

- Hand Auger

- Direct Push

- Screened Interval

- Std. Penetration Test (SPT)

- Cuttings

- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-1B
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/20/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Earthprobe 200
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
							6" - 1.5' Brown silty SAND
	2.0						1.5' - 3' Dark to light gray fine SAND
	4.0						
							3' - 7' Brown to dark brown silty SAND. Sampled 6 - 7'
Strong petroleum odor starting at 6'	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Direct Push
- ▒ - Cuttings
- ▒ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-2
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
							6" - 1' Tan silty SAND
	2.0						1' - 3' Dark to light gray fine SAND
	4.0						3' - 7' Light to dark brown silty SAND. Sampled 6 - 7'
Strong petroleum odor starting at 6'	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-3
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/20/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Earthprobe 200
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged by:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
EOB @ 2 feet bgs	2.0						6" - 2' Brown silty SAND. Refusal from concrete at 2'
	4.0						
	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

▤ - Screened Interval

■ - Hand Auger

▥ - Direct Push

■ - Std. Penetration Test (SPT)

▩ - Cuttings

▒ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-3B
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By. B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
	2.0						6" - 5' Brown silty SAND
	4.0						
	6.0						5' -7' Tan fine silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-4
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" Concrete
	2.0						6" - 2.5' Mottled brown/orange silty SAND
	4.0						2.5 - 3.5' Light tan fine silty SAND
							3.5 - 6' Brown to tan silty SAND
Strong petroleum odor starting at 6'	6.0						6 - 7' Dark brown silty SAND
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Std. Penetration Test (SPT)
- Submitted for laboratory analysis
- Direct Push
- Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-5
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 4" Concrete
	2.0						4" - 2.5' Tan to black silty SAND
	4.0						2.5 - 5' Gray silty SAND
Petroleum odor starting at 6.5'	6.0						5 - 7' Mottled brown to tan to brown silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Std. Penetration Test (SPT)
- Submitted for laboratory analysis
- Direct Push
- Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-6
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 4" Concrete
	2.0						4" - 3.5' Tan to brown silty SAND
	4.0						3.5' - 4' Light gray fine SAND
Strong petroleum odor starting at 6'	6.0						4' - 7' Brown to dark brown silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Std. Penetration Test (SPT)
- Submitted for laboratory analysis
- Direct Push
- Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-7
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 4" Concrete
	2.0						
	4.0						4" - 7' Mottled brown & tan silty SAND. Sampled 6 - 7'
	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-8
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 4" Concrete
	2.0						4" - 2.5' Tan to brown silty SAND
	4.0						2.5' - 3.5' Light gray fine SAND
	6.0						3.5' - 7' Mottled tan & brown silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-9
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Earthprobe 200
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 4" Concrete
	2.0						4" - 2.5' Tan to brown silty SAND
	4.0						2.5' - 3.5' Light gray fine SAND
	6.0						3.5' - 7' Mottled tan & brown silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▥ - Direct Push
- ▩ - Cuttings
- ▒ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-10
Construction Date: 02/29/08
Drilling Contractor: Environmental Svcs. & Soltns., PLLC
Drilling Method: Hand auger

Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 5" Asphalt and stone
							5" - 8" Concrete
	2.0						8" - 4' Brown & light gray mottled fine SAND
	4.0						4' - 6' Reddish brown silty SAND
	6.0			0 ppm FID			6' - 7' Tan silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-11
Location:	7158 Market Street (US Hwy 17)	Construction Date:	02/29/08
	Wilmington, North Carolina	Drilling Contractor:	Environmental Svcs. & Soltns., PLLC
Project No.:		Drilling Method:	Hand auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 5" Asphalt and stone
	2.0						5" - 5' Brown silty SAND with layers of light gray sand.
	4.0						
	6.0			0 ppm FID			5' - 6' Dark red/brown silty SAND
							6' - 7' Tan silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-12
Construction Date: 02/29/08
Drilling Contractor: Environmental Svcs. & Soltns., PLLC
Drilling Method: Hand auger

Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 2" Asphalt. 2" - 6" Tan silty SAND
	2.0						6" - 3' Gray to light gray fine SAND.
	4.0						3' - 7' Dark brown silty SAND. Sampled 6 - 7'
	6.0			0 ppm FID			
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

▤ - Screened Interval

■ - Hand Auger

■ - Std. Penetration Test (SPT)

▒ - Submitted for laboratory analysis

▥ - Direct Push

▒ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-13
Location:	7158 Market Street (US Hwy 17)	Construction Date:	02/29/08
	Wilmington, North Carolina	Drilling Contractor:	Environmental Svcs. & Soltns., PLLC
Project No.:		Drilling Method:	Hand auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 3" Asphalt.
							3" - 1' Tan silty SAND with small stones
	2.0						1' - 4' Gray to light gray fine SAND
	4.0						4' - 6' Dark brown silty SAND
	6.0			3198 FID			6' - 7' Dark gray slightly clayey SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

▤ - Screened Interval

■ - Hand Auger

■ - Std. Penetration Test (SPT)

▒ - Submitted for laboratory analysis

▥ - Direct Push

▒ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: SB-14
Construction Date: 02/29/08
Drilling Contractor: Environmental Svcs. & Soltns., PLLC
Drilling Method: Hand auger
Logged By: B. Lievre
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 2" Asphalt.
							2" - 9" Tan silty SAND with small stones
	2.0						9" - 3' Dark brown silty SAND. Refusal at 3'
	4.0						
	6.0						
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SB-14B
Location:	7158 Market Street (US Hwy 17)	Construction Date:	02/29/08
	Wilmington, North Carolina	Drilling Contractor:	Environmental Svcs. & Soltns., PLLC
Project No.:		Drilling Method:	Hand auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
	2.0						0 - 2" Asphalt. 2" - 9" Tan silty SAND with small stones 9" - 1.5' Dark brown silty SAND 1.5' - 4' Light gray fine SAND
	4.0						
	6.0			0 FID			4' - 7' Dark brown silty SAND. Sampled 6 - 7'
	8.0						
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

▤ - Screened Interval

▬ - Hand Auger

▥ - Direct Push

▬ - Std. Penetration Test (SPT)

▩ - Cuttings

▒ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

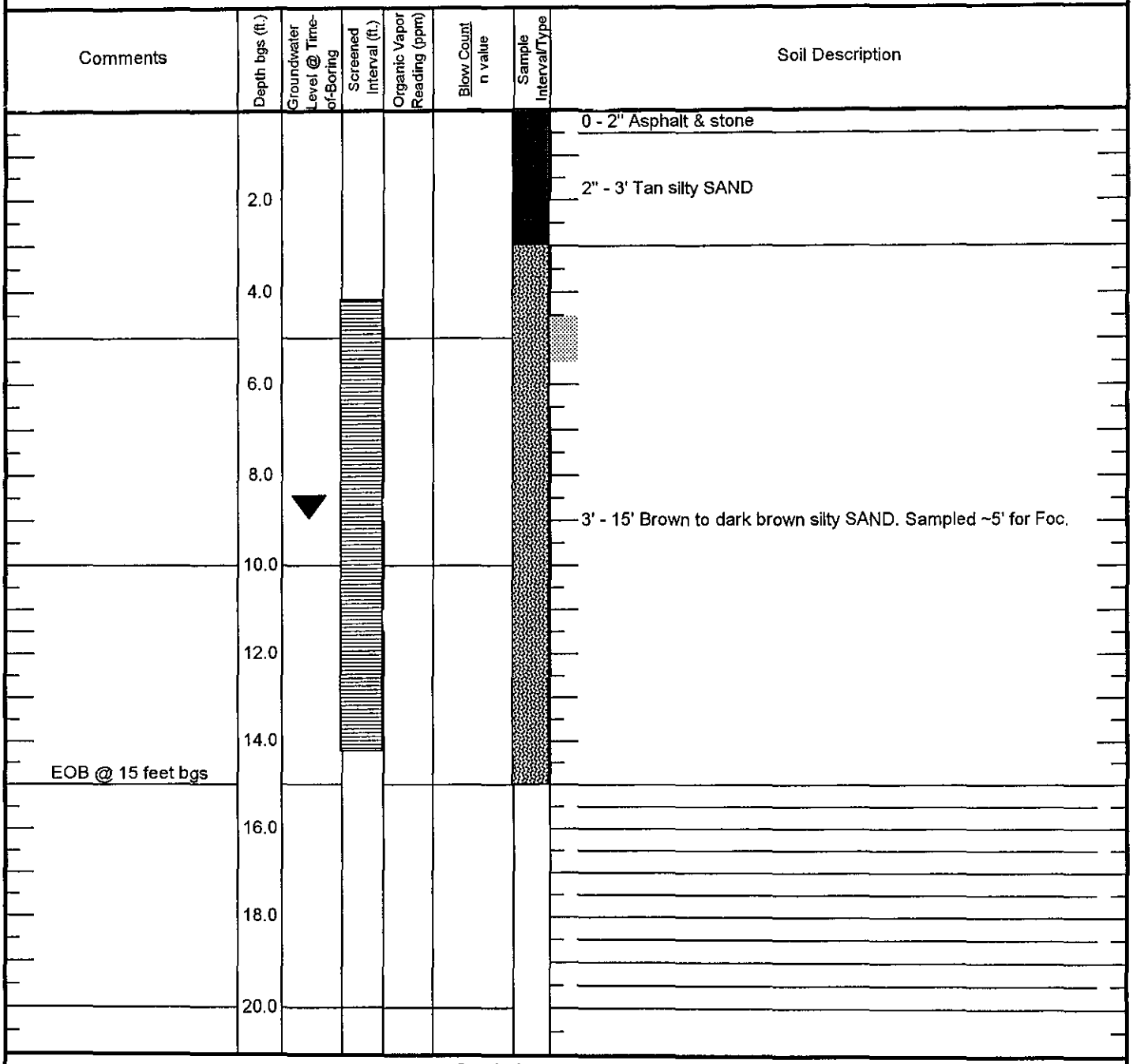
Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: MW-6
Construction Date: 09/20/07
Drilling Contractor: Geologic Exploration
Drilling Method: Hollow-stem auger

Logged By: B. Lievre
Top-of-Casing Elev.: NA



Symbols

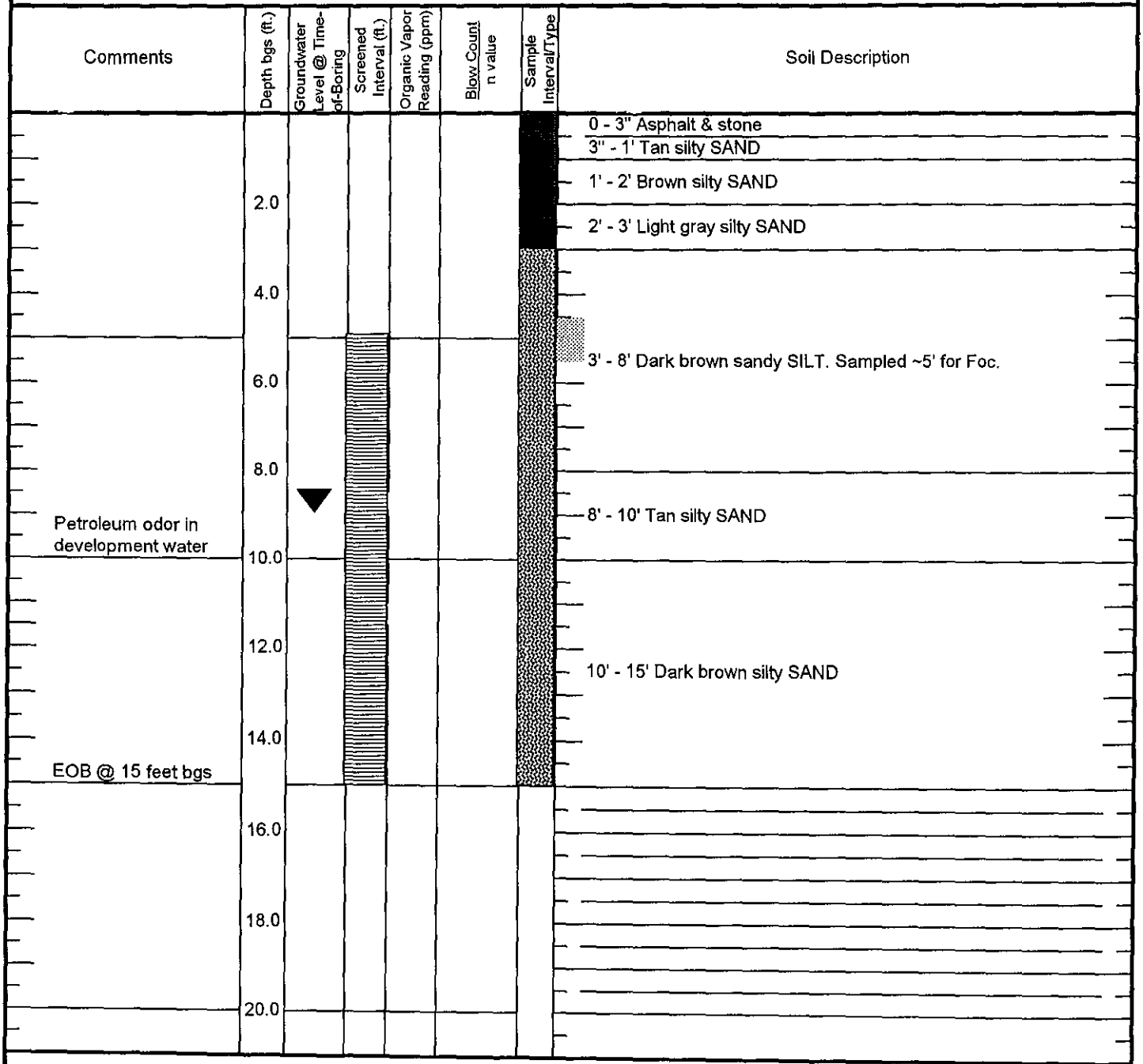
- ▼ - Groundwater Level @ Time-of-Boring
- ▭ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	MW-7
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/20/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Hollow-stem auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA



Symbols

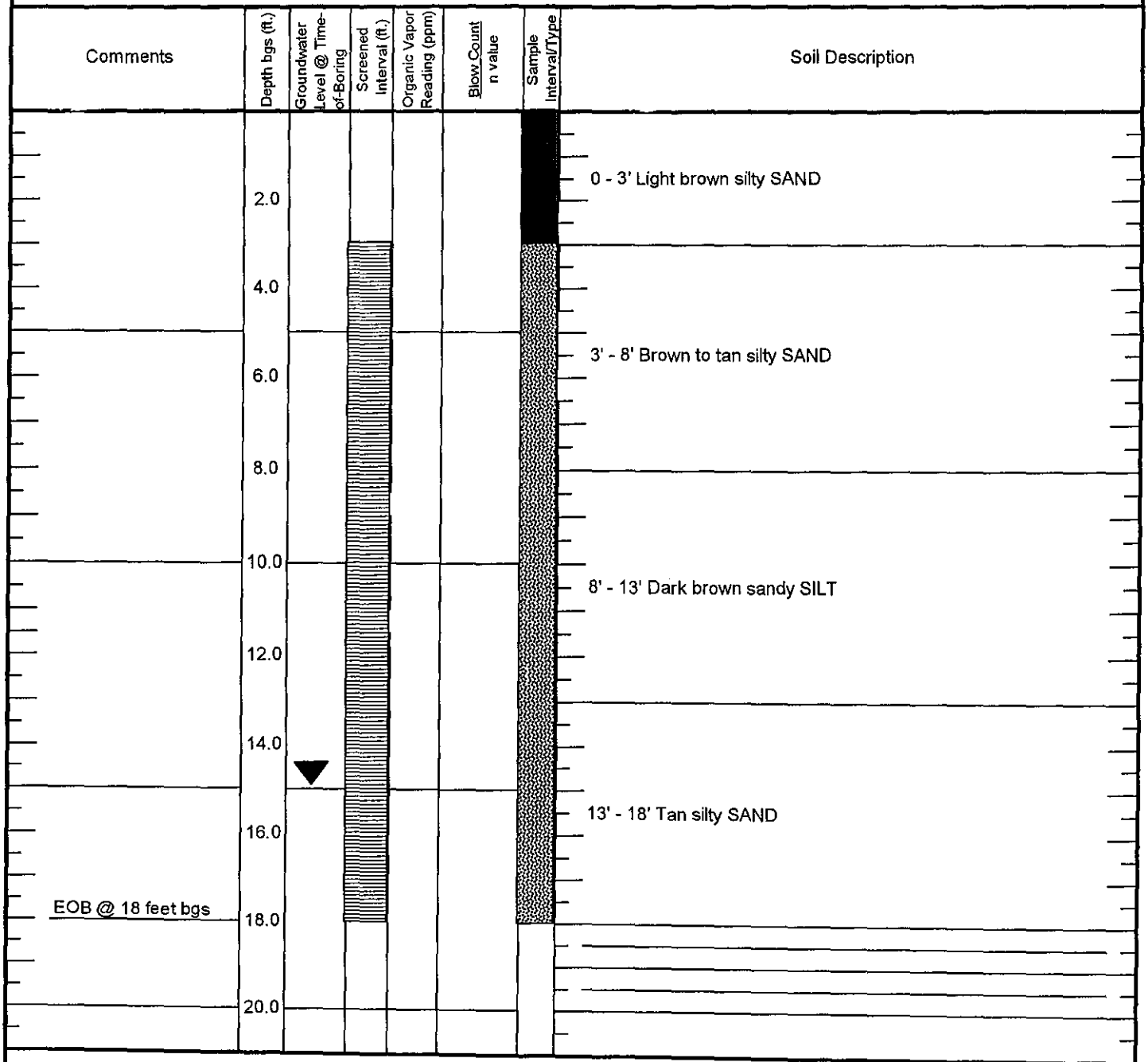
- ▼ - Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Direct Push
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	MW-8
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/21/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Hollow-stem auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA



Symbols

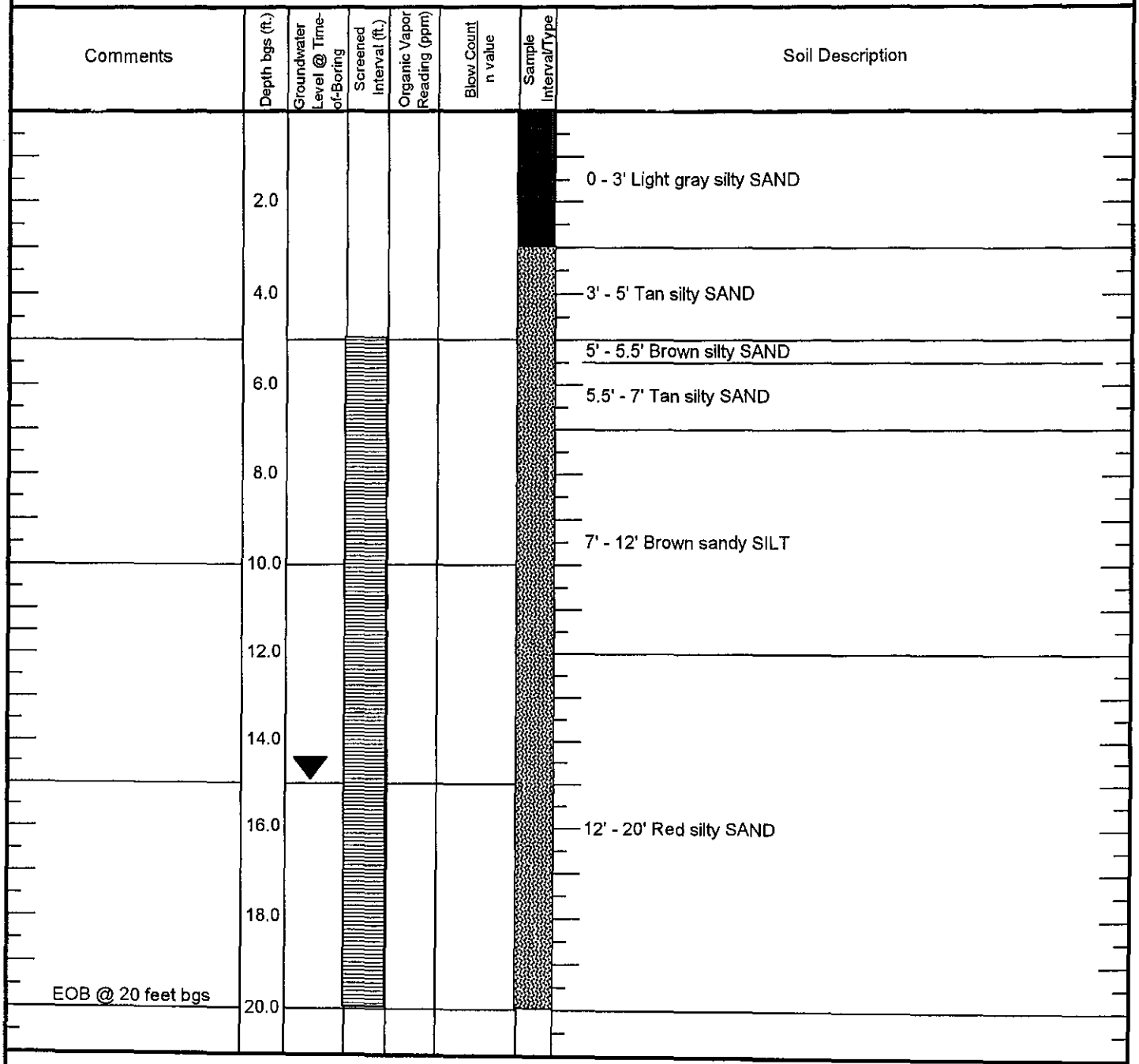
- ▼ - Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Direct Push
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	MW-9
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/21/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Hollow-stem auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA



Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▭ - Screened Interval
- ■ - Hand Auger
- ■ - Std. Penetration Test (SPT)
- ▒ - Submitted for laboratory analysis
- ▥ - Direct Push
- ▩ - Cuttings

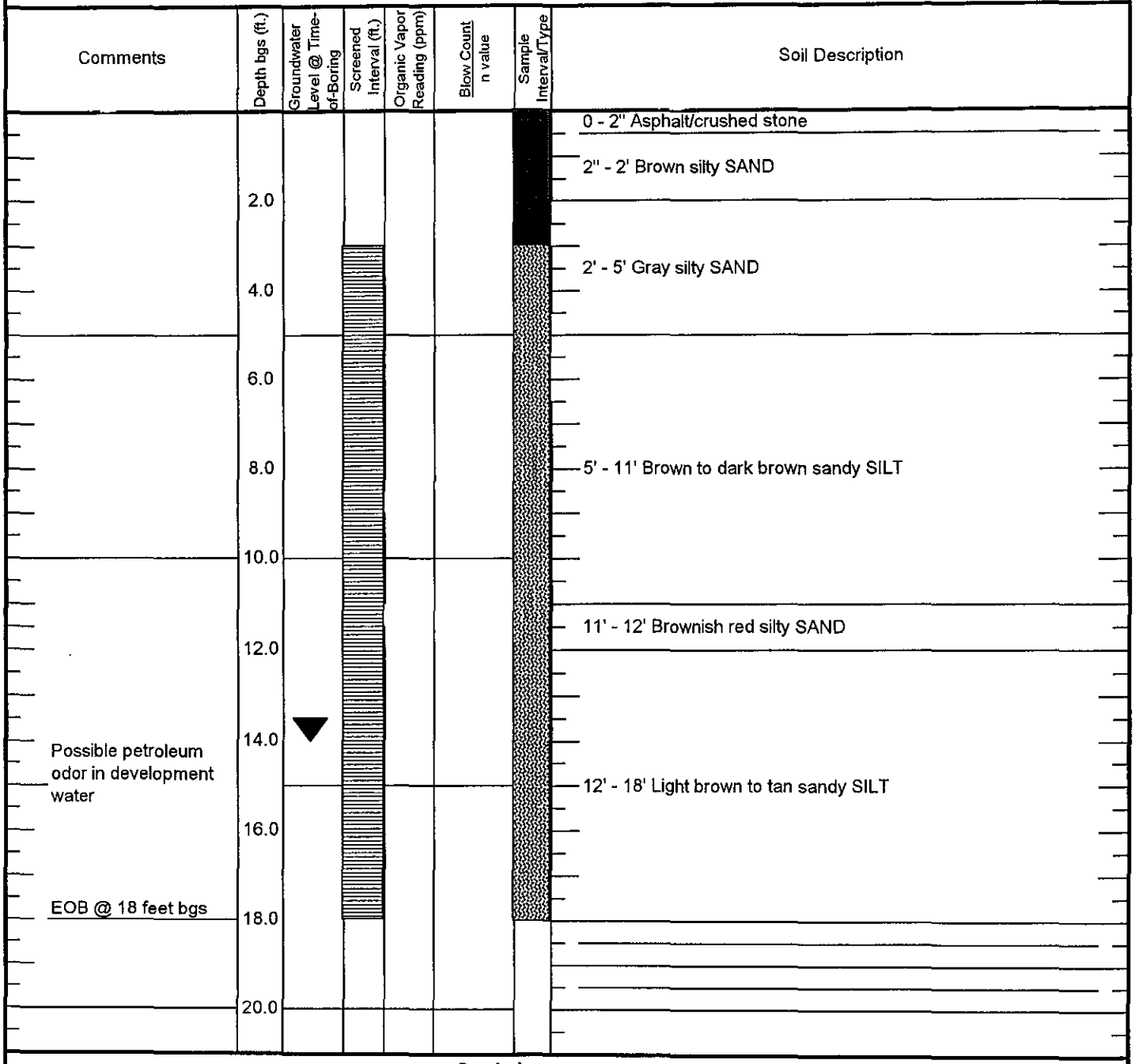
Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: MW-10
Construction Date: 09/21/07
Drilling Contractor: Geologic Exploration
Drilling Method: Hollow-stem auger
Logged By: B. Lievre
Top-of-Casing Elev.: NA



Symbols

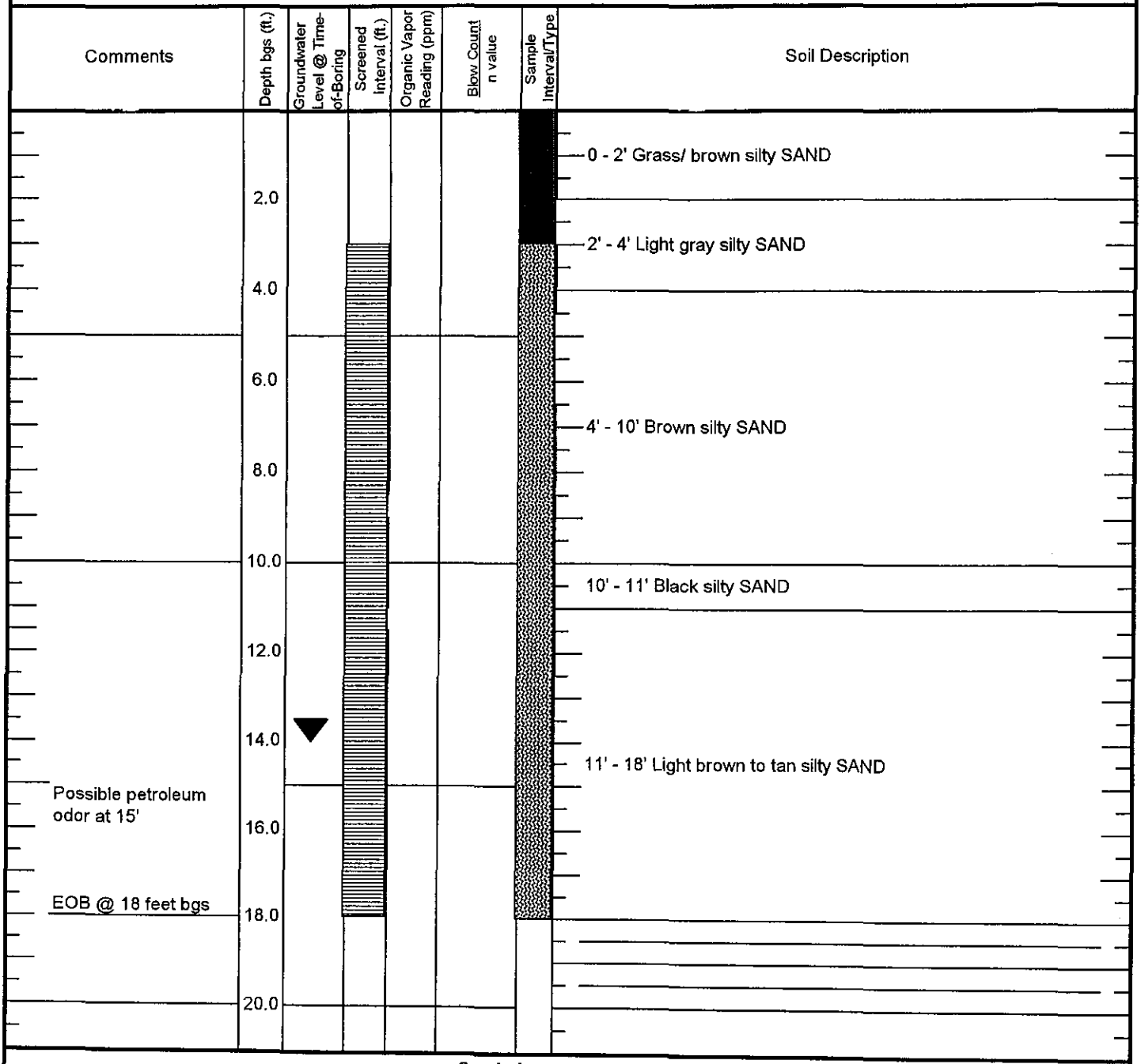
- Groundwater Level @ Time-of-Boring
- Screened Interval
- Hand Auger
- Std. Penetration Test (SPT)
- Submitted for laboratory analysis
- Direct Push
- Cuttings

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	MW-11
Location:	7158 Market Street (US Hwy 17)	Construction Date:	09/21/07
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Hollow-stem auger
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	B. Lievre
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA



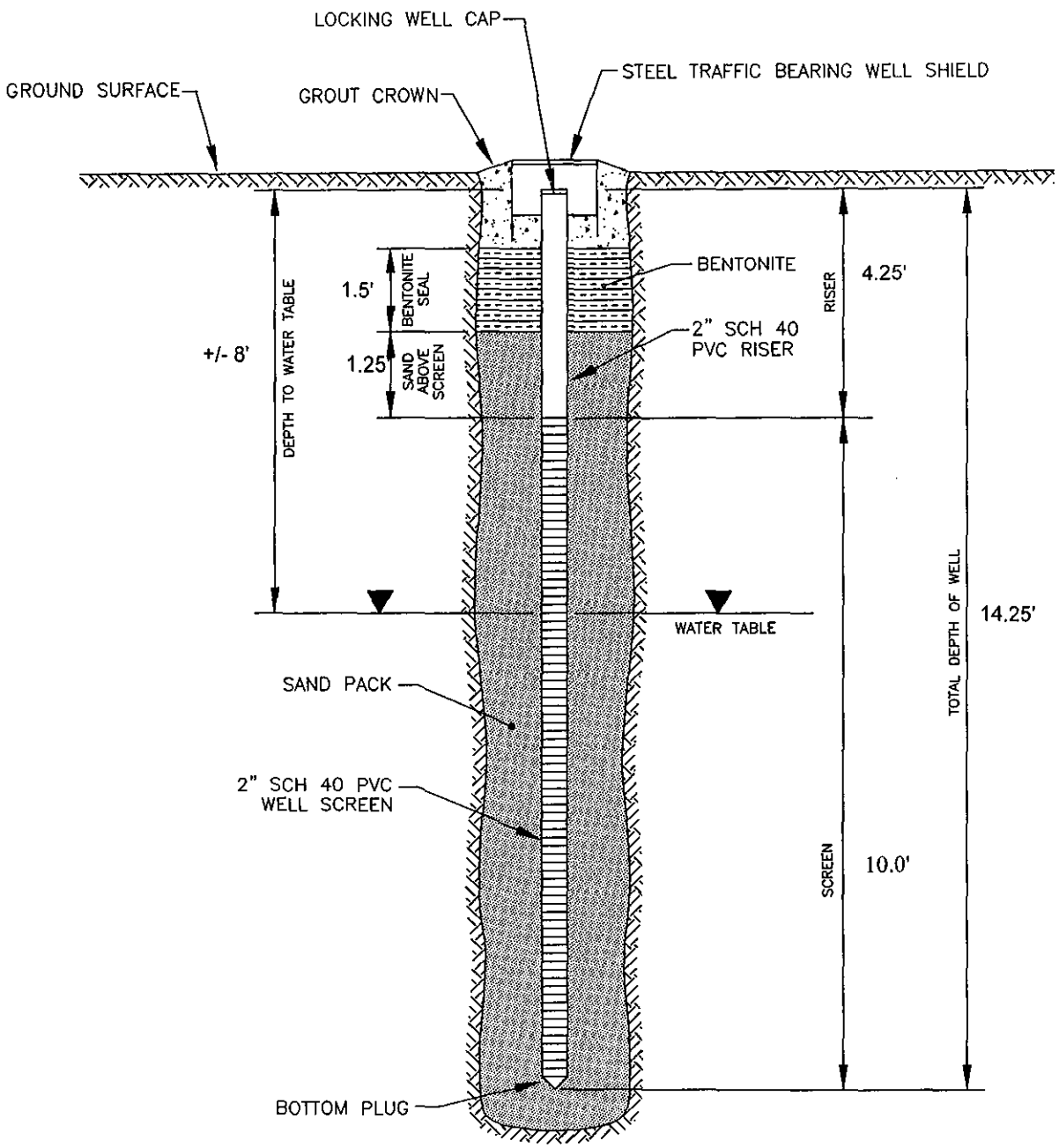
Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▭ - Screened Interval
- ▭ - Hand Auger
- ▭ - Std. Penetration Test (SPT)
- ▭ - Direct Push
- ▭ - Cuttings
- ▭ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

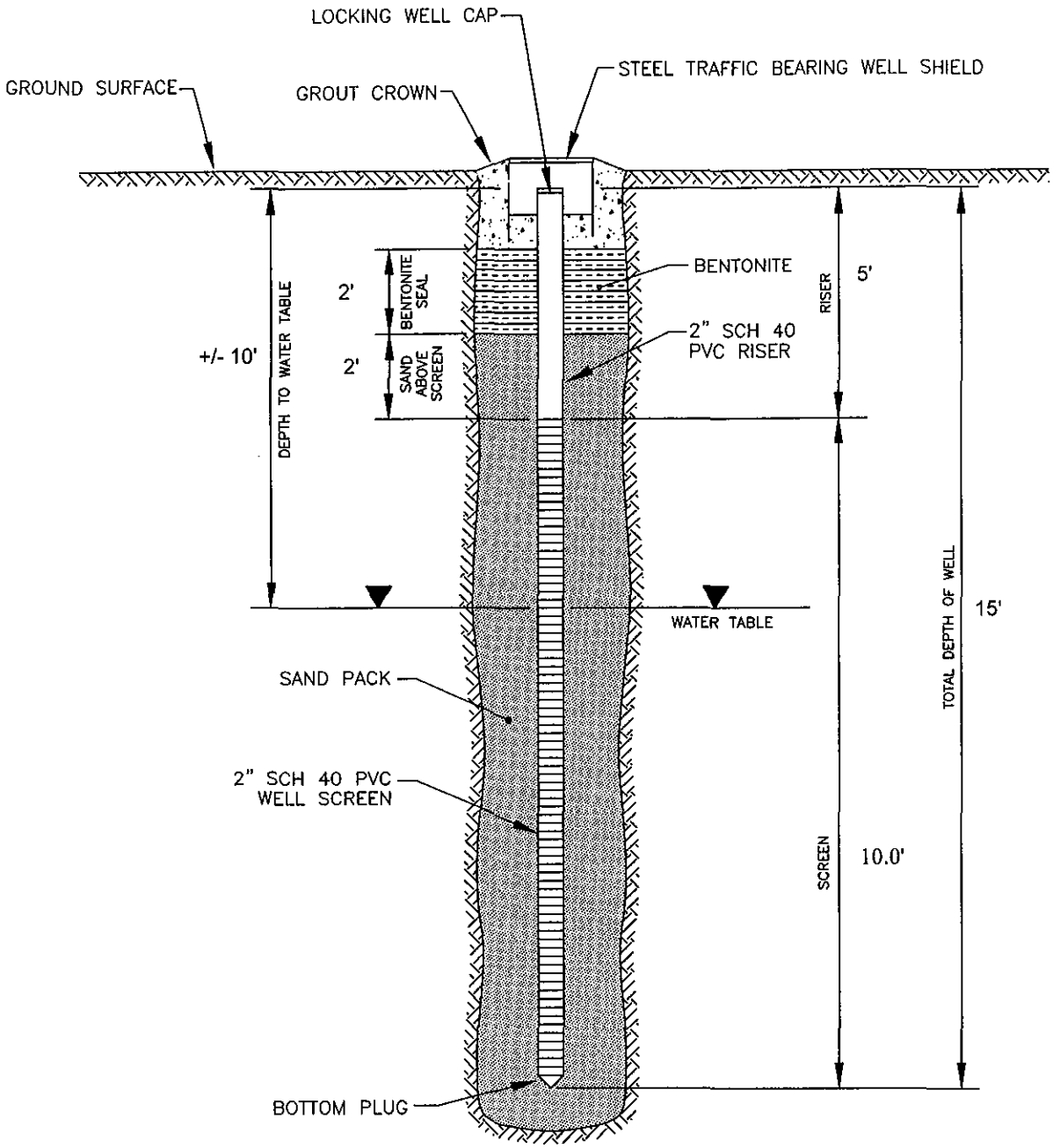
MW-6



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Companies, Inc. Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW-GEN

MW-7



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Companies, Inc. Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW-GEN

MW-1

WELL CONSTRUCTION RECORD

North Carolina – Department of Environment and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Ray Rogers CERTIFICATION # 2428

WELL CONTRACTOR COMPANY NAME SEI Environmental, Inc. PHONE # (919) 832-2535

STATE WELL CONSTRUCTION PERMIT # (if applicable) _____ ASSOCIATED WQ PERMIT # (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, list Use _____

2. WELL LOCATION:
   Nearest Town: Wilmington County New Hanover
   7158 Market Street (Scotchman #35)
   (Street Name, Numbers, Community, or Subdivision and Lot No., Zip Code)

   ☐ Ridge ☐ Slope ☐ Valley ☒ Flat
   (check appropriate box)
   Latitude / longitude of well location
   _____
   (degrees/minutes/seconds)
   Latitude/longitude source: ☐ GPS ☑ Topographic map
   (check box)

3. OWNER Worsley Companies, Inc.
   ADDRESS Post Office Box 3227
   (Street or Route No.)
   Wilmington (City or Town) North Carolina (State) 28406 (Zip Code)
   (910) 395-5300
   Area Code – Phone Number

4. DATE DRILLED 09/20/04
5. TOTAL DEPTH 20.0 Feet
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 10 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A
11. DISINFECTION: Type N/A Amount N/A

DEPTH From	To	DRILLING LOG Formation Description
0	.5	Asphalt
.5	3	Dark brown sand
3	5	White & grey sand
5	20	Dark Brown sand

12. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
FROM	0	TO 5	FT	2.0"	Sch40	PVC
FROM		TO	FT			
FROM		TO	FT			

13. GROUT:

	Depth			Material	Method
FROM	0	TO 2	FT	Portland	Slurry
FROM		TO	FT		

14. SCREEN:

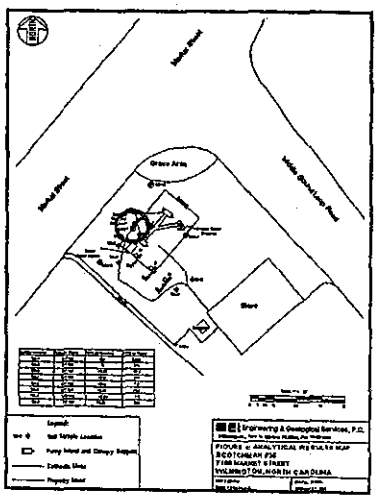
	Depth			Diameter		Slot Size		Material
FROM	5	TO 20	FT	2	in	0.010	in	PVC
FROM		TO	FT		in		in	

15. SAND/GRAVEL PACK:

	Depth			Size	Material
FROM	3	TO 20	FT	20/40	Fine Silica Sand
FROM					

Topographic / Land setting:

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common names.



16 REMARKS: Bentonite Seal 2' – 3'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CONTRACTOR OR AGENT (ORIGINAL ON FILE) DATE 12/15/04

Submit original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

MW-2

WELL CONSTRUCTION RECORD

North Carolina – Department of Environment and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Ray Rogers CERTIFICATION # 2428

WELL CONTRACTOR COMPANY NAME SEI Environmental, Inc. PHONE # (919) 832-2535

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, list Use

2. WELL LOCATION:
   Nearest Town: Wilmington County New Hanover
   7158 Market Street (Scotchman #35)
   (Street Name, Numbers, Community, or Subdivision and Lot No., Zip Code)

   ☐ Ridge ☐ Slope ☐ Valley ☒ Flat (check appropriate box)
   Latitude / longitude of well location (degrees/minutes/seconds)
   Latitude/longitude source: ☐ GPS ☑ Topographic map (check box)

3. OWNER Worsley Companies, Inc.
   ADDRESS Post Office Box 3227 (Street or Route No.)
   Wilmington (City or Town) North Carolina (State) 28406 (Zip Code)
   (910) 395-5300 (Area Code – Phone Number)

4. DATE DRILLED 09/20-21/04
5. TOTAL DEPTH 30 Feet
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 8 FT. (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A
11. DISINFECTION: Type N/A Amount N/A

DEPTH From	To	DRILLING LOG Formation Description
0	.5	Asphalt
.5	4	White & grey sand
4	30	Dark brown sand

12. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
FROM	0	TO 25	FT	2.0"	Sch40	PVC
FROM	0	TO 20	FT	6.0"	Sch40	PVC
FROM		TO	FT			

13. GROUT:

	Depth			Material	Method
FROM	0	TO 19	FT	Portland	Tremmie
FROM	0	TO 20	FT	Portland	Tremmie

14. SCREEN:

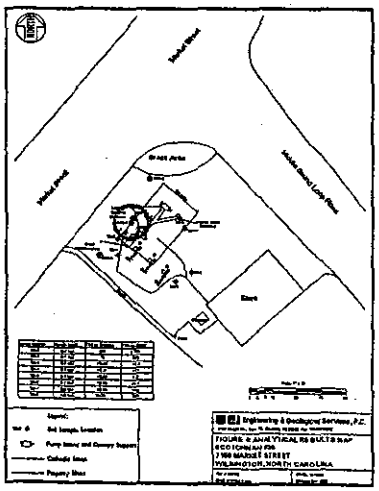
	Depth			Diameter		Slot Size		Material
FROM	25	TO 30	FT	2	in	0.010	in	PVC
FROM		TO	FT		in		in	

15. SAND/GRAVEL PACK:

	Depth			Size	Material
FROM	22	TO 30	FT	20/40	Fine Silica Sand
FROM					

Topographic / Land setting:

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common names.



16 REMARKS: Bentonite Seal 19' – 22'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CONTRACTOR OR AGENT (ORIGINAL ON FILE) DATE 12/15/04

Submit original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

MW-3

WELL CONSTRUCTION RECORD

North Carolina – Department of Environment and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Ray Rogers CERTIFICATION # 2428

WELL CONTRACTOR COMPANY NAME SEI Environmental, Inc. PHONE # (919) 832-2535

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, list Use

2. WELL LOCATION:
   Nearest Town: Wilmington County New Hanover
   7158 Market Street (Scotchman #35)
   (Street Name, Numbers, Community, or Subdivision and Lot No., Zip Code)

   ☐ Ridge ☐ Slope ☐ Valley ☒ Flat (check appropriate box)
   Latitude / longitude of well location (degrees/minutes/seconds)
   Latitude/longitude source: ☐ GPS ☑ Topographic map (check box)

3. OWNER Worsley Companies, Inc.
   ADDRESS Post Office Box 3227 (Street or Route No.)
   Wilmington (City or Town) North Carolina (State) 28406 (Zip Code)
   (910) 395-5300 (Area Code – Phone Number)

4. DATE DRILLED 09/20/04
5. TOTAL DEPTH 20.0 Feet
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 9 FT. (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A
11. DISINFECTION: Type N/A Amount N/A

DEPTH From		To	DRILLING LOG Formation Description
0	-	.5	Asphalt
.5	-	3	White sand
3	-	6	Light brown sand
6	-	20	Dark Brown sand

12. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
FROM	0	TO 5	FT	2.0"	Sch40	PVC
FROM		TO	FT			
FROM		TO	FT			

13. GROUT:

	Depth			Material	Method
FROM	0	TO 2	FT	Portland	Slurry
FROM		TO	FT		

14. SCREEN:

	Depth			Diameter		Slot Size		Material
FROM	5	TO 20	FT	2	in	0.010	in	PVC
FROM		TO	FT		in		in	

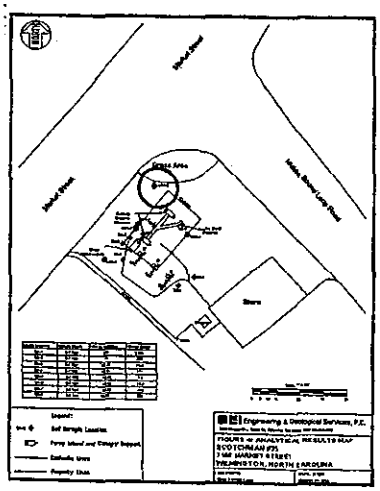
15. SAND/GRAVEL PACK:

	Depth			Size	Material
FROM	3	TO 20	FT	20/40	Fine Silica Sand
FROM					

Topographic / Land setting:

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common names.



16 REMARKS: Bentonite Seal 2' – 3'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CONTRACTOR OR AGENT (ORIGINAL ON FILE) DATE 12/15/04

Submit original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

MW-4

WELL CONSTRUCTION RECORD

North Carolina – Department of Environment and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Ray Rogers CERTIFICATION # 2428

WELL CONTRACTOR COMPANY NAME SEI Environmental, Inc. PHONE # (919) 832-2535

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, list Use

2. WELL LOCATION:
   Nearest Town: Wilmington County New Hanover
   7158 Market Street (Scotchman #35)
   (Street Name, Numbers, Community, or Subdivision and Lot No., Zip Code)

   ☐ Ridge ☐ Slope ☐ Valley ☒ Flat
   (check appropriate box)
   Latitude / longitude of well location
   (degrees/minutes/seconds)
   Latitude/longitude source: ☐ GPS ☑ Topographic map
   (check box)

3. OWNER Worsley Companies, Inc.
   ADDRESS Post Office Box 3227
   (Street or Route No.)
   Wilmington (City or Town) North Carolina (State) 28406 (Zip Code)
   (910) 395-5300
   Area Code – Phone Number

4. DATE DRILLED 09/20/04
5. TOTAL DEPTH 20.0 Feet
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 8 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A
11. DISINFECTION: Type N/A Amount N/A

DEPTH From	To	DRILLING LOG Formation Description
0	.5	Asphalt
.5	4	White sand
4	8	Light brown sand
8	20	Dark brown sand

12. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
FROM	0	TO 5	FT	2.0"	Sch40	PVC
FROM		TO	FT			
FROM		TO	FT			

13. GROUT:

	Depth			Material	Method
FROM	0	TO 2	FT	Portland	Slurry
FROM		TO	FT		

14. SCREEN:

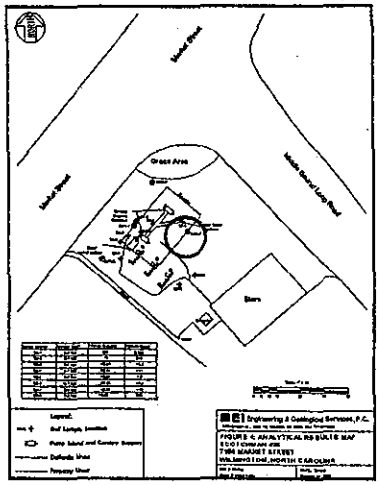
	Depth			Diameter		Slot Size		Material
FROM	5	TO 20	FT	2	in	0.010	in	PVC
FROM		TO	FT		in		in	

15. SAND/GRAVEL PACK:

	Depth			Size	Material
FROM	3	TO 20	FT	20/40	Fine Silica Sand
FROM		TO	FT		

Topographic / Land setting:

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common names.



16 REMARKS: Bentonite Seal 2' – 3'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CONTRACTOR OR AGENT (ORIGINAL ON FILE) DATE 12/15/04

Submit original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

MW-3

WELL CONSTRUCTION RECORD

North Carolina – Department of Environment and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Ray Rogers CERTIFICATION # 2428

WELL CONTRACTOR COMPANY NAME SEI Environmental, Inc. PHONE # (919) 832-2535

STATE WELL CONSTRUCTION PERMIT # (if applicable) _____ ASSOCIATED WQ PERMIT # (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, list Use _____

2. WELL LOCATION:
   Nearest Town: Wilmington County New Hanover
   7158 Market Street (Scotchman #35)
   (Street Name, Numbers, Community, or Subdivision and Lot No., Zip Code)

   ☐ Ridge ☐ Slope ☐ Valley ☒ Flat (check appropriate box)
   Latitude / longitude of well location _____ (degrees/minutes/seconds)
   Latitude/longitude source: ☐ GPS ☑ Topographic map (check box)

3. OWNER Worsley Companies, Inc.
   ADDRESS Post Office Box 3227 (Street or Route No.)
   Wilmington (City or Town) North Carolina (State) 28406 (Zip Code)
   (910) 395-5300 (Area Code – Phone Number)

4. DATE DRILLED 09/20/04
5. TOTAL DEPTH 20.0 Feet
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 8 FT. (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A
11. DISINFECTION: Type N/A Amount N/A

DEPTH From	To	DRILLING LOG Formation Description
0	.5	Asphalt
.5	3	White sand
3	6	Light brown sand
6	20	Dark brown sand

12. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
FROM	0	TO 5	FT	2.0"	Sch40	PVC
FROM		TO	FT			
FROM		TO	FT			

13. GROUT:

	Depth			Material	Method
FROM	0	TO 2	FT	Portland	Slurry
FROM		TO	FT		

14. SCREEN:

	Depth			Diameter		Slot Size		Material
FROM	5	TO 20	FT	2	in	0.010	in	PVC
FROM		TO	FT		in		in	

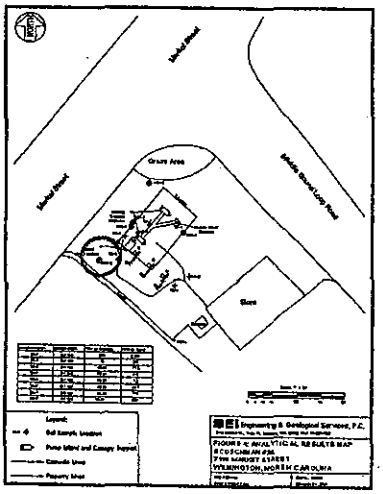
15. SAND/GRAVEL PACK:

	Depth			Size	Material
FROM	3	TO 20	FT	20/40	Fine Silica Sand
FROM		TO	FT		

Topographic / Land setting:

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common names.



16 REMARKS: Bentonite Seal 2' – 3'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CONTRACTOR OR AGENT (ORIGINAL ON FILE) DATE 12/15/04

Submit original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-6

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/20/07

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 15.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 5.0	Ft.	2 INCH	SCH 40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 1.0	Ft.	Portland bentonite	SLURRY
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5.0	To 15.0	Ft.	2.0 in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 3.0	To 15.0	Ft.	20-40	Fine Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND

11. REMARKS:

Bentonite seal from 1.0 to 3.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-7

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/20/07

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 15.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 5.0	Ft.	2 INCH	SCH 40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 1.0	Ft.	Portland bentonite	SLURRY
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter		Slot Size		Material
From 5.0	To 15.0	Ft.	2.0	in.	.010	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 3.0	To 15.0	Ft.	20-40	Fine Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND

11. REMARKS:

Bentonite seal from 1.0 to 3.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-8

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/21/07

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 18.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 3.0	Ft.	2 INCH	SCH 40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 1.0	Ft.	Portland bentonite	SLURRY
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter		Slot Size		Material
From 3.0	To 18.0	Ft.	2.0	in.	.010	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 2.0	To 18.0	Ft.	20-40	Fine Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND
15.0	18.0	BROWN SAND

11. REMARKS:

Bentonite seal from 1.0 to 2.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-9

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/21/07

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE ___ ___ _____

LONGITUDE ___ ___ _____

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC |
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 20.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From ___ To ___ From ___ To ___

From ___ To ___ From ___ To ___

From ___ To ___ From ___ To ___

6. CASING:

	Depth			Diameter	Thickness/ Weight	Material
From 0.0	To 5.0	Ft.		2 INCH	SCH 40	PVC
From	To	Ft.				
From	To	Ft.				

7. GROUT:

	Depth			Material	Method
From 0.0	To 1.0	Ft.		Portland bentonite	SLURRY
From	To	Ft.			
From	To	Ft.			

8. SCREEN:

	Depth			Diameter		Slot Size		Material
From 5.0	To 20.0	Ft.		2.0	in.	.010	in.	PVC
From	To	Ft.			in.		in.	
From	To	Ft.			in.		in.	

9. SAND/GRAVEL PACK:

	Depth			Size	Material
From 3.0	To 20.0	Ft.		20-40	Fine Silica Sand
From	To	Ft.			
From	To	Ft.			

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND
15.0	18.0	BROWN SAND
18.0	20.0	ORANGE SAND

11. REMARKS:

Bentonite seal from 1.0 to 3.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-10

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/21/07

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE
LONGITUDE
May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 18.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 3.0	Ft.	2 INCH	SCH 40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 1.0	Ft.	Portland bentonite	SLURRY
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter		Slot Size		Material
From 3.0	To 18.0	Ft.	2.0	in.	.010	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

9. SAND/GRAVEL PACK:

Depth			Size	Material
From 2.0	To 18.0	Ft.	20-40	Fine Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND
15.0	18.0	BROWN SAND

11. REMARKS:

Bentonite seal from 1.0 to 2.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS. AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2854

1. WELL CONTRACTOR:

STEPHEN SLOAN
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) MW-11

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 09/21/07

TIME COMPLETED ____ AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7160 MARKET STREET
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE ___ ___ ____

LONGITUDE ___ ___ ____

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SCOTCHMAN #35

STREET ADDRESS 7160 MARKET STREET

WILMINGTON | NC |
City or Town | State | Zip Code

CONTACT PERSON WORSLEY COMPANIES, INC.

MAILING ADDRESS P.O. BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

(_____)-_____
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 18.0'

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 7.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From ____ To ____ From ____ To ____
From ____ To ____ From ____ To ____
From ____ To ____ From ____ To ____

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 3.0	Ft.	2 INCH	SCH 40	PVC
From ____	To ____	Ft.			
From ____	To ____	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 1.0	Ft.	Portland bentonite	SLURRY
From ____	To ____	Ft.		
From ____	To ____	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 3.0	To 18.0	Ft.	2.0 in.	.010 in.	PVC
From ____	To ____	Ft.	____ in.	____ in.	
From ____	To ____	Ft.	____ in.	____ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 2.0	To 18.0	Ft.	20-40	Fine Silica Sand
From ____	To ____	Ft.		
From ____	To ____	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	1.0	ASPHALT/GRAVEL
1.0	3.0	BLACK SAND
3.0	5.0	WHITE SAND
5.0	11.0	BROWN SAND
11.0	15.0	BROWN/BLACK SAND
15.0	18.0	BROWN SAND

11. REMARKS:

Bentonite seal from 1.0 to 2.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen B Sloan — 10/23/07
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

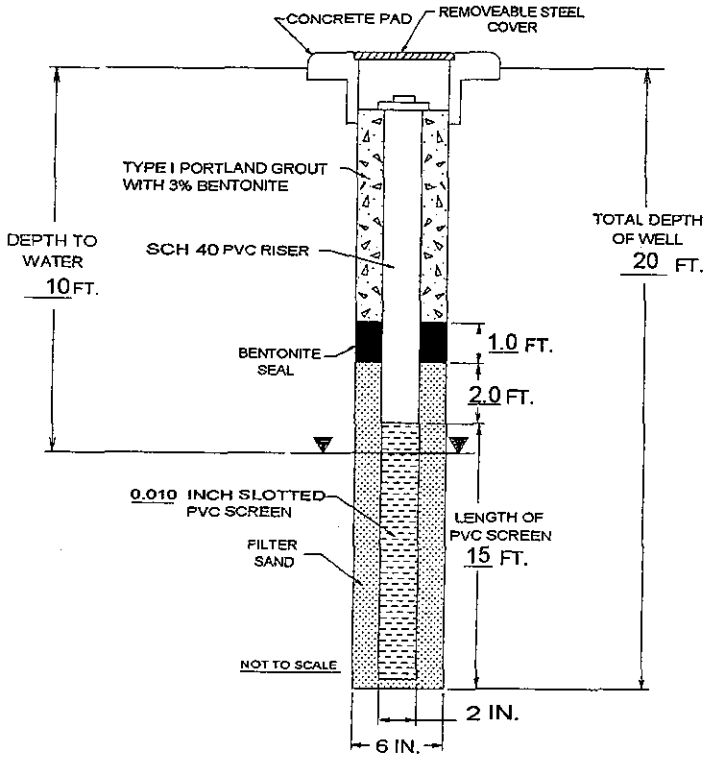
STEPHEN SLOAN
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

Boring Log and Type II W .l Construction Details

WELL IDENTIFICATION MW-1 DATE DRILLED: 09/20/04
STATE PERMIT #: WORK ORDER #: 504785
PROJECT NAME: Scotchman #35
SITE ADDRESS: 7158 Market Street, Wilmington, NC
LATITUDE: LONGITUDE:
TOP OF CASING ELEV.: LAND SURFACE ELEV.:

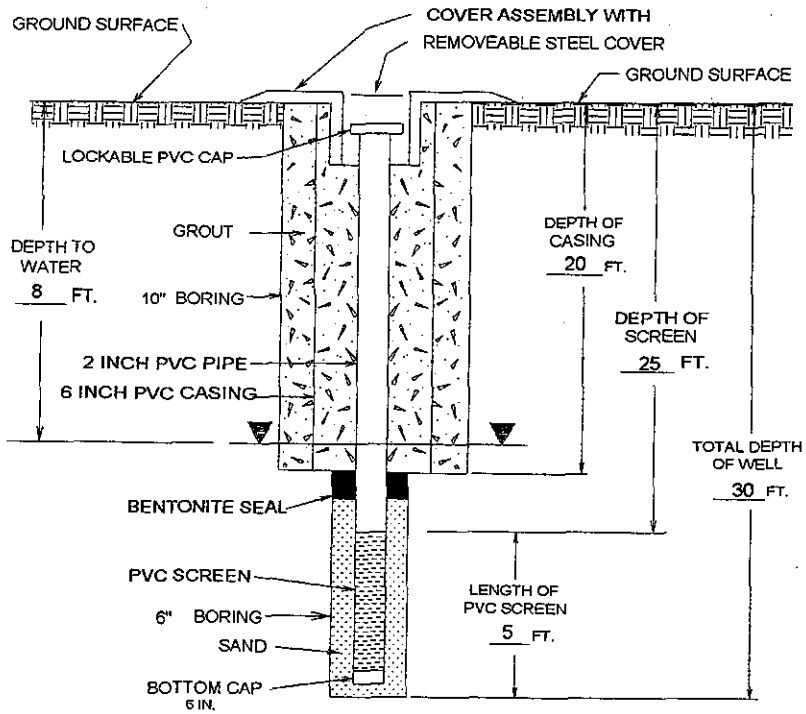


DRILLING METHOD: Hollow stem auger
SAMPLING METHOD:
GRAVEL PACK SIZE: 20/40 Silica sand
SLOT SIZE: 0.010 inches
COMMENTS:

DEPTH	SAMPLE NUMBER	BLOW COUNT	RECOV-ERY	OVA (ppm)	UNIFIED METHOD	DESCRIPTIVE LOG
0						Asphalt
						Dark brown sand
						White & grey sand
5						Dark Brown sand
10						
15						
20						End of bore
25						

Boring Log and Type III Well Construction Details

WELL IDENTIFICATION: MW-2 DATE DRILLED: 09/20-21/04
STATE PERMIT #: _____ WORK ORDER #: 504785
PROJECT NAME: Scotchman #35
SITE ADDRESS: 7158 Market Street, Wilmington, NC
LATITUDE: _____ LONGITUDE: _____
TOP OF CASING ELEV.: _____ LAND SURFACE ELEV.: _____

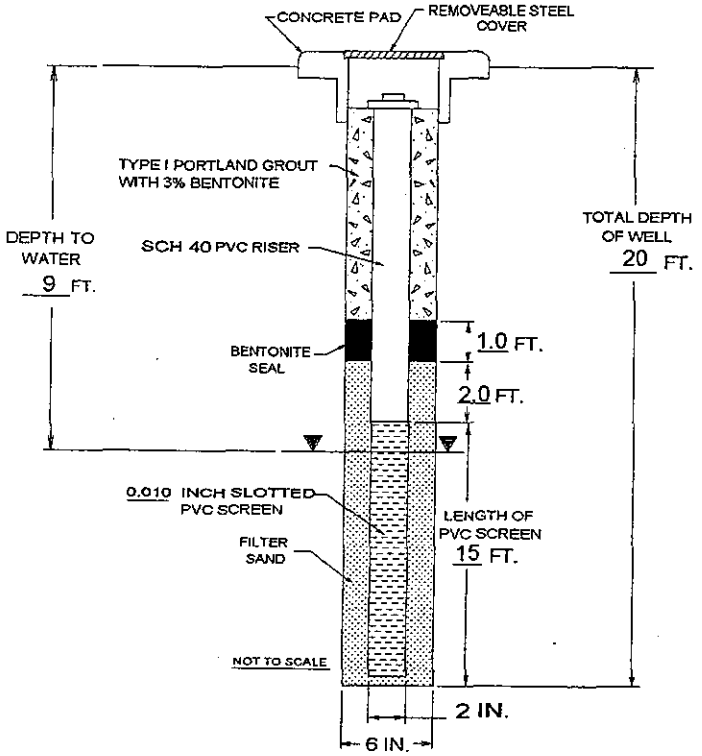


DRILLING METHOD: Hollow Stem Auger/mud rotary
SAMPLING METHOD: _____
GRAVEL PACK SIZE: 20/40 Silica sand
SLOT SIZE: 0.010"
COMMENTS: _____

DEPTH	SAMPLE NUMBER	BLOW COUNT	RECOV-ERY	OVA (ppm)	UNIFIED METHOD	DESCRIPTIVE LOG
						Asphalt
						White & grey sand
						Dark brown sand
5						
10						
15						
20						
25						
30						End of bore
35						
40						

Boring Log and Type II W. . Construction Details

WELL IDENTIFICATION MW-3 DATE DRILLED: 09/20/04
STATE PERMIT #: _____ WORK ORDER #: 504785
PROJECT NAME: Scotchman #35
SITE ADDRESS: 7158 Market Street, Wilmington, NC
LATITUDE: _____ LONGITUDE: _____
TOP OF CASING ELEV.: _____ LAND SURFACE ELEV.: _____

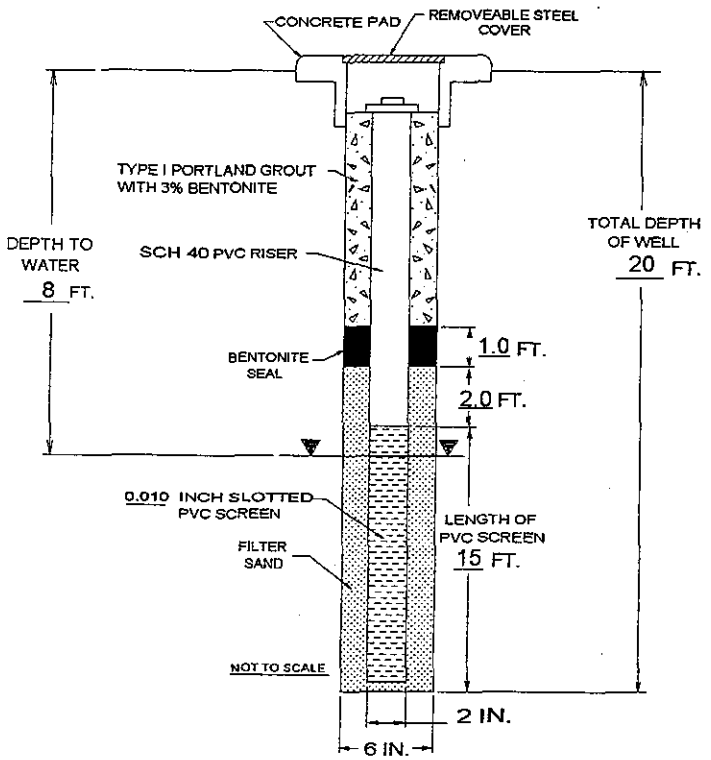


DRILLING METHOD: Hollow stem auger
SAMPLING METHOD: _____
GRAVEL PACK SIZE: 20/40 Silica sand
SLOT SIZE: 0.010 inches
COMMENTS: _____

DEPTH	SAMPLE NUMBER	BLOW COUNT	RECOVERY	OVA (ppm)	UNIFIED METHOD	DESCRIPTIVE LOG
0						Asphalt
						White sand
						Light brown sand
5						
						Dark Brown sand
10						
15						
20						End of bore
25						

Boring Log and Type II W[illegible] Construction Details

WELL IDENTIFICATION MW-4 DATE DRILLED: 09/20/04
STATE PERMIT #: _____ WORK ORDER #: 504785
PROJECT NAME: Scotchman #35
SITE ADDRESS: 7158 Market Street, Wilmington, NC
LATITUDE: _____ LONGITUDE: _____
TOP OF CASING ELEV.: _____ LAND SURFACE ELEV.: _____

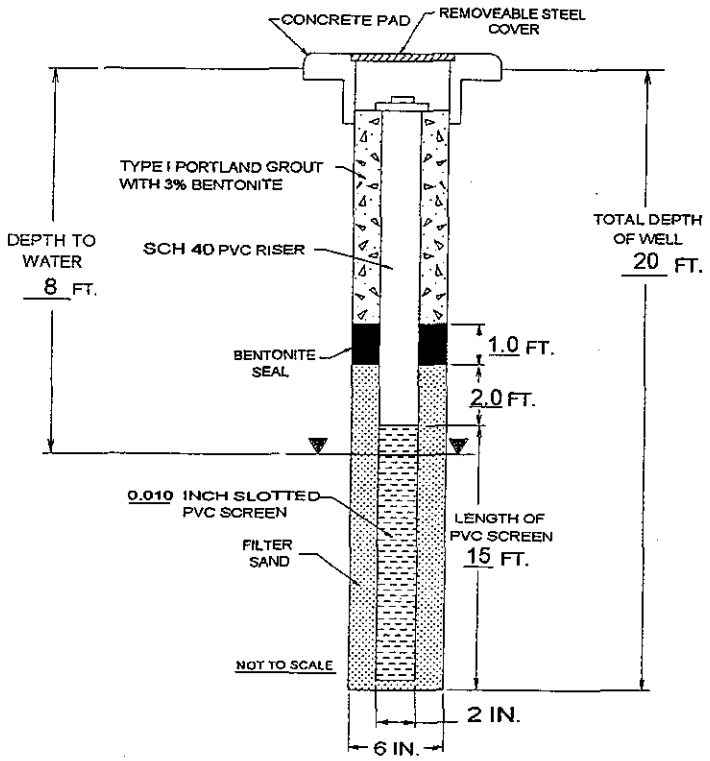


DRILLING METHOD: Hollow stem auger
SAMPLING METHOD: _____
GRAVEL PACK SIZE: 20/40 Silica sand
SLOT SIZE: 0.010 inches
COMMENTS: _____

DEPTH	SAMPLE NUMBER	BLOW COUNT	RECOV-ERY	OVA (ppm)	UNIFIED METHOD	DESCRIPTIVE LOG
0						Asphalt
						White sand
						Light brown sand
5						
						Dark Brown sand
10						
15						
20						End of bore
25						

Boring Log and Type II W[illegible] Construction Details

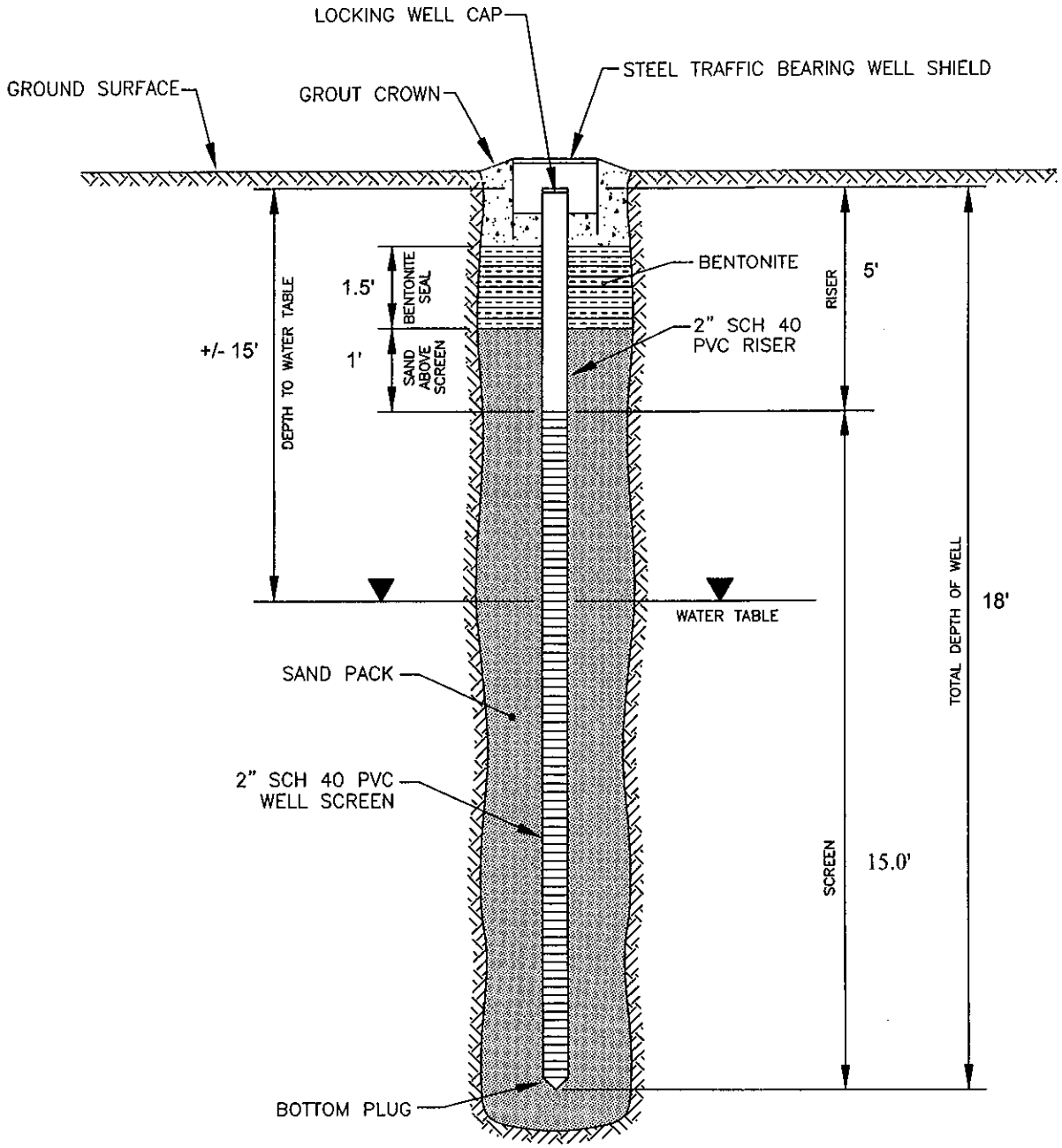
WELL IDENTIFICATION MW-5 DATE DRILLED: 09/20/04
STATE PERMIT #: _____ WORK ORDER #: 504785
PROJECT NAME: Scotchman #35
SITE ADDRESS: 7158 Market Street, Wilmington, NC
LATITUDE: _____ LONGITUDE: _____
TOP OF CASING ELEV.: _____ LAND SURFACE ELEV.: _____



DRILLING METHOD: Hollow stem auger
SAMPLING METHOD: _____
GRAVEL PACK SIZE: 20/40 Silica sand
SLOT SIZE: 0.010 inches
COMMENTS: _____

DEPTH	SAMPLE NUMBER	BLOW COUNT	RECOVERY	OVA (ppm)	UNIFIED METHOD	DESCRIPTIVE LOG
0						Asphalt
						White sand
						Light brown sand
5						
						Dark Brown sand
10						
15						
20						End of bore
25						

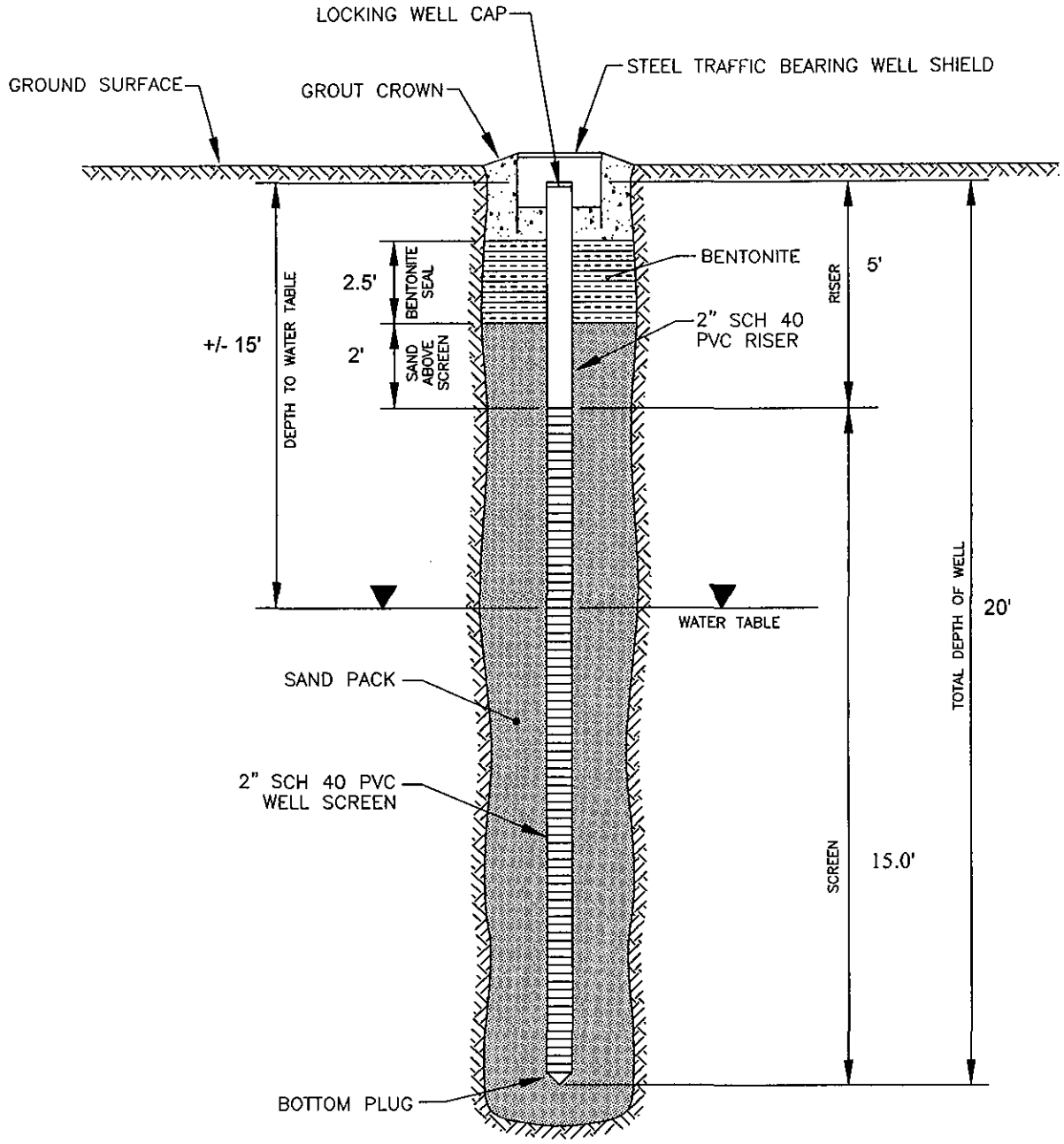
MW-8



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION	
PROJECT MANAGER: B. Lievre		Worsley Companies, Inc. Scotchman #35, Wilmington, NC	
DESIGNED BY		DRAWING DESCRIPTION	
DRAWN BY		MONITORING WELL DETAIL	
REVIEWED BY	DATE	SCALE: NONE	CAD NO.: MW-GEN

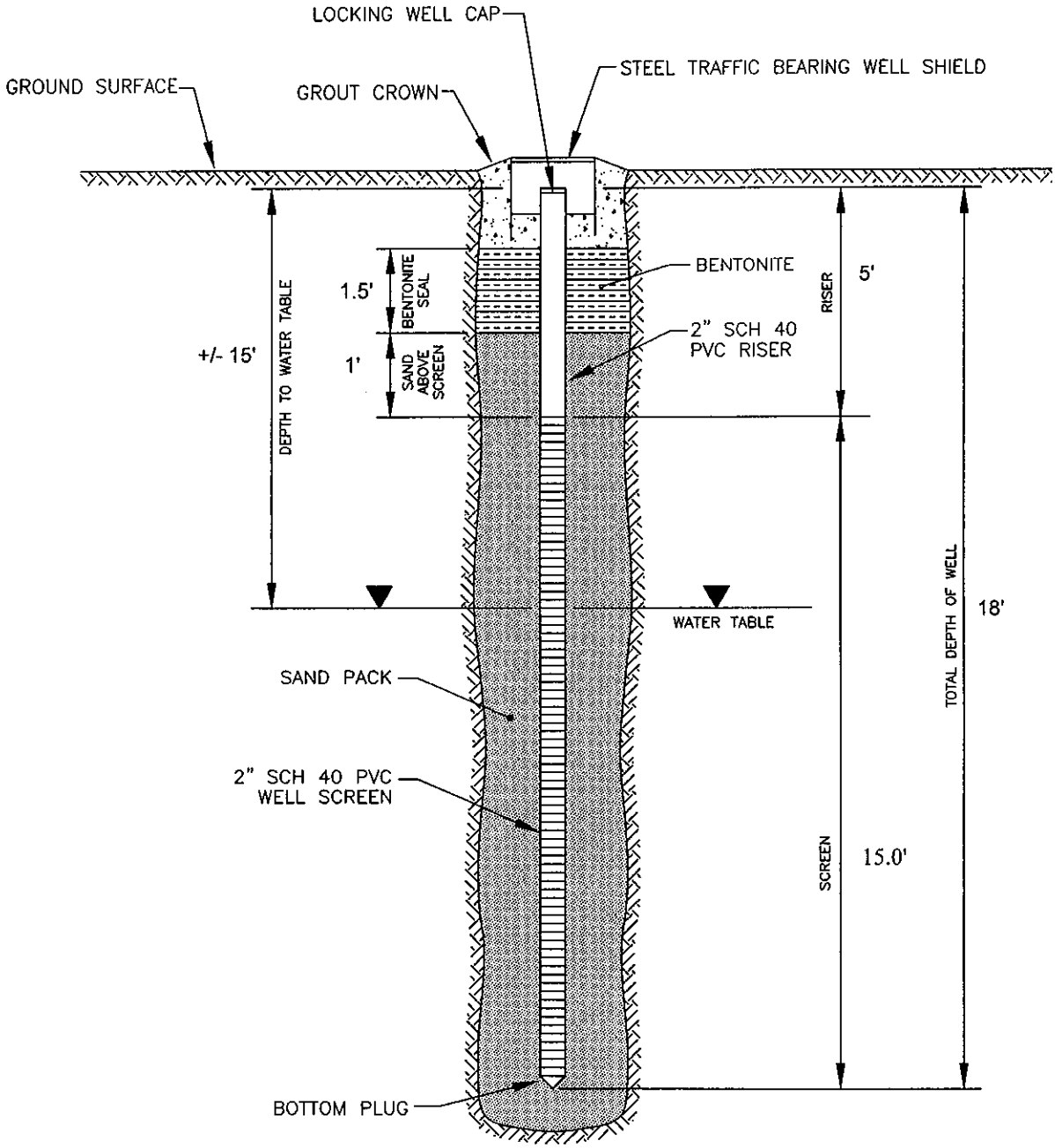
MW-9



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Companies, Inc. Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW-GEN

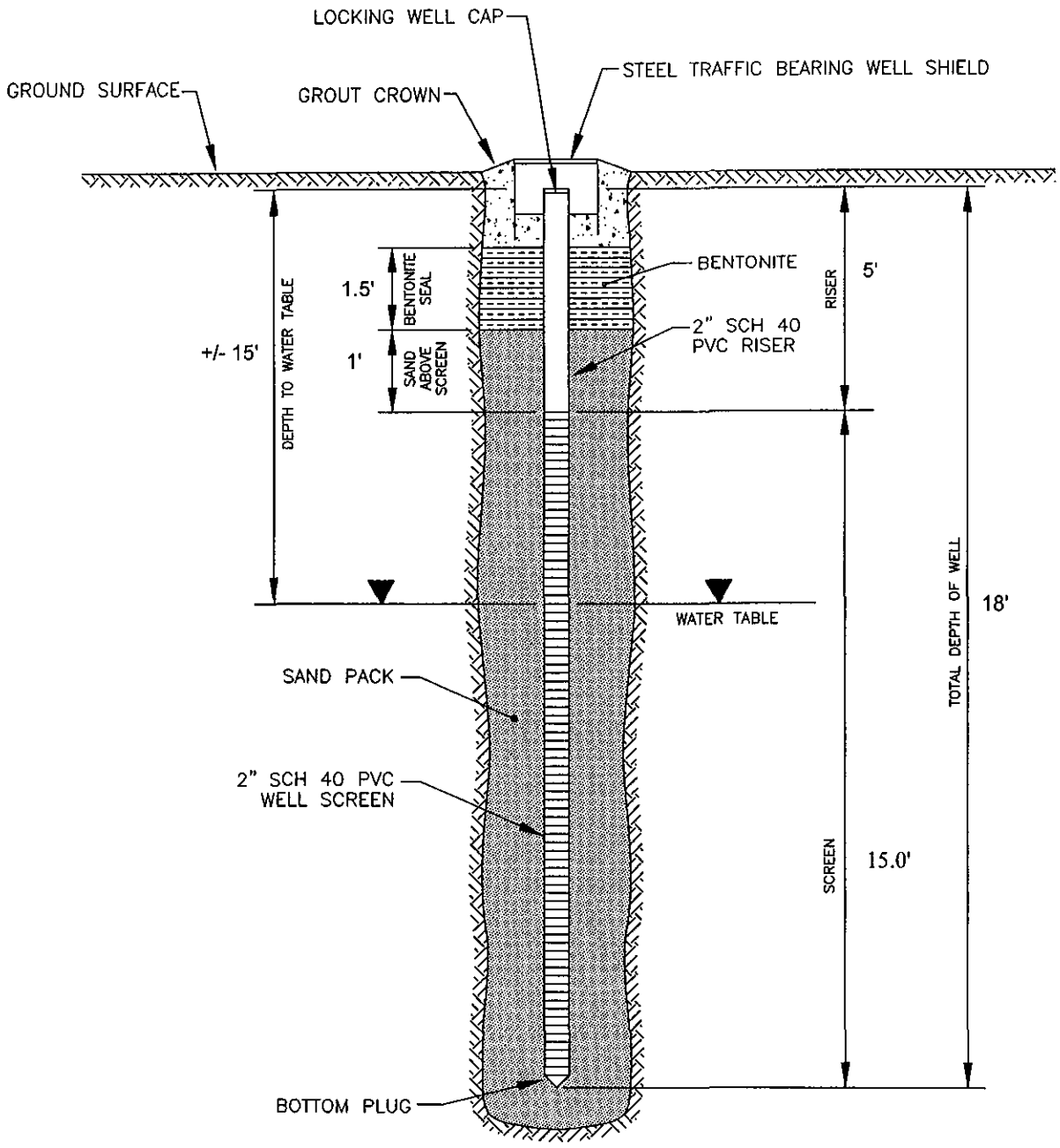
MW-10



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Companies, Inc. Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW--GEN

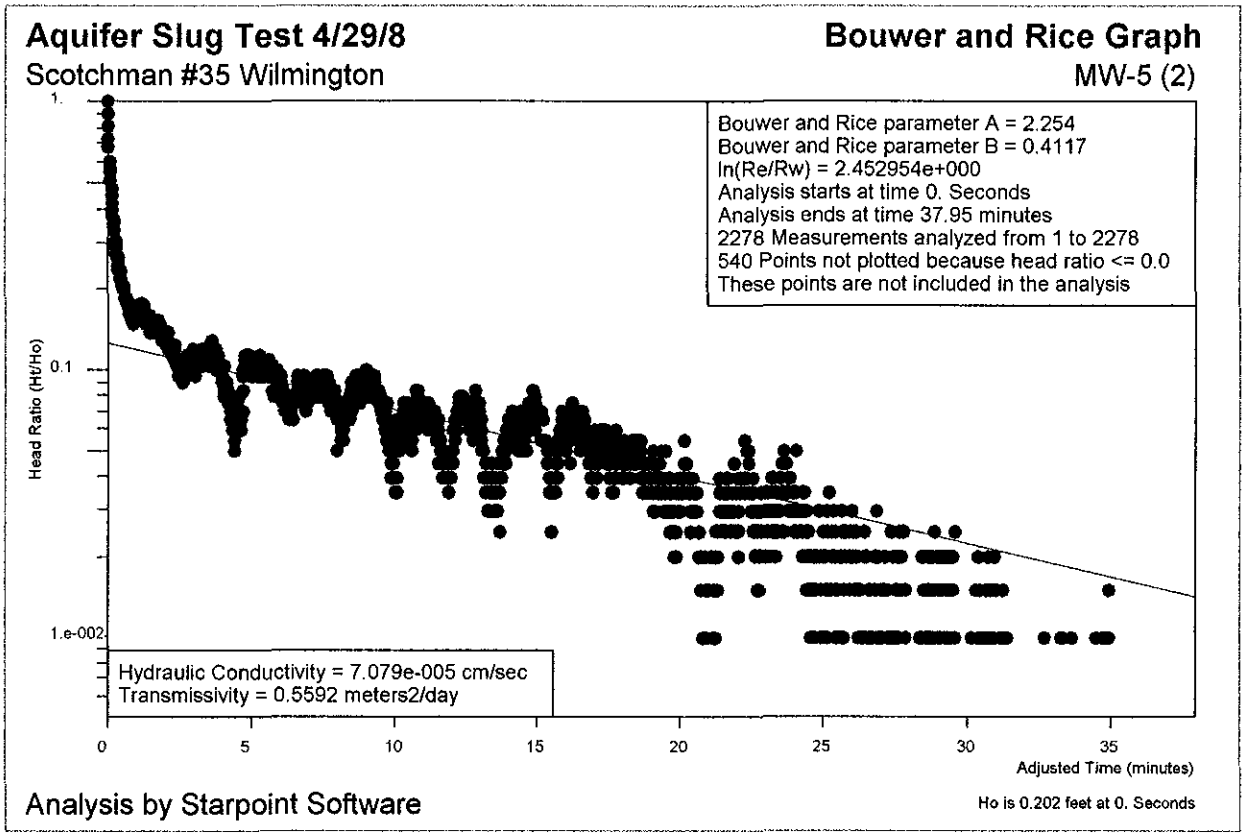
MW-11

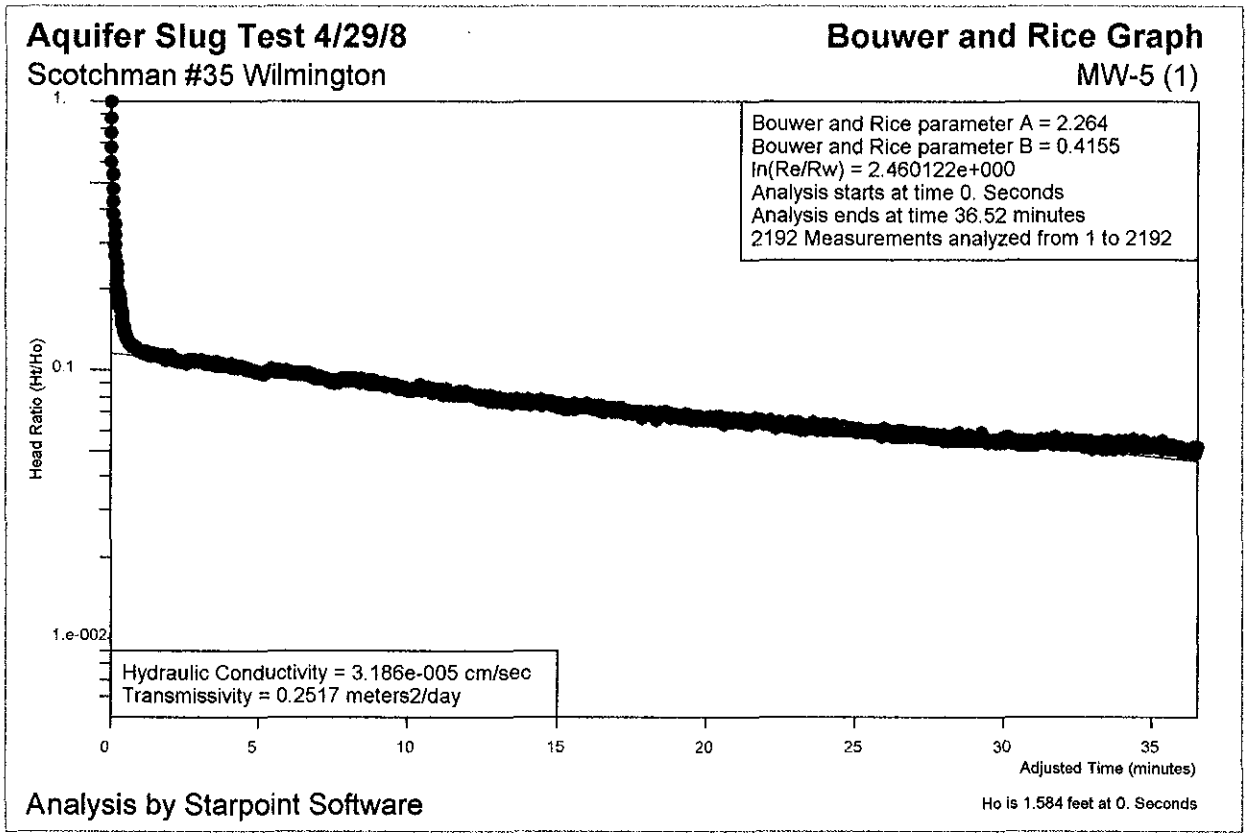


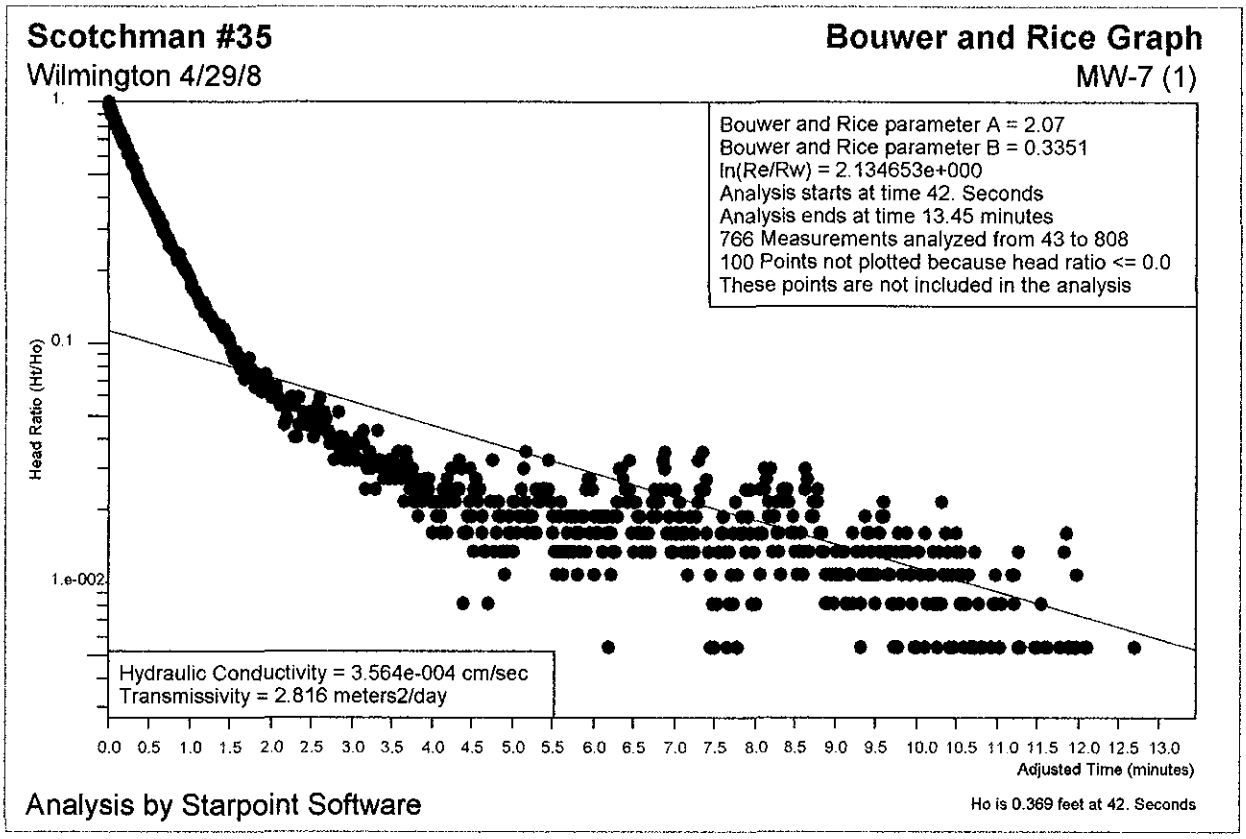
Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

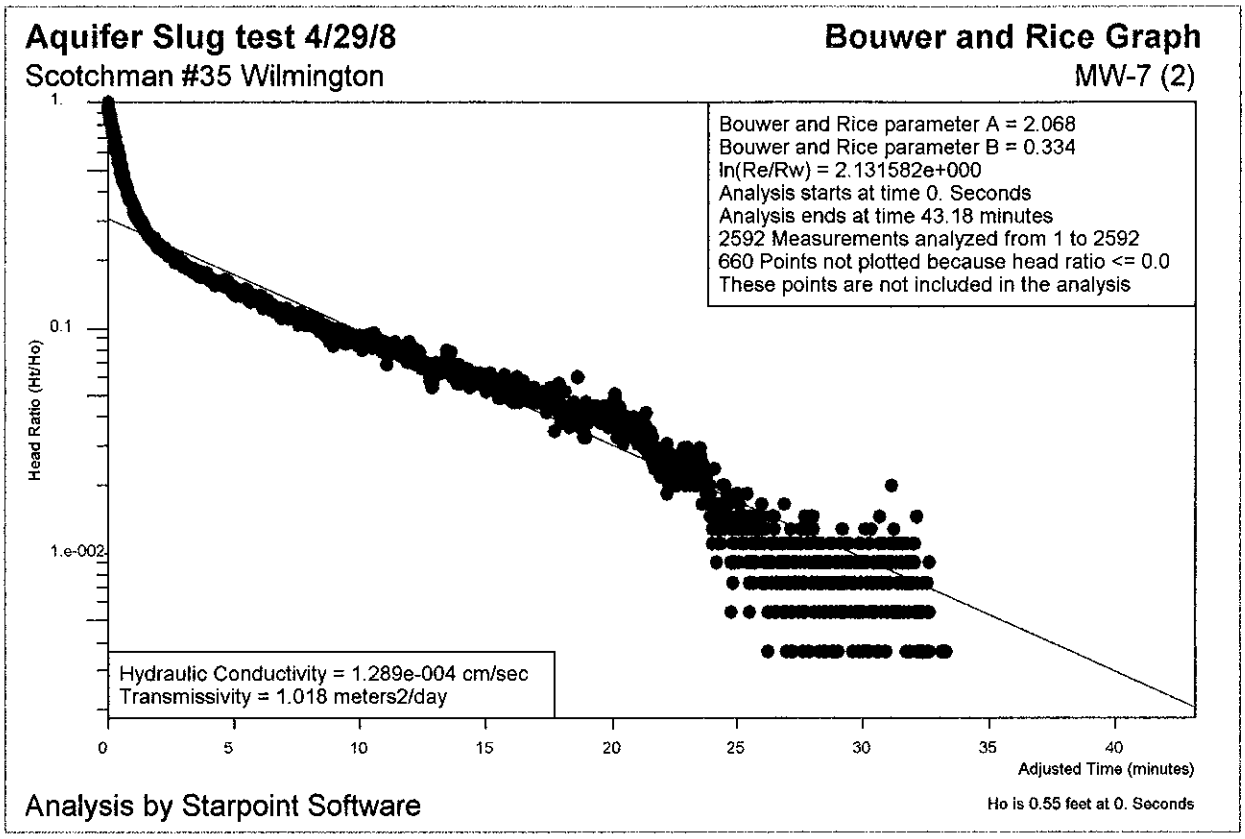
PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Companies, Inc. Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW-GEN

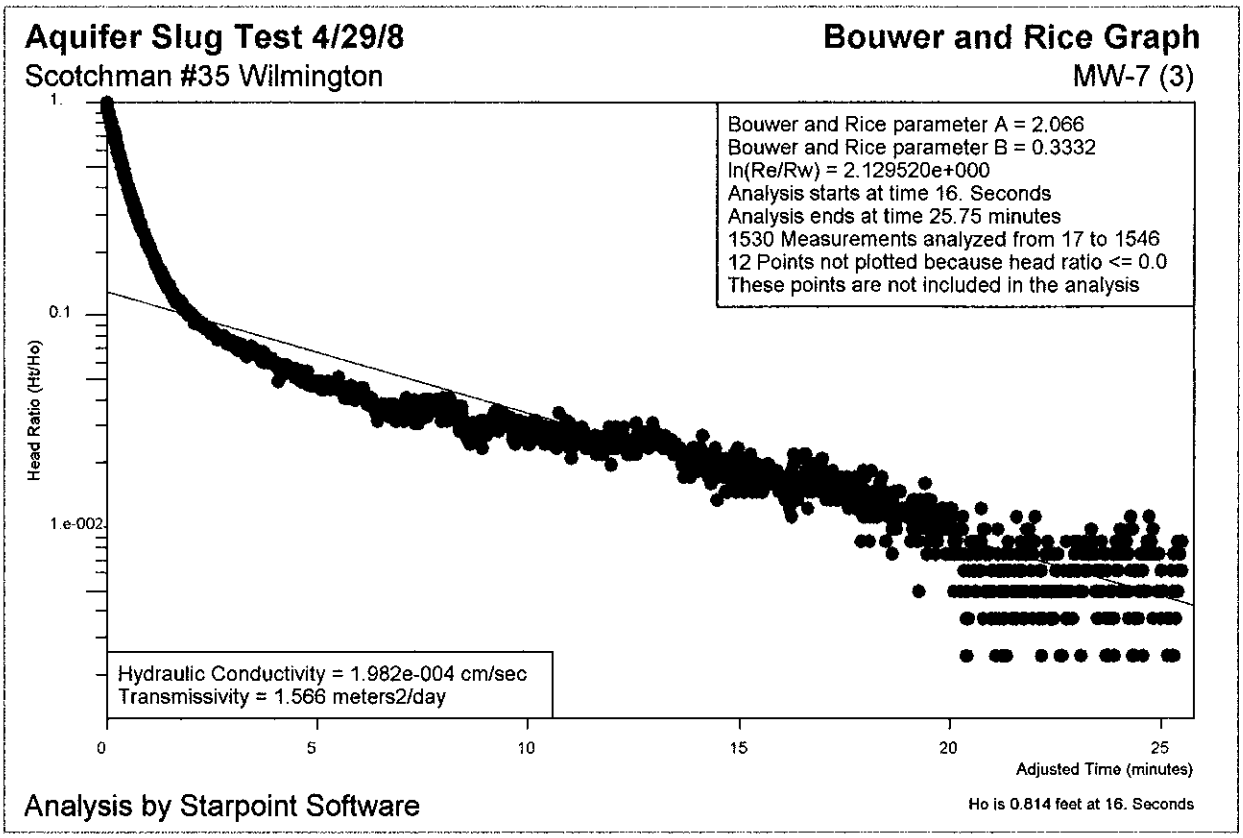
APPENDIX C

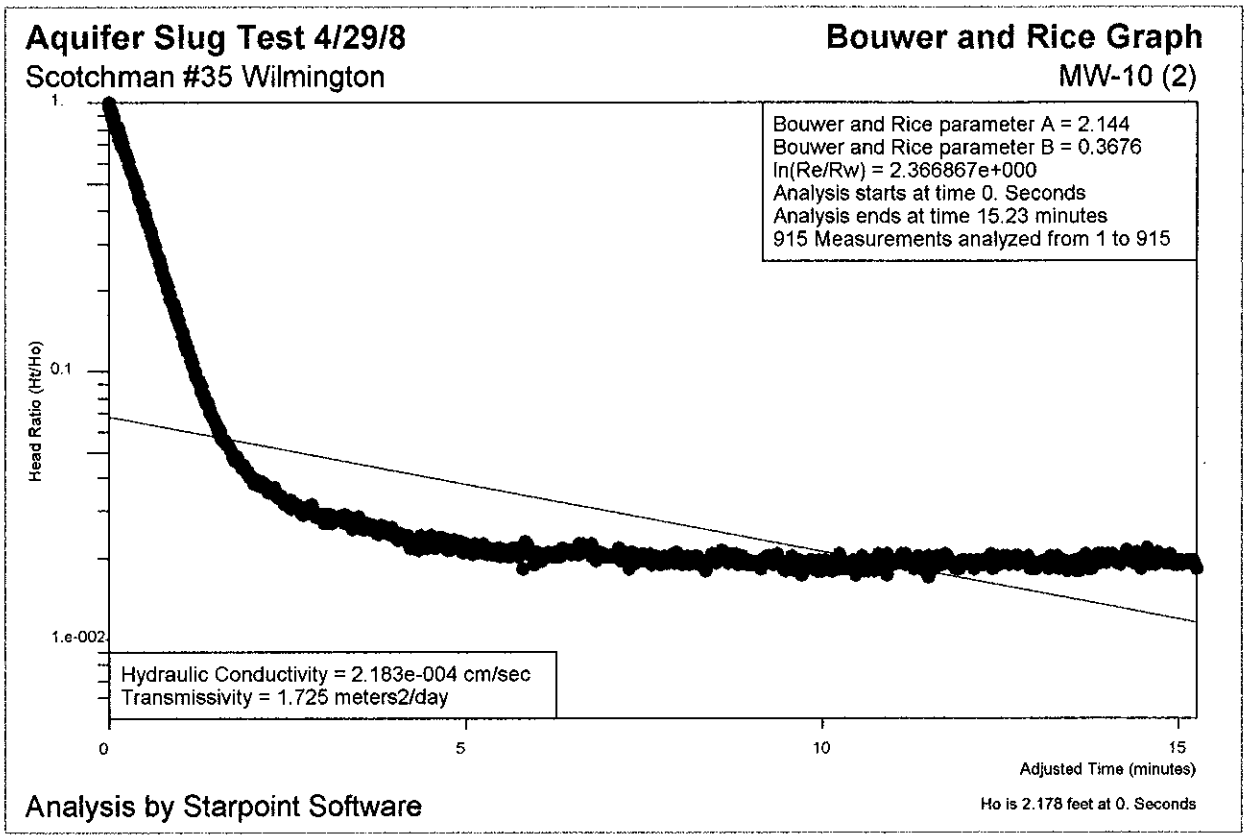

Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-5 (2)
Bouwer and Rice parameter A = 2.254
Bouwer and Rice parameter B = 0.4117
ln(Re/Rw) = 2.452954e+000
Analysis starts at time 0. Seconds
Analysis ends at time 37.95 minutes
2278 Measurements analyzed from 1 to 2278
540 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 7.079e-005 cm/sec
Transmissivity = 0.5592 meters2/day
0
5
10
15
20
25
30
35
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 0.202 feet at 0. Seconds

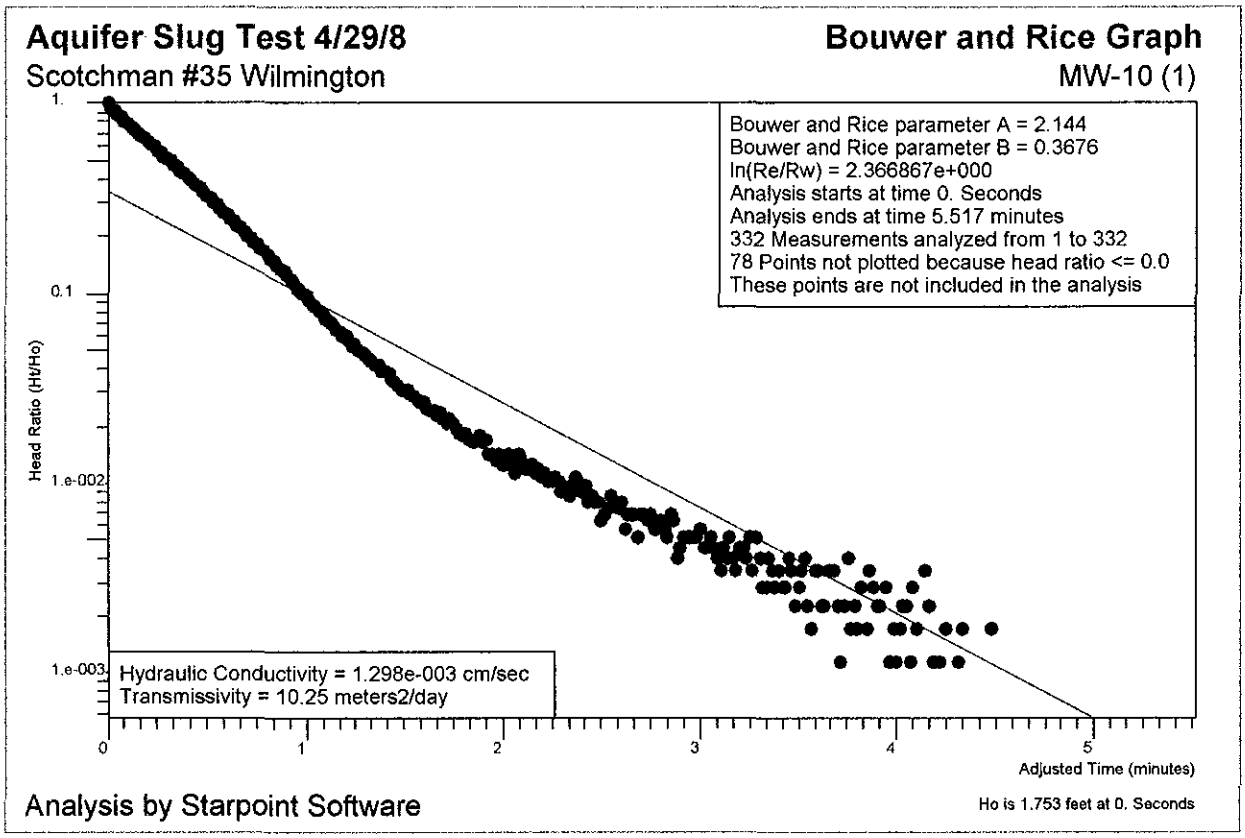

Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-5 (1)
Bouwer and Rice parameter A = 2.264
Bouwer and Rice parameter B = 0.4155
ln(Re/Rw) = 2.460122e+000
Analysis starts at time 0. Seconds
Analysis ends at time 36.52 minutes
2192 Measurements analyzed from 1 to 2192
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 3.186e-005 cm/sec
Transmissivity = 0.2517 meters2/day
0
5
10
15
20
25
30
35
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 1.584 feet at 0. Seconds

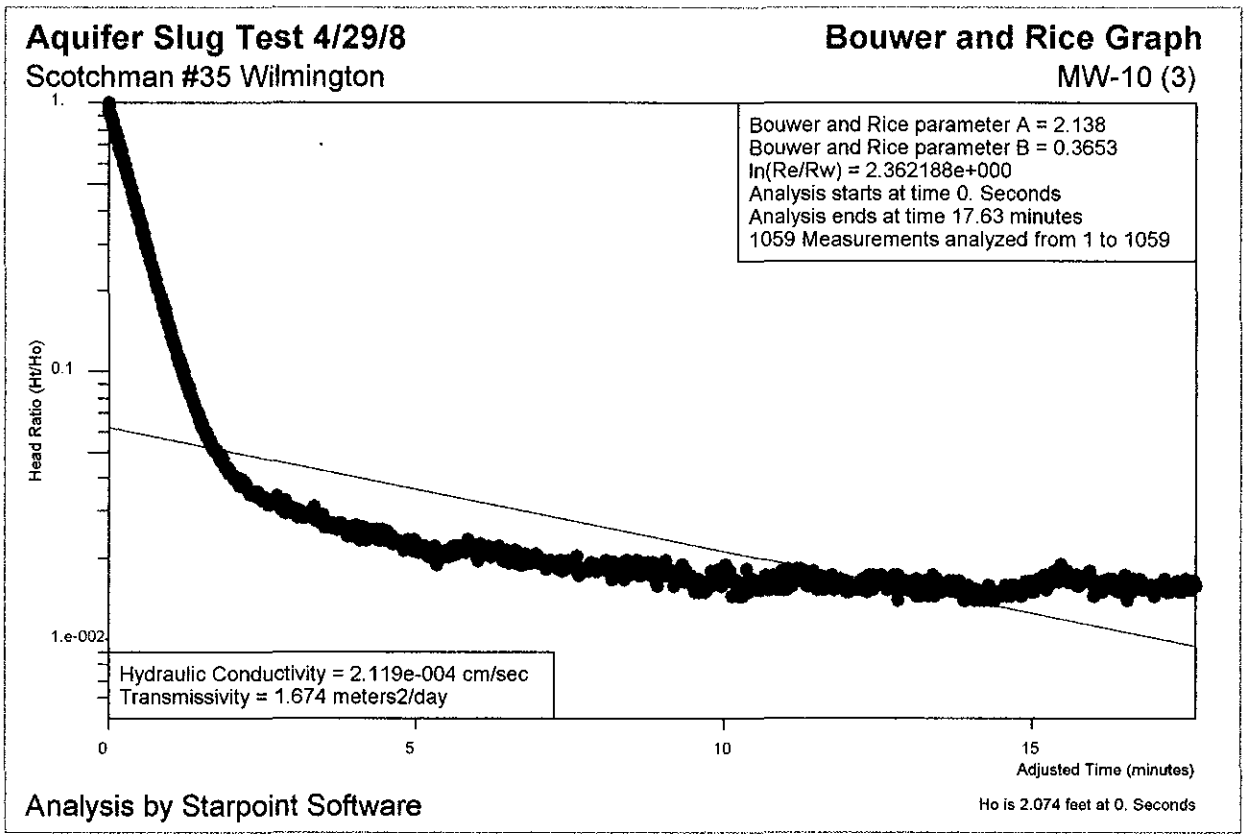

Scotchman #35
Bouwer and Rice Graph
Wilmington 4/29/8
MW-7 (1)
Bouwer and Rice parameter A = 2.07
Bouwer and Rice parameter B = 0.3351
ln(Re/Rw) = 2.134653e+000
Analysis starts at time 42. Seconds
Analysis ends at time 13.45 minutes
766 Measurements analyzed from 43 to 808
100 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 3.564e-004 cm/sec
Transmissivity = 2.816 meters2/day
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 0.369 feet at 42. Seconds


Aquifer Slug test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-7 (2)
Bouwer and Rice parameter A = 2.068
Bouwer and Rice parameter B = 0.334
ln(Re/Rw) = 2.131582e+000
Analysis starts at time 0. Seconds
Analysis ends at time 43.18 minutes
2592 Measurements analyzed from 1 to 2592
660 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 1.289e-004 cm/sec
Transmissivity = 1.018 meters2/day
0
5
10
15
20
25
30
35
40
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 0.55 feet at 0. Seconds


Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-7 (3)
Bouwer and Rice parameter A = 2.066
Bouwer and Rice parameter B = 0.3332
ln(Re/Rw) = 2.129520e+000
Analysis starts at time 16. Seconds
Analysis ends at time 25.75 minutes
1530 Measurements analyzed from 17 to 1546
12 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 1.982e-004 cm/sec
Transmissivity = 1.566 meters2/day
0
5
10
15
20
25
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 0.814 feet at 16. Seconds


Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-10 (2)
Bouwer and Rice parameter A = 2.144
Bouwer and Rice parameter B = 0.3676
ln(Re/Rw) = 2.366867e+000
Analysis starts at time 0. Seconds
Analysis ends at time 15.23 minutes
915 Measurements analyzed from 1 to 915
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 2.183e-004 cm/sec
Transmissivity = 1.725 meters2/day
0
5
10
15
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 2.178 feet at 0. Seconds


Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-10 (1)
Bouwer and Rice parameter A = 2.144
Bouwer and Rice parameter B = 0.3676
ln(Re/Rw) = 2.366867e+000
Analysis starts at time 0. Seconds
Analysis ends at time 5.517 minutes
332 Measurements analyzed from 1 to 332
78 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
1.e-003
Hydraulic Conductivity = 1.298e-003 cm/sec
Transmissivity = 10.25 meters2/day
0
1
2
3
4
5
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 1.753 feet at 0. Seconds


Aquifer Slug Test 4/29/8
Bouwer and Rice Graph
Scotchman #35 Wilmington
MW-10 (3)
Bouwer and Rice parameter A = 2.138
Bouwer and Rice parameter B = 0.3653
ln(Re/Rw) = 2.362188e+000
Analysis starts at time 0. Seconds
Analysis ends at time 17.63 minutes
1059 Measurements analyzed from 1 to 1059
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 2.119e-004 cm/sec
Transmissivity = 1.674 meters2/day
0
5
10
15
Adjusted Time (minutes)
Analysis by Starpoint Software
Ho is 2.074 feet at 0. Seconds

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405
Telephone: (910) 392-3050

May 11, 2008

VIA HAND DELIVERY

North Carolina Department of Environment and Natural Resources
Division of Waste Management, UST Section
Attn: Ms. Deborah Mayo
127 Cardinal Drive Extension
Wilmington, North Carolina 28405-3845

Re: Submission of *Corrective Action Plan Report*
Scotchman #35
7160 Market Street, Wilmington, North Carolina
Incident No. 32152

Dear Ms. Mayo:

Please accept the attached *Corrective Action Plan Report* on behalf of our client, Worsley Operating Corporation. Please feel free to contact me at (910) 470-7890 if you have any questions or comments regarding this or other matters.

Respectfully yours,

Bryan K. Lievre

Bryan K. Lievre, P.E.
President

Attachment
cc: Mrs. Maureen Jackson, Worsley Operating Corporation

CORRECTIVE ACTION PLAN REPORT

For The

SCOTCHMAN #35

7160 MARKET STREET

WILMINGTON, NORTH CAROLINA

Prepared By:

ENVIRONMENTAL SERVICES & SOLUTIONS, PLLC

P.O. BOX 12055

WILMINGTON, NORTH CAROLINA 28405

TELEPHONE (910) 392-3050

Prepared For:

WORSLEY OPERATING CORPORATION

P.O. BOX 3227

WILMINGTON, NORTH CAROLINA 28406

CORRECTIVE ACTION PLAN REPORT

MAY 11, 2009

Site Name: Scotchman #35
Site Address: 7160 Market Street
Wilmington, New Hanover County, North Carolina
Facility I.D.: 0-020168
UST Incident Number: 32152
Site Priority Ranking and Reason: High – 287A
Water supply wells with 1000 feet of site
Land Use Category: Residential
UST Owner: Worsley Operating Corporation
Address: P.O. Box 3227
Wilmington, North Carolina 28406
Property Owner: Entrepreneur, Inc.
Address: P.O. Box 3227
Wilmington, North Carolina 28406

Consultant: Environmental Services & Solutions, PLLC
Address: P.O. Box 12055
Wilmington, North Carolina 28406
Telephone: (910) 343-1991

Release Information
Date Discovered: March 24, 2004
Latitude: 34.271944 North
Longitude: 77.818889 West
Estimated Quantity of Release: Unknown
Cause of Release: Unknown

Bryan K. Lievre 5/11/09

UST Information:

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	1961	Active
2	Gasoline	6,000	1961	Active
3	Gasoline	4,000	1961	Active
4	Diesel	6,000	1961	4/25/04

I, Bryan Lievre a Professional Engineer for Environmental Services & Solutions, PLLC, do certify that the information in this report is correct and accurate to the best of my knowledge. Environmental Services & Solutions, PLLC is licensed to practice engineering in North Carolina. The certification number of the company is P-0146.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLES

FIGURES

APPENDICES

CORRECTIVE ACTION PLAN REPORT
FOR
SCOTCHMAN #35
7160 MARKET STREET
WILMINGTON, NORTH CAROLINA

1.0 INTRODUCTION

Environmental Services and Solutions, PLLC (ESS) has prepared the following report for the site referenced above on behalf of our client, Worsley Operating Corporation. This report has been prepared pursuant to Title 15A of the North Carolina Administrative Code (NCAC), Chapter 2, Subchapter 2L and in accordance with the *Guidelines for Assessment and Corrective Action for UST Releases*, provided by the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management (DWM), Underground Storage Tank (UST) Section, dated July 15, 2008 with Change 1, effective December 1, 2008.

1.1 PURPOSE

Environmental Services & Solutions, PLLC (ESS) was retained by Worsley Operating Corporation to develop a Corrective Action Plan (CAP) for Scotchman #35 facility located in at 7160 Market Street, New Hanover County, North Carolina. The site location is indicated on the topographic map in **Figure 1**. The site plan, shown on **Figure 2**, illustrates monitoring well locations and major existing features.

The site was ranked by the Division of Waste Management (DWM) as "high risk". This report was prepared and submitted in accordance with a Notice of Regulatory Requirement (NORR) letter, dated September 2, 2008. The NORR required the submittal of this report within 90 days of its receipt. The submittal of this report was postponed, with approval from NCDENR, in order to complete additional assessment activities and perform on site field testing to evaluate various remedial alternatives.

The cause of contamination at the site is due to release(s) from the former UST systems. Due to the high risk status and land use classification cleanup of groundwater is required to standards specified within Title 15A of the North Carolina Administrative Code, Subchapter 2L, Section .0202 (2L Standards) and soil to the lowest of residential maximum soil contaminant concentrations (MSCCs) or soil-to-groundwater MSCCs. Soil and groundwater remediation are required. Prior assessment information is included in **Appendix A**.

1.2 BACKGROUND

Presently, the site is an active retail motor fuel outlet and convenience store. There are three active USTs located on the property. The property is owned by Entrepreneur Inc., of Wilmington, North Carolina. Available data on the facility's UST systems are tabulated below.

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	4/16/1961	Active
2	Gasoline	6,000	4/16/1961	Active
3	Gasoline	4,000	4/16/1961	Active
4	Diesel	1,000	4/16/1961	4/25/2004

On and around May 24, 2004, impacted soil was documented through laboratory analysis during activities related to the closure-in-place of the diesel UST system. The consultant at the time, SEI Engineering & Geological Services, P.C. (SEI) , completed and submitted a UST Form *24-Hour Release and UST Leak Reporting Form* to NCDENR. Documentation of the closure-in-place was provided in a *Underground Storage Tank Closure Report,* dated June 15, 2004 and submitted to the NCDENR Wilmington Regional Office by SEI.

On December 29, 2004, SEI submitted a *Limited Site Assessment (LSA) Report* to NCDENR. The LSA Report provided results of soil and groundwater sampling during and after the installation of four Type II shallow monitoring wells (i.e. MW-1, MW-3, MW-4 and MW-5) and one Type III monitoring well (i.e. MW-2), as well as a limited receptor survey.

In response to the findings presented in the *LSA Report*, the NCDENR classified the site as High Risk - H287A and issued a NORR, dated January 3, 2007, requiring WCI to conduct a Comprehensive Site Assessment (CSA). The *high-risk* classification was assigned due to the presence of a water supply wells located within 1,000 feet of the confirmed release area. Additionally, the levels of groundwater contamination for benzene exceeded 2L Standards. It should be noted that free product has not been encountered on the site.

At the request of our client, ESS personnel performed activities pursuant to the completion of a CSA Report. CSA activities included the advancement of over fourteen soil borings (SB-1, SB-1B, SB-2, SB-3, SB-3B, SB-4 through SB-14, and SB-14B), the installation of six monitoring wells (i.e. MW-6 through MW-11), updated the receptor survey of the area, and performed fate and transport modeling for the site. The results of these activities were provided in a *CSA Report*, dated May 16, 2008.

In correspondence dated July 15, 2008, NCDENR responded to the *CSA Report* and recommended site risk reduction through abandonment of all supply wells in the vicinity of the site. On August 28, 2008, Environmental Services & Solutions, PLLC (ESS) personnel subsequently mailed eight right-of-entry (ROE) agreements with cover letters to the each of the confirmed water supply wells within 1,000 feet of the site. The ROE agreements requested the well owners to allow Worsley Operating Corporation to conduct site activities including, "... abandonment of any supply wells and connection to the municipal

water supply system...". ESS received one signed ROE, one conditionally signed ROE and two returned ROEs stamped "unable to deliver".

Consequently, the costs for preparing a Corrective Action Plan (CAP) including bid specifications and associated tasks were requested in correspondence from NCDENR, dated September 23, 2008. The above work was approved by NCDENR in Task Authorization Number 32152-5. A copy of the DENR correspondence and Task Authorization forms are provided in **Appendix B**.

1.3 INTERIM REMEDIAL ACTIONS

To date no interim remedial actions have taken place at the subject facility.

1.4 PREVIOUS REPORTS

The following documents have been prepared for WCI and submitted to the North Carolina Department of Environment and Natural Resources (NCDENR):

- *UST Closure Report,* prepared by SEI dated June 15, 2004;
- *Limited Site Assessment Report,* prepared by SEI dated December 29, 2004; and,
- *Comprehensive Site Assessment*, prepared by ESS dated May 16, 2008.

1.5 PERMITS

A permit was issued for the operation of the USTs at the site (Facility I.D. number 0-020168). Permits have also been granted by the North Carolina Department of Transportation and NCDENR for monitoring wells MW-8 and MW-9, which were installed in the NC DOT right of way along the north side of US Highway 17. No other permits are known to have been issued for this site.

1.6 RECEPTOR INFORMATION

As defined by the North Carolina Department of Environment and Natural Resources (NCDENR), a receptor is "any human, plant or animal that is or has the potential to be adversely affected by the release or migration of contaminants." With respect to the site, the following sections present information regarding potential receptor pathways for the migration of petroleum compounds and pathway relationships to the site. Information regarding receptors was previously provided by ESS, as discussed below.

1.6.1 Water Supply Wells

In 2004, SEI conducted a survey to determine the location of water supplies located within a 1,500-foot radius of the subject facility. ESS conducted a receptor survey update in 2007. Information was gathered through mail questionnaires, site reconnaissance and contacts with City of Wilmington and New Hanover County personnel.

Information collected during the mail-survey process is detailed below. Based on the responses received, the survey data have been summarized and included in **Appendix C**. A cross-referenced water supply well location map is also included in Appendix C.

- A total of 9 water supply wells were identified within a 1,500-foot radius of the subject site, eight of which are present within 1000 feet of the source area.
- All properties can be connected to the City of Wilmington water supply or the New Hanover County water supply.
- Five of the nine wells are reportedly used for potable purposes.
- The subject facility is also connected to the municipal water system.

1.6.2 Adjacent Property Owners and Occupants

The names and addresses of owners having properties located adjacent or contiguous to the subject facility are presented in Appendix C.

1.6.3 Public Water Supply

Per conversations with the New Hanover County Engineers Office, public water in the vicinity of the site is furnished by New Hanover County and the City of Wilmington. The county water is furnished to residential developments to the west of Market Street. According to a telephone conversation with Mr. Jim Bonser of the City of Wilmington Public Utility Office and information obtained from that office, the City of Wilmington provides water north on Market Street to the approximate limits of the 1500-foot radius and the majority of properties east of Market Street. Mr. Bonser also indicated that connection to the municipal system is not mandatory but is currently available.

1.6.4 Surface Water

At least four storm water retention ponds are located to the northwest and occur within a 1,500-feet radius of the site. As depicted in Figure 1, the closest of these ponds is located approximately 1,200 feet southwest of the site. An unnamed tributary of the Howe Creek lies approximately 1,000 feet south of the site. Howe Creek is tidally influenced and drains into the Intracoastal Waterway.

1.6.5 Wellhead Protection Areas

The site and areas located within 1,500 feet of the site are not located within a Wellhead Protection Area, as defined in 42 USC 300h-7(e).

1.6.6 Surrounding Land Use

The Market Street business corridor is primarily zoned by New Hanover County as B-2. The B-2 Highway Business District is a heavy commercial zoning. Its purpose is to provide for the proper grouping and development of business uses which best accommodate the needs of the motoring public with a regional orientation. Residential developments to the west of Market Street business corridor are

zoned residential R-10 and R-15 and to the east are zoned residential R-15 and R-20. The zoning boundaries are provided in a figure included in Appendix C.

1.6.7 Subsurface Structures

Information gathered by ESS personnel identified the presence several underground utilities in the vicinity of the site. These include water supply lines, sanitary sewer lines, and storm water lines.

The City of Wilmington has an 8-inch PVC water supply line, which services the vicinity of the site and is present on the east side of the Market Street right-of-way extending north within 1500 feet of the site. A branch of that line extends from Market Street to the southern side of the right-of-way of Middle Sound Loop Road. The depth of this line is reportedly at least 2 feet bgs.

Two eight-inch diameter sanitary sewer lines are present in the vicinity of the site with one with one line on each side of Market Street. Both lines are reportedly present in the North Carolina Department of Transportation right-of-way for Market Street but both reportedly terminate south of the site. The sanitary sewer lines are reportedly constructed to a depth ranging from approximately seven to 10 feet bgs.

A reinforced concrete storm water pipe is located approximately 500 hundred feet south of the site and provides storm water control southward. The pipe ranges in diameter from 15 to 24-inches and is constructed with an invert depth of approximately 6 feet below ground surface.

1.7 Regional Geology

The subject facility is located within the Atlantic Coastal Plain province. Overall, the Atlantic Coastal Plain slopes eastward at an average rate of less than three feet per mile. The coastal plain is basically flat in interstream areas, but is broken by low escarpments adjacent to stream valleys. New Hanover County is a relatively flat sandy plain with a relief ranging from mean sea level (MSL) to approximately 50 feet above MSL. The subject facility lies approximately 25 feet above mean sea level.

The Atlantic Coastal Plain province consists of two natural subdivisions, the Outer Coastal Plain (Tidewater Region) and the Inner Coastal Plain. The Tidewater Region is defined by land surface being less than 40 to 50 feet above mean sea level and its proximity to the coastline. The surficial aquifer within the Tidewater Region is composed of fine sand, silt, clay, shell, peat beds, and scattered deposits of coarser-grained material. West of the Tidewater Region, within the Inner Coastal Plain, the unconsolidated sediments of the surficial aquifer become coarser-grained and more poorly sorted. The subject facility lies within the Inner Coastal Plain.

Names of the North Carolina aquifers, located within the coastal plain, are generally taken from the predominant geologic formation with which an aquifer is associated. The lithology of each formation is

significant with respect to the manner in which it will influence aquifer properties such as groundwater chemistry, hydraulic conductivity, groundwater velocity, and vertical movement.

The formations capable of yielding good water quality (potable water) are those not older than late Cretaceous. The deep, older formations generally contain water too salty for potable use. The potable water aquifers, lying within the late Cretaceous and younger sediments, are generally comprised of imperfectly connected sand beds, limestone, to unconsolidated sediments of the surficial sands. Confining units also may be present, which separate the major aquifers. These confining units consist of clay beds or groups of clay beds and silt with varying amounts of sand. The lithology of a confining unit tends to retard the vertical exchange (movement) of groundwater between upper and lower aquifer systems.

As part of the Atlantic Coastal Plain province, New Hanover County has four predominant aquifer systems in the vicinity of the site. In descending order these include:

- Surficial aquifer comprised of Pleistocene and Pliocene age sediments;
- Castle Hayne aquifer with sediments generally of Eocene age;
- Peedee aquifer which is comprised of Late Cretaceous age sediments; and,
- Black Creek aquifer.

Specific aquifer information was obtained from the publication, *Hydrogeologic Framework of the North Carolina Atlantic Coastal Plain* (U.S. Geological Survey Professional Paper 1404-I. M.D. Winner, Jr. and R.W. Coble, 1996). The geological profiles were obtained from Borings #91 and #111 along cross-section L-L' of the publication. The site occurs between the borings.

The surficial aquifer and Castle Hayne aquifer are separated by the Castle Hayne confining unit and the Castle Hayne aquifer and Pedee aquifer are separated by the Pedee confining unit.

Generally, the surficial aquifer is of major importance due to its extended coverage throughout the Coastal Plain. Precipitation infiltrating this aquifer is responsible for the bulk of water recharging the Coastal Plain aquifer system. The surficial aquifer transmits water laterally to streams and serves as a source bed holding the water that moves down gradient to the deeper aquifers. The surficial aquifer occurs within approximately 5 to 20 feet below ground surface (bgs) in most areas of the county and yields sufficient water for domestic use.

Surficial aquifer sediments in the Tidewater Region were deposited under shallow marine or estuarine conditions. These consist of fine sand, silt, clay, shell, and peat beds, plus scattered deposits of coarser-grained material in the form of relic beach ridges and floodplain alluvium. The average thickness of the

surficial aquifer in the Tidewater Region is approximately 38 feet. The aquifer is composed of 79 percent permeable material and has an estimated hydraulic conductivity of 35 feet per day.

The underlying Castle Hayne confining unit is composed of beds of clay, sandy clay, and clay with sandy streaks. Throughout much of the area, the Castle Hayne confining unit is thin, with an average thickness of about 14 feet, and contains enough sand to allow significant vertical movement between the surficial aquifer and the underlying Castle Hayne aquifer. The Castle Hayne confining unit contact was not defined in the borings.

The Castle Hayne aquifer is predominantly composed of limestone (including shell, dolomitic, and sandy limestone ranging from loosely consolidated to hard/crystallized) and sand with minor amounts of clay and was deposited under marine conditions. Sand bed intervals have varying carbonate content and range from fine to coarse grains, but are typically composed of fine to medium sand. Clay occurs as marl beds less than 10 feet thick or as a matrix in both sand and limestone beds. Typically, the upper portion of the Castle Hayne aquifer consists of limestone, while the lower portion is mainly sand.

The Castle Hayne aquifer is the most productive in North Carolina. Along its western margin, it occurs near land surface in New Hanover County and is exposed in many streams in the area. The aquifer is greater than 52 feet thick and contains approximately 64 percent permeable material. The estimated hydraulic conductivity is 65 feet per day.

The Peedee confining unit is overlain by the Castle Hayne aquifer in the area. The Peedee confining unit is approximately 28 feet in thickness and contains sediments with less than 15 percent permeability. The Peedee confining unit is composed of clay, silty clay and sandy clay and represents the Cenozoic-Mesozoic geological boundary.

The Peedee aquifer primarily occurs within the Peedee Formation. The Peedee Formation consists of fine to medium-grained sand interbedded with gray to black marine clay and silt. Glauconitic sand beds and thin beds of consolidated calcareous sandstone and impure limestone are interlayered in the sands in places. The Peedee aquifer is approximately 300 feet thick in the vicinity of the site and has an estimated hydraulic conductivity of 34 feet per day.

The Black Creek confining unit is overlain by the Peedee aquifer. The Black Creek confining unit is approximately 42 feet thick in the Wilmington area and contains sediments having less than 12 percent permeability. The Black Creek aquifer, overlain by the Black Creek confining unit, has a thickness of approximately 334 feet, and the estimated hydraulic conductivity is 25 feet per day.

In general, potable water is not captured from the aquifers located at depths beyond the Black Creek aquifer. These include the Upper Cape Fear and Lower Cape Fear Aquifers.

1.8 Site Specific Geology

Field assessment methodologies performed for the CSA were initiated, in part, to obtain information useful in evaluating the relationship between the area's geology/hydrogeology and the potential for migration of petroleum-related contaminants. The following discussion represents the results of the CSA activities performed to obtain data for this purpose. It is important to note that the information provided in the U.S. Geological Survey, Professional Paper 1401-I, *Hydrogeologic Framework of the North Carolina Coastal Plain*, 1996) regarding the area in the vicinity of the site did not define the Castle Hayne confining unit. Therefore, the surficial aquifer may be directly underlain by the Castle Hayne aquifer.

The site occurs on the boundary of the Leon Sand (LE) and Kureb (Kr) sand as defined by the Department of Agriculture (now Natural Resources Conservation Service). The Leon Sand occurs on level elevations and it is typically poorly drained soil found on rims of depressions, on smooth flats and occurs as indefinite patterns on uplands and stream terraces. The profile, in descending order, consists of the following; 3-inches of dark gray sand, 13-inches of light gray sand, 24-inches of dark reddish brown sand, and 64-inches of light gray sand.

The Kureb Sand (Kr) occurs on slopes of 1 to 8 percent. It is excessively drained soil is on long broad undulating ridges and uplands. Permeability is high and available water capacity is very low. Additionally, infiltration is moderate and runoff is slow. The profile for this sand, in descending order, consists of the following; 3-inches of dark gray sand, 23-inches of light gray sand, and 89-inches of brownish yellow sand in the upper portion and pale brown sand in the lower portion. (*U.S. Department of Agriculture: Soil Conservation Service, Soil Survey of New Hanover County, North Carolina, 1997).*

Based upon the soil boring data reported SEI and observations by ESS during the monitoring well and soil boring advancements, the surficial geology generally of a fine to medium-grained silty sand ranging in color from light gray to dark brown. Based upon the site specific data collected by SEI during the monitoring well installations all monitoring wells, including well MW-2, the Type III well did not penetrate the surficial aquifer.

2.0 ASSESSMENT ACTIVITIES

2.1 SOIL ASSESSMENT

On May 13, 2004, as part of the UST closure activities, soil sampling was performed by SEI with respect to the former diesel UST system. Samples SB-1 through SB-6 were collected at six to seven feet below ground surface (bgs). Samples SB-7 (2-3 feet bgs) and SB-8 (1-2 feet bgs) were collected along the product line and dispenser, respectively. All soil samples were submitted for laboratory analysis by EPA Method 8015, Total Petroleum Hydrocarbons (TPH) with both sample preparation 5030 (gasoline) and 3550 (diesel). The soil samples were collected using direct push technology.

Soil sampling during LSA activities in September 2004 included the collection of sample SS-1 (MW-1) at a depth of five to seven feet bgs. The sample was submitted to a laboratory for analysis by EPA Method 8260B and 8270C and Massachusetts Department of Environmental Protection (MADEP) Methods for volatile and extractable petroleum hydrocarbons (VPH and EPH, respectively).

During CSA activities, on September 20, 2007, Geologic Exploration, Inc. of Statesville, North Carolina, on behalf of ESS advanced 11 soil borings (SB-1 through SB-9, SB-1B and SB-3B). ESS personnel obtained nine soil samples (i.e. SB-1B, SB-2, SB-3B, and SB-4 through SB-9) at depths of six to seven feet bgs. It should be noted that refusal was encountered at boring locations SB-1 and SB-3 at shallow depths so additional borings were installed in the vicinity of prior sampling locations. All soil samples were obtained using Geoprobe direct push sampling equipment including a three feet long split spoon sampler with a clear plastic liner. Prior to each location, the split spoon sampling equipment was properly deconned to prevent cross contamination.

Based on the results of soil samples collected from prior CSA soil sampling activities, ESS personnel advanced five additional soil borings (i.e. SB-10 through SB-14) on February 29, 2008. These soil samples were obtained utilizing a hand auger which was deconned prior to each sampling location.

All recent soil samples were delivered to the project laboratory for analyses by EPA Methods 8260B and 8270C as well as MADEP Methods for VPH and EPH. In addition, samples collected at SB-8, MW-6 and MW-7 were analyzed for Fraction of Organic Carbon by Method D2974.

The laboratory results are summarized in tables and depicted in figures which are included in Appendix A.

2.2 GROUNDWATER ASSESSMENT

2.2.1 Monitoring Well Installations

As part of LSA activities in 2004, SEI provided oversight for the installation of four shallow Type II monitoring wells, MW-1, MW-3, MW-4, and MW-5 and one Type III well, MW-2. In 2007, ESS personnel provided oversight of wells MW-6 through MW-11. These wells were installed as part of the CSA activities to assist in delineating the dissolved petroleum hydrocarbon plume identified earlier during the LSA. These shallow wells were constructed to a depth ranging from 14 to 20 feet bgs.

The Type II monitoring wells installed during CSA activities were constructed in accordance with well construction standards, as specified in 15A NCAC 2C. All shallow monitoring wells were installed using hollow-stem auger drilling equipment. The wells were constructed with two-inch diameter well casings made of flush-joint, threaded schedule-40 polyvinyl chloride (PVC). The PVC well screens are 0.010-inch slot with screened intervals of 10 to 15 feet. A coarse sand pack (filter pack) was used to

backfill the well annuli to a depth averaging approximately one-foot to two feet above the shallow well screens. A six-inch to one-foot thick bentonite seal was placed above the filter packs, and neat cement was used to fill the remainder of the well annuli to ground surface.

All wells were installed as flush-mounted and were provided with sealing and locking caps. Protective manhole-type covers were placed over each well upon completion. The approximate well locations are depicted in Figure 2.

2.2.2 Groundwater Flow and Occurrence

Upon review of the Scotts Hill Quadrangle topographic map (7.5 minute series topographic map, U.S. Geological Survey –USGS), the surficial groundwater in the vicinity of the site would be expected to flow in a south-southeasterly direction and mimic surface topography. Contrary to expectations, data reported in the *LSA Report*, prepared by SEI in October 2004 and data obtained by ESS in during September 2007 reflect potential groundwater flow toward the north and west. However, groundwater elevations obtained during the December 2008, sampling event indicate a potential flow direction toward the east and southeast. A summary of water table elevation data is presented in **Table 1**. Groundwater elevations have been derived from the water table elevation data collected during the comprehensive sampling event of December 5, 2008 and are presented on **Figure 3**.

2.2.3 Groundwater Sampling

As part of the LSA field activities, groundwater samples were collected by SEI from monitoring wells MW-1 through MW-5 on October 4, 2004. Laboratory analysis included Methods 602 with methyl tertiary butyl ether (MTBE), isopropyl ether (IPE), and Naphthalene, 601, 625, 504.1 (EDB), and MADEP Methods for VPH and EPH.

ESS personnel collected groundwater samples from wells MW-1 through MW-11 on September 24, 2007. The groundwater samples from monitoring wells MW-6 through MW-11 submitted to the laboratory for analyses EPA Method 602 with MTBE, IPE, and naphthalene EPA Method 625 plus ten most prominently identifiable peaks, as well as MADEP Methods for VPH and EPH. The groundwater samples from monitoring wells MW-1 through MW-5 were submitted to the laboratory for analyses EPA Method 602 with MTBE, IPE, and naphthalene. Samples from monitoring wells MW-1, MW-3, MW-6, MW-7, MW-8, and MW-9 were also submitted for analysis of natural attenuation parameters including nitrate and sulfate by Method 9056. Natural attenuation parameters were also measured from all monitoring wells using a Horiba Water Quality monitor. Natural attenuation parameters included pH, specific conductivity, dissolved oxygen (DO), temperature and oxidation reduction potential (ORP).

On December 5, 2008, ESS personnel collected groundwater samples from wells MW-1 through MW-11. At the time of sample collection, the water levels were recorded for each well utilizing an oil/water interface probe. Prior to sample collection, the respective well volumes were calculated, and a minimum

of three well volumes was purged from each well column to ensure replacement of stagnant water with representative formation water.

The samples from the monitoring wells were collected using a disposable, PVC bailers and nylon chord. The samples were slowly poured from the bailers into laboratory-supplied containers, and the containers were sealed, labeled, and immediately placed on ice for delivery to Environmental Science Corp. of Mt. Juliet, Tennessee, NC Laboratory, Certificate Number ENV375. The groundwater samples from monitoring wells MW-1 through MW-11 were submitted to the laboratory for analyses EPA Method 602 with MTBE, IPE, and naphthalene.

The laboratory results of the December 5, 2008 sampling event indicated the presence of petroleum compounds above 2L Standards in wells MW-1, MW-3, MW-4, MW-5, and MW-11. The current laboratory results of groundwater samples are provided in **Table 2.** The laboratory report is included in **Appendix E.** Natural attenuation parameters were also measured from all monitoring wells using a Horiba Water Quality monitor. Natural attenuation parameters included pH, specific conductivity, dissolved oxygen (DO), temperature and oxidation reduction potential (ORP). A summary of the natural attenuation parameters is provided in **Table 3**.

3.0 PROPOSED CORRECTIVE ACTION

3.1 OBJECTIVES

The objectives of this CAP are to develop plans to;

- Mitigate impacted soil to applicable MSCCs;
- Mitigate impacted groundwater to 2L Standards; and,
- Select and employ remedial processes that are protective of human health and the environment.

As required by 15A NCAC 2L .0115(m), soil contamination at high risk sites must be remediated to the lower of:

a) Residential or industrial/commercial maximum soil contaminant concentrations, whichever is applicable; or,

b) Soil-to-water maximum soil contaminant concentrations.

Groundwater must be remediated to 2L Standards for high risk sites. As recommended by the *Guidelines for Assessment and Corrective Action for UST Releases* (NCDENR, 2008), the feasibility of risk reduction through applicability of natural attenuation at the site, excavation of impacted soil, and alternate water supply to nearby residents, has been exhaustively evaluated.

3.2 EVALUATION OF REMEDIATION ALTERNATIVES

The evaluation of clean-up alternatives was conducted by comparison of system process, feasibility, limitations, permitting and right of access requirements, and capital and operation/maintenance costs. Clean up of soil and groundwater was evaluated.

3.2.1 Evaluation of Municipal Water Supply Well Connection

On August 28, 2008 ESS personnel mailed seven right of entry agreements with cover letters to the each of the confirmed water supply wells within 1,000 feet of the site. The right of entry agreements requested the well owners to allow Worsley Operating Corporation to conduct site activities including, "... abandonment of any supply wells and connection to the municipal water supply system...". Two of the eight well owners responded and only one agreed to the conditions. A unanimous agreement was necessary to lower the risk classification.

3.2.2 Soil Remediation Alternatives

Based on the findings in the *CSA Report*, impacted soil above STW-MSCCs is anticipated to be limited to an area beneath the current product dispensers. The tear drop shaped area is approximately 45 feet in length and ranging from 30 feet at the widest dimension to approximately 9 feet at it's narrowest dimension. The area defined by the impacted soil is estimated as 900 ft^2. Assuming a maximum soil contamination depth of 15 feet provides a volume of contaminated soil of approximately 500 cubic yards. Assuming a bulk density of 1.5 tons per cubic yard, provides a mass of 750 tons of petroleum contaminated soil.

Following is a brief description of remedial technologies and an evaluation of feasibility for each alternative. Remedial alternatives to address soil contamination at the subject site include:

- Soil Vapor Extraction; and
- Excavation

3.2.2.1 Soil Vapor Extraction

System Process

Soil vapor extraction (SVE), also known as soil venting or vacuum extraction, is an in situ remedial technology that reduces concentrations of volatile constituents in petroleum products adsorbed to soils in the unsaturated (vadose) zone. With this technology, a vacuum is applied to the soil matrix to create a negative pressure gradient that causes movement of vapors toward extraction wells. Volatile constituents are readily removed from the subsurface through the extraction wells. The extracted vapors are then treated, as necessary, and discharged to the atmosphere.

Feasibility

This technology has been proven effective in reducing concentrations of volatile organic compounds (VOCs) and certain semi-volatile organic compounds found in petroleum products at UST sites. SVE is generally more successful when applied to the lighter (more volatile) petroleum products, such as gasoline. Review of data obtained during LSA and CSA activities conducted at the site indicate that SVE could be a feasible remedial alternative. In addition, the technology needed to implement this alternative is readily available. The application of SVE can serve to mitigate, through phase transfer, adsorbed-phase petroleum. SVE can also capture vapor-phase petroleum induced through air sparging and control migration of fugitive petroleum vapors. In addition, SVE could induce airflow (oxygen) through the native soil, which may enhance the intrinsic biodegradation of recalcitrant petroleum and petroleum additive compounds.

Limitations

Factors that limit SVE include the occurrence of a shallow water table surface, low intrinsic permeability, and high moisture content in the soil. In addition, high boiling point compounds such as naphthalene and other polyaromatic hydrocarbons (PAH's) are not as readily captured.

Discharge/Disposal of Treated Groundwater

SVE is an in-situ remedial alternative. Thus, disposal of groundwater is not required.

Costs

Refer to following sections for cost information regarding SVE.

3.2.2.2 Excavation

System Process

Excavation as a remedial alternative would involve closing the current petroleum retail business, dismantling the canopy and UST systems (dispensers, product lines, etc.), removing the concrete pad, and excavating contaminated soil. The contaminated soil would be hauled off site and disposed of in accordance with NCDENR guidelines. After excavation, the area will be backfilled with clean fill material from an off-site source. The surfaces would be restored to original, pre-excavation conditions.

Feasibility

Excavation is a proven technology and implementation of this alternative has been approved by NCDENR on numerous sites. The primary advantage of the excavation of contaminated soil is the immediate removal of all adsorbed contaminants within targeted source areas and the elimination of risks associated with residual VOC impacts. The open excavation also serves to collect grossly impacted groundwater, which can be easily captured with an appropriate vacuum truck. However, excavating at the site presents some challenging logistical issues and concerns with respect to facility disruption.

Limitations

The major limitation of excavating at the subject site is the extent of the soil contamination and the disruption to facility operations that will occur during the excavation process. In addition, there are some safety and logistical concerns with the potential impact to site structures and underground utilities. Another concern is the transfer of contaminated soil from one location to another without treatment.

Discharge/Disposal of Groundwater

Discharge and/or disposal of groundwater will not be required (other than that captured in the open excavation).

Costs

The costs for excavation, transport, disposal and backfill are estimated at $59 per ton. Based on an estimated 750 tons of contaminated soil to be removed, the cost is approximately $44,250. These costs do not include site restoration or loss of site business income, supervisory time, endpoint sampling nor reporting requirements.

Recommended Action

Excavation is currently not recommended as a remedial alternative at the subject site. Excavation could not be easily performed near the existing dispenser island without jeopardizing the stability of these structures. Additional activities would then be required for contaminated soil which could not be easily removed.

3.2.3 Groundwater Remediation

Following is a brief description of three active remedial technologies as well as a "do-nothing" approach, which would require further monitoring of groundwater quality, at a minimum. An evaluation of the feasibility for each alternative is also included. Possible remedial alternatives to address residual impacts to ground water include:

- Air Sparging with Soil Vapor Extraction (AS/SVE);
- Ground Water Pump and Treat;
- Dual-Phase Extraction (DPE) and Treatment; and
- Monitored Natural Attenuation (MNA) / Enhanced MNA.

3.2.3.1 Air Sparging with Soil Vapor Extraction (AS/SVE)

System Process

AS/SVE technology is an *in-situ* technology that combines the injection of air into the saturated zone with vapor recovery (through vacuum) from the unsaturated zone. The injected air results in a phase transfer of hydrocarbons from the dissolved groundwater to a vapor phase, which can be recovered by an extraction system in the unsaturated zone. The vapors collected by the SVE system may require treatment to meet regulatory limits prior to discharge. AS/SVE provides an increase in dissolved oxygen concentrations in the aquifer, which can stimulate indigenous heterotrophic microbial activity and result in contaminant mass reduction. AS/SVE can reduce both soil and ground water volatile organic compound (VOC) and semi-volatile compound concentrations.

Feasibility

AS/SVE is a proven technology that has had success at similar sites. AS/SVE has proven to mitigate dissolved-phase petroleum within a short period of time relative to groundwater pump and treatment. In addition, the equipment and technology needed to implement this alternative are readily available.

Limitations

Factors that limit this technology include the occurrence of a shallow water table surface, low permeability soil and low hydraulic conductivity, proximity to water supplies (potential to accelerate contaminant migration), extremely high dissolved iron concentrations in groundwater, and presence of free product. Petroleum vapors generated during the air sparing process should be controlled, where appropriate, with SVE to avoid impact to underground structures (i.e. conduits or basements).

Discharge/Disposal of Treated Groundwater

AS/SVE is an in-situ remedial alternative. Thus, disposal of groundwater is not required.

Costs

The estimated capital costs for an AS/SVE system at the subject site would be approximately $112,000. The average annual operation and maintenance (O&M) costs for an AS/SVE system range from $20,000 to $40,000. The estimated duration for an AS/SVE system at the subject site is three to five years.

Recommended Action

AS/SVE is the recommended alternative for groundwater remediation at the site.

3.2.3.2 Groundwater Pump and Treat

System Process

Groundwater pump and treat is an *ex-situ* remediation technology that uses vertical or horizontal recovery

wells (or trenches) to extract contaminated groundwater from those areas of the aquifer with the highest levels of dissolved contaminants in groundwater. Following contaminant removal at the surface through air stripping and/or carbon adsorption, the treated water may be discharged in accordance with local POTW/NPDES permit requirements, or re-injected into the aquifer (closed loop system). Groundwater recovery can provide hydraulic control and limit contaminant migration. Consequently, this application is particularly important if exposure pathways are identified and the threat to human health is imminent.

Feasibility

Pump and treat has been widely accepted and applied by the regulatory community as a means to control the migration and removal of free-phase product and dissolved phase VOCs from groundwater. Pump tests and ground water modeling would be necessary to design the pumping system to ensure complete capture of the dissolved phase plume. This technology can be successful if the following criteria are met: (1) the system design is based upon a comprehensive aquifer characterization; (2) the recovery well locations provide contaminant recovery and hydraulic control; (3) all secondary sources are eliminated; (4) the effectiveness is carefully monitored; and (5) appropriate operational and maintenance modifications are conducted.

Limitations

Groundwater pump and treat systems are effective in controlling the down-gradient migration of contaminant plumes. However, these systems have had limited success in reducing contaminant mass. The primary limitation of this alternative is the time required to achieve the ground water clean-up goals.

Discharge/Disposal of Treated Groundwater

A POTW or a NPDES Permit would have to be obtained for the pump and treat system to discharge the extracted and treated ground water at the site.

Costs

The estimated capital costs for a pump and treat system at the subject site would be approximately $150,000 to $250,000. Average annual operation and maintenance (O&M) and ground water monitoring costs for groundwater pump and treat systems range from $30,000 to $60,000. The estimated duration for a pump and treat system at the subject site is at least ten years.

Recommended Action

Ground water pump and treat is not recommended as a remedial alternative due to high O&M costs, the long duration of system operation, and the questionable effectiveness of achieving groundwater clean-up goals.

3.2.3.3 Dual-Phase Extraction (DPE) and Treatment

System process

DPE is the concurrent application of conventional groundwater recovery and high vacuum extraction. The application of a vacuum increases the hydraulic gradient and consequently, increases the liquid recovery rates. Vacuum extraction can effectively recover volatile compounds in the vadose and saturated zones. The liquid captured in the vacuum is recovered and the vapor is discharged to the atmosphere. The vacuum extraction may also enhance biodegradation through the induction of oxygen into the subsurface. This can be enhanced through the addition of soil vents. This technology is most effective when used to recover petroleum within soil or bedrock that exhibit low permeability. Pilot tests are generally required prior to implementation to determine the vacuum and groundwater radius, sustainable pumping rate, vapor flow rate, and other parameters.

Feasibility

Site specific conditions may not warrant application of DPE at this site, although additional field tests would be required to substantiate this statement.

Limitations

Although DPE is an effective technology for recovering both fluids (groundwater/free product) and vapor phase hydrocarbons from existing monitoring/recovery wells, it may not be an effective long-term remediation strategy. DPE also requires complex monitoring and control during operation. Compound limitations of this technology are similar to those limitations for application of the SVE and conventional pump and treat.

Discharge/Disposal of Treated Groundwater

A POTW or a NPDES Permit would have to be obtained for the pump and treat system to discharge the extracted and treated ground water at the site. In addition, an air discharge permit may also be required.

Costs

Capital and operating costs are similar to those described in *Section 3.2.3.2.*

Recommended Action

DPE is not the recommended remedial alternative, mainly due to anticipated high costs associated with the purchase, installation and operation of this system.

3.2.3.4 Monitored Natural Attenuation (MNA) / Enhanced MNA

System Process

Natural attenuation (NA) is the evaluation and demonstration that naturally occurring physical, chemical and/or biological processes are reducing the mass, mobility, toxicity, volume, or concentration of VOCs in ground water to achieve site-specific remedial objectives within a time frame that is reasonable when compared to other remedial methods. However, a longer time frame may be required before contaminant concentrations are reduced to below groundwater standards via NA. Therefore, NA is often combined with other remedial alternatives, such as source area removal or treatment, as an overall strategy for site clean up. Typically, this approach also requires on-going monitoring costs.

NA can also be enhanced with microbial-based technology that involves the alteration of the subsurface environment to provide optimal conditions for hydrocarbon-degrading bacteria. Groundwater analysis should be conducted to establish the condition of the subsurface and evaluate the feasibility of this technology. Important water quality parameters include the indigenous heterotrophic bacteria population, nutrients (N, K, and P), the availability of oxygen as the primary aerobic electron acceptor, the presence of inhibitors such as other metals, free-phase product, and pH or temperatures outside of acceptable ranges.

Enhanced NA can be achieved through a combination of the following: the addition of nutrients (such as nitrogen or phosphorous), the injection of oxygen or other electron acceptors, or the inoculation of microbe colonies.

Feasibility

NA modeling efforts were conducted and reported in the *CSA Report*. The modeling results indicated the First Order Decay simulations provided a 10-year resolution of the groundwater benzene plume following removal of the source area. However, modeling results indicated no attenuation of the benzene plume would occur with the source area intact.

Strong evidence of microbial decay is observed within the petroleum plume. The decay rates of petroleum within an aerobic environment will typically exceed the decay rates in an anoxic or anaerobic environment (Howard, et al., 1991). Consequently, the removal of the source area would greatly excel attenuation of benzene and other petroleum constituents. Natural attenuation can be actively enhanced through supplementation with an electron acceptor, such as oxygen, and the appropriate ratio of nutrients.

Limitations

The primary limitation of NA is the time frame that may be required to achieve clean-up goals and the costs required for long-term ground water monitoring.

Discharge/Disposal of Treated Ground Water

NA is an in-situ remedial alternative. Thus, disposal of groundwater would not be required.

Costs

Costs associated with Enhanced NA at the subject site have not been evaluated at the time of this report. The annual cost associated with the NA remedial alternative, including semi-annual monitoring of ground water in selected site wells, evaluation of the attenuation process and reporting to NCDENR, is estimated at $20,000 a year, however some of these costs can be shared with the AS/SVE system monitoring.

Recommended Action

NA is not a recommended remedial alternative at this time.

3.3 SELECTED REMEDIATION ALTERNATIVES

The selection process included the elimination of technologies that were not feasible and the selection of the option(s) that was most feasible. Based on the information collected during prior assessment activities, the evaluation of currently available remedial technologies at the site, and the most recent groundwater sampling events conducted on September 24, 2007 and December 5, 2008, ESS recommends the following remedial alternatives:

- AS/SVE is the selected remedial alternative to address on-site impacted soil and groundwater. Impacted groundwater is likely present beneath Market Street. However, data obtained during the recent groundwater sampling events indicated the extent of the petroleum beneath Market Street may be limited and inconsequential.

3.3.1 Pilot Tests

The AS pilot test was conducted on January 16, 2009, and the SVE test was conducted on February 13, 2009. The tests were conducted to determine the feasibility of the AS/SVE technology as well as define design parameters and radius of influence.

3.3.1.1 Air Sparging and Soil Vapor Extraction Well Installations

The well utilized for on-site air sparging field pilot tests was well MW-2, which was previously installed by others. Monitoring well MW-2 was completed as a Type III, deep well to a depth of 30 feet below ground surface (bgs). Monitoring well MW-2 is constructed with five feet of 2-inch diameter, 0.010 inch slotted schedule 40 polyvinyl chloride (PVC) well screen from 25 to 30 feet bgs.

Oversight of the installation of the observation well OB-1 was provided by ESS personnel on January 7, 2009. Observation well OB-1 was constructed by Geologic Exploration and completed to a total depth of 20 feet bls with 18 feet of 2-inch diameter, 0.010 slotted schedule 40 PVC screen from 2 to 20 feet bls, and 2 feet of 2-inch schedule 40 PVC solid casing above the screen.

Well SVE-1 was installed on January 7, 2009, prior to the completion of the corrective action plan for the subject site. SVE-1 was completed to a total depth of 8 feet below land surface (bls) with six feet of 2-inch diameter, 0.010 slotted schedule 40 PVC screen from 2 to 8 feet bls and 2 feet of 2-inch schedule 40 PVC solid casing above the screen.

The wells were properly constructed to prevent vertical short-circuiting. The pilot well locations are depicted in **Figure 2** and the well construction details are provided in **Appendix D**.

3.3.1.2 Soil Vapor Extraction

A soil vapor extraction pilot test was conducted at the site by ESS personnel on February 13, 2009. The test was conducted with a Roots, Model 24 URAI positive displacement blower capable of producing 6 inches of mercury and approximately 80 standard cubic feet per minute (scfm). Observation wells for the SVE test included OB-1, MW-3, MW-4, MW-10, and MW-11.

The test began with a bleeder valve that was 100% open for a duration of 10 minutes. After observing little to no influence, the bleed air valve was incrementally closed to provide varying air flow rates from the well head (SVE-1).

Measurements collected from the SVE-1 well head included air flow, temperature, and vacuum. Measurements from the blower discharge included relative humidity, temperature, and TLV readings. The measurements from the dilution air included airflow, temperature, and relative humidity.

Table 4 provides a summary of SVE pilot test measurements. As anticipated, increased applied vacuum resulted in increased well head airflow. In addition, increased applied vacuum at well SVE-1 resulted in increased observed vacuum in both wells OB-1 and MW-3. Increased airflow from SVE-1 also resulted in increase petroleum mass discharge (as gasoline in lbs/hour). With an applied vacuum of 51 inches of water column, an observed vacuum of 1.5 inches of water column was noted in well MW-3 (15 feet from the applied vacuum).

3.3.1.3 Air Sparging

An air sparging test was performed by ESS personnel on December 13, 2007. A Coleman Powermate direct drive air compressor, Model Number VL0502710.01 was used to provide air supply to the Type III monitoring well MW-2. Observation wells for the AS test included OB-1, MW-4, MW-11, MW-11, MW-6 and MW-8.

The minimum breakthrough pressure is that required to overcome the hydrostatic, sand pack, friction loss, and formation pressure. The maximum breakthrough pressure was observed to be 7.5 pounds per square inch (psi). The test was started by applying a pressure to well MW-2 at a flowrate of 1 standard cubic feet

per minute (scfm) and subsequently incrementally increasing the airflow rate. **Table 5** provides details regarding the performance of the air sparging field test.

The sparge pilot test data suggests that only one scfm per well would provide an effective influence of 0.10 feet of rise in the water table at a radial distance of at least 34 feet.

3.3.2 Rational for AS/SVE Design

Data collected from the pilot tests was used in the design of the air sparging/soil vacuum extraction systems. This information was used to size the necessary equipment and ancillary piping. The system is designed to mitigate contaminants within the aquifer and impacted soil profile.

The following system design parameters were established based upon the pilot testing, empirical data, as well as data collected from sites with similar characteristics:

- Conservatively, the design zone of influence for the air sparging wells is approximately 30 feet with an injection flow rate of 1 to 3 scfm and pressure of 8 to 8.5 psi. Although three wells should cover the estimate horizontal extent of petroleum contamination in groundwater at the site, a fourth well has been added on the west edge of the plume. The placement of this additional well is intended to inhibit off-site migration of petroleum due to the operation of the system.

- A conservative design radius of influence for the vertical vacuum extraction wells has been estimated at 15 feet with an extraction flow rate of 30 scfm and vacuum of 51 inches of water column.

- It should be noted that proposed equipment would be oversized in the event some additional pressure and/or flow requirements will be needed.

3.3.3 Proposed Treatment System Design

The design of the AS/SVE system was based upon the currently defined extent of on-site dissolved-phase petroleum, the results of the pilot tests, the logistics of the existing buildings and current store operation. The system will consist of the following: one compartmented system trailer which will house the AS system and the SVE system. The equipment will generally consist of the air compressor and vacuum blower, air flow meters, solenoids, associated fittings, a control panel, 4 air sparging wells and 6 vertical soil vapor extraction wells, and associated piping. Several supply lines will furnish air to the AS wells and several extraction lines will return air from the SVE wells. A connection will be installed such that the air sparging system will only be activated if the SVE wells are operating. The soil vacuum extraction system will operate continuously.

The proposed SVE and AS well locations with projected radius of influence are provided in **Figure 4**. **Figure 5** provides the proposed layout of remedial systems indicating piping layout and location of remedial building.

3.3.3.1 Air Sparging and Soil Vacuum Well Construction

The SVE wells will be constructed as two-inch diameter threaded schedule 40 PVC with 0.01-slotted screen 8 to 10 feet in length. The wells shall be placed at a depth of approximately 8 to 10 feet bgs. Each well shall be furnished with its own two inch diameter line to the remedial building. Once inside the building the lines may be manifolded in such a manner to allow for proper airflow. All wells will be provided with a tee near the surface and a threaded cap covered with a manway to enable later inspection, if required. **Figure 6** provides construction details regarding proposed SVE wells.

The AS wells will be constructed using two-inch diameter threaded schedule 40 PVC to a depth of approximately 30 feet bgs with slotted 0.01 screen section from 25 to 30 feet bgs. The AS well will have a bentonite seal and the annulus will be sealed with Portland cement to prevent short-circuiting of the injected air into the subsurface. A tee that will furnish air to the well will be included near the top of the riser. The riser will be capped with a threaded plug. Wells will be completed with a flush-mounted, manway and cover that will allow access to the wellhead plumbing. **Figure 7** provides construction details regarding proposed AS wells.

3.3.3.2 System Plumbing and Trenching

Six (6) vertical soil vacuum extraction wells will be located in the areas of impacted soil and in proximity to the AS wells. Each vertical SVE well will be provided a vacuum by a two inch diameter dedicated pipe. The SVE system will operate on a continuous basis.

Four air sparge wells should sufficiently cover the horizontal extent of petroleum contamination in groundwater at the site. Shared piping runs will provide cost effective construction. Each AS well will have its own dedicated supply line.

The trenching will typically be excavated to a depth of two to three feet bgs. The trenches will be lined with 0.25 inch rounded gravel and the piping runs will be constructed with Schedule 40 PVC. Petroleum impacted soil will be disposed of properly. All backfill material will clean and be compacted.

3.3.3.3 Equipment Selection

The two most important criteria for the selection of air sparging equipment are the required air pressure/ airflow and pressure loss. Airflow is measured in standard cubic feet per minute (scfm). Based upon the Ideal Gas Law, the airflow (scfm) is a function of air supply, injection temperature, and pressure.

Air pressure loss through the system is also an important consideration in the equipment selection.

System pressure losses are calculated based upon standard industrial practices for pressure loss calculations of compressible fluid (air) flow. The anticipated losses throughout the system are negligible.

The selected compressor(s) for the sparging system will require continuous flow rate of one to three scfm at a pressure of up to eight psig. The air compressor(s) will be rotary vane design. The selected compressors will be three-phase, 208 to 230 volts, and rated not to exceed a noise level of 75 decibels (db). Compressor discharge temperature should not exceed 140 °F. A heat exchanger or after-cooler will be integrated within the system to insure proper discharge temperature.

The appropriate pressure relief valve, particulate filters, oil filters (if necessary), and check valve will be included as safe guards to prevent damage to the air sparging system. In addition, a bleed-off valve will be installed between the compressor and air supply manifold.

The selected blower(s) will be capable of providing at least a continuous flow rate of 60 scfm at a vacuum of 80 to 90 inches of water. The application of one or more blowers will be determined based upon the manufacturers vacuum/air flow curves and observations during start-up activities. The blower(s) may be a regenerative type, three-phase, 230 volt. The appropriate pressure relief valves, particulate filters, and check valve will be included as safe guards to prevent damage to the blower. A silencer will be installed to reduce the noise level to below 75 db. The motor should be equipped with an hour meter.

3.3.3.4 Compressor Air Supply Manifold

Several air supply lines will be connected to the manifold. The manifold and piping from the compressors will be one to two inches in diameter and constructed of galvanized pipe. From the main manifold, two-inch diameter galvanized pipe will connect the wells to the main piping. Each supply line will contain an airflow gauge for air velocity measurements, a gate valve, an electric solenoid valve, and a pressure gauge. A temperature gauge, pressure gauge, and air velocity gauges will also be installed on the main supply line.

3.3.3.5 Vacuum Air Return Line Manifold

Several air return lines will be connected to the manifold. The manifold and piping from the blower will be three to four inches in diameter for the main line and two-inches in diameter to the specific wells and constructed of PVC pipe. Each supply line will contain an airflow gauge for air velocity measurements, a gate valve, and a vacuum gauge.

3.3.3.6 Electrical

All electrical systems will be installed to local electrical codes. The electrical power will be furnished through 208-230 volt three-phase wiring from the distribution panel to the control panel and from the control panel to the air sparging compressor. The solenoids will be powered by 115-volt single phase wiring from the control panel.

3.3.3.7 Treatment Building

The treatment system shall consist of a building or trailer with approximate dimensions 6 feet wide by 12 feet long with exterior dimensions of approximately 7 feet wide by 17 feet long. A permanent wall will be constructed within the trailer to isolate and provide a vapor barrier between the SVE system from the AS system. The SVE side will be equipped with a double access door or single door with an opening of at least 36 inches wide. Exterior access to the AS side can be provided by a single standard sized door. insulation of interior wall and ceiling. The SVE and AS compartments within the trailer will be each be equipped with;

- Industrial lighting fixtures and light to sufficiently illuminate the interior of the building
- Single speed, 12" exhaust fan, exhaust fan intake guard, and exhaust fan gable shutters. Operation of the fan shall be automatically controlled by a manual thermostat.
- A louver located near the compressor for adequate ventilation that will open freely with operation of the exhaust fan.
- A general purpose utility power outlet in the AS compartment only.
- A fire extinguisher (rated A,B&C), a first-aid kit, hearing and eye protectors.
-

System shall comply with North Carolina regulations and meet approval of New Hanover County Inspections Department if necessary. The trailer will house the air distribution manifold, compressors, blowers, solenoids, gauges, flow meters, electrical wiring and accessories. All electrical wiring and equipment will conform to local building codes.

3.4 SUITABILITY OF NATURAL ATTENUATION

Although the analytical results demonstrate that ground water standards have been exceeded, amendments to 15A NCAC 2L .0106 and 15A NCAC 2P .0402(a) that became effective January 2, 1996, and 15A NCAC 2L .0115 (1998) require examination of the risk posed by the impact of the release as part of the corrective action planning process. This risk analysis is requisite for any person required to implement an approved CAP and who is seeking reimbursement for the work associated with the planning and implementation of the CAP from the Commercial or Non-Commercial Leaking Underground Storage Tank Cleanup Funds. The amendments require the implementation of a CAP that relies upon natural processes for the remediation of impacted ground water if no receptor is at risk. Receptors typically include potable water-supply wells, surface waters, and regions of ground water that have been identified for planned resource development by state or local governments. Other receptors may include underground utilities, basements, etc.

Natural attenuation, or intrinsic remediation, involves the passive reduction of contaminant concentrations by physical and intrinsic microbial processes. Physical attenuation of contaminants includes the processes of volatilization, dispersion, and sorption onto aquifer matrix materials. These processes tend to reduce or "attenuate" the concentrations of contaminants in ground water but do not affect their chemical composition and toxicity. It is reasonable to believe that dispersion is ongoing at the site because it is a process inherent to the flow of a solute through a porous medium. Additionally, ground water isoconcentration maps illustrate a spreading plume that is indicative of dispersion processes.

Biological processes also degrade petroleum-based compounds. Aerobic microbial growth utilizes oxygen for an electron source and the organic carbon (contaminant) as a food source. However, a longer time frame may be required before contaminant concentrations are reduced to below ground water standards via natural attenuation. Typically, this approach requires on-going monitoring costs.

Natural Attenuation modeling efforts were conducted and reported within the *CSA Report*. The modeling results indicated the First Order Decay simulations provided a 10-year resolution of the groundwater benzene plume following removal of the source area. However, modeling results indicated no attenuation of the benzene plume would occur with the source area intact.

Therefore, treatment of the off-site, down-gradient edge of the plume by the processes of natural attenuation is recommended, following mitigation of the source area (on-site impacted soil and groundwater).

4.0 MONITORING PLAN

Site status reports that summarize site activities will be submitted on a semi-annual basis. The reports will include groundwater sampling results, air discharge sampling results, and system operation and maintenance evaluation and records. The reports will include an evaluation of the effectiveness of the AS/SVE system and natural attenuation.

4.1 GROUNDWATER

Performance of the system will be characterized by conducting a pre-system groundwater sampling event in all monitoring wells. During the system operation, groundwater sampling events will be conducted on a semi-annual basis. The system will be temporarily shut-off during the sampling event. Samples will be collected from on and off-site monitoring wells. All groundwater samples will be analyzed for target compounds by EPA Method 602.

4.2 AS/SVE SYSTEM

The performance of the systems will also be monitored through sampling of the SVE air discharge. Samples will be continuously screened on-site with the aid of a VOC analyzer meter during all site visits.

The contaminant levels in the groundwater will meet one of the following conditions for consideration of system shut down or system evaluation:

- Contaminant levels detected in all monitoring and water supplies are below standards set forth in 15A NCAC 2L .0202 for a period of one year.

- An asymptotic relationship between measurable contaminant levels in monitoring wells and cumulative remediation system operational data has been established which suggests that continued operation would not result in any significant reduction or removal of mass. When the targeted concentrations within the air discharge reach asymptotic conditions, then a system reevaluation may be conducted.

5.0 COST ESTIMATE

A summary of the cost associated with each task for the proposed design and installation of the corrective action system and subsequent monitoring plan is presented in **Table 6**. An estimate of approximately $254,000 is proposed for this corrective action plan. This estimate is based upon current Trust Fund Rates, the lowest bids for the fabrication and installation of the AS and SVE systems, and an operational period of 5 years followed by one year of groundwater monitoring.

6.0 IMPLEMENTATION SCHEDULE

A proposed schedule of implementation is shown in **Table 7**.

7.0 PUBLIC NOTIFICATION

In accordance with NCAC Title 15 A, Subchapter 2L, notices were submitted to the following;

- New Hanover County Manager, Bruce Shell, 230 Government Drive, Suite 195, Wilmington, NC 28403
- New Hanover County Health Director, David E. Rice, 2029 South 17th Street, Wilmington, NC 28401
- Contiguous Property (7158 Market Street), Cecil Covil et al, 129 Middle Sound Loop Road, Wilmington, NC 28411

The notifications are attached in **Appendix F**. Copies of certified return receipt cards will be provided upon receipt.

8.0 LIMITATIONS

This report has been prepared for the exclusive use of Worsley Operating Corporation. The opinions included herein are based on information obtained during the study, on our experience in accordance with currently accepted hydrogeologic and engineering practices, and relevant regulatory guidelines at this time and location. Other than this, no warranty is implied or intended.

TABLES

TABLE 1
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
				12/5/2008	12.50	--	82.45
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
				12/5/2008	12.71	--	82.17
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
				12/5/2008	10.56	--	84.21
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
				12/5/2008	9.84	--	84.95
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
				12/5/2008	12.12	--	82.54
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
				12/5/2008	7.73	--	86.95
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
				12/5/2008	8.67	--	85.65
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
				12/5/2008	10.55	--	84.51
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
				12/5/2008	11.89	--	82.45
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
				12/5/2008	10.32	--	84.20
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29
				12/5/2008	12.07	--	82.67

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas Depth to water has been adjusted due to presence of free product using th following formula's:
   $DTW\text{-}DTP=X_0$; $(78\%)(X_0) = X_1$; $DTW\text{-}X_1 = DTW_{ADJ}$
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 2
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*1,000*	*550*	*530*	*200*	*70*	*21*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**42**	12	94	110	5.8	**<1.0**	**70**
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	8.3
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
	12/5/2008	**41**	550	**590**	**2,500**	<1.0	<1.0	**170**
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	12
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
	12/5/2008	<1.0	<5.0	1.3	<3.0	<1.0	<1.0	<5.0
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**87**	47	380	**640**	15	<1.0	**170**
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	12
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**1.7**	<5.0	18	<3.0	<1.0	<1.0	6.5

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 3
SUMMARY OF NATURAL ATTENUATION PARAMETERS FOR SOIL AND GROUNDWATER
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well/ Boring No.	Date	Naturally Occurring Carbon (percent)
SB-8	9/20/2007	0.0066
MW-6	9/20/2007	0.0053
MW-7	9/20/2007	0.013
Average		**0.008**

Well No.	Date	pH (S.U.)	Specific Conductivity (mS/m)	Dissolved Oxygen (mg/L)	Temperature (°C)	ORP (mV)	Nitrate (mg/L)	Sulfate (mg/L)
MW-1	9/24/2007	6.78	76.4	1.29	25.0	-210	<0.10	32
	12/5/2008	5.36	52.7	0.94	22.5	-77	NA	NA
MW-3	9/24/2007	6.88	46.6	1.27	26.3	-277	<0.10	15
	12/5/2008	5.29	43.3	0.62	22.7	-95	NA	NA
MW-4	9/24/2007	6.59	29.2	1.26	27.6	-235	NA	NA
	12/5/2008	5.33	37.5	0.80	23.9	-44	NA	NA
MW-5	9/24/2007	6.84	54.4	1.07	25.8	-184	NA	NA
	12/5/2008	5.53	52.5	0.89	22.9	-90	NA	NA
MW-6	9/24/2007	7.24	48.2	3.62	24.7	164	0.33	7.5
	12/5/2008	6.00	31.3	2.27	18.1	114	NA	NA
MW-7	9/24/2007	7.63	61.9	5.33	28.9	183	1.90	38
	12/5/2008	5.89	40.5	8.46	21.1	88	NA	NA
MW-8	9/24/2007	6.95	0.1	5.41	26.3	100	<0.10	18
	12/5/2008	5.28	43.6	4.53	19.9	21	NA	NA
MW-9	9/24/2007	6.52	23.0	2.77	23.1	36	<0.10	24
	12/5/2008	5.48	22.0	6.45	20.0	95	NA	NA
MW-10	9/24/2007	6.70	40.8	2.21	27.2	-70	NA	NA
	12/5/2008	5.08	36.2	1.33	23.6	29	NA	NA
MW-11	9/24/2007	6.90	32.7	1.26	24.5	70	NA	NA
	12/5/2008	5.62	28.7	3.06	21.9	-25	NA	NA
MW-2	9/24/2007	5.80	22.8	2.45	24.7	51	NA	NA
	12/5/2008	4.38	8.4	1.31	22.3	78	NA	NA

Notes:
- S.U. is an abbreviation for Standard Units
- mS/m is an abbreviation for milliSiemens per meter
- mg/L is an abbreviation for milligrams per liter
- °C is an abbreviation for degrees Celcius
-ORP is an abbreviation for oxygen reduction potential
- mV is an abbreviation for millivolts
- NA indicates that this information is not available

TABLE 4
SOIL VAPOR EXTRACTION FIELD PILOT TEST DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

		Observational Parameters										
Date	Time	Well Head			Discharge					Dilution Air		
		air flow (scfm)	temp (F)	well head vaccum (in. water)	relative humidity (%)	temperature (F)	air flow (ft^3/min)	air flow (scfm)	TLV readings (ppm)	air flow (ft^3/min)	temp (F)	relative humidity (%)
2/13/2009	11:30	start test - bleeder valve 100% open										
2/13/2009	11:35	12	63	24	24	90	45	43	0	33.0	68	26
2/13/2009	11:40	adjust air flow to 20 scfm										
2/13/2009	11:45	20	61.5	34	24	97	43	40	100	22.5	66.5	25
2/13/2009	12:30	20	62	34	22	101	43	40	140	22.5	68.5	
2/13/2009	12:40	adjust air flow to 30 scfm										
2/13/2009	12:45	30	62.5	51	24	100	39	36	300	8.5	69	27
2/13/2009	13:15	30	62.5	51	23	110	39	36	220	8.5	70	28
2/13/2009	13:15	adjust air flow to 36 scfm - bleeder valve 100% closed										
2/13/2009	13:20	36	63	61	22	117.5	36	31	450	0.0	--	--
2/13/2009	13:45	36	62.5	61	21	110	36	31	430	0.0	--	--
2/13/2009	14:00	adjust air flow to 25 scfm										
2/13/2009	14:05	25	62.5	44	20	110	40	37	280	15.0	72	25

		Observation Wells Data									
Date	Time	OB-1		MW-3		MW-4		MW-10		MW-11	
		DTW (feet)	Vacuum (inches)	DTW (feet)	Vacuum (inches)	DTW (feet)	Vacuum (inches)	DTW (feet)	Vacuum (inches)	DTW (feet)	Vacuum (inches)
2/13/2009	11:00	12.98	0	11.44	0	10.50	nm	10.63	0	13.20	0
2/13/2009	11:30	start test - bleeder valve 100% open									
2/13/2009	11:35	nm	0	nm	0	nm	nm	nm	nm	nm	nm
2/13/2009	11:40	adjust air flow to 20 scfm									
2/13/2009	11:45	12.95	2	11.45	0	10.50	0	10.62	0	13.15	0
2/13/2009	12:30	nm	2	nm	1	nm	0	nm	0	nm	0
2/13/2009	12:40	adjust air flow to 30 scfm									
2/13/2009	12:45	nm	3.5	nm	1.5	nm	nm	nm	nm	nm	nm
2/13/2009	13:15	12.93	3.5	11.4	0	10.50	0	10.60	0	13.12	0
2/13/2009	13:15	adjust air flow to 36 scfm - bleeder valve 100% closed									
2/13/2009	13:20	nm	4.5	nm	2	nm	nm	nm	nm	nm	nm
2/13/2009	13:45	12.93	5	11.41	2	10.51	0	10.60	0	13.11	0
2/13/2009	14:00	adjust air flow to 25 scfm									
2/13/2009	14:05	nm	4.0	nm	1.0	nm	nm	nm	nm	nm	nm

Distance to Well SVE-1		
Well	(ft)	
OB-1	7'11"	7.9
MW-3	14'9"	14.8
MW-4	28'9"	28.8
MW-11	35'6"	35.5
MW-10	40'10"	40.8

TABLE 5
AIR SPARGING FIELD PILOT TEST DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

		Operational Parameters		Observational Parameters					
		Injected Air		OB-1	MW-4	MW-11	MW-10	MW-6	MW-8
Date	Time	Well Head Pressure (psi)	Air Flow (ft^3/min)	DTW (ft below TOC)	DTW (ft below TOC)	DTW (ft below TOC)	DTW (ft below TOC)	DTW (ft below TOC)	DTW (ft below TOC)
1/16/2009	9:00	pre-test DTW readings		12.68	***	12.34	10.45	8.28	10.38
1/16/2009	9:30	breakthrough @ 7.5 psig							
1/16/2009	9:30	8.5	1	start test @ 1 cfm					
1/16/2009	10:00	8.0	1	12.35	***	12.25	10.40	8.28	***
1/16/2009	10:30	8.0	1	12.32	10.26	12.23	10.38	8.27	***
1/16/2009	11:00	8.0	1	12.31	10.24	12.22	10.37	8.25	10.23
1/16/2009	11:15	8.5	3	increase to 3 cfm					
1/16/2009	11:45	8.5	3	11.02	10.18	12.12	10.25	8.23	***
1/16/2009	12:15	8.0	3	10.32	10.15	12.10	10.25	8.22	***
1/16/2009	12:45	8.0	3	---	10.12	12.08	10.21	8.26	9.98
1/16/2009	12:50	9.0	6	increase to 6 cfm					
1/16/2009	13:15	9.0	6	---	10.07	12.00	10.13	8.20	***
1/16/2009	13:45	8.5	6	---	10.03	12.01	10.12	8.19	9.81
1/16/2009	14:00	9.0	7.3	increase to 7.3 cfm					
1/16/2009	14:25	8.8	7.3	---	9.99	11.98	10.10	8.18	9.79
1/16/2009	14:30	Stop Testing							
1/16/2009									
Horizontal Distance to AS Well MW-2 (ft)				10.75	33.25	34.42	56.83	64.75	100.67
Top of Casing Elevation				***	94.79	94.74	94.52	94.68	95.06

notes;

--- indicates no measurements due to severe bubbling

*** indicates no measurements collected

DTW - depth to water below top-of-casing

ENVIRONMENTAL SERVICES & SOUTIONS, PLLC

TABLE 6

REMEDIAL COST ESTIMATE

SCOTCHMAN #35

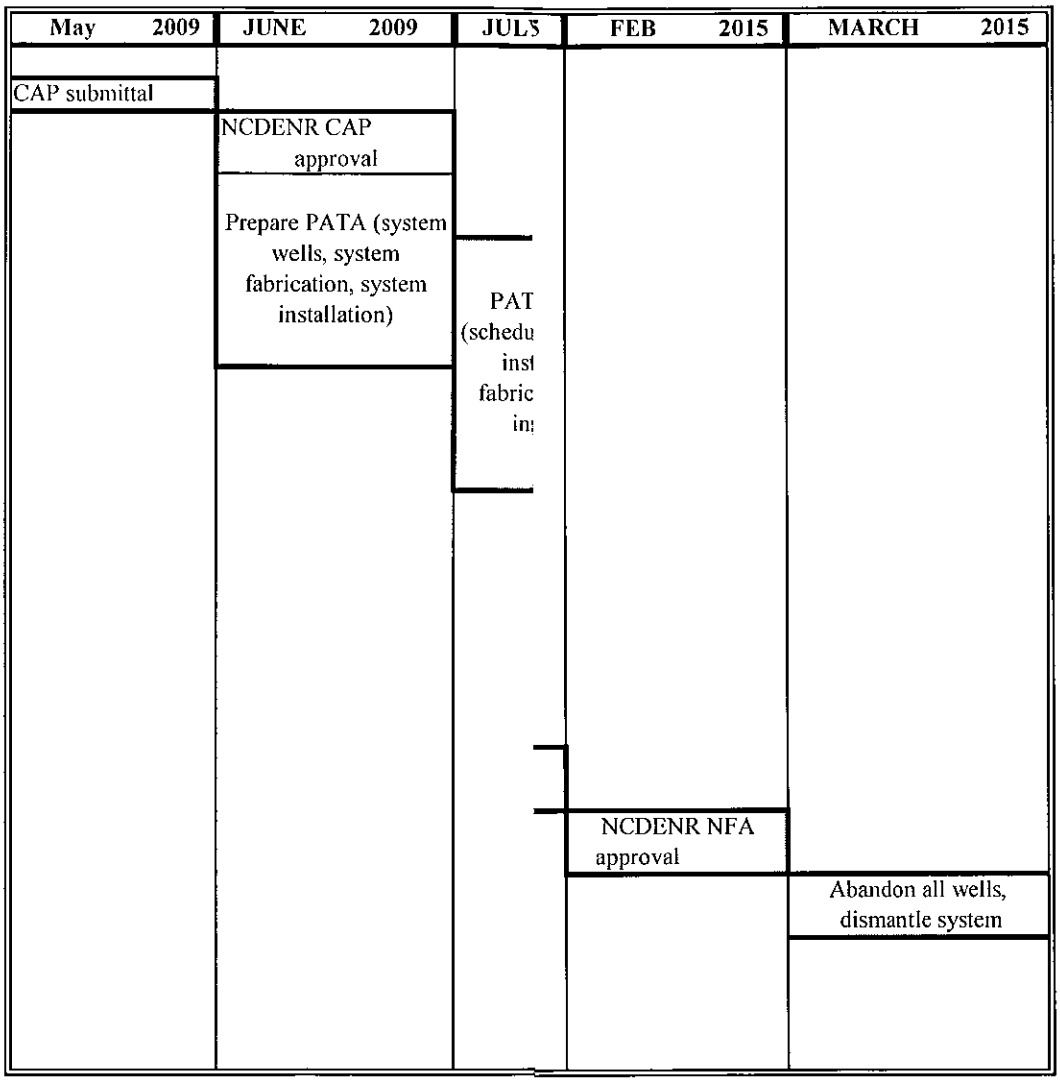
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Task	Activity		Unit Cost	No. of Units	No. of Events	Subtotal	Assumptions/reasoning
1.060	Request for bid		$400	1	1	**$400**	9.060
3.101	Field Supervision		$95	8	6	**$4,560**	*4 air sparging wells and 6 sve wells & confirmatory sampling*
3.111	Soil Boring		$15	8	2	**$240**	*confimatory sampling (2 @ 8 ft each)*
3.113	2" type II monitoring well		$45	30	4	**$5,400**	*4 air sparging wells (30 ft)*
	2" type II monitoring well		$45	10	6	**$2,700**	*6 sve wells (10 ft)*
3.398	Driller Mobilization		$350	1	3	**$1,050**	
3.399	Well abandonment		$6	20	10	**$1,200**	*MW-1 to MW-11*
	Well abandonment		$6	30	1	**$180**	*MW-2*
	Well abandonment		$6	30	4	**$720**	*4 air sparging wells (30 ft)*
	Well abandonment		$6	10	6	**$360**	*6 sve wells (10 ft)*
3.500	Drill Crew Per Diem		$142	1	4	**$568**	*AS/SVE well drilling*
4.031	Monitoring well sampling		$155	11	10	**$17,050**	*semi-annual (10 events)*
	Monitoring well sampling		$155	11	2	**$3,410**	*post system sampling (2 events)*
4.090	Laboratory Analyses						
	Soil						
	Code	Method					
	Code 408	8260	$215	1	2	**$430**	*confimatory sampling (soil)*
	Code 410	8270	$207	1	2	**$414**	
	Code 423	VPH/EPH	$193	1	2	**$386**	
	Groundwater						
	Code	Method					
	Code 220	602	$70	11	10	**$7,700**	*semi-annual (10 events)*
	Code 272	6200B	$95	11	2	**$2,090**	*confimatory sampling (gw - 2 events)*
	Code 343	VPH/EPH	$194	11	2	**$4,268**	
	Code 301	625	$231	11	2	**$5,082**	
	Code 330	3030C	$15	11	2	**$330**	
	Code 280	504.1	$49	11	2	**$1,078**	
6.100	Active Remediation Monitoring Report		$1,551	1	1	**$1,551**	
6.101	Subsequent Reports		$889	1	9	**$8,001**	
6.170	Site Closure Report		$771	1	1	**$771**	
7.065	Cost for Multiple Technology Systems		$72,400	1	1	**$72,400**	*AS and SVE system fabrication*
7.081	Field Supervision of System Install		$97	30	1	**$2,910**	
7.100	Cost of system install		$38,450	1	1	**$38,450**	*System installation - Harvest Environmental*
7.201	Cost of sched. Maint.		$93	6	4	**$2,232**	*6 hrs/visit weekly (first month)*
			$93	6	59	**$32,922**	*6 hours/visit monthly (remaining 59 months)*
7.250	Cost of supplies/equipment		$400	1	7	**$2,800**	*repace vanes & filters seven times*
7.260	Cost of operating expenses		$500	1	60	**$30,000**	*primarily utility costs for 60 months*
9.060	Drummed soil disposal		$145	14	1	**$2,030**	*Est costs for remedial well cuttings - disposal*
Grand Total						**$253,683**	

Notes:

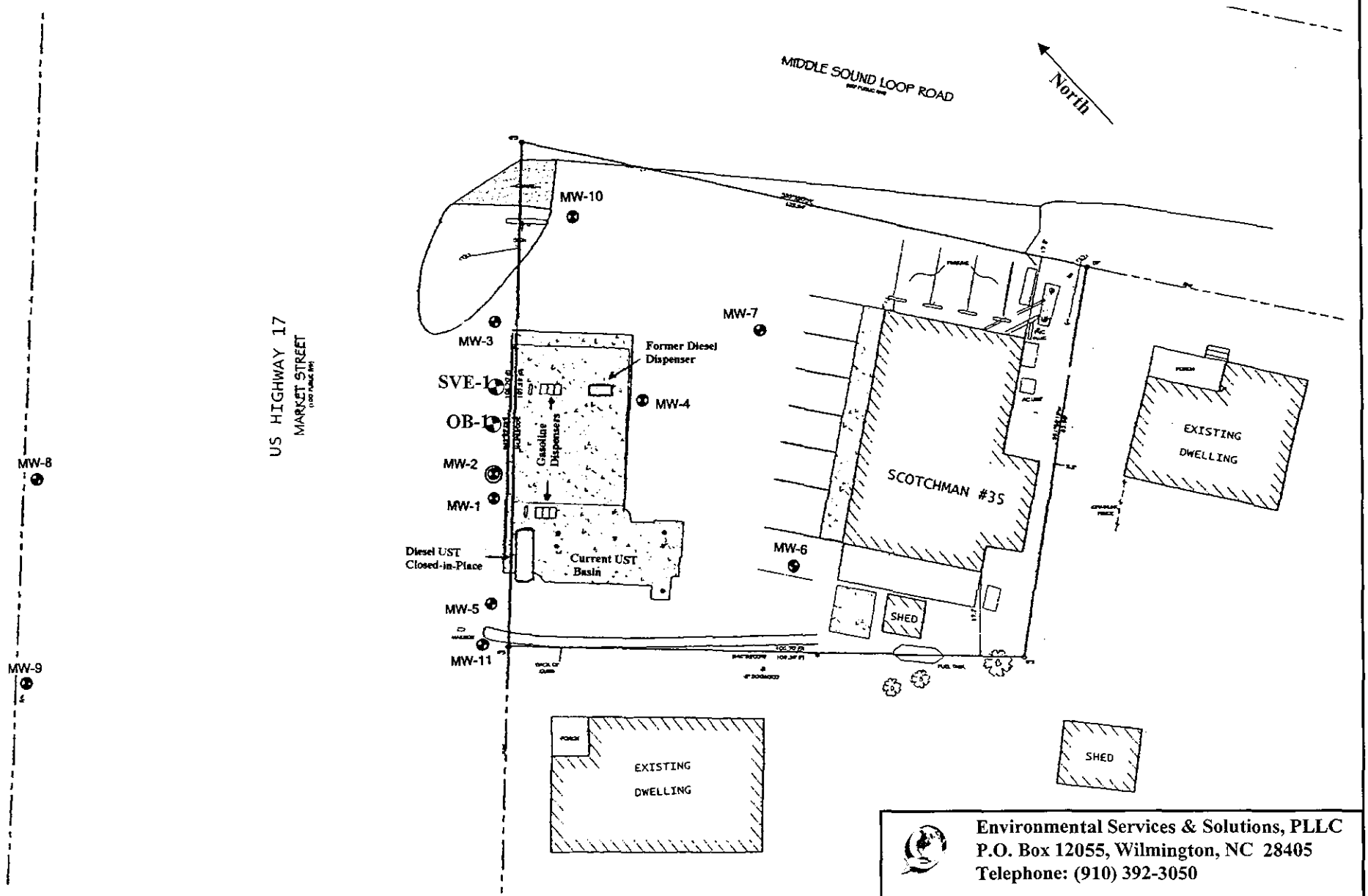
.is table is only intended as an estimate of costs associated with typical AS/SVE clean-up activities.

All of the tasks required to complete this corrective action may not have been included in this table, although an attempt was made to do so. In addition, site conditions may necessitate cost changes.


May 2009
JUNE 2009
JULY
FEB 2015
MARCH 2015
CAP submittal
NCDENR CAP approval
Prepare PATA (system wells, system fabrication, system installation)
PAT (schedu inst fabric in
NCDENR NFA approval
Abandon all wells, dismantle system

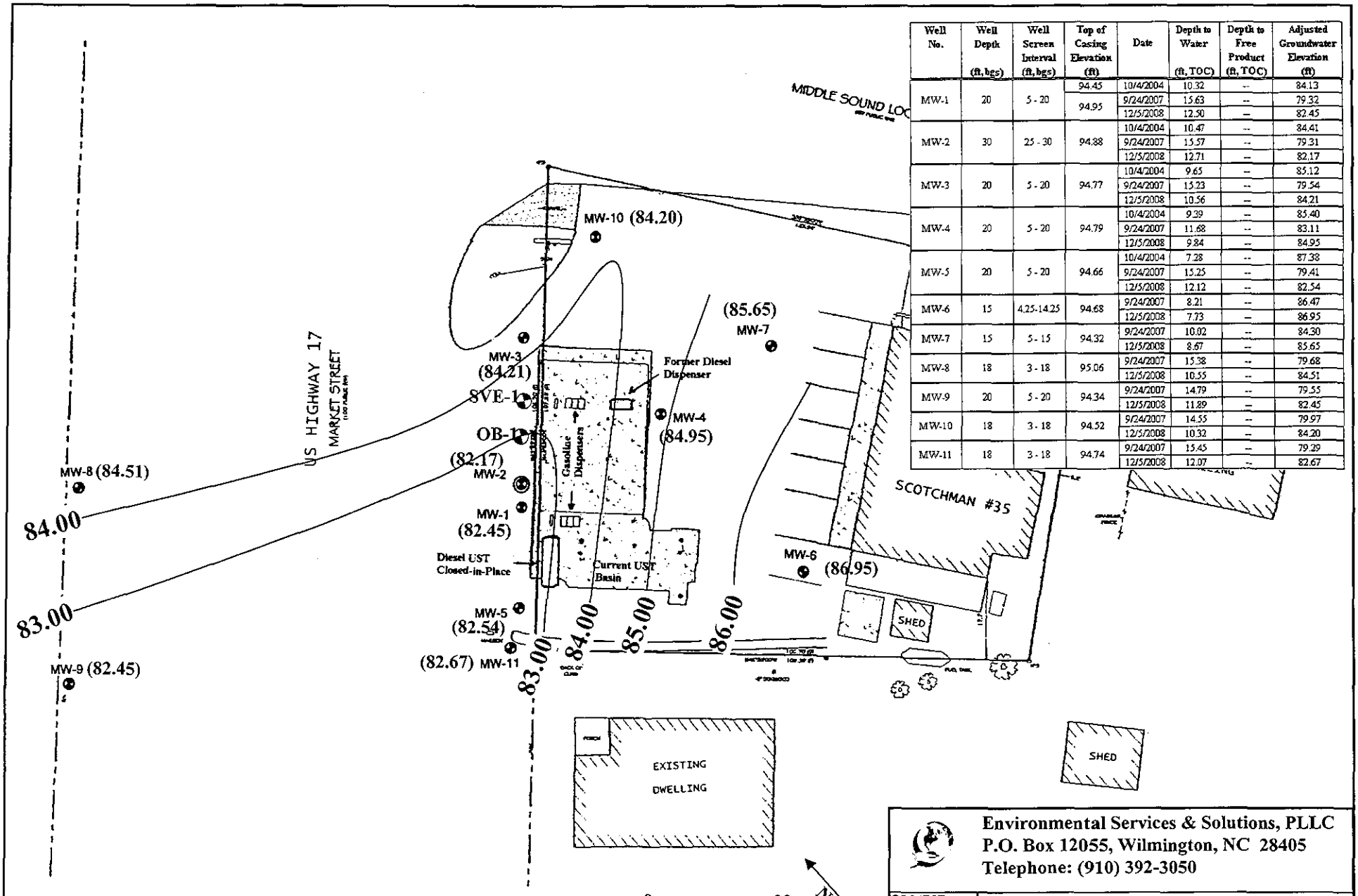
FIGURES

Environmental Services & Solutions, PLLC P.O. Box 12055, Wilmington, NC 28405 Telephone: (910) 392-3050	Title: Topographic Vicinity Map		Figure No. 1
Drawn By: BKL	Date: 5-5-08	Location: Scotchman #35 Wilminmgton, NC	
Checked By: FP	Date: 5-5-08		



Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

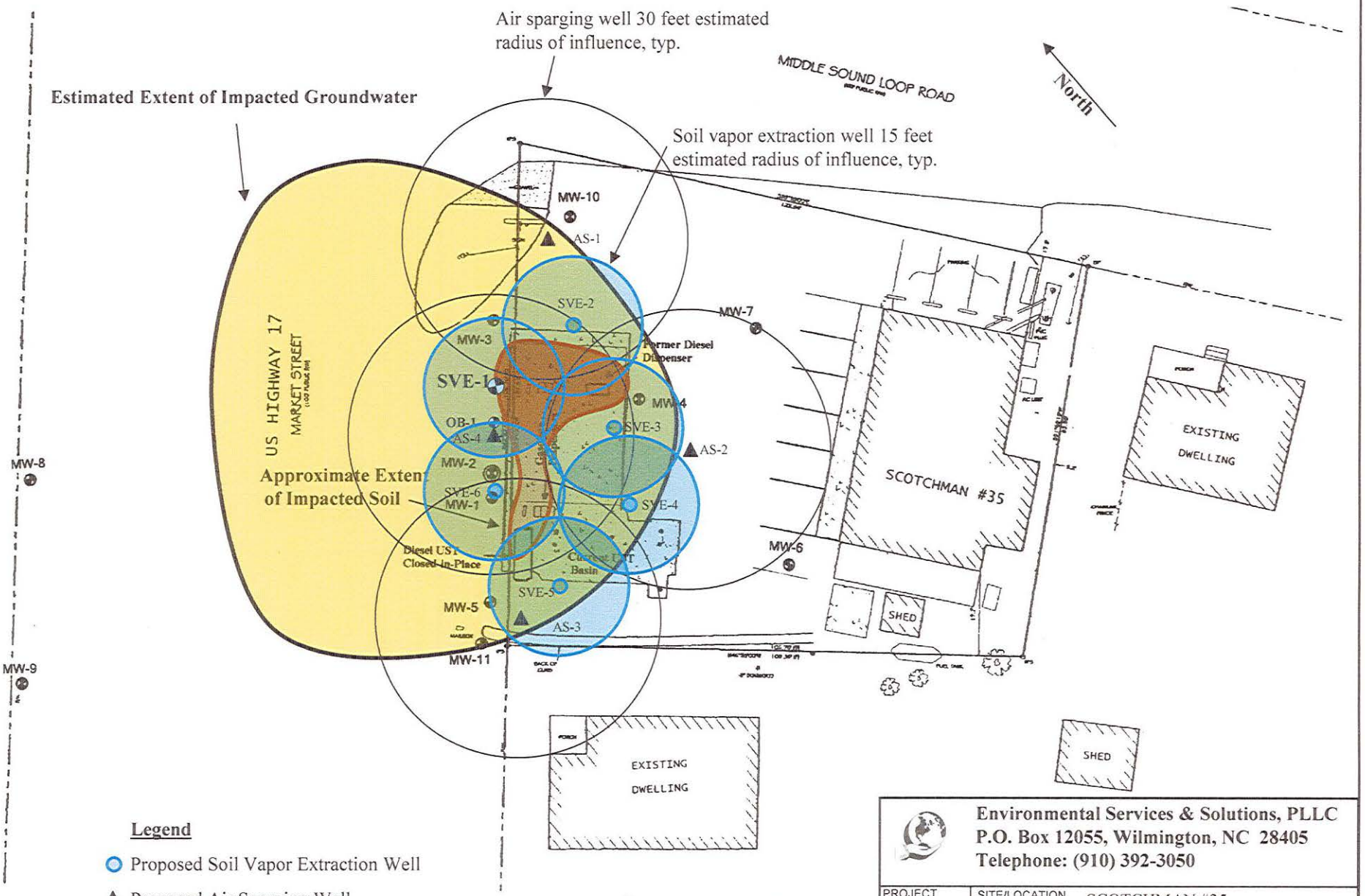
PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
4/20/09	**SITE MAP**	2



Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
				12/5/2008	12.50	--	82.45
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
				12/5/2008	12.71	--	82.17
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
				12/5/2008	10.56	--	84.21
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
				12/5/2008	9.84	--	84.95
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
				12/5/2008	12.12	--	82.54
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
				12/5/2008	7.73	--	86.95
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
				12/5/2008	8.67	--	85.65
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
				12/5/2008	10.55	--	84.51
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
				12/5/2008	11.89	--	82.45
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
				12/5/2008	10.32	--	84.20
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29
				12/5/2008	12.07	--	82.67

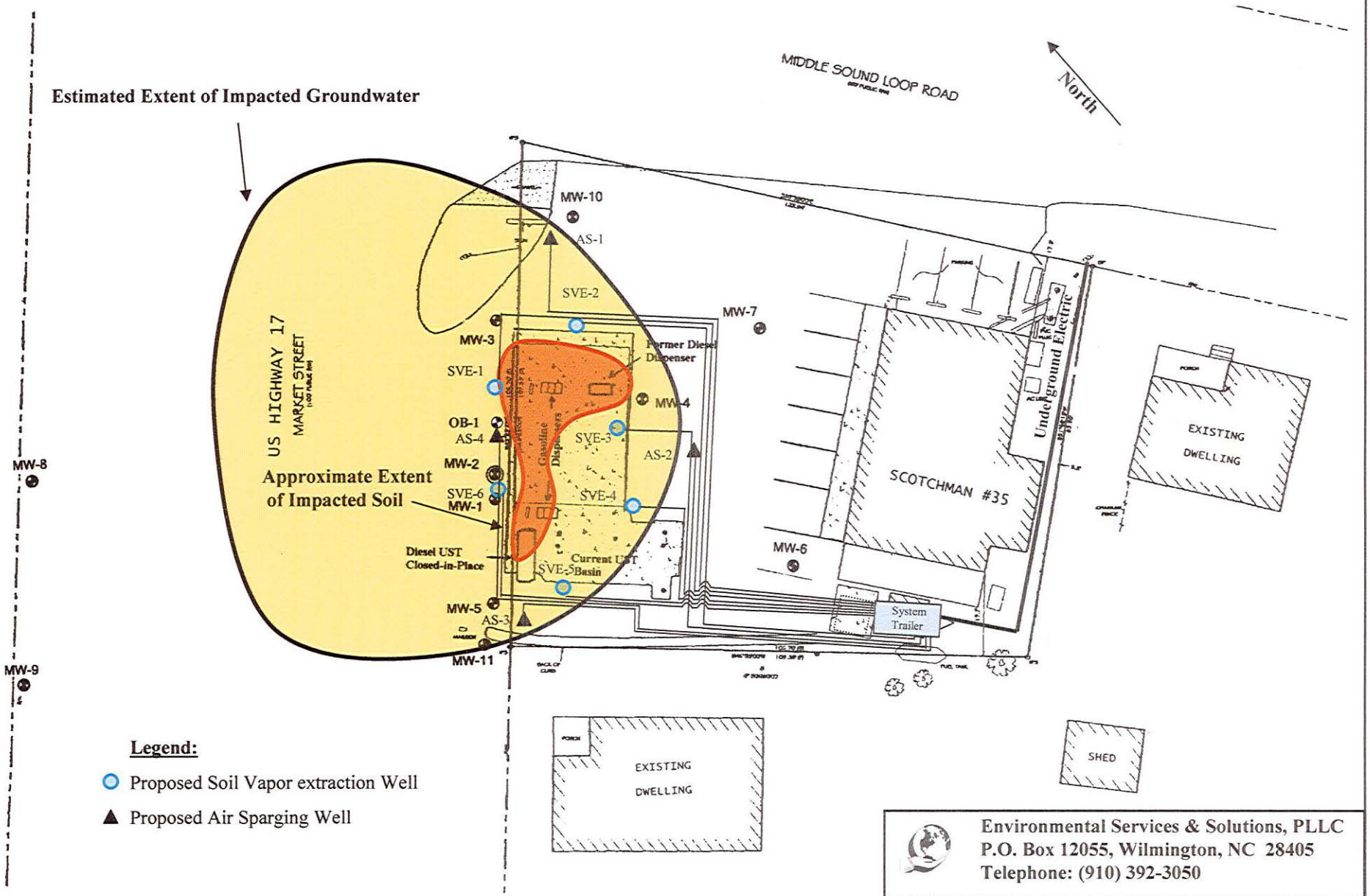
Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
4/20/09	**Groundwater Elevation Map (12/5/08)**	3



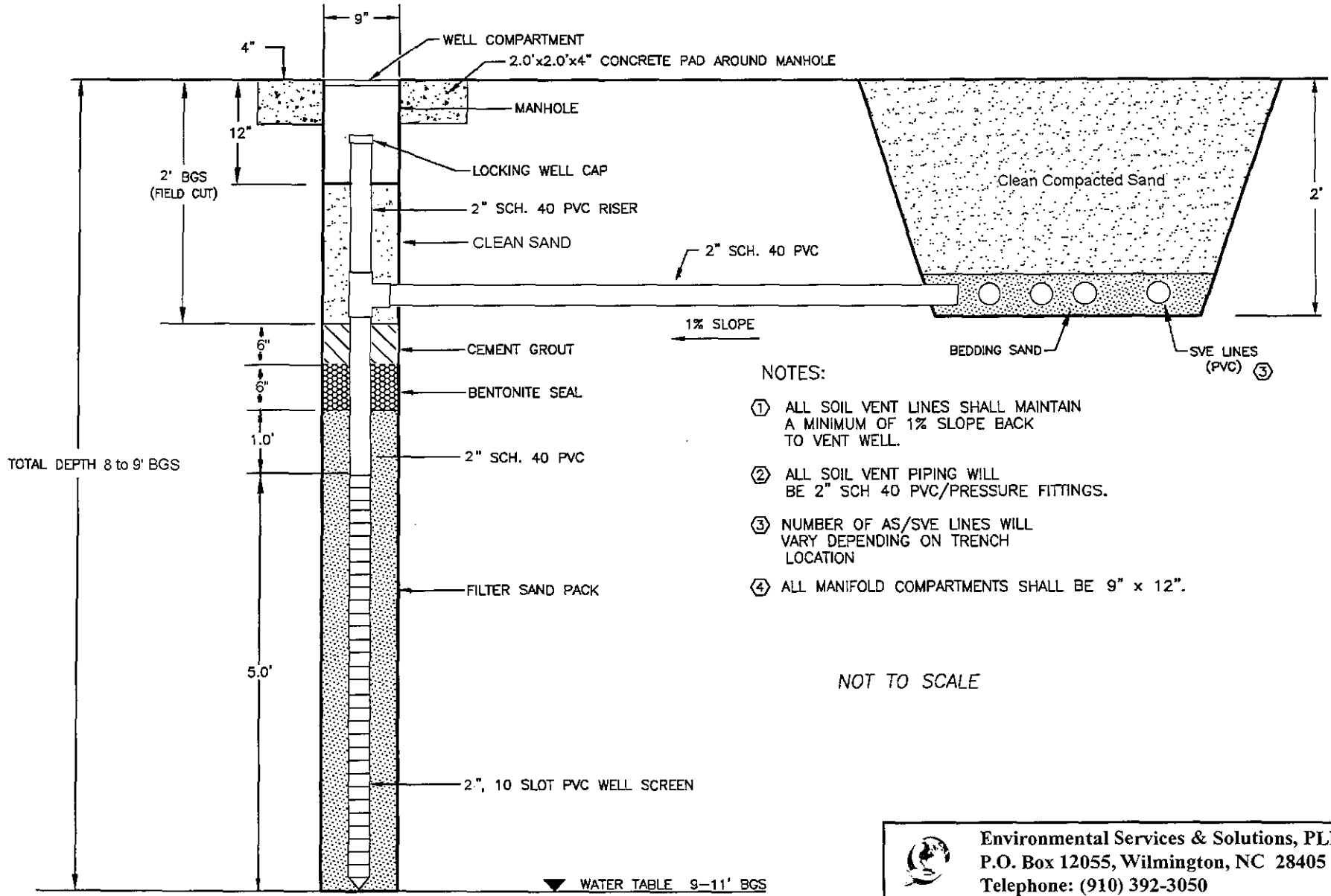
Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION		
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC		
DATE	DRAWING DESCRIPTION		FIGURE NO.
4/23/09	**Proposed System Well Locations and Projected Radius of Influence**		4



Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
4/23/09	**Proposed Remedial System Layout**	5



NOTES:

① ALL SOIL VENT LINES SHALL MAINTAIN A MINIMUM OF 1% SLOPE BACK TO VENT WELL.

② ALL SOIL VENT PIPING WILL BE 2" SCH 40 PVC/PRESSURE FITTINGS.

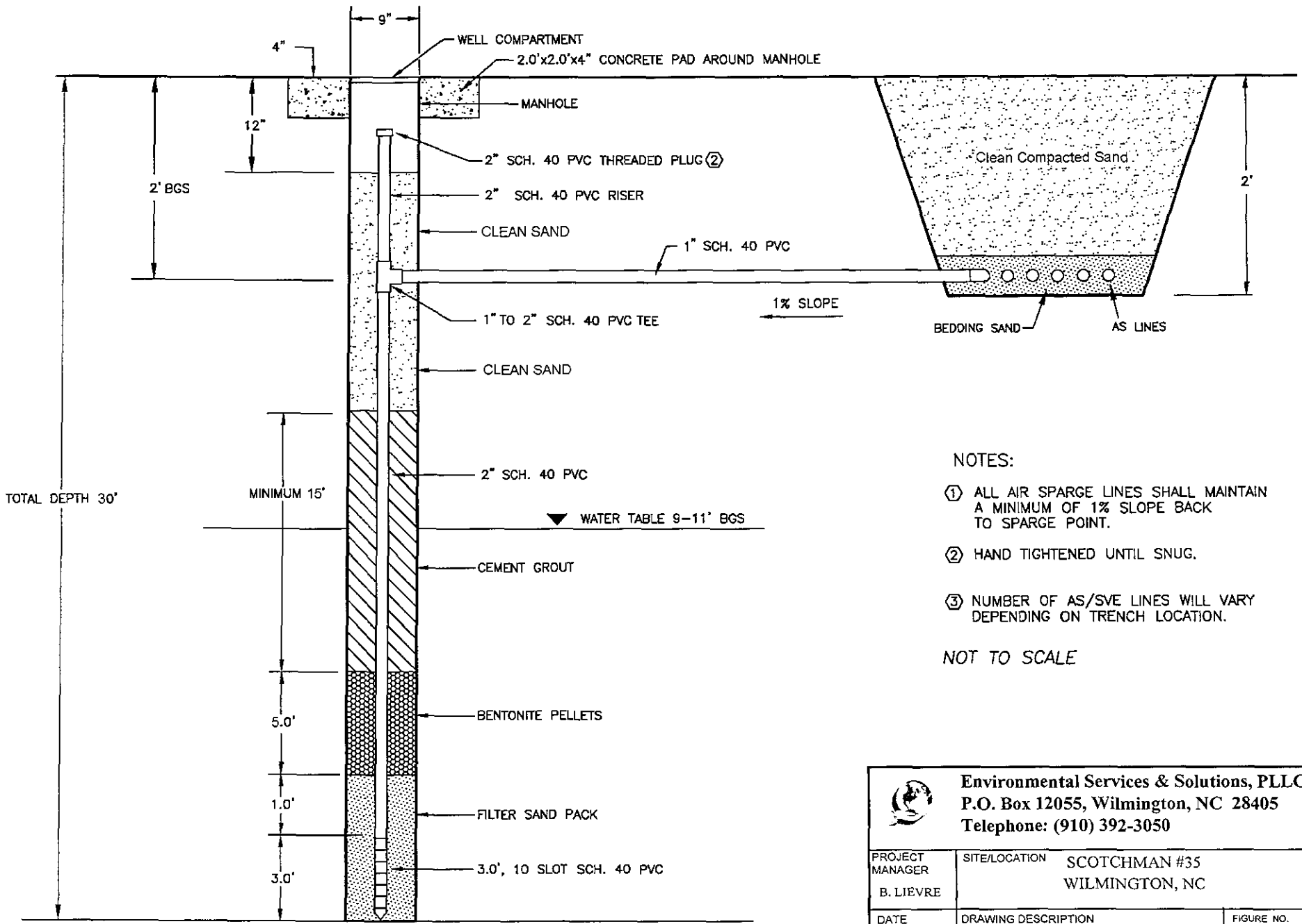
③ NUMBER OF AS/SVE LINES WILL VARY DEPENDING ON TRENCH LOCATION

④ ALL MANIFOLD COMPARTMENTS SHALL BE 9" x 12".

NOT TO SCALE

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
5/9/08	**SVE Wellhead and Trench Detail**	6



NOTES:

(1) ALL AIR SPARGE LINES SHALL MAINTAIN A MINIMUM OF 1% SLOPE BACK TO SPARGE POINT.

(2) HAND TIGHTENED UNTIL SNUG.

(3) NUMBER OF AS/SVE LINES WILL VARY DEPENDING ON TRENCH LOCATION.

NOT TO SCALE

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
2/27/09	**Air Sparging Wellhead and Trench Detail**	7

APPENDIX A

TABLE 3
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas Depth to water has been adjusted due to presence of free product using th following formula's:
   DTW-DTP=X_0 ; (78%)(X_0) = X_1 ; DTW-X_1 = DTW_{ADJ}
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 4
SUMMARY OF TPH LABORATORY RESULTS FOR SOIL SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample Location	Sampling Date	Sample Depth (ft, bgs)	TPH GRO (mg/kg)	TPH DRO (mg/kg)	Sample Reasoning
NC DWM Action Levels			*10*	*10*	
SB-1	5/13/2004	6 - 7	**380**	**2,500**	Pit Sidewall
SB-2	5/13/2004	6 - 7	**13**	**210**	Pit Sidewall
SB-3	5/13/2004	6 - 7	<0.53	<4.2	Pit Sidewall
SB-4	5/13/2004	6 - 7	<0.54	<11	Pit Sidewall
SB-5	5/13/2004	6 - 7	<0.52	7.9	Pit Sidewall
SB-6	5/13/2004	6 - 7	<0.55	<4.4	Pit Sidewall
SB-7	5/13/2004	2 - 3	<0.53	<10	Product Line
SB-8	5/13/2004	1 - 2	<0.56	**980**	Dispenser

Notes: 1.) TPH GRO - Total petroleum hydrocarbons, gasoline range organics by EPA Method 8015 with 5035 preparation
2.) TPH DRO - Total petroleum hydrocarbons, diesel range organics by EPA Method 8015 with 3550 preparation
3.) **Bold** numbers exceed DWM Action Levels
4.) ft, bgs - feet, below ground surface
5.) mg/kg - milligrams per kilogram
6.) Samples obtained by others

Sample ID →	SS-1	SB-1B	SB-2		SB-14B	SOIL-TO-WATER MSCCs	RESIDENTIAL MSCCs	INDUSTRIAL/ COMMERCIAL MSCCs
Sample Depth (ft.) →	5 - 7	6 - 7	6 - 7		6 - 7			
Sample Date →	9/20/2004	9/20/2007	9/20/2007		2/29/2008			
Analyses →	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH		EPA Methods 8260 & 8270 & MADEP VPH & EPH			
Detected Compounds ↓	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)		Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
Acetone	<0.028	<26	<26	150	<0.054	3	1,564	40,880
Benzene	<0.0011	<0.52	<0.53	<2.9	<0.0011	0.0056	22	200
n-Butylbenzene	<0.0011	**7.9**	**5.7**	<2.9	<0.0011	4	156	4,088
sec-Butyl benzene	<0.0011	2.8	2.6	**3.3**	<0.0011	3	156	4,088
1,2-Dichloropropane	<0.0011	**1.3**	<0.53	<2.9	<0.0011	0.0029	9	84
Ethylbenzene	<0.0011	**5.8**	**3.4**	**33**	<0.0011	0.24	1,560	40,000
Isopropyl benzene	<0.0011	**2.7**	1.6	**7.3**	<0.0011	2	1,564	40,880
4-Isopropyl toluene	<0.0011	<0.52	<0.53	7.2	<0.0011	NA	NA	NA
Naphthalene	<0.0057	**19**	**19**	**41**	<0.0054	0.58	63	1,635
n-Propylbenzene	<0.0011	**12**	**6.1**	**24**	<0.0011	2	156	4,088
Toluene	<0.0057	<2.6	<2.6	**25**	<0.0054	7	3,200	82,000
Trichloroethene	<0.0011	**0.91**	**0.89**	<2.9	<0.0011	0.0183	58	520
1,2,4-Trimethylbenzene	<0.0011	<0.52	<0.53	**230**	<0.0011	8	782	20,440
1,2,3-Trimethylbenzene	NA	0.59	0.56	52	<0.0011	NA	NA	NA
1,3,5-Trimethylbenzene	<0.0011	<0.52	<0.53	**64**	<0.0011	7	782	20,440
Total Xylenes	<0.0034	<1.6	<1.6	**210**	<0.0032	5	32,000	200,000
Acenaphthene	<0.38	0.27	<0.039	<7.8	<0.36	8	940	24,000
Benzo (a) anthracene	**1.1**	<0.038	<0.039	<7.8	<0.36	0.34	0.88	8
Benzo (b) fluoranthene	**1.2**	<0.038	<0.039	<7.8	<0.36	1	0.88	8
Benzo (g,h,i) perylene	0.50	<0.038	<0.039	<7.8	<0.36	6,720	469	12,264
Benzo (k) fluoranthene	0.51	<0.038	<0.039	<7.8	<0.36	12	9	78
Benzo (a) pyrene	**1.2**	<0.038	<0.039	<7.8	<0.36	0.091	0.088	0.78
Chrysene	1.2	<0.038	<0.039	<7.8	<0.36	38	88	780
Fluoranthene	2.2	<0.038	<0.039	<7.8	<0.36	276	620	16,400
Fluorene	<0.38	0.46	<0.039	<7.8	<0.36	44	620	16,400
Ideno (1,2,3-cd) pyrene	0.48	<0.038	<0.039	<7.8	<0.36	3	0.88	8
Naphthalene	<0.38	<0.038	<0.039	**15**	<0.36	0.58	63	1,635
Phenanthrene	0.97	0.76	<0.039	<7.8	<0.36	60	469	12,264
Pyrene	1.8	0.089	<0.039	<7.8	<0.36	286	469	12,264
C_9-C_{10} Aromatics	<5.7	**370**	**330**	**870**	<5.4	34	469	12,264
C_{11}-C_{22} Aromatics	<6.2	**1,600**	**1,200**	**300**	<7.0			
C_5-C_8 Aliphatics	<5.7	**260**	**74**	**510**	<5.4	72	939	24,528
C_9-C_{12} Aliphatics	<5.7	**950**	740	,000	<5.4	3,255	9,386	245,280
C_9-C_{18} Aliphatics	<6.2	**2,900**	2,500	140	<7.0			
C_{19}-C_{36} Aliphatics	<6.2	790	740	70	<7.0	#	93,860	##

Notes:

- < denotes analytical result below laboratory method detection limit. Number to rig
- Analytical results are presented in milligrams per kilogram (mg/kg).
- Analytical results exceeding Soil-to-Water Maximum Soil Contaminant Concentra
- Analytical results exceeding the most stringent MSCCs are in **bold** type.
- Analytical results exceeding Industrial/Commercial MSCCs are shaded.
- No other compounds were detected at levels above laboratory quantitation limits
- # Considered immobile
- ## Health based level >100%
- NA information is not available

TABLE 6
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

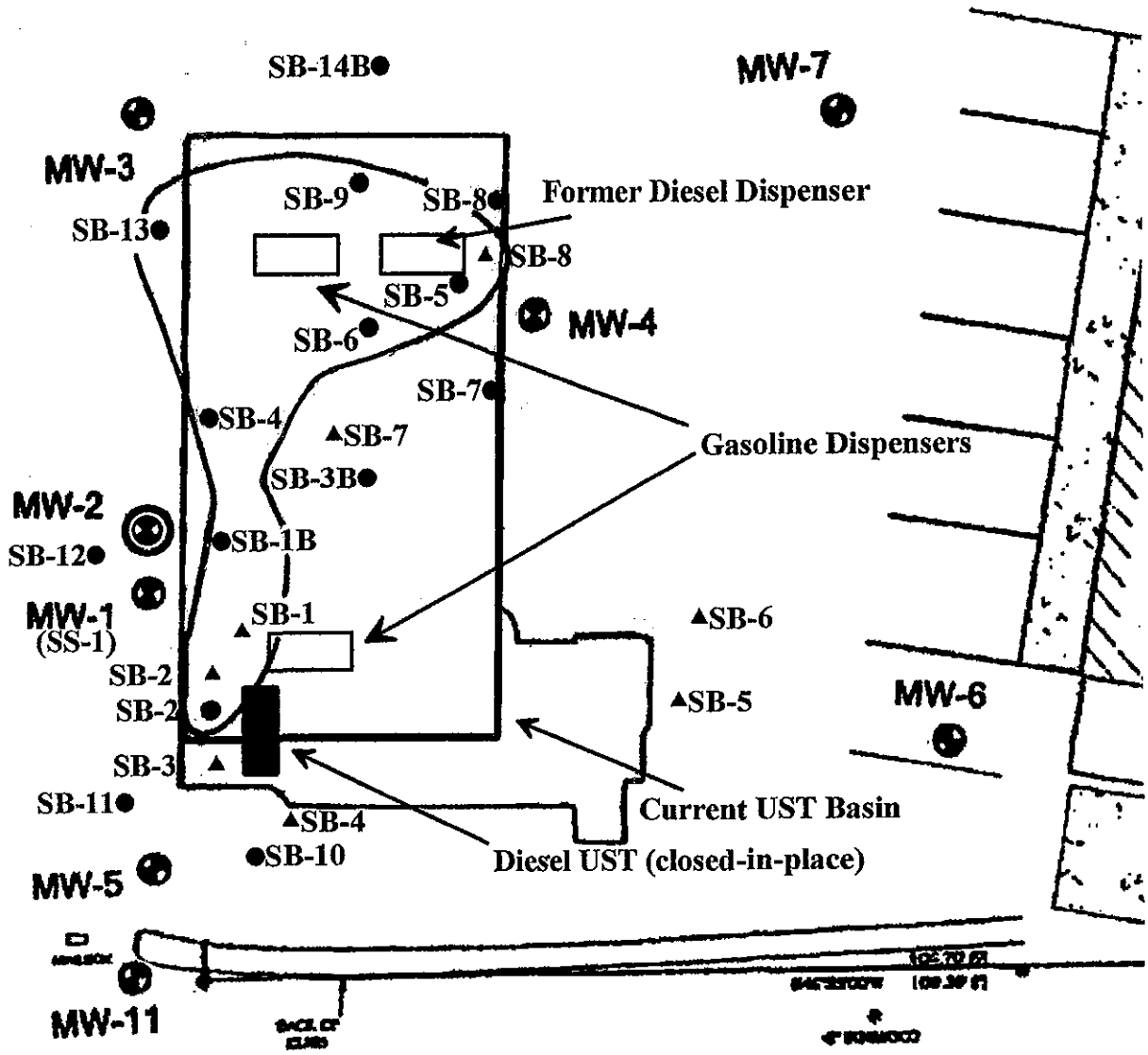
Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*1,000*	*550*	*530*	*200*	*70*	*21*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	12
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

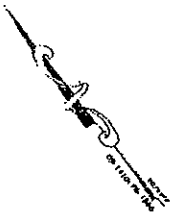
NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others

Sample ID →	MW-1	MW-2		MW-11		
Sample Date →	10/4/2004	10/4/2004		9/24/2007		
Analyses →	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)		EPA 602 & 625, MADEP VPH & EPH	NCAC 2L Groundwater Quality Standards	Gross Contaminant Levels (GCLs)
Detected Compounds ↓	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)		Compound Concentrations (ug/L)	(ug/L)	(ug/L)
Benzene	**30**	<1	1.0	<1.0	1	5,000
Toluene	<100	<5	5.0	<5.0	1,000	257,500
Ethylbenzene	**760**	<1	1.0	<1.0	550	29,000
Total Xylenes	**830**	<3	3.0	<3.0	530	87,500
MTBE	<20	<1	1.0	<1.0	200	200,000
IPE	<20	<1	1.0	<1.0	70	70,000
Lead	**34**	<5		NA	15	15,000
EDB	<0.010	<0.0		NA	0.0004	50
1-Methylnaphthalene	88	<		NA	NA	NA
2-Methylnaphthalene	**140**	<		NA	14.0	NA
Naphthalene	**270**	<	<5	<5	21	15,500
C_5-C_8 Aliphatics (VPH)	**1,300**	<1	100	<100	420	NE
C_9-C_{12} Aliphatics (VPH)	**6,100**	2	100	<100	4,200	NE
C_9-C_{18} Aliphatics (EPH)	<100	2	100	<100		
C_{19}-C_{36} Aliphatics (EPH)	<100	<1	100	<100	42,000	NE
C_9-C_{10} Aromatics (VPH)	**4,700**	1	100	<100	210	NE
C_{11}-C_{22} Aromatics (EPH)	**330**	<1	100	<100		

NOTES:

- MW-1 to MW-5 sampled and analyzed by others during Phase II
- Analytical results presented in micrograms per liter (ug/L).
- < denotes analytical result below laboratory method detection lim
- NE denotes narrative standard has not been established for compo
- NA denotes that this sample was not analyzed for this compound
- Analytical results exceeding NCAC 2L Groundwater Quality Sta
- All other compounds were below quantitation limits.





Extent of impacted soil above Residential MSCCs

SB-2 ● Boring conducted during CSA activities

SB-2 ▲ Boring conducted during UST activities

Note -
UST activity sample SB-7 collected at 2-3 feet bgs
UST activity sample SB-8 collected at 1-2 feet bgs
LSA activity sample SS-1 (MW-1) collected at 5-7 feet bgs
All other samples collected at 6-7 feet bgs
bgs - below ground surface

0 15

SCALE IN FEET

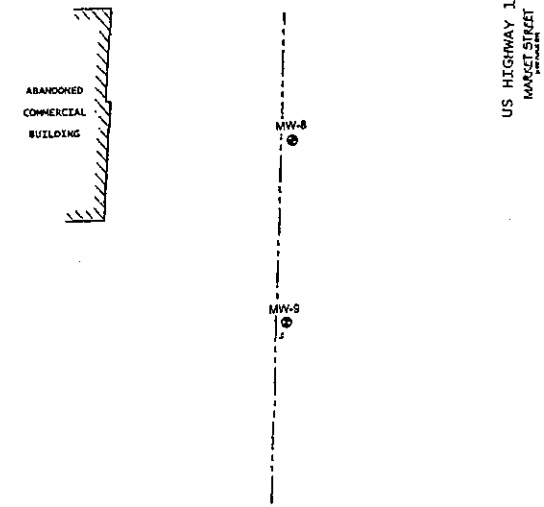
Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**		Title: Soil Boring and Sample Locations	Figure No. 4
Drawn By: MHH	Date: 5/7/8	Location: Scotchman #35 Wilmington, NC	
Checked By: BKL	Date: 5/7/8		

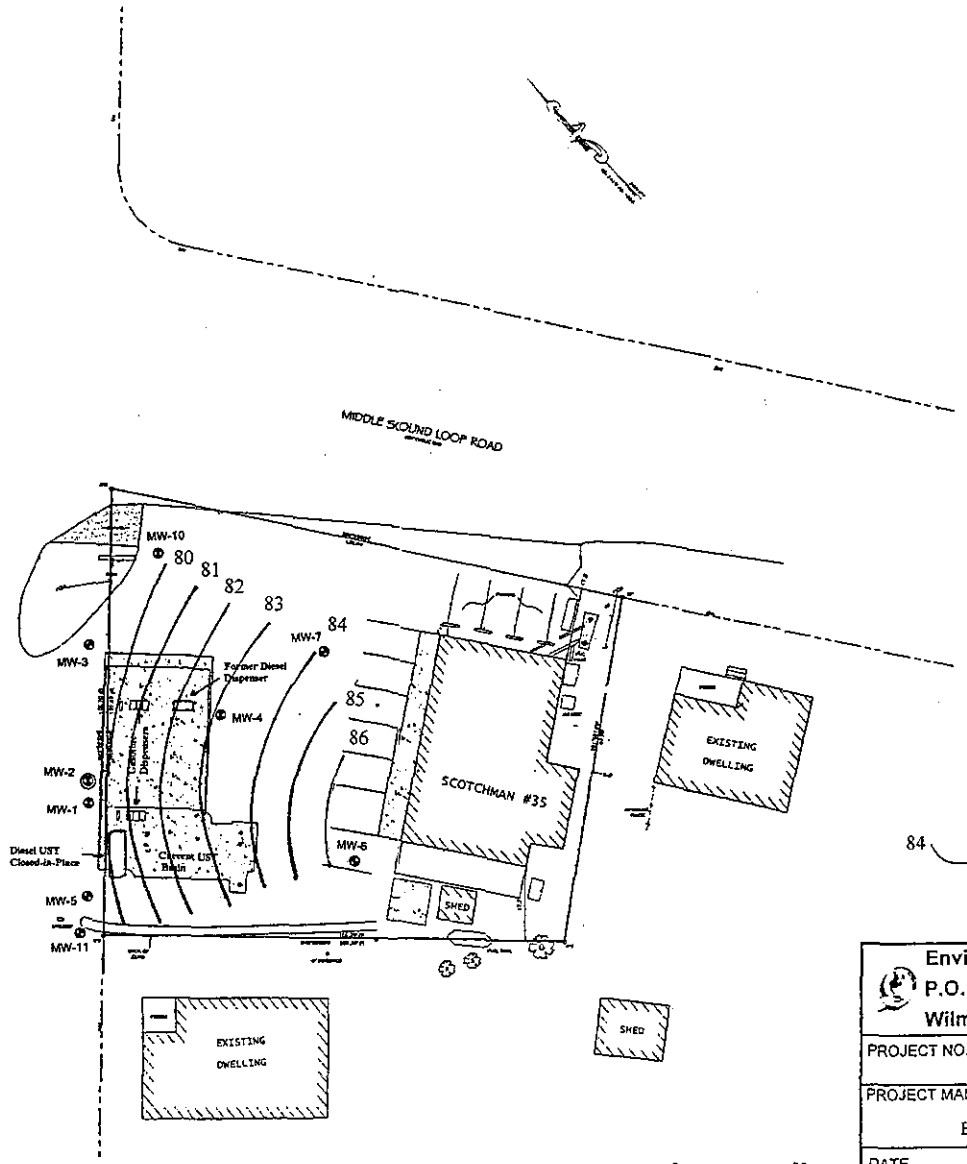
PUMP HOUSE

SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29

NOTES:
1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted groundwater elevations are based on top-of-casing elevations minus the depth to water, whereas Depth to water has been adjusted due to presence of free product using th following formula's:
   $DTW\text{-}DTP=X_0$; $(78\%)(X_0) = X_1$; $DTW\text{-}X_1 = DTW_{ADJ}$
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements obtained prior to 9/24/07 obtained by others





LEGEND

- IRON PIPES SET AT ALL CORNERS
- OAK
- DOGWOOD
- UTILITY POLE
- GUY WIRE
- GAS VALVE
- SANITARY SEWER MANHOLE
- WATER METER
- TYPE II MONITORING WELL
- TYPE III MONITORING WELL

84 — Groundwater elevation and contour (relative to site datum)

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION: Scotchman #35, Wilmington, North Carolina
PROJECT MANAGER: B. Lievre	
DATE: 5/7/8	DRAWING DESCRIPTION: Groundwater Elevation Map
FIGURE NO. 5	

PUMP HOUSE

SUMMARY OF RISK BASED LABORATORY RESULTS FOR GROUNDWATER
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

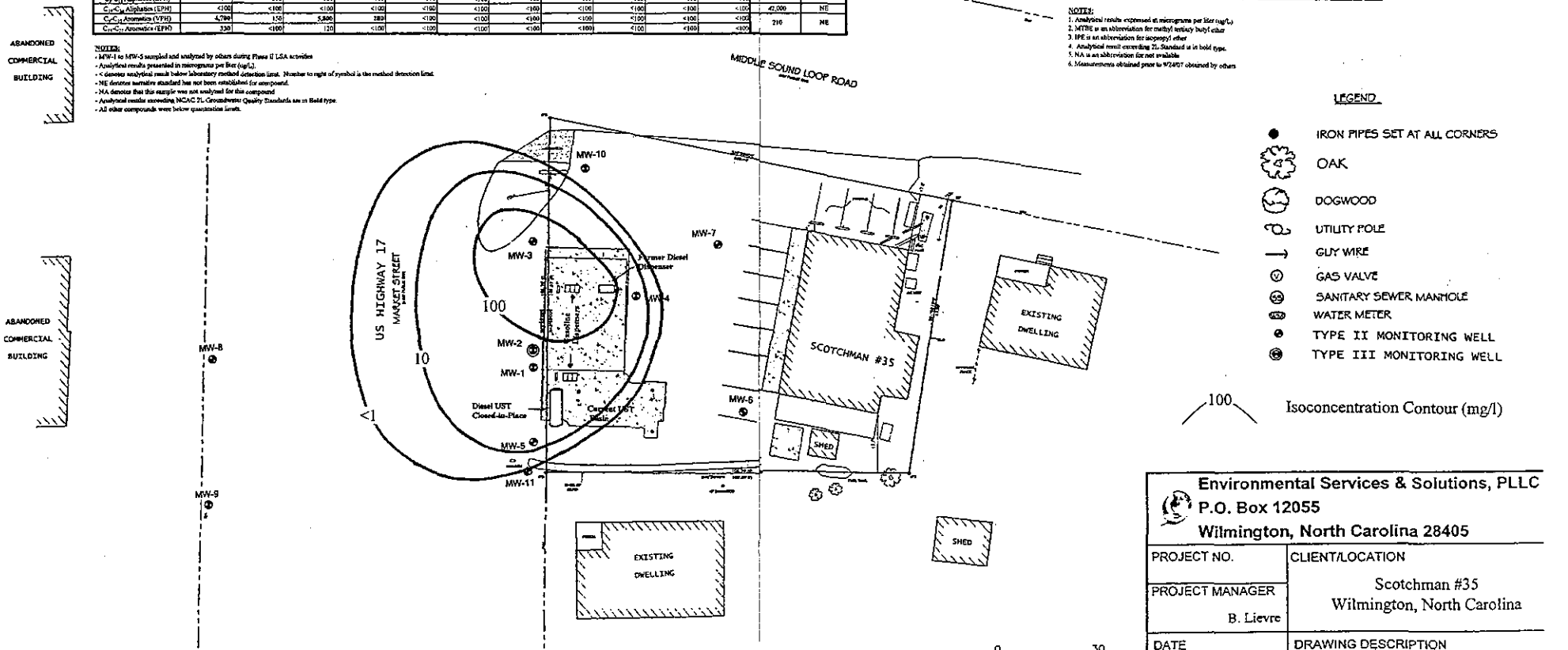
Sample ID →	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	NCAC 2L Groundwater Quality Standards	Gross Contaminant Levels (GCLs)
Sample Date →	10/4/2004	10/4/2004	10/4/2004	10/4/2004	10/4/2004	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007	9/24/2007		
Analyses →	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)	EPA 601 & 625, MADEP VPH & EPH	EPA 601 & 625, MADEP VPH & EPH	EPA 601 & 625, MADEP VPH & EPH	EPA 601 & 625, MADEP VPH & EPH	EPA 601 & 625, MADEP VPH & EPH	EPA 601 & 625, MADEP VPH & EPH		
Detected Compounds ↓	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	(ug/L)	(ug/L)
Benzene	36	<1.0	740	23	32	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5,000
Toluene	<100	<5.0	1,900	220	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1,000	257,500
Ethylbenzene	760	<1.0	490	65	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	550	29,000
Total Xylenes	830	<3.0	2,600	250	<30	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	530	87,500
MTBE	<20	<1.0	<100	<10	270	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	200	200,000
IPE	<20	<1.0	<70	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	70	70,000
Lead	34	<5.0	6.3	7.6	7.0	NA	NA	NA	NA	NA	NA	15	15,000
EDB	<0.010	<0.010	<0.010	<0.010	<0.010	NA	NA	NA	NA	NA	NA	0.0004	50
1-Methylnaphthalene	89	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	140	<10	<50	<10	<10	NA	NA	NA	NA	NA	NA	140	NA
Naphthalene	270	<10	120	17	<10	<5	<5	<5	<5	<5	<5	21	13,500
C_5-C_8 Aliphatics (VPH)	1,300	<100	6,100	570	370	<100	<100	<100	<100	<100	<100	420	NE
C_9-C_{12} Aliphatics (VPH)	6,100	290	12,000	970	210	<100	<100	<100	<100	<100	<100	4,200	NE
C_9-C_{18} Aliphatics (EPH)	<100	260	130	<100	<100	<100	<100	<100	<100	<100	<100		
C_{19}-C_{36} Aliphatics (EPH)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	42,000	NE
C_9-C_{22} Aromatics (VPH)	4,700	150	5,800	280	<100	<100	<100	<100	<100	<100	<100	210	NE
C_{11}-C_{22} Aromatics (EPH)	330	<100	120	<100	<100	<100	<100	<100	<100	<100	<100		

NOTES:
- MW-1 to MW-5 sampled and analyzed by others during Phase II LSA activities
- Analytical results presented in micrograms per liter (ug/L).
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is the method detection limit.
- NE denotes sorvative standard has not been established for compound.
- NA denotes that this sample was not analyzed for this compound
- Analytical results exceeding NCAC 2L Groundwater Quality Standards are in Bold type.
- All other compounds were below quantation limit.

SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

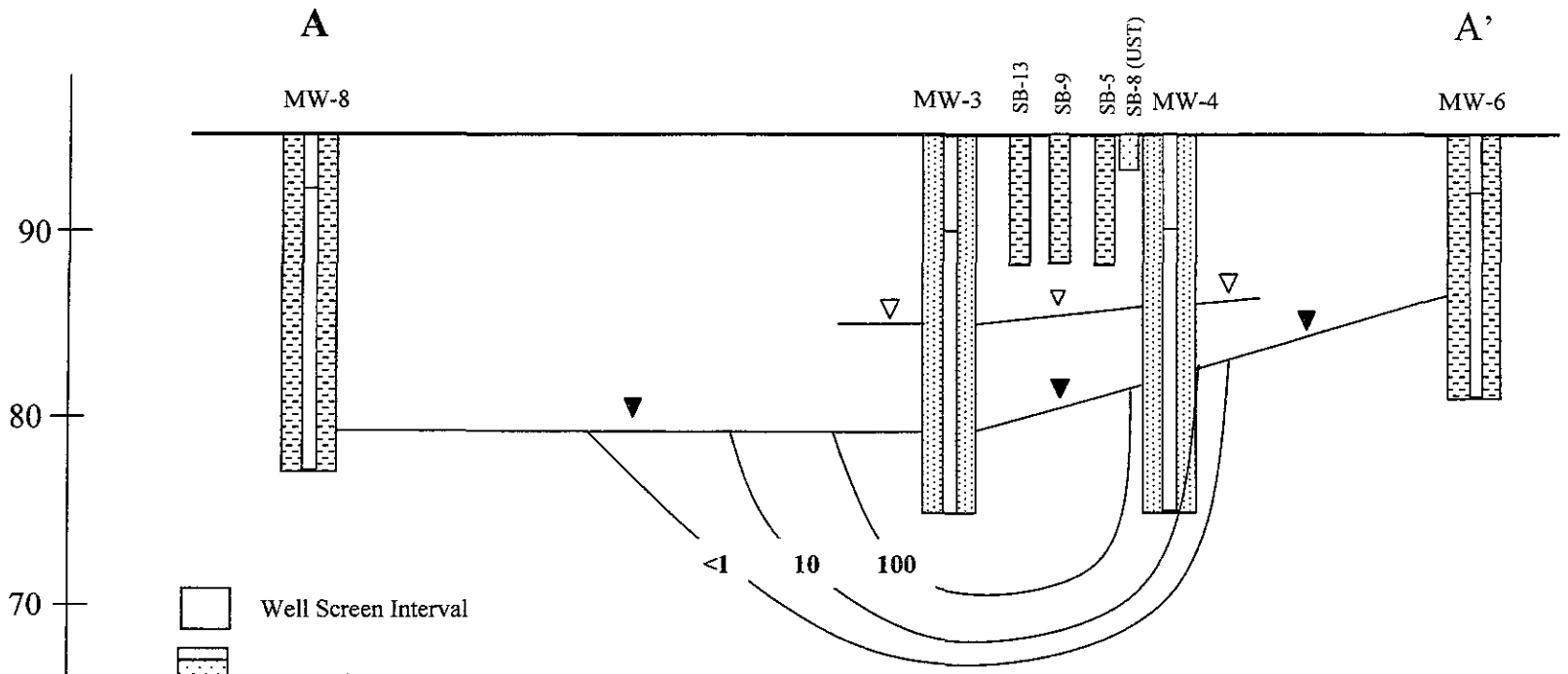
Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		1	1,000	550	530	200	70	21
MW-1	10/4/2004	36	<100	760	830	<20	<70	270
	9/24/2007	1.1	<5.0	18	<3.0	<1.0	<1.0	<5.0
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<2.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-3	10/4/2004	260	1,900	490	2,600	<100	<70	120
	9/24/2007	18	<30	190	220	<10	<10	<50
MW-4	10/4/2004	23	220	65	250	<10	<10	17
	9/24/2007	3.7	5.9	5.6	67	<1.0	<1.0	5.2
MW-5	10/4/2004	32	<50	<10	<30	270	<10	<10
	9/24/2007	<1.0	<5.0	1.8	<3.0	2.9	<1.0	<5.0
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

NOTES:
1. Analytical results expressed at micrograms per liter ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others



Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION: Scotchman #35, Wilmington, North Carolina
PROJECT MANAGER: B. Lievre	
DATE: 4/15/07	DRAWING DESCRIPTION: Benzene Isoconcentration Map
FIGURE NO. 6	



Well Screen Interval

SP: Sand

SP: Fine Sand

SM: Silty Sand

SC: Clayey Sand

ML: Clayey Silt

ML: Sandy Silt

CL: Sandy Clay

Impacted Soil Above Soil-to-Groundwater MSCCs (mg/kg)

– 100 – Benzene Isoconcentration Contour (mg/l)

Groundwater Elevation (September 2007)

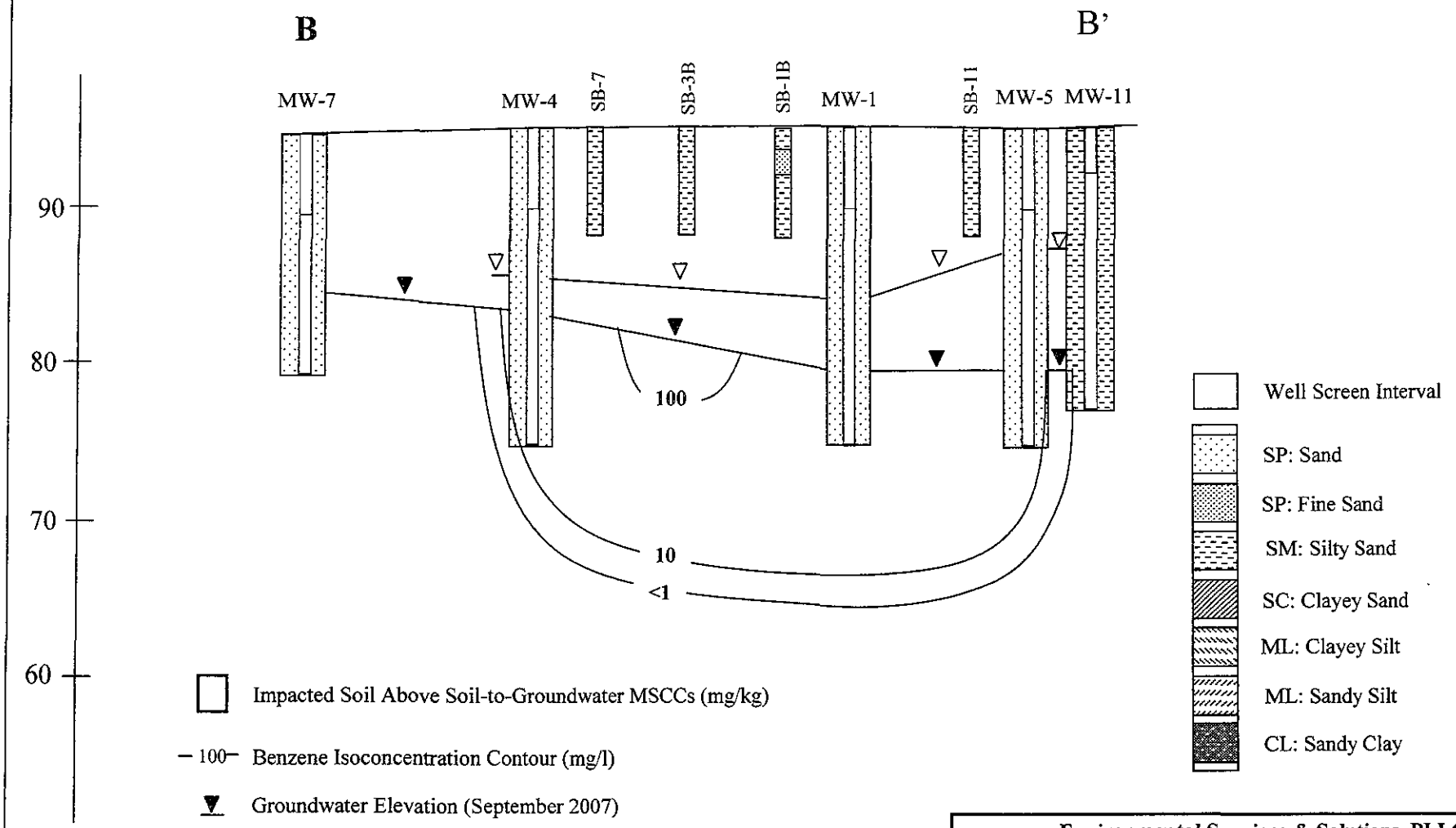
Groundwater Elevation (October 2004.)

Horizontal 1 inch = 30 feet
Vertical 1 inch = 10 feet

Note: well and boring diameters are not to scale

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
5/9/08	Cross-Section A-A'	10



Horizontal 1 inch = 20 feet
Vertical 1 inch = 10 feet

Note: well and boring diameters are not to scale

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
5/9/08	Cross-Section B-B'	11

APPENDIX B

NCDENR
North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor
William G. Ross Jr., Secretary

Division of Waste Management
Underground Storage Tank Section

Dexter R. Matthews, Director

September 2, 2008

CERTIFIED MAIL 7008 1140 0002 9558 8356
RETURN RECEIPT REQUESTED
CT Corporation System, Registered Agent
Worsley Operating Corporation
225 Hillsborough Street
Raleigh, NC 27603

Re: Notice of Regulatory Requirements
15A NCAC 2L .0407(b)
Risk-based Assessment and Corrective Action
for Petroleum Underground Storage Tanks

Scotchman #35
7160 Market Street
New Hanover County
Incident Number: 32152
Risk Classification: High
Ranking: 287A

Dear CT Corporation System:

The Comprehensive Assessment Report received on May 16, 2008 has been reviewed by the UST Section, Wilmington Regional Office. The review indicates that corrective action is necessary to remediate environmental contamination. Title 15A NCAC 2L .0407(b) requires you to comply with the assessment and cleanup requirements of Title 15A NCAC 2N .0707 and Title 15A NCAC 2L .0106(c) and 2L .0106(h). A Corrective Action Plan (CAP) with a schedule for implementation of the CAP prepared in accordance with these requirements and the most recent version of the *Guidelines for Assessment and Corrective Action for UST Releases* must be received by this office within 90 days of the date of this notice. In the Corrective Action Plan, natural attenuation of groundwater contamination must be used to the maximum extent possible, and it must demonstrated that the elimination of potential receptors, leading to risk reduction, is not immediately practicable. A responsible party who submits a Corrective Action Plan that proposes natural attenuation or cleanup to alternate standards must provide public notice as specified in 15A NCAC 2L .0409(a). Failure to implement the plan and schedule in the manner and time specified may result in the assessment of civil penalties and/or the use of other enforcement mechanisms.

In accordance with the most recent version of the *Guidelines for Assessment and Corrective Action for UST Releases,* effective July 15, 2008, the following actions must be performed, in the order listed, ***prior*** to the preparation and submittal of the Corrective Action Plan:

1) Pilot, aquifer, and natural attenuation testing and groundwater modeling must be completed and evaluated, as required for the specific incident site;

2) Engineering designs and calculations must be produced for the active remedial technologies, excavations, water line connections, etc., which have been determined to be viable for the specific incident site;
3) Bids for purchase and installation must be received for the active remedial technologies, excavations, water line connections, etc., which have been determined to be viable for the specific incident site;
4) The permit(s) required for implementation of the **selected** remedial option obtained.

Effective October 1, 2004, the Department requires that all work following the submittal of the Limited Site Assessment Report (Title 15A NCAC 2L .0405) be preapproved if State Trust Fund reimbursement is anticipated. To comply with this requirement, a completed Preapproval/Claim Authorization Form, encompassing the required remedial activities, must be received in this office within 14 days of the date of this letter. Upon completion of the preapproved activities, you should submit your claim promptly.

Because a release or discharge has been confirmed, a Licensed Geologist or a Professional Engineer, certified by the State of North Carolina, is required to prepare and certify all reports submitted to the Department in accordance with 15A NCAC 2L .0103(e) and 2L .0111(b).

If you have any questions regarding trust fund eligibility or reimbursement from the Commercial or Noncommercial Leaking Petroleum Underground Storage Tank Cleanup Funds, please contact the UST Section Trust Fund Branch at (919) 733-8486. If you have any questions regarding the actions that must be taken or the rules mentioned in this letter, please contact me at the address or telephone number listed below.

Sincerely,

Deborah Mayo

Deborah Mayo
Hydrogeologist II
Wilmington Regional Office

cc: New Hanover County Health Department – Cathy Timpy
Maureen Jackson – Worsley Operating Corporation
Environmental Services and Solutions, PLLC
WiRO

UST Regional Offices

Asheville (ARO) – 2090 US Highway 70, Swannanoa, NC 28778 **(828) 296-4500**

Fayetteville (FAY) – 225 Green Street, Suite 714, Systel Building, Fayetteville, NC 28301 **(910) 433-3300**

Mooresville (MOR) – 610 East Center Avenue, Suite 301, Mooresville, NC 28115 **(704) 663-1699**

Raleigh (RRO) – 1628 Mail Service Center, Raleigh, NC 27699 **(919) 791-4200**

Washington (WAS) – 943 Washington Square Mall, Washington, NC 27889 **(252) 946-6481**

Wilmington (WIL) – 127 Cardinal Drive Extension, Wilmington, NC 28405 **(910) 796-7215**

Winston-Salem (WS) – 585 Waughtown Street, Winston-Salem, NC 27107 **(336) 771-5000**

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405
Telephone: (910) 392-3050

September 23, 2008

North Carolina Department of Environment and Natural Resources
Division of Waste Management, UST Section
Attn: Ms. Deborah Mayo
127 Cardinal Drive Extension
Wilmington, North Carolina 28405-3845

Re: Submittal of CAP Task Authorization
Scotchman #35
7160 Market Street, Wilmington, North Carolina
Incident No. 32152

Dear Ms. Mayo:

Please accept this letter and attachments on behalf of our client, Worsley Operating Corporation to respond to the *Notice of Regulatory Requirements* (NORR), dated September 2, 2008 which requested the submittal of a *Corrective Action Plan (CAP)*.

As you are aware, Environmental Services & Solutions, PLLC (ESS) attempted to gain access from nearby property owners to have their water supply wells abandoned. The purpose of these activities was to attempt to lower the risk associated with the site, thereby eliminating the need for additional remedial activities at the site. Right of Entry (ROE) agreements that provided for abandonment of water supply wells and connection to the municipal water supply were prepared and mailed on August 28, 2008, to the following properties; 7148, 7158, 7155, 7201, 7213, 7222 Market Street and 125 and 129 Middle Sound Loop Road. Copies of these agreements were previously submitted to your attention.

As of September 22, 2008, ESS received one signed ROE (7213 Market Street), one conditionally signed ROE (125 Middle Sound Loop Road) and two returned and stamped, "unable to deliver" ROEs (7201 and 7155 Market Street). After further investigation, the property at 7201 Market Street is under Testamentary Trust (Will Trust) and the residence and out-buildings at 7155 Market Street have been razed. The condition and location of the water supply at 7155 Market Street are no longer known. Please find attached a copy of the approved, conditionally approved and returned ROEs.

Based upon the incomplete ROE response and the urgency of your office to proceed with cleanup activities, ESS has prepared a directed preapproval/claim authorization form for completion of CAP activities. The CAP will evaluate the feasibility of both active and passive remedial alternatives for soil and groundwater. Consequently, the proposed work primarily incorporates a pre-CAP groundwater sampling event including the collection of natural attenuation parameters in groundwater, soil vapor extraction (SVE) and air sparging (AS) pilot tests, and the preparation of an active soil and groundwater CAP. Costs for the design and bid specification/acquisition are also included in the authorization form.

The SVE pilot test will require the construction of a SVE well (SVE-1) and an observation well (OB-1). The air sparging test will be conducted using the existing deep well MW-2 with well OB-1 as an observation point. In addition, the existing site monitoring wells will also serve as observation points. The locations of the pilot test wells are provided in the attached figure. The attached Directed Preapproval/Claim Authorization Form and summary table provide details regarding the proposed costs.

Finally, ESS respectfully requests an extension of 90 days to obtain approval of the enclosed costs, schedule and perform required field work, prepare the CAP Report, prepare bid specifications and obtain bids for the systems.

Please feel free to contact me at (910) 470-7066 if you have any questions or comments regarding this or other matters.

Respectfully yours,

Bryan K. Lievre

Bryan K. Lievre, P.E.
President

Enclosures
cc: Mrs. Maureen Jackson, Worsley Operating Corporation

PREAPPROVAL/CLAIM AUTHORIZATION FORM

Department of Environment & Natural Resources - Division of Waste Management

Site Name	Scotchman #35	City / County	Wilmington/New Hanover	Incident #	32152
Responsible Party	Worsley Operating Corporation	Incident Mgr	Deborah Mayo	Region	WiRO
RP Type *(Owner/Operator / Landowner / Attorney-in-fact)*	Owner	**TA Supplement / Change Order**	no	Prev. TA #	

Primary Consultant	Environmental Services & Solutions, PLLC
Phone / Fax Number	(910) 392-3050
Project Mgr / Email	Bryan Lievre
Proposal# / Scope Dates	9/23/2008
Has STF Eligibility Been Determined?	YES / NO / Pending

(Reserved for Incident Manager)

Task Authorization Number:	
Site Risk / Rank / Abatement:	
Type (Comm / NonComm / Both)	
***Site Status** (Active or NFA/Date)*	

describes the scope of work and the rationale for the proposed activities. If you discover that unexpected tasks must be performed, incurring costs that exceed the

- **Attach all Main Consultant/Contractor invoices.**
- **Attach proof of payment directly to the front of each invoice.**

PREAPPROVAL / TASK AUTHORIZATION

(See Instructions / RRD for Tasks requiring Preapproval / Task Authorization)

FINAL REIMBURSEMENT

(Must Complete with Claim Submittal)

Third Party?	Task #	Lab Code#	Proposed Units / Type *(Consultant)*	RO Auth	Proposed Rate/Price *(Consultant)*	CO Auth	Proposed Task Subtotal *(Consultant)*	Preapproved Subtotal *(UST Section)*	Dates of Work *(Consultant)* Started / Completed	Claimed Amount *(Consultant)*
☐	2.300		4 / drum		$40.00		$160.00			
☐	3.101		5 / hr		$95.00		$475.00			
☐	3.113		30 / ft		$45.00		$1,350.00		/	
☐	3.398		1 / event		$350.00		$350.00		/	
☐	4.031		11 / well		$155.00		$1,705.00		/	
☐	4.070	*880*	1 / sample		$145.00		$145.00		/	
☐	4.090	*220*	11 / well		$43.00		$473.00		/	
☐		*530*	11 / well		$1.00		$11.00		/	
☐		*540*	11 / well		$1.00		$11.00		/	
☐		*550*	11 / well		$1.00		$11.00		/	
☐		*560*	11 / well		$1.00		$11.00		/	
☐		*570*	11 / well		$2.00		$22.00		/	
☐	5.050		1 / event		$3,058.00		$3,058.00		/	
☐	5.060		1 / event		$3,496.00		$3,496.00	$	/	
☐	6.070		1 / site		$4,466.00		$4,466.00		/	
☐	6.082		1 / site		$390.00		$390.00		/	
☐	7.015		1 / site		$3,000.00		$3,000.00		/	
☐	7.015		1 / site		$2,000.00		$2,000.00		/	
☐	9.060		1 / low bid		$665.00		$665.00		/	
☐			/						/	

	Requested	*Preapproved*		*Claimed*
TOTALS:	$21,799.00			
Total Standard Costs (Non-Third Party)	$21,164.00		***Total Standard Costs***	
Total applied as Third Party Costs	$0.00		***Total Third Pty Costs***	

Main Consultant	Project Mgr Signature:	Bryan Lievre	Date: 9/23/08
UST Section	RO Task Authorization:		Date:
	CO Rate Authorization:		Date:

***Important: The date of reimbursement of costs approved herein is dependent on the balance of funds in the Trust Fund. There may be a delay in the reimbursement of claims for work done.**

** SSA = "See Supporting Attachment" for additional details on sub-task unit reductions in multi-phase tasks *(e.g. Tasks 2.084, 4.090, 7.420, etc.)*

*** ✓ +/- Reviewer Initials = Task, Unit count, or Rate approved in full as presented by Consultant.

Table 1

Cost Estimate for Trust Fund Pre-Approval

Scotchman #35, 7158 Market Street, Wilmington, North Carolina

Task	Activity	Unit Cost	# Units	Total	Assumptions/Reasoning
2.300	Cost for drums	$40.00 /drum	4	$160.00	Estimate 4 drums to containerize soil cuttings
3.113	Supervision of Drilling activities	$45.00 ft	30	$1,350.00	drilling supervision of SVE-1 (SVE pilot test well) and OB-1(observation well) (1 hr travel & 4 hrs field)
3.113	Multi-phase Drilling	$45.00 ft	30	$1,350.00	drilling SVE-1 (SVE pilot test wel l - 10 ft) and OB-1 (observation well - 20 ft)
3.398	Drill Rig Mobilization	$350.00 event	1	$350.00	Mobilization to drill SVE-1 and OB-1
4.031	Groundwater sampling	$155.00 well	11	$1,705.00	PreCAP sample MW-1 through MW-11
4.070	SVE sample (air)	$145.00 sample	1	$145.00	Air Stream sample from SVE pilot test
4.090	Laboratory Analysis	$43.00 well	11	$473.00	Method 602 + MTBE, IPE, Naphthalene
	Groundwater: DO	$1.00 well	11	$11.00	natural attenuation field sampling of existing wells (i.e. MW1 - MW11)
	Groundwater pH	$1.00 well	11	$11.00	
	Groundwater Spec Cond.	$1.00 well	11	$11.00	
	Groundwater Temp.	$1.00 well	11	$11.00	
	Groundwater: ORP	$2.00 well	11	$22.00	
5.050	SVE pilot test	$3,058.00 event	1	$3,058.00	SVE pilot test
5.060	Insitu Air Sparge pilot test	$3,496.00 event	1	$3,496.00	AS pilot test
6.070	CAP (active soil and gw)	$4,466.00 site	1	$4,466.00	active soil and groundwater
6.082	Public Notification (CAP)	$390.00 site	1	$390.00	public notification for CAP
7.015	Design/Specify technology	$3,000.00 site	1	$3,000.00	soil cleanup technology design and bids
		$2,000.00 site	1	$2,000.00	groundwater cleanup technology design and bids
9.060	Cost for Disposal of Drummed Soil	$665.00 low bid	1	$665.00	Disposal of drill cuttings. Rick with ES&J 910-567-6138 $425/mob + $60/drum
TOTAL				**$ 22,674.00**	

Environmental Services & Solutions, PLLC
Wilmington, NC 28405
(910) 470-7890

RIGHT OF ENTRY
("the License")

The property owner(s) (referred to in this Agreement as the "Owner(s)") have the sole right to possession of the property for which a right of entry is granted by this document. The property is located at:

7213 Market Street
Wilmington, North Carolina

The Owner(s) give Worsley Operating Corporation (the "Licensee"), its agents, employees, and assigns, the right to enter upon the property to do all activities required to complete their work. The work will consist of the proper abandonment of a water supply well. The Owner(s) acknowledge that Environmental Services & Solutions, PLLC is an agent of the Licensee.

This License is effective immediately upon signing. Licensee agrees to repair or cause to be repaired any damage to the property resulting from entry onto the property by Licensee, its agents, employees, or assigns, by restoring the property, as much as reasonably possible, to its condition immediately prior to the entry.

Dated this 17th day of September, 2008.

"Owner(s):

Deloris C. Ryals
Signature

Deloris C. Ryals
Printed Name

"Licensee":
Environmental Services & Solutions, PLLC.
Agent for Licensee

Signature

Printed Name

Its:

Environmental Services & Solutions, PLLC
Wilmington, NC 28405
(910) 470-7890

RIGHT OF ENTRY
("the License")

The property owner(s) (referred to in this Agreement as the "Owner(s)") have the sole right to possession of the property for which a right of entry is granted by this document. The property is located at:

125 Middle Sound Loop Road
Wilmington, North Carolina

The Owner(s) give Worsley Operating Corporation (the "Licensee"), its agents, employees, and assigns, the right to enter upon the property to do all activities required to complete their work. The work will consist of the proper abandonment of a water supply well. The Owner(s) acknowledge that Environmental Services & Solutions, PLLC is an agent of the Licensee.

This License is effective immediately upon signing. Licensee agrees to repair or cause to be repaired any damage to the property resulting from entry onto the property by Licensee, its agents, employees, or assigns, by restoring the property, as much as reasonably possible, to its condition immediately prior to the entry.

Dated this 9 day of 2009, 2008.

"Owner(s)"

Signature

Printed Name

"Licensee"
Environmental Services & Solutions, PLLC
Agent for Licensee

Signature

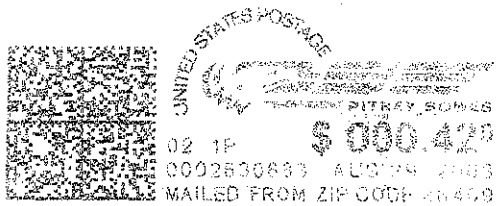
Printed Name

Its:

WE WILL ABANDON WELL IF WE CAN be Remburse For Haveing Already hooked up to city water.

Phone 336-287-8460 THANK YOU

ES&S, PLLC
P.O. Box 12055
Wilmington, NC 28405



Atrium at Middle Sound Land
7155 Market Street
Wilmington, NC 28411

NIXIE 283 DC 1 00 09/02/09
RETURN TO SENDER
NOT DELIVERABLE AS ADDRESSED
UNABLE TO FORWARD
BC: 29405010055 *1354-14933-29-42

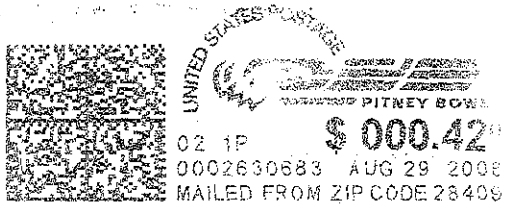
28411143751 28405@0100

ESES, PLLC
P.O. Box 12055
Wilmington, NC
28405

Rochelle O Persell Testamentary Trust
St. Augustine, FL 32086

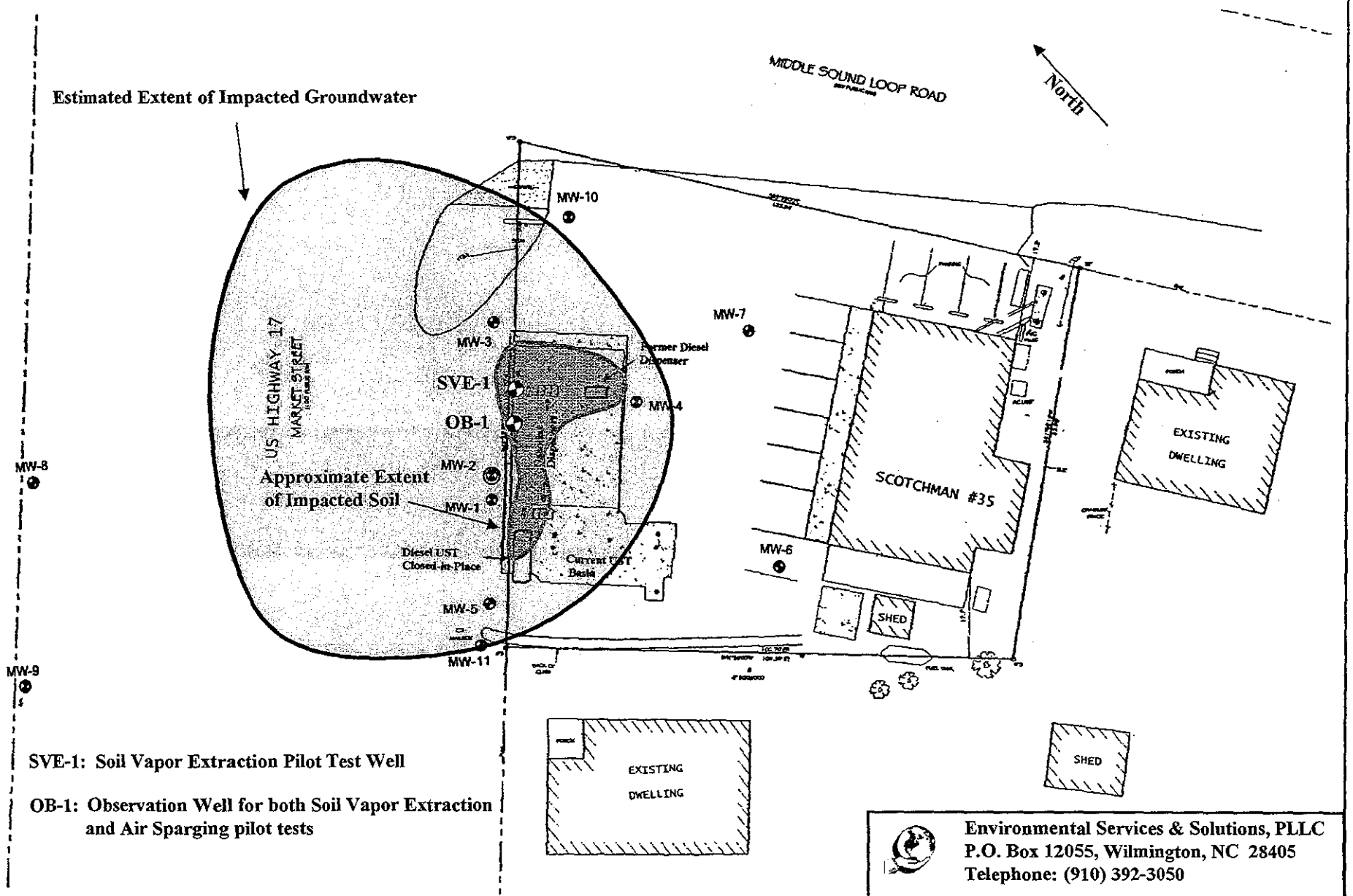
This is a will trust, no current owner at this time

Ms. Pearl Rochelle
13 Eugene Place
St. Augustine, FL 32080



NIXIE 322 CC 1 78 09/05/08
RETURN TO SENDER
ATTEMPTED - NOT KNOWN
UNABLE TO FORWARD
BC: 28405010055 *2754-17227-29-42

32080*5338 28405@0100



SVE-1: Soil Vapor Extraction Pilot Test Well

OB-1: Observation Well for both Soil Vapor Extraction and Air Sparging pilot tests

Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC
DATE	DRAWING DESCRIPTION / FIGURE NO.
9/23/08	**Proposed Pilot Test Wells**

State of North Carolina
Department of Environment
and Natural Resources
Wilmington Regional Office
Division of Waste Management
UST Section

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Mathews, Director

NCDENR
NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

October 9, 2008

Ms. Maureen Jackson
Worsley Operating Corporation
P. O. Box 3227
Wilmington, NC 28406

Subject: Pre-approval Task Authorization 32152-5
Scotchman #35
7160 Market Street
Wilmington, New Hanover County
Incident No. 32152
High 287A

Dear Ms. Jackson:

Please see the attached Directed Pre-approval Task Authorization Form for a complete listing of the pre-approved tasks and the dollar amounts allowed for each task. If you have any questions concerning this task authorization, please contact me at (910) 796-7263.

Sincerely,

Deborah Mayo

Deborah Mayo
Hydrogeologist II

cc: Bryan Lievre - Environmental Services and Solutions, PLLC
WiRO- UST

PREAPPROVAL/CLAIM AUTHORIZATION FORM

Department of Environment & Natural Resources - Division of Waste Management

Site Name	Scotchman #35	City / County	Wilmington/New Hanover	Incident #	32152
Responsible Party	Worsley Operating Corporation	Incident Mgr	Deborah Mayo	Region	WiRO
RP Type *(Owner/Operator / Landowner / Attorney-in-fact)*	Owner	**TA Supplement / Change Order**	no	**Prev. TA #**	

Primary Consultant	Environmental Services & Solutions, PLLC
Phone / Fax Number	(910) 392-3050
Project Mgr / Email	Bryan Lievre
Proposal# / Scope Dates	9/23/2008
Has STF Eligibility Been Determined?	YES / NO / Pending

(Reserved for Incident Manager)

Task Authorization Number:	32152 – 5
Site Risk / Rank / Abatement:	#2 87 A
Type (Comm / NonComm / Both)	Comm
***Site Status** (Active or NFA/Date)*	Active

describes the scope of work and the rationale for the proposed activities. If you discover that unexpected tasks must be performed, incurring costs that exceed the

- **Attach all Main Consultant/Contractor invoices.**
- **Attach proof of payment directly to the front of each invoice.**

PREAPPROVAL / TASK AUTHORIZATION

(See Instructions / RRD for Tasks requiring Preapproval / Task Authorization)

FINAL REIMBURSEMENT

(Must Complete with Claim Submittal)

Third Party?	Task #	Lab Code#	Proposed Units / Type *(Consultant)*	RO Auth	Proposed Rate/Price *(Consultant)*	CO Auth	Proposed Task Subtotal *(Consultant)*	Preapproved Subtotal *(UST Section)*	Dates of Work *(Consultant)* Started / Completed	Claimed Amount *(Consultant)*
☐	2.300		4 / drum	DTM	$40.00	✓	$160.00	160	/	
☐	3.101		5 / hr	DTM	$95.00		$475.00	475	/	
☐	3.113		30 / ft	DTM	$45.00		$1,350.00	1350	/	
☐	3.398		1 / event	DTM	$350.00		$350.00	350	/	
☐	4.031		11 / well	DTM	$155.00		$1,705.00	1705	/	
☐	4.070	*880*	1 / sample	DTM	$145.00		$145.00	145	/	
☐	4.090	*220*	11 / well	DTM	$43.00		$473.00	473	/	
☐		*530*	11 / well	DTM	$1.00		$11.00	11	/	
☐		*540*	11 / well	DTM	$1.00		$11.00	11	/	
☐		*550*	11 / well	DTM	$1.00		$11.00	11	/	
☐		*560*	11 / well	DTM	$1.00		$11.00	12	/	
☐		*570*	11 / well	DTM	$2.00		$22.00	22	/	
☐	5.050		1 / event	DTM	$3,058.00		$3,058.00	3058	/	
☐	5.060		1 / event	DTM	$3,496.00		$3,496.00	$ 3496	/	
☐	6.070		1 / site	DTM	$4,466.00		$4,466.00	4466	/	
☐	6.082		1 / site	DTM	$390.00		$390.00	390	/	
☐	7.015		1 / site	DTM	$3,000.00		$3,000.00	3000	/	
☐	7.015		1 / site	DTM	$2,000.00		$2,000.00	2000	/	
☐	9.060		1 / low bid	DTM	$665.00	↓	$665.00	665	/	
☐			/						/	

	Requested	*Preapproved*		*Claimed*
TOTALS:	$21,799.00	21799		
Total Standard Costs (Non-Third Party)	$21,164.00		***Total Standard Costs***	
Total applied as Third Party Costs	$0.00		***Total Third Pty Costs***	

Main Consultant	Project Mgr Signature:	Bryan Lievre	Date: 9/23/08
UST Section	RO Task Authorization:	[signature]	Date: 9/26/08
	CO Rate Authorization:	[signature]	Date: 10/6/08

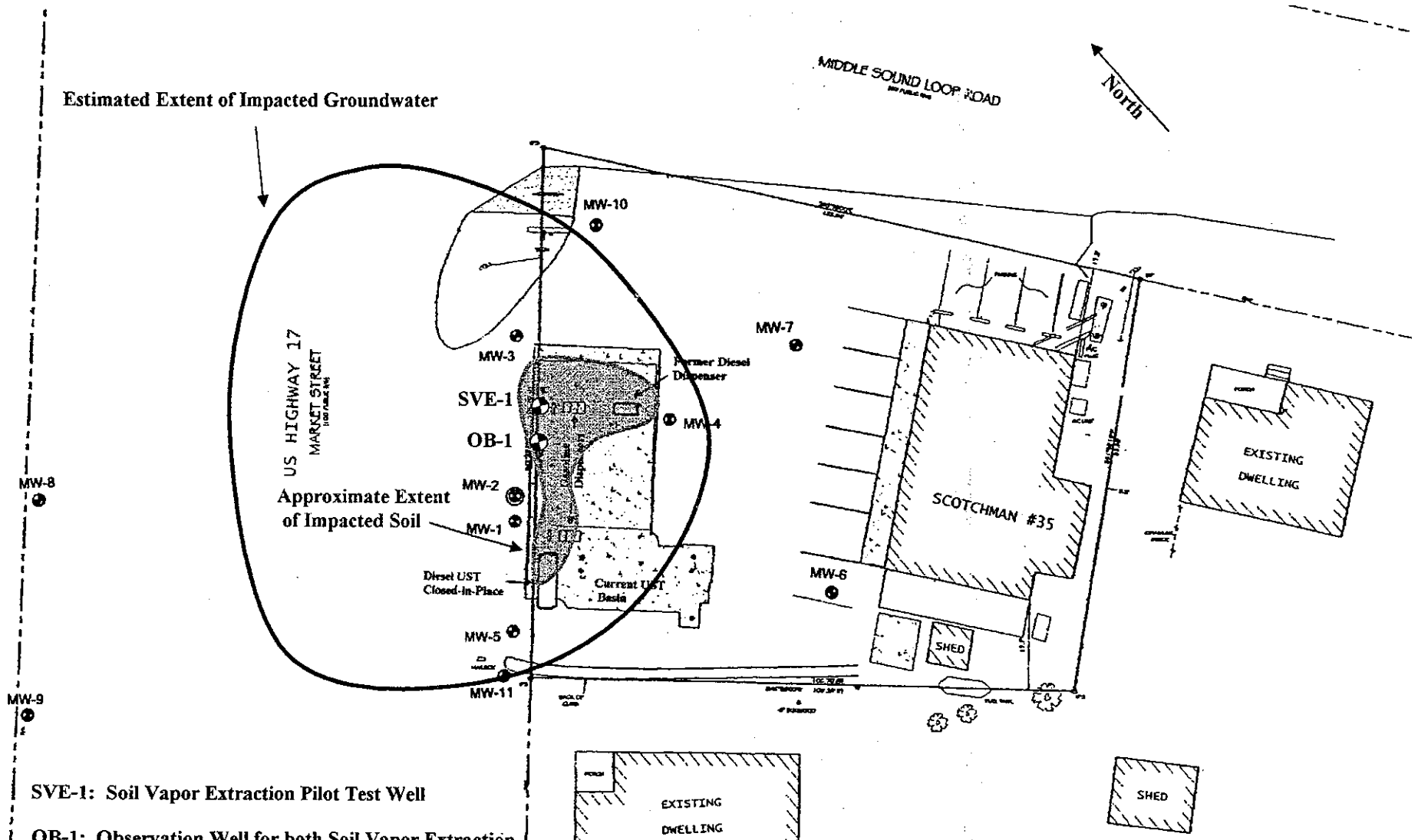
***Important: The date of reimbursement of costs approved herein is dependent on the balance of funds in the Trust Fund. There may be a delay in the reimbursement of claims for work done.**

** SSA = "See Supporting Attachment" for additional details on sub-task unit reductions in multi-phase tasks *(e.g. Tasks 2.084, 4.090, 7.420, etc.)*

*** ✓ +/- Reviewer Initials = Task, Unit count, or Rate approved in full as presented by Consultant.

Table 1
Cost Estimate for Trust Fund Pre-Approval
Scotchman #35, 7158 Market Street, Wilmington, North Carolina

Task	Activity	Unit Cost	# Units	Total	Assumptions/Reasoning
2.300	Cost for drums	$40.00 /drum	4	$160.00	Estimate 4 drums to containerize soil cuttings
3.113	Supervision of Drilling activities	$45.00 ft	30	$1,350.00	drilling supervision of SVE-1 (SVE pilot test well) and OB-1(observation well) (1 hr travel & 4 hrs field)
3.113	Multi-phase Drilling	$45.00 ft	30	$1,350.00	drilling SVE-1 (SVE pilot test wel l - 10 ft) and OB-1 (observation well - 20 ft)
3.398	Drill Rig Mobilization	$350.00 event	1	$350.00	Mobilization to drill SVE-1 and OB-1
4.031	Groundwater sampling	$155.00 well	11	$1,705.00	PreCAP sample MW-1 through MW-11
4.070	SVE sample (air)	$145.00 sample	1	$145.00	Air Stream sample from SVE pilot test
4.090	Laboratory Analysis	$43.00 well	11	$473.00	Method 602 + MTBE, IPE, Naphthalene
	Groundwater: DO	$1.00 well	11	$11.00	natural attenuation field sampling of existing wells (i.e. MW1 - MW11)
	Groundwater pH	$1.00 well	11	$11.00	
	Groundwater Spec Cond.	$1.00 well	11	$11.00	
	Groundwater Temp.	$1.00 well	11	$11.00	
	Groundwater: ORP	$2.00 well	11	$22.00	
5.050	SVE pilot test	$3,058.00 event	1	$3,058.00	SVE pilot test
5.060	Insitu Air Sparge pilot test	$3,496.00 event	1	$3,496.00	AS pilot test
6.070	CAP (active soil and gw)	$4,466.00 site	1	$4,466.00	active soil and groundwater
6.082	Public Notification (CAP)	$390.00 site	1	$390.00	public notification for CAP
7.015	Design/Specify technology	$3,000.00 site	1	$3,000.00	soil cleanup technology design and bids
		$2,000.00 site	1	$2,000.00	groundwater cleanup technology design and bids
9.060	Cost for Disposal of Drummed Soil	$665.00 low bid	1	$665.00	Disposal of drill cuttings. Rick with ES&J 910-567-6138 $425/mob + $60/drum
TOTAL				**$ 22,674.00**	



SVE-1: Soil Vapor Extraction Pilot Test Well

OB-1: Observation Well for both Soil Vapor Extraction and Air Sparging pilot tests

08 SEP 29 PM 1:13

RECEIVED/DENR
OWM UST SECTION

Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	
PROJECT MANAGER B. LIEVRE	SITE/LOCATION SCOTCHMAN #35 WILMINGTON, NC
DATE 9/23/08	DRAWING DESCRIPTION **Proposed Pilot Test Wells**
	FIGURE NO.

APPENDIX C

TABLE 1
WATER SUPPLY WELL INFORMATION
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

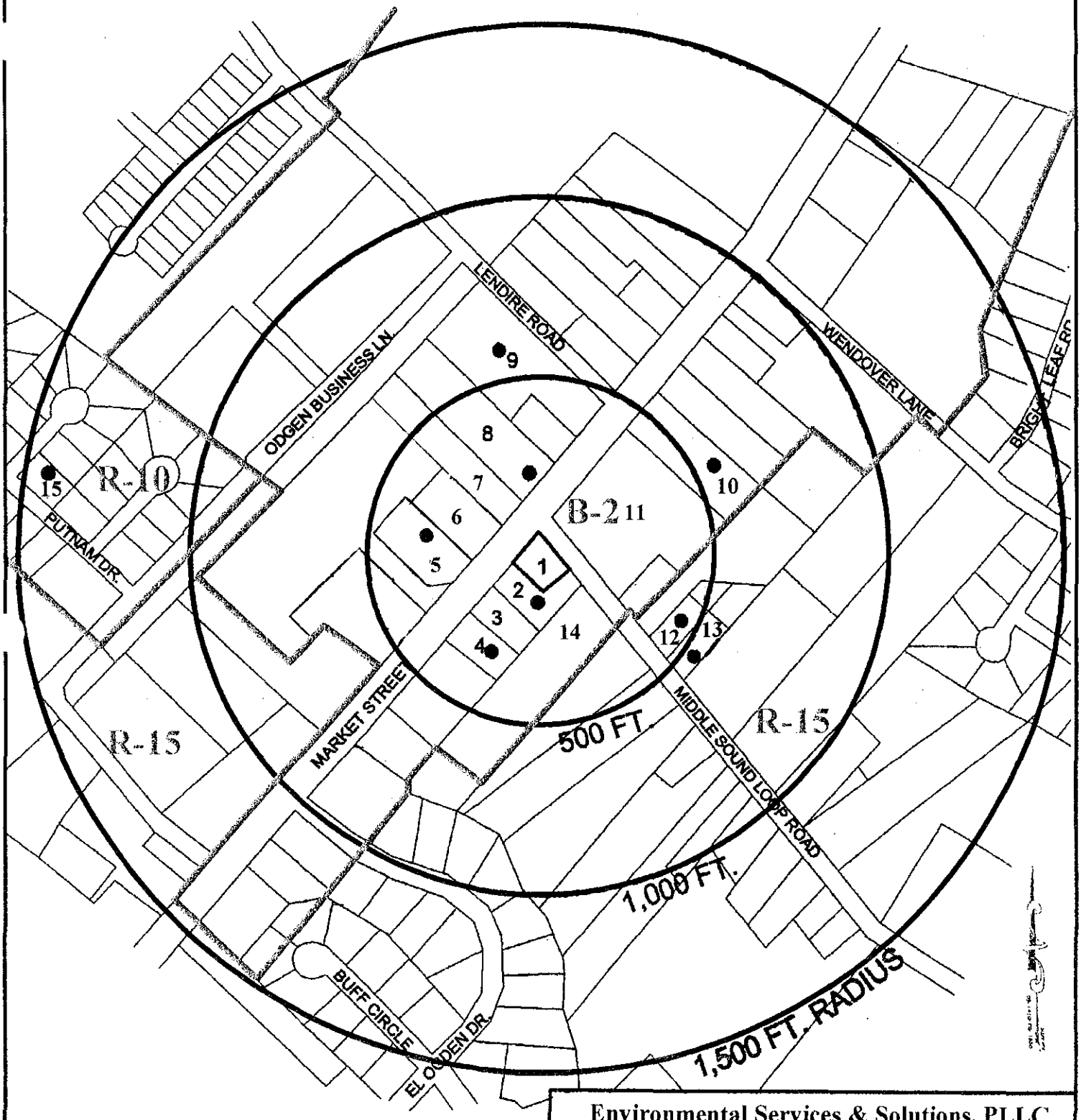
Map ID/ Well Number	Well Owner/User	Owner/User Address	Owner/User Phone Number	Well Use	Well Depth (ft BGS)	Type of Well	Well Casing Depth (ft BGS)	Well Screen Interval (x to y ft BGS)	Distance from Source area of release (ft)
2	Cecil Covil Etal & Richard Covil Estate	7158 Market St. Wilmington, NC 28411	(910) 686-7783	not used	unknown	unknown	unknown	unknown	175
4	Cecil Covil T, Et Ux Etal & Richard Covil Estate	7148 Market St. Wilmington, NC 28411	(910) 686-7783	cleaning	unknown	unknown	unknown	unknown	300
5	Atrium at Middle Sound Land Wilmington, NC 28402	7155 Market St. Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	300
8	Pearl L Rochelle C/O Jones' Seafood	7201 Market St. Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	300
9	Deloris Ryals	906 Bayshore Dr. Wilmington, NC 28405	(910) 686-4559	not used irrigation	180	unknown	60	unknown	550
10	Troy T. & Bertha R. Martin C/O B&T Imports	7222 Market St. Wilmington, NC 28411	(910) 686-0338	drinking	100	unknown	unknown	unknown	550
12	Tammy C. Winslow Kernersville, NC 27284	125 Middle Sound Loop Rd Wilmington, NC 28411	unknown	drinking	unknown	unknown	unknown	unknown	475
13	Cecil & Shirley Covil	129 Middle Sound Loop Wilmington, NC 28411	(910) 686-7783	drinking irrigation	80	unknown	unknown	unknown	550
15	Mark Francolini	7100 Ragland Court Wilmington, NC 28411	(910) 686-3536	irrigation	unknown	unknown	unknown	unknown	1,450

NOTES:

- Well Numbers correspond to Figure 3
- Pearl L Rochelle resides at;
  18 Euguene Place
  St. Augustine, FL 32080

TABLE 2
ADJACENT AND CONTIGUOUS PROPERY INFORMATION
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Map ID	Owner/Occupant Name Mailing Address	Address
1	**Entrepreneur, Inc.** **Wilmington, NC 28406**	7160 Market St. Wilmington, NC 28411
2	Cecil Covil Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7158 Market St. Wilmington, NC 28411
3	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7154 Market St. Wilmington, NC 28411
4	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	7148 Market St. Wilmington, NC 28411
5	Atrium at Middle Sound Land Wilmington, NC 28402	7155 Market St. Wilmington, NC 28411
6	CDA Properties, LLC Southern Pines, NC 28387	7161 Market St. Wilmington, NC 28411
7	Atrium at Middle Sound Land Wilmington, NC 28402	7167 Market St. Wilmington, NC 28411
8	Pearl L Rochelle C/O Jones' Seafood	7201 Market St. Wilmington, NC 28411
9	Deloris Ryals	906 Bayshore Dr. Wilmington, NC 28405
10	Troy T. & Bertha R. Martin C/O B&T Imports	7222 Market St. Wilmington, NC 28411
11	Covil J W Mamie L C/O Atlantic Coast Foods, Inc. 112 Queens Creek Rd #1 Swansboro, NC 28584	7208 Market St. Wilmington, NC 28411
12	Tammy C. Winslow Kernersville, NC 27284	125 Middle Sound Loop Road Wilmington, NC 28411
13	Cecil Covil T, Et Ux Etal 129 Middle Sound Loop Rd. Wilmington, NC 28411	129 Middle Sound Loop Rd. Wilmington, NC 28411
14	Covil J W Mamie L 7158 Market St. Wilmington, NC 28405	106 Middle Sound Loop Rd. Wilmington, NC 28411
15	Mark Francolini	7100 Ragland Court Wilmington, NC 28411



4 ● Water Supply Well
note - Property number corresponds to Table

R-15 New Hanover County Zoning Code

0 500

SCALE IN FEET

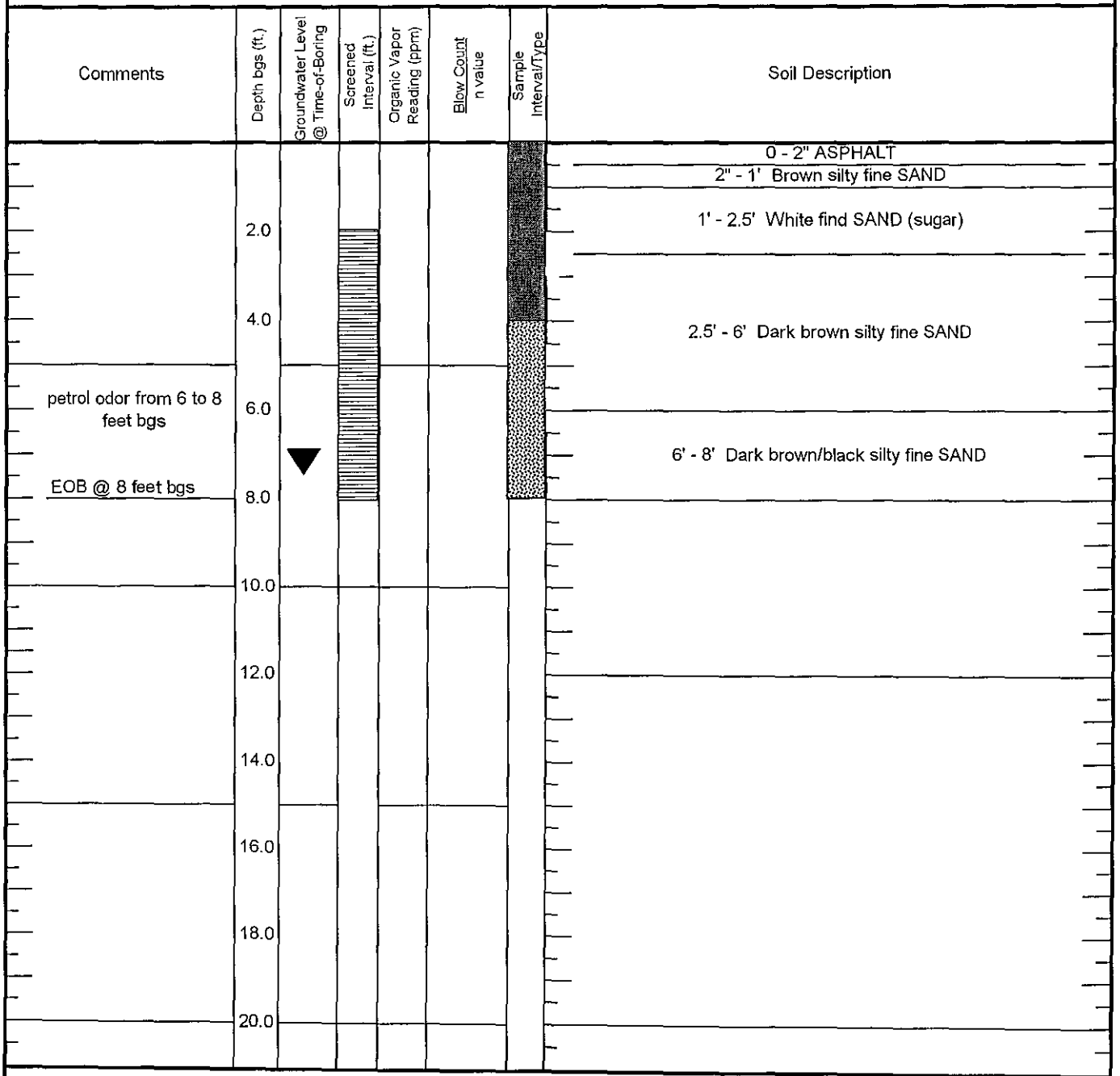
Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405

PROJECT NO.	CLIENT/LOCATION
PROJECT MANAGER B. Lievre	Scotchman #35 Wilmington, North Carolina
DATE 5/5/08	DRAWING DESCRIPTION **Water Supply Well Location and Parcel Map**
FIGURE NO. 3	

APPENDIX D

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	SVE-1
Location:	7158 Market Street (US Hwy 17)	Construction Date:	01/07/09
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drill Rig Type:	6620DT
Client:	Worsley Operating Corporation	Drilling Method:	Hollow stem auger
	P.O. Box 3227	Logged By:	M.Haseltine
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA



Symbols

- Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	OB-1
Location:	7158 Market Street (US Hwy 17)	Construction Date:	01/07/09
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drill Rig Type:	6620DT
Client:	Worsley Operating Corporation	Drilling Method:	Hollow stem auger
	P.O. Box 3227	Logged By:	M.Haseltine
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 3" Asphalt
	2.0						3" - 3' Brown silty fine SAND
	4.0						3' - 4' White fine SAND (sugar)
							4' - 5' Lavender silty fine SAND (sugar)
							5' - 6' Brown silty fine SAND
	6.0						
	8.0	▼					
petrol odors from 6 to 20 feet bgs	10.0						6' - 15' Dark brown silty fine SAND
	12.0						
	14.0						
	16.0						15'- 20' Brown silty fine SAND
	18.0						
EOB @ 20 feet bgs	20.0						

Symbols

▼ - Groundwater Level @ Time-of-Boring

- Screened Interval
- Hand Auger
- Direct Push
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by a PID - photoionization detector
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2579

1. WELL CONTRACTOR:

DANNY SUMMERS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) SVE-1

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 11/25/08

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7158 MARKET STREET 28411
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUDE
LONGITUDE

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SM #35

STREET ADDRESS 7158 MARKET STREET

WILMINGTON | NC | 28411
City or Town | State | Zip Code

CONTACT PERSON WORSLEY OPERATING CORPORATION

MAILING ADDRESS PO BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 8.0 FEET

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From To From To
From To From To
From To From To

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 2.0	Ft.	2 INCH	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 0.5	Ft.	Portland bentonite	SLURRY
From	To	Ft.		
From	To	Ft.		

8. SCREEN:

	Depth		Diameter		Slot Size		Material
From 2.0	To 8.0	Ft.	2.0	in.	.010	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 1.5	To 8.0	Ft.	20-40	Fine Silica Sand
From	To	Ft.		
From	To	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	8.0	WHITE/TAN SAND

11. REMARKS:

Bentonite seal from 0.5 to 1.5 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE 11/26/08

DANNY SUMMERS
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2579

1. WELL CONTRACTOR:

DANNY SUMMERS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704)- 872-7686
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) OB-1

STATE WELL PERMIT#(if applicable)

DWQ or OTHER PERMIT #(if applicable)

WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 11/25/08

TIME COMPLETED AM ☐ PM ☐

3. WELL LOCATION:

CITY: WILMINGTON COUNTY NEW HANOVER

7158 MARKET STREET 28411
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(check appropriate box)

LATITUD . ___ ___

LONGITUDE ___ ___ ___

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

4. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY SM #35

STREET ADDRESS 7158 MARKET STREET

WILMINGTON | NC | 28411
City or Town | State | Zip Code

CONTACT PERSON WORSLEY OPERATING CORPORATION

MAILING ADDRESS PO BOX 3227

WILMINGTON | NC | 28406
City or Town | State | Zip Code

( )-
Area code - Phone number

5. WELL DETAILS:

a. **TOTAL DEPTH:** 20.0 FEET

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☒

c. **WATER LEVEL** Below Top of Casing: 10.0 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** N/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

6. CASING:

	Depth		Diameter	Thickness/ Weight	Material
From 0.0	To 2.0	Ft.	2 INCH	SCH 40	PVC
From ___	To ___	Ft.			
From ___	To ___	Ft.			

7. GROUT:

	Depth		Material	Method
From 0.0	To 0.5	Ft.	Portland bentonite	SLURRY
From ___	To ___	Ft.		
From ___	To ___	Ft.		

8. SCREEN:

	Depth		Diameter	Slot Size	Material
From 2.0	To 20.0	Ft.	2.0 in.	.010 in.	PVC
From ___	To ___	Ft.	___ in.	___ in.	
From ___	To ___	Ft.	___ in.	___ in.	

9. SAND/GRAVEL PACK:

	Depth		Size	Material
From 1.0	To 20.0	Ft.	20-40	Fine Silica Sand
From ___	To ___	Ft.		
From ___	To ___	Ft.		

10. DRILLING LOG

From	To	Formation Description
0.0	8.0	WHITE/TAN SAND
8.0	18.0	GRAY SAND
18.0	20.0	GRAY CLAY

11. REMARKS:

Bentonite seal from 0.5 to 1.0 Feet.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

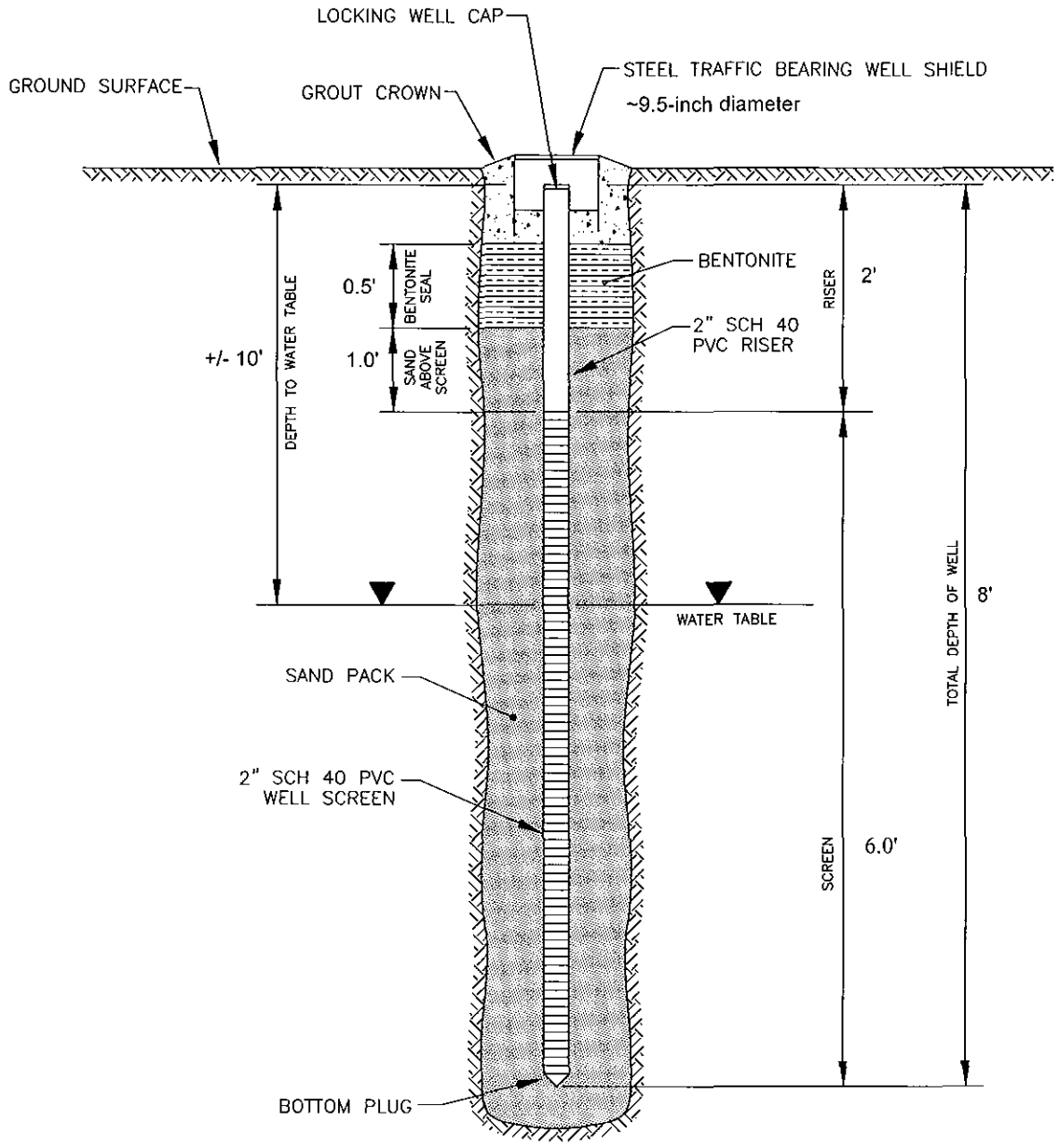
[signature] 11/26/08
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

DANNY SUMMERS
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 7/05

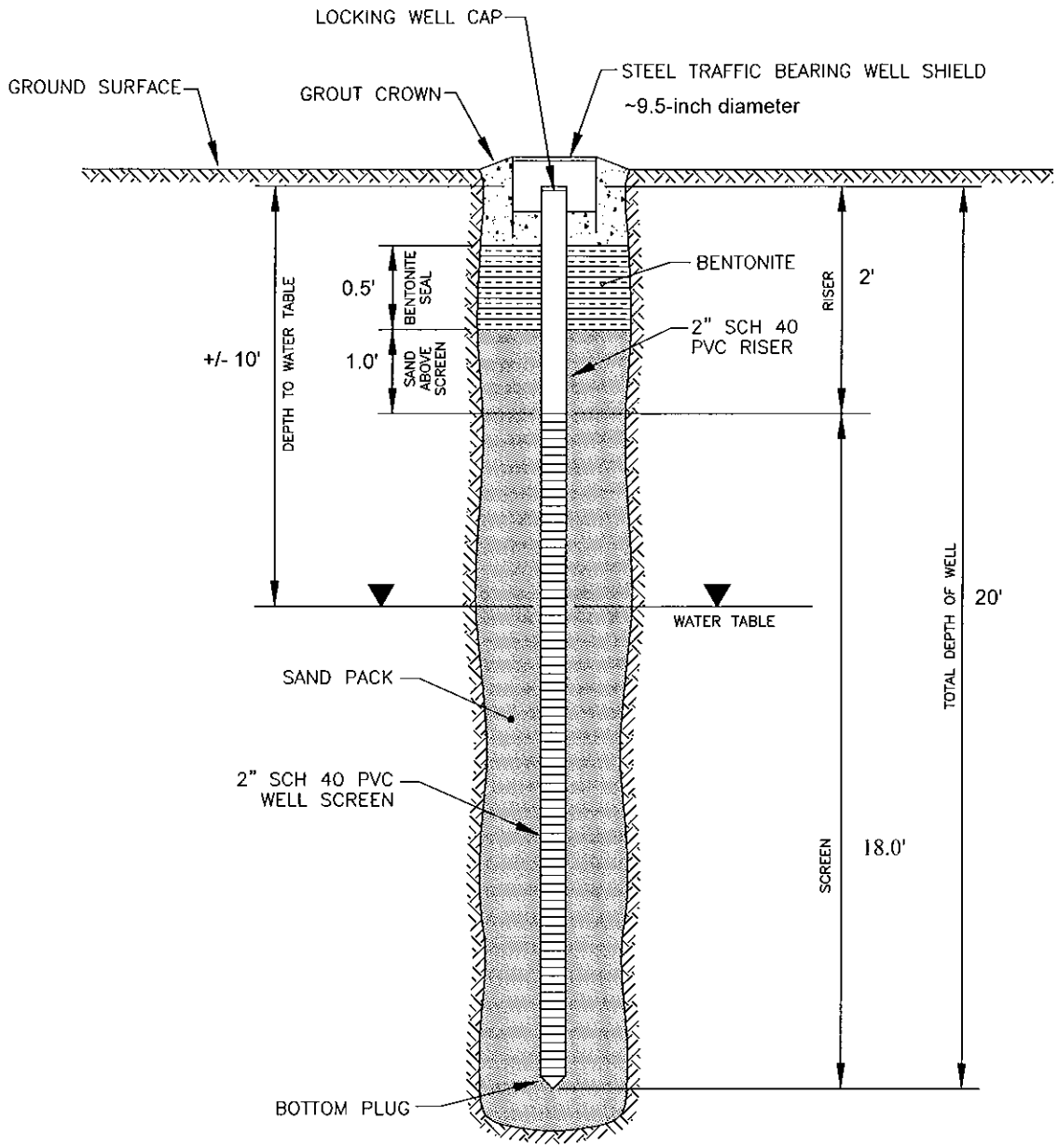
SVE-1



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Operating Corp, Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW--GEN

OB-1



Environmental Services & Solutions, PLLC
PO Box 12055, Wilmington, NC 28405
Tel. (910) 392-3050

PROJECT NO.	FIGURE NO.	CLIENT/LOCATION: Worsley Operating Corp, Scotchman #35, Wilmington, NC
PROJECT MANAGER: B. Lievre		
DESIGNED BY		DRAWING DESCRIPTION: MONITORING WELL DETAIL
DRAWN BY		
REVIEWED BY	DATE	SCALE: NONE / CAD NO.: MW-GEN

APPENDIX E

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Maureen Jackson
Worsley Operating Corp.
PO Box 3227

Wilmington, NC 28406

Report Summary

Wednesday December 10, 2008

Report Number: L378213
Samples Received: 12/06/08
Client Project: SM35

Description: Scotchman #35

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By: Jimmy Hunt, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375,DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Maureen Jackson
Worsley Operating Corp.
PO Box 3227
Wilmington, NC 28406

December 10,2008

ESC Sample # : L378213-01

Date Received : December 06, 2008
Description : Scotchman #35

Site ID : Scotchman #35

Sample ID : MW-1

Project # : SM35

Collected By : Jeff Jackson
Collection Date : 12/05/08 10:45

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Benzene	42.	1.0	ug/l	602MS	12/07/08	1
Toluene	12.	5.0	ug/l	602MS	12/07/08	1
Ethylbenzene	94.	1.0	ug/l	602MS	12/07/08	1
Total Xylenes	110	3.0	ug/l	602MS	12/07/08	1
Methyl tert-butyl ether	5.8	1.0	ug/l	602MS	12/07/08	1
Di-isopropyl ether	BDL	1.0	ug/l	602MS	12/07/08	1
Naphthalene	70.	5.0	ug/l	602MS	12/07/08	1
Surrogate Recovery						
Toluene-d8	101.		% Rec.	602MS	12/07/08	1
Dibromofluoromethane	100.		% Rec.	602MS	12/07/08	1
4-Bromofluorobenzene	102.		% Rec.	602MS	12/07/08	1

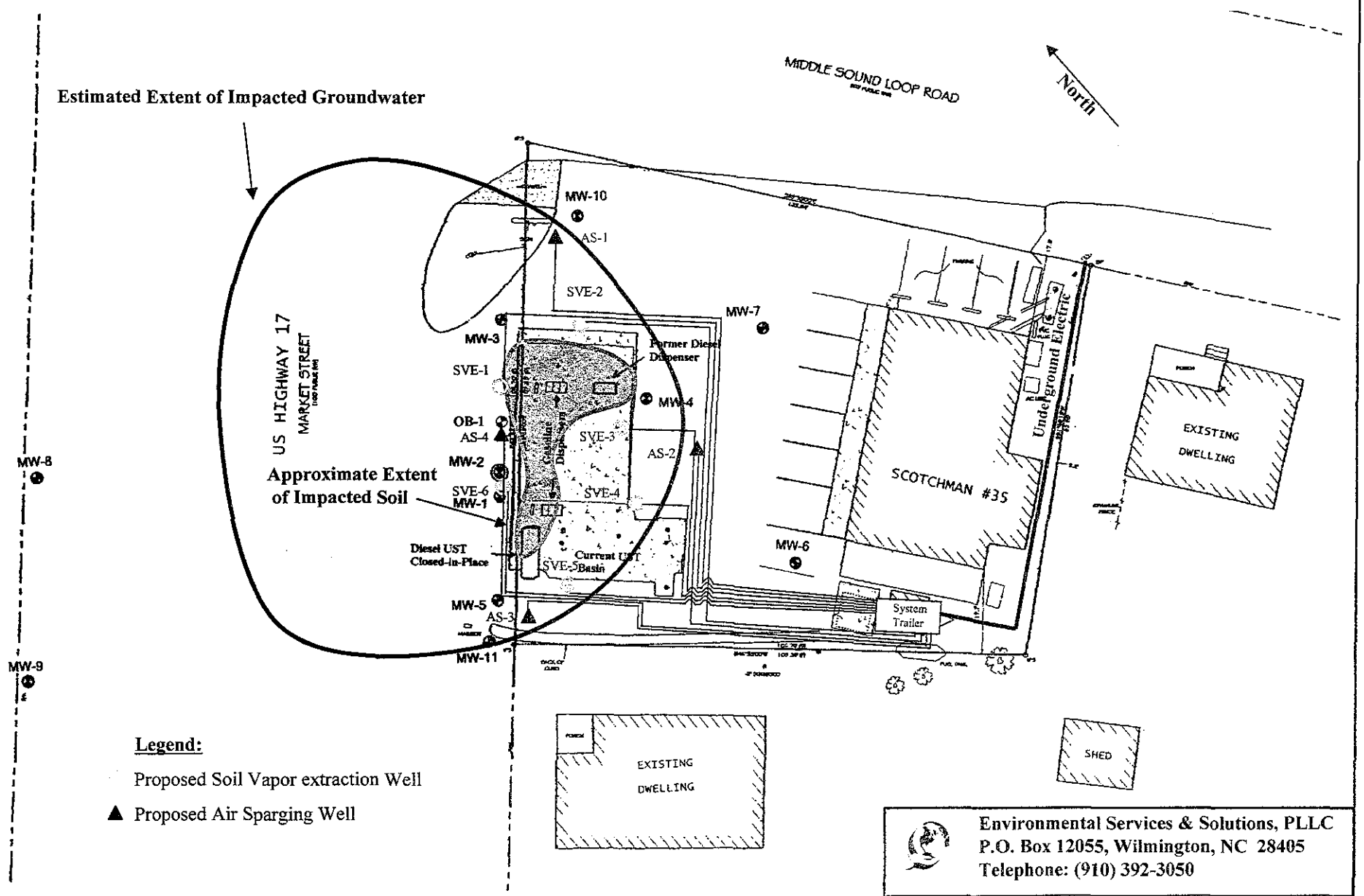
BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.

.
Reported: 12/10/08 15:48 Printed: 12/10/08 15:49

TABLE 2
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*1,000*	*550*	*530*	*200*	*70*	*21*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**42**	12	94	110	5.8	<1.0	**70**
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	8.3
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
	12/5/2008	**41**	550	**590**	**2,500**	<1.0	<1.0	**170**
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	12
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
	12/5/2008	<1.0	<5.0	1.3	<3.0	<1.0	<1.0	<5.0
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**87**	47	380	**640**	15	<1.0	**170**
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	12
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**1.7**	<5.0	18	<3.0	<1.0	<1.0	6.5

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others



Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER: B. LIEVRE	SITE/LOCATION: SCOTCHMAN #35 WILMINGTON, NC	
DATE: 4/23/09	DRAWING DESCRIPTION: **Proposed Remedial System Layout**	FIGURE NO. 5

ACTIVE REMEDIATION MONITORING REPORT

June 30, 2010

Site Name: Scotchman #35
Site Address: 7162 Market Street
Wilmington, New Hanover County, North Carolina
Facility I.D.: 0-020168
UST Incident Number: 32152
Site Priority Ranking and Reason: High – 287A
Water supply wells with 1000 feet of site
Land Use Category: Residential

UST Owner: Worsley Operating Corporation
Address: P.O. Box 3227
Wilmington, North Carolina 28406
Property Owner: Entrepreneur, Inc.
Address: P.O. Box 3227
Wilmington, North Carolina 28406

Consultant: Environmental Services & Solutions, PLLC
Address: P.O. Box 12055
Wilmington, North Carolina 28406
Telephone: (910) 343-1991

Release Information
Date Discovered: March 24, 2004
Latitude: 34.271944 North
Longitude: 77.818889 West
Estimated Quantity of Release: Unknown
Cause of Release: Unknown

UST Information:

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	1961	N/A
2	Gasoline	6,000	1961	N/A
3	Gasoline	4,000	1961	N/A
4	Diesel	6,000	1961	4/25/04

I, Michael Haseltine a Professional Geologist for Environmental Services & Solutions, PLLC, do certify that the information in this report is correct and accurate to the best of my knowledge. Environmental Services & Solutions, PLLC is licensed to practice engineering in North Carolina. The certification number of the company is P-0146.

made of flush-joint, threaded schedule-40 PVC, with 0.010-inch slotted well screens. A coarse sand pack (filter pack) was used to backfill the well annuli to a depth averaging approximately one-foot above the well screens. A one-foot thick bentonite seal was placed above the filter packs, and neat cement was used to fill the remainder of the well annuli to ground surface.

On August 25 and 26, 2009 ESS provided oversight for the installation of the AS system wells AS-1 through AS-4. The AS wells were generally installed to a depth of 30 feet bgs and screened from 27 to 30 feet bgs. The AS wells were constructed with two-inch diameter well casings made of flush-joint, threaded schedule-40 PVC, with 0.010-inch slotted well screens. A coarse sand pack (filter pack) was used to backfill the well annuli to a depth averaging approximately three feet above the well screens. A ten-foot thick bentonite seal was placed above the filter packs, and neat cement was used to fill the remainder of the well annuli to ground surface. The system well boring logs, as-built diagrams, and well construction records are provided in **Appendix C**.

5.0 REMEDIATION SYSTEM INFORMATION

5.1 SYSTEM DESCRIPTION

Remedial systems at the site include one soil vapor extraction (SVE) units and one air sparging (AS) unit. All systems are mounted within an enclosed trailer which has been placed near the southwest corner of the on-site building. The trailer is compartmentalized into two separate areas. One area encloses the AS equipment and controllers and the other compartment encloses the explosion proof SVE system.

The soil vapor extraction (SVE) system utilizes a separate, seven and one-half three horsepower Ametek regenerative blower, model numbers EN808. The SVE system is equipped with a moisture condensate tank, air filters, vacuum gauges, pressure relief valves, temperature gauges and other appurtenances. The SVE system was designed to operate 24 hours per day.

The SVE system is designed to recover vapor from one main line. The line is designed to provide a vacuum to six vertical SVE wells (SVE-1 through SVE-6) and is equipped with pressure gauges, flow meters and flow regulating valves.

The air sparging (AS) system utilizes a Gardner Denver, Elmo Rietschle, rotary vane compressor, model V-DLT40. From the compressor, air moves through a flow meter as well as pressure and temperature gauges, and then into the main header. The main header provides air to four separate one-inch diameter supply lines which provide air to each of the four separate air sparge wells (As-1 through AS-4). Each supply line is equipped with pressure gauges, flow meters, and flow regulating valves. A site map which depicts the layout of the remedial system is provided in **Appendix D**.

5.2 SYSTEM OPERATION AND MAINTENANCE

Maintenance visits were performed on a monthly basis during the period from December 1, 2009 through June 30, 2010. During this reporting period, air was furnished to all air sparging wells (AS-1 through As-4) and vacuum to system wells SVE-1 through SVE-6. A total of 5016 hours of potential operational time was possible during this period.

Table 4 provides a summary of systems operations for this period. Copies of operation and maintenance logs are provided in **Appendix D**.

5.3 SYSTEM EFFECTIVENESS

SVE System

Hour meter readings indicate the SVE system was operational for approximately 85% of the time. The SVE system operated 4271 hours of the possible 5016 hours, or 85 percent of the reporting period. The SVE system was non-operational for a few weeks due to a faulty electrical relay, an occasional high moisture level automatic shut down, and prior to and during the scheduled groundwater sampling event.

AS System

Hour meter readings indicate that the system was operational for approximately 5005 hours, or approximately 99% of the time. The AS system was shut down during the reporting period to replace the compressor vanes and prior to and during the scheduled groundwater sampling event.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations have been made based on readily available information and collected field data, as reported herein.

6.1 CONCLUSIONS

- Laboratory results of groundwater samples obtained on May 13, 2010, from monitoring wells MW-3, MW-5, and MW-11 indicated the presence of petroleum related compounds in excess of 2L Standards. Laboratory results of samples obtained from well MW-4 indicated the presence of petroleum related compounds at concentrations above detection limits but below 2L Standards. Petroleum compounds were not indicated above detection limits within the remaining samples.
- During the May 13, 2010 sampling event, generally lower levels of petroleum were noted in monitoring wells MW-1, MW-3, MW-5, and MW-11 as compared with the previous sampling event.
- The AS and SVE systems were started on December 1, 2009. All systems are currently operational.

TABLE 1
SUMMARY OF MONITORING AND REMEDIATION WELL CONSTRUCTION DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Installation Date	Well Diameter (inches)	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)
MW-1	9/20/2004	2	20	5 - 20	94.45 94.95
MW-2	9/20/2004	2	30	25 - 30	94.88
MW-3	9/20/2004	2	20	5 - 20	94.77
MW-4	9/20/2004	2	20	5 - 20	94.79
MW-5	9/20/2004	2	20	5 - 20	94.66
MW-6	9/20/2007	2	15	4.25-14.25	94.68
MW-7	9/20/2007	2	15	5 - 15	94.32
MW-8	9/21/2007	2	18	3 - 18	95.06
MW-9	9/21/2007	2	20	5 - 20	94.34
MW-10	9/21/2007	2	18	3 - 18	94.52
MW-11	9/21/2007	2	18	3 - 18	94.74
OB-1	11/25/2008	2	20	2 - 20	NA
SVE-1	11/25/2008	2	8	2 - 8	NA
SVE-2	8/24/2009	2	9	4 - 9	NA
SVE-3	8/24/2009	2	9	4 - 9	NA
SVE-4	8/24/2009	2	9	4 - 9	NA
SVE-5	8/24/2009	2	9	4 - 9	NA
SVE-6	8/24/2009	2	9	4 - 9	NA
AS-1	8/25/2009	2	30	27 - 30	NA
AS-2	8/25/2009	2	30	27 - 30	NA
AS-3	8/25/2009	2	30	27 - 30	NA
AS-4	8/25/2009	2	29	26 - 29	NA

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. Wells installed prior to 2007 completed by others

TABLE 2
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7162MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
				12/5/2008	12.50	--	82.45
				5/13/2010	13.65	--	81.30
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
				12/5/2008	12.71	--	82.17
				5/13/2010	13.33	--	81.55
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
				12/5/2008	10.56	--	84.21
				5/13/2010	10.91	--	83.86
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
				12/5/2008	9.84	--	84.95
				5/13/2010	10.57	--	84.22
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
				12/5/2008	12.12	--	82.54
				5/13/2010	13.19	--	81.47
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
				12/5/2008	7.73	--	86.95
				5/13/2010	7.97	--	86.71
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
				12/5/2008	8.67	--	85.65
				5/13/2010	9.12	--	85.20
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
				12/5/2008	10.55	--	84.51
				5/13/2010	11.90	--	83.16
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
				12/5/2008	11.89	--	82.45
				5/13/2010	12.77	--	81.57
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
				12/5/2008	10.32	--	84.20
				5/13/2010	9.98	--	84.54
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29
				12/5/2008	12.07	--	82.67
				5/13/2010	11.61	--	83.13

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements collected prior to 9/24/07 obtained by others

TABLE 3
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*600*	*600*	*500*	*20*	*70*	*6*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**42**	12	94	110	5.8	<1.0	**70**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	**8.3**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
	12/5/2008	**41**	550	590	**2,500**	<1.0	<1.0	**170**
	5/13/2010	**13.2**	382	515	**1,921**	<1.0	<1.0	**285**
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	**12**
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
	12/5/2008	<1.0	<5.0	1.3	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	2.7	29.8	15.0	<1.0	<1.0	**15.0**
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**87**	47	380	**640**	15	<1.0	**170**
	5/13/2010	**28.0**	28.7	1.2	48.3	10.7	<1.0	<2.0
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	**12**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0

TABLE 3
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

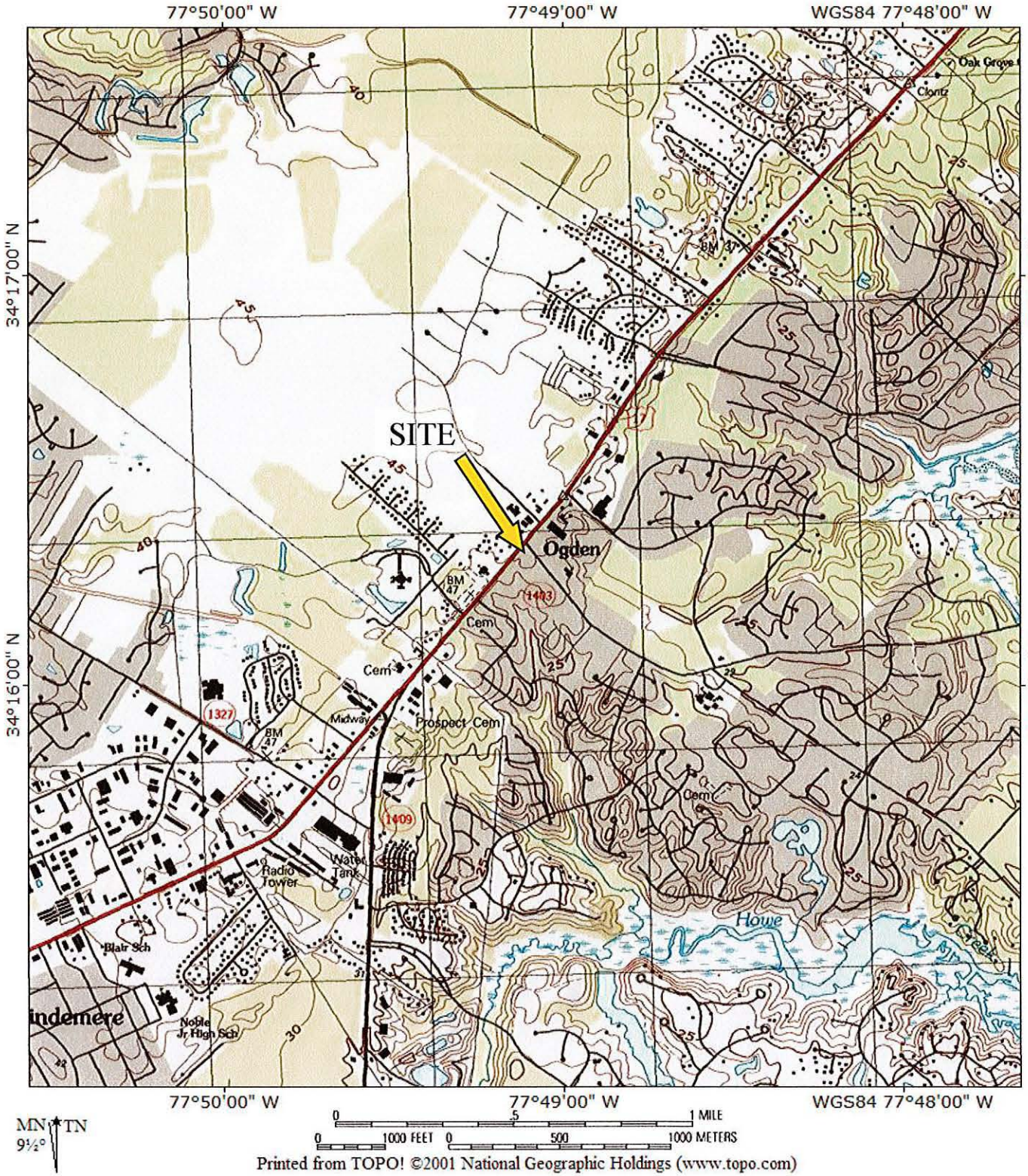
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**1.7**	<5.0	18	<3.0	<1.0	<1.0	**6.5**
	5/13/2010	**1.5**	<1.0	2.8	<3.0	<1.0	<1.0	<2.0

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others

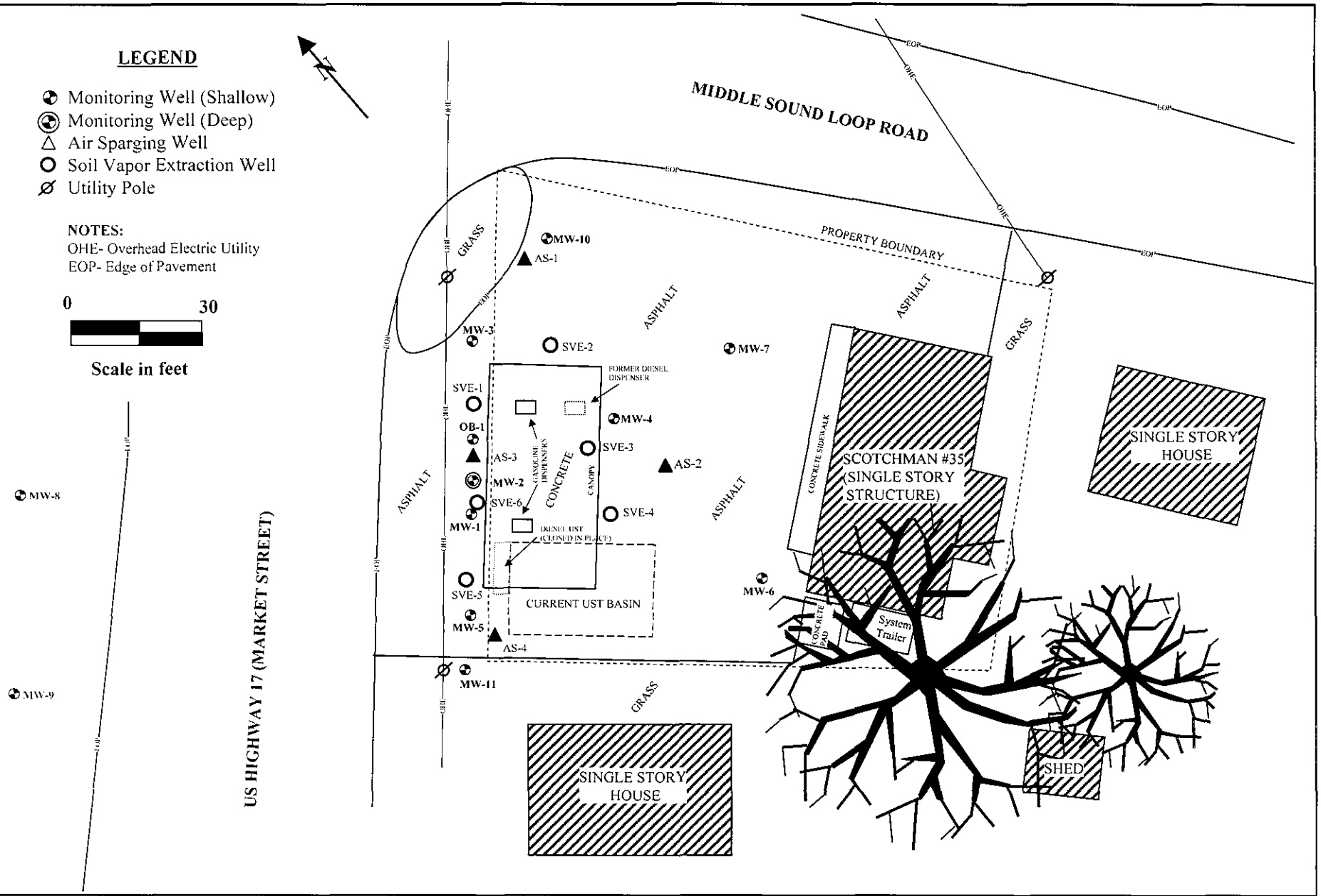
TABLE 4
SUMMARY OF REMEDIAL SYSTEM OPERATIONAL DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Date	Status at		Comments
	Arrival	Departure	
12/1/2009	Off	On	Initial Start-up and airflow, vacuum and pressure adjustments, checked water levels in all monitoring wells, noted bubbling in wells.
12/15/2009	AS On, SVE Off	AS On, SVE Off	Monthly O&M - SVE high moisture level tripped system but did not shut down AS system, drained 80 gals liquid from moisture tank during visit. Starter motor relay is also malfunctioning, SVE system will not operate. Check vanes and filters.
1/6/2010	AS On, SVE Off	AS On, SVE Off	Monthly O&M - checked AS vanes and filters, noted bubbling in wells. SVE system down for repairs.
1/14/2010	AS On, SVE Off	All On	Met Enviro-Equipment on-site for SVE starter relay repair. Restart SVE system.
1/15/2010	AS On, SVE Off	All On	Monthly O&M - SVE high moisture level tripped system, drained 35 gals liquid from moisture tank during visit. Check vanes and filters. Adjust air flow
2/2/2010	All On	All On	Monthly O&M - drained 10 gals liquid from moisture tank. Check vanes and filters. Adjust SVE vacuum based on water in flow meters. Noted bubbling in monitoring wells.
2/15/2010	All On	All On	Drained 10 gals liquid from moisture tank. Check vanes and filters. Adjust air flows.
3/11/2010	All On	All On	Monthly O&M - drained 10 gals liquid from moisture tank during visit. Check vanes and filters. Adjust AS air flows based on bubbling noted in monitoring wells.
4/19/2010	All On	All On	Monthly O&M - drained 5gals liquid from moisture tank during visit. Check vanes and filters. Adjust air flows based on bubbling noted in monitoring wells.
5/11/2010	All On	All Off	Monthly O&M - drained 50 gals liquid from moisture tank during visit. Check vanes and filters. Noted bubbling noted in monitoring wells. Shut down systems for pending groundwater sampling event.
5/13/2010	All Off	All On	Restart systems following groundwater sampling
6/15/2010	All On	All On	Monthly O&M - drained 5 gals liquid from moisture tank during visit. Changed AS vanes and filters. Adjust air flows based on bubbling noted in monitoring wells.

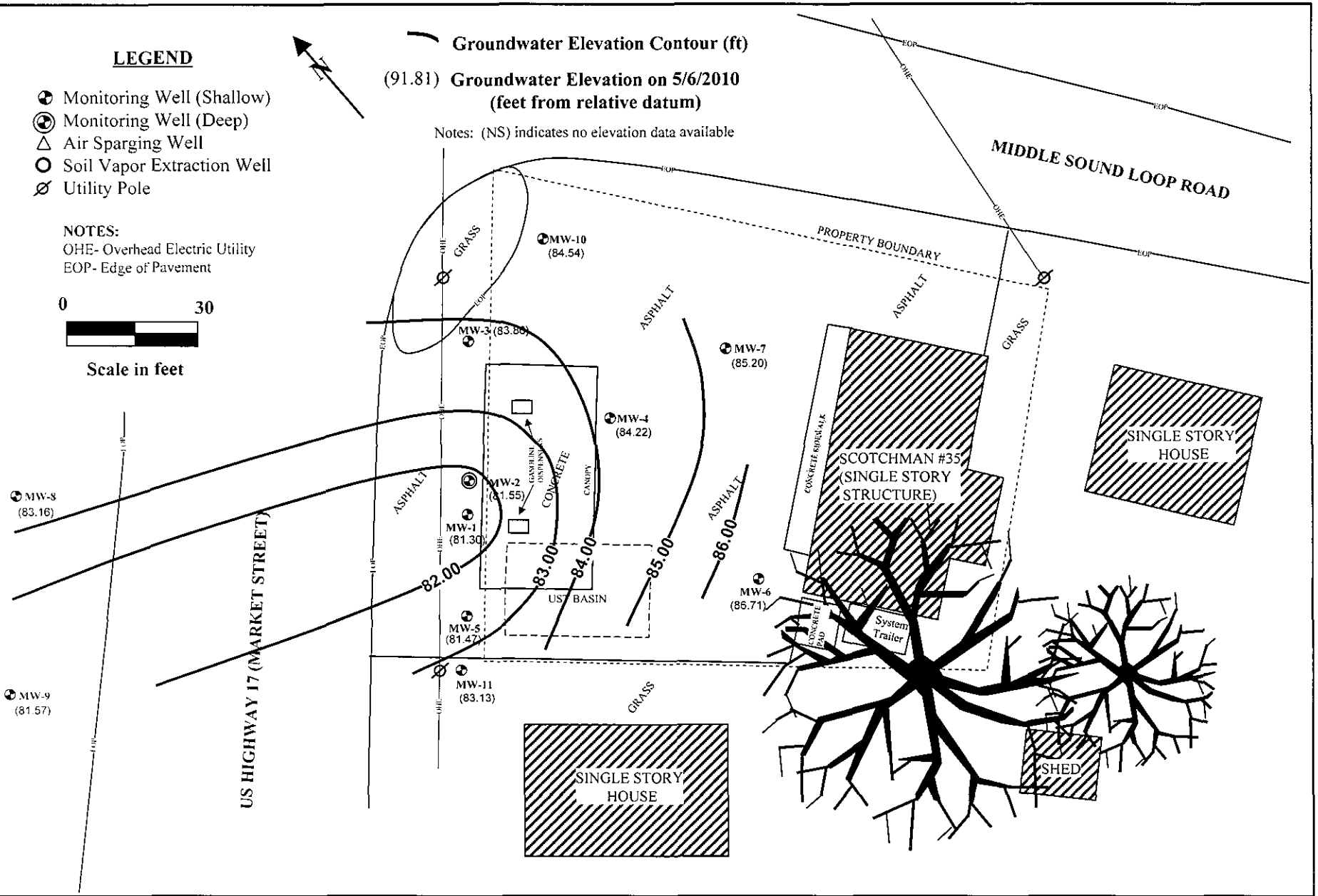
FIGURES



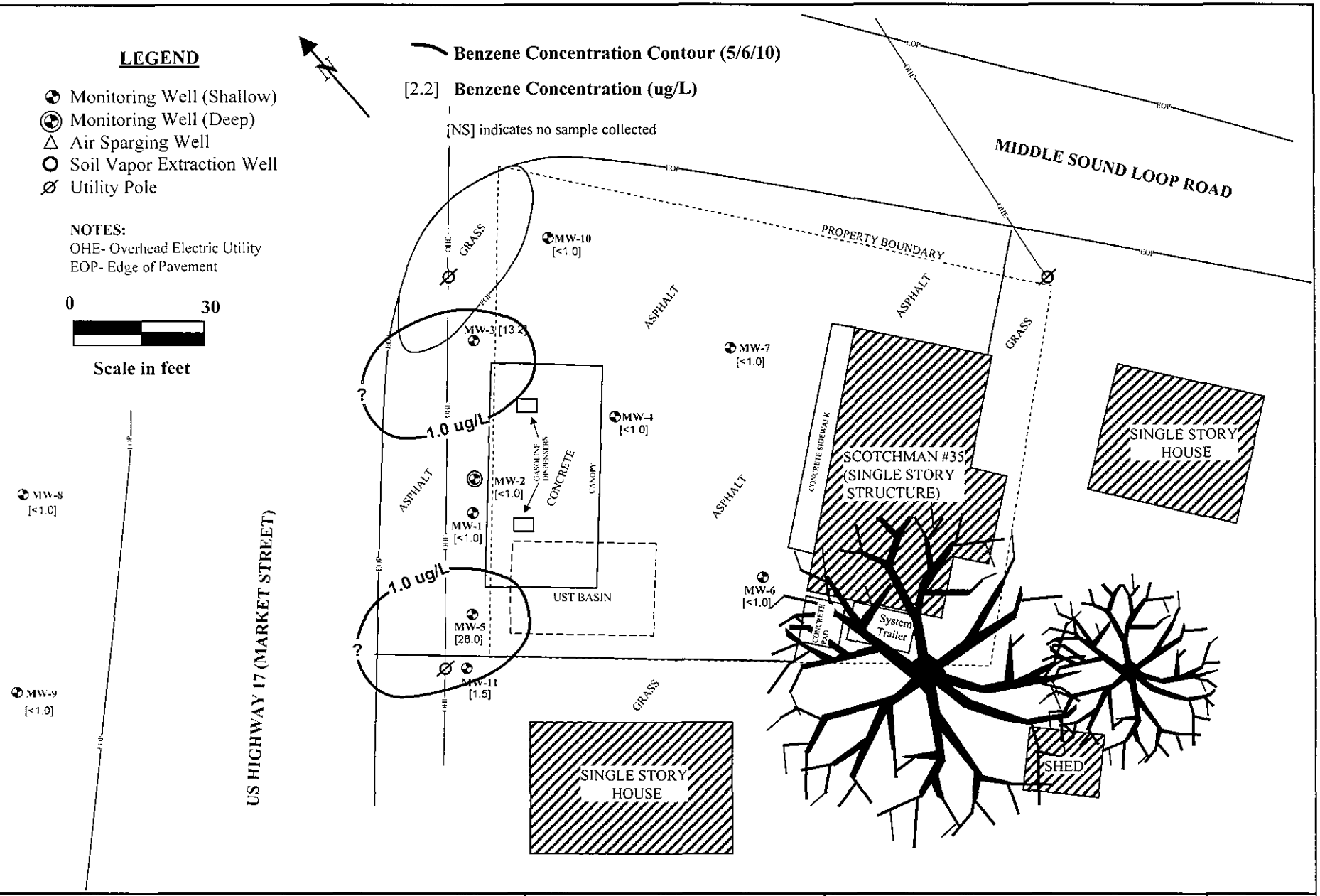
Environmental Services & Solutions, PLLC P.O. Box 12055, Wilmington, NC 28405 Telephone: (910) 392-3050	Title: Topographic Vicinity Map		Figure No. 1
Drawn By: BKL	Date: 5-5-08	Location: Scotchman #35 Wilminmgton, NC	
Checked By: FP	Date: 5-5-08		



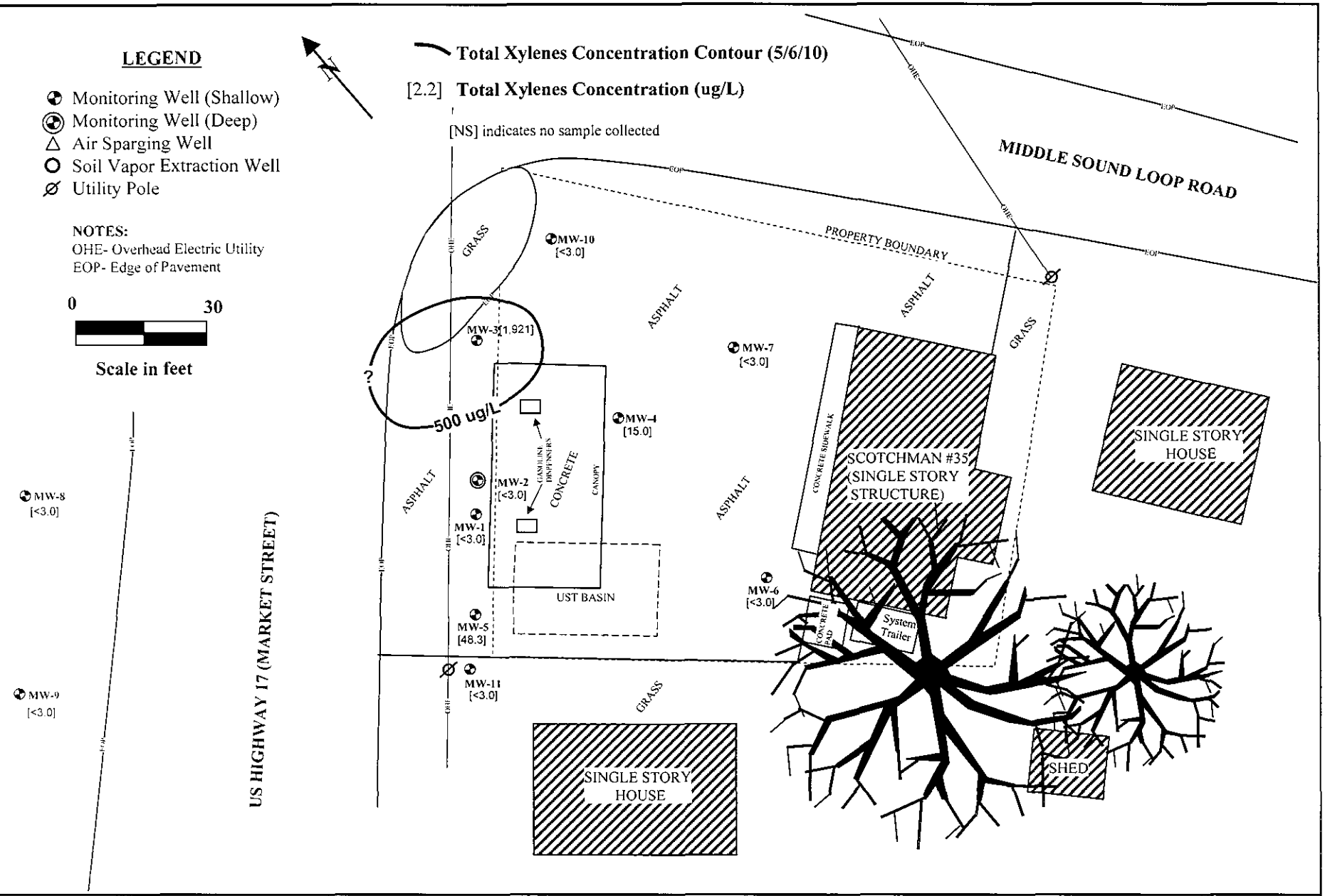
Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 06/29/10	Title: Site Map	Figure No. 2
	Checked By: BKL Date: 06/29/10	Location: Scotchman #35 Wilmington, NC	



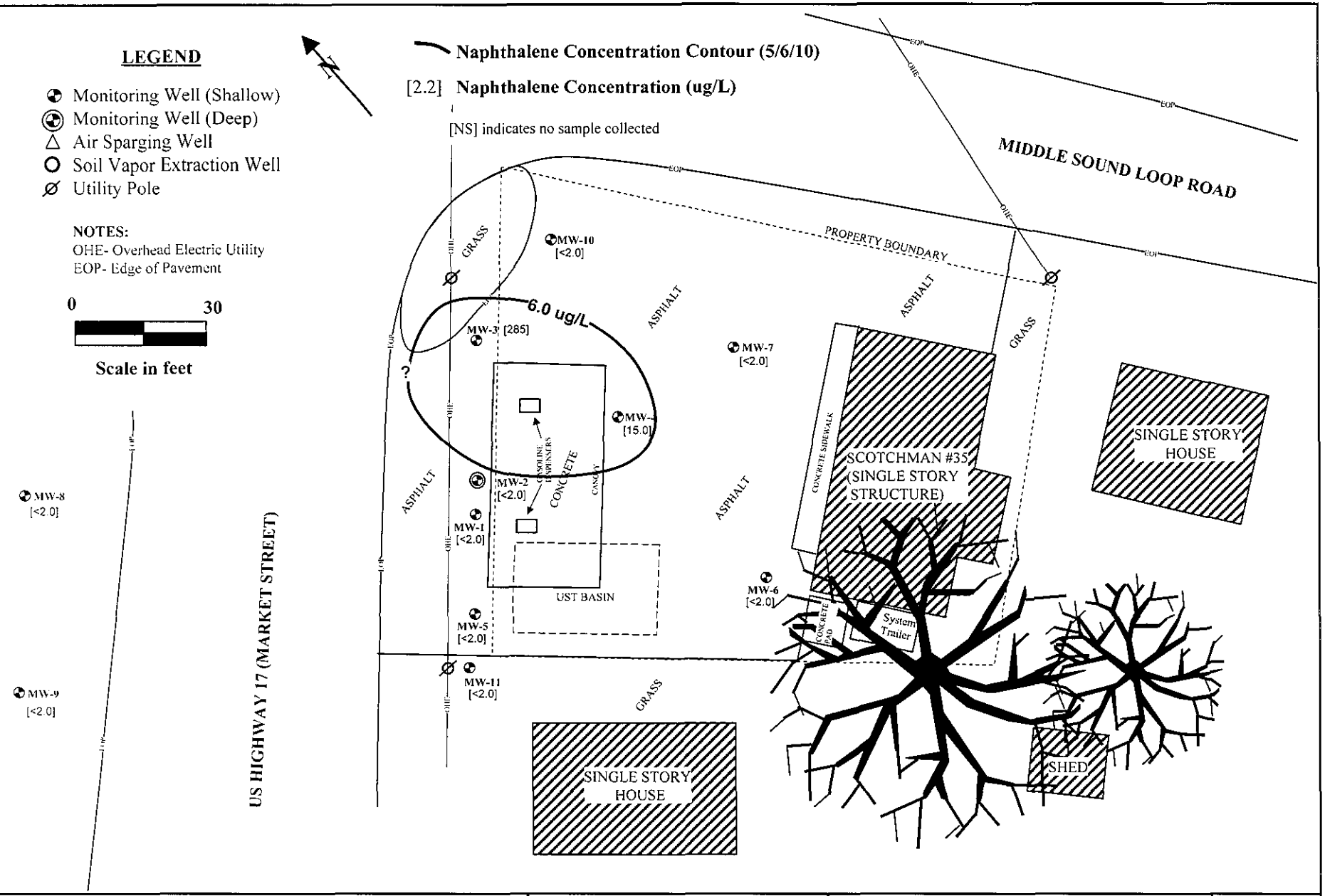
Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 06/29/10	Title: Groundwater Elevation Contour Map (5/13/10)	Figure No. 3
	Checked By: BKL Date: 06/29/10	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 06/29/10	Title: Horizontal Extent of Benzene above 2L Standards	Figure No. 4
	Checked By: BKL Date: 06/29/10	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 06/29/10	Title: Horizontal Extent of Total Xylenes above 2L Standards	Figure No. 5
	Checked By: BKL Date: 06/29/10	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 06/29/10	Title: Horizontal Extent of Naphthalene above 2L Standards	Figure No. 6
	Checked By: BKL Date: 06/29/10	Location: Scotchman #35 Wilmington, NC	

ACTIVE REMEDIATION MONITORING REPORT

For The

SCOTCHMAN #35

7158 MARKET STREET

WILMINGTON, NORTH CAROLINA

Prepared By:

ENVIRONMENTAL SERVICES & SOLUTIONS, PLLC

P.O. BOX 12055

WILMINGTON, NORTH CAROLINA 28405

TELEPHONE (910) 392-3050

Prepared For:

WORSLEY OPERATING CORPORATION

P.O. BOX 3227

WILMINGTON, NORTH CAROLINA 28406

ACTIVE REMEDIATION MONITORING REPORT

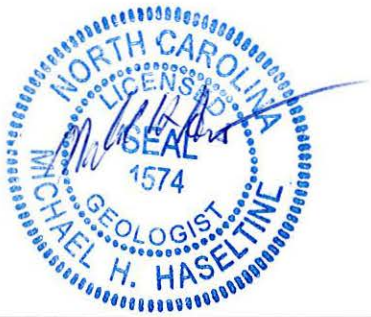
January 8, 2013

Site Name: Scotchman #35
Site Address: 7162 Market Street
Wilmington, New Hanover County, North Carolina
Facility I.D.: 0-020168
UST Incident Number: 32152
Site Priority Ranking and Reason: High – 287A
Water supply wells with 1000 feet of site
Land Use Category: Residential

UST Owner: Worsley Operating Corporation
Address: P.O. Box 3227
Wilmington, North Carolina 28406
Property Owner: Entrepreneur, Inc.
Address: P.O. Box 3227
Wilmington, North Carolina 28406

Consultant: Environmental Services & Solutions, PLLC
Address: P.O. Box 12055
Wilmington, North Carolina 28406
Telephone: (910) 343-1991

Release Information
Date Discovered: March 24, 2004
Latitude: 34.271944 North
Longitude: 77.818889 West
Estimated Quantity of Release: Unknown
Cause of Release: Unknown



UST Information:

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	1961	N/A
2	Gasoline	6,000	1961	N/A
3	Gasoline	4,000	1961	N/A
4	Diesel	6,000	1961	4/25/04

I, Michael Haseltine a Professional Geologist for Environmental Services & Solutions, PLLC, do certify that the information in this report is correct and accurate to the best of my knowledge. Environmental Services & Solutions, PLLC is licensed to practice engineering in North Carolina. The certification number of the company is P-0146.

TABLE OF CONTENTS

ACTIVE REMEDIATION MONITORING REPORT
FOR THE
SCOTCHMAN #35
7162 MARKET STREET
WILMINGTON, NORTH CAROLINA

Environmental Services and Solutions, PLLC (ESS) has prepared the following *Active Remediation Monitoring Report* for the site referenced above on behalf of our client, Worsley Operating Corporation (WOC). This report has been prepared pursuant to Title 15A of the North Carolina Administrative Code (NCAC), Chapter 2, Subchapter 2L and in accordance with the *Guidelines for Assessment and Corrective Action for UST Releases*, provided by the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management (DWM), Underground Storage Tank (UST) Section, dated July 15, 2008.

1.0 INTRODUCTION

Laboratory results of groundwater samples obtained during the previous sampling events on December 6, 2011, and June 26, 2012 indicated the absence of target petroleum compounds in excess of 2L Standards. The remedial systems were temporarily shut-down on November 15, 2011 due to an air compressor malfunction. The systems have not been restarted. ESS recommended no further action in the *Active Remediation Monitoring Report* dated December 19, 2011. Upon review of the report, the NCDENR requested two additional semi-annual groundwater sampling events in correspondence dated January 5, 2012.

In correspondence dated September 5, 2012 the NCDENR requested an additional groundwater sampling event as well as collection of soil samples to document soil cleanup. ESS requested approval for the costs in correspondence dated September 14, 2012. The costs were approved in correspondence dated October 10, 2012 (Task Authorization 32152-17). This report summarizes the results of the requested groundwater sampling events and the advancement of soil borings and laboratory analysis of collected soil samples. Copies of recent correspondence are provided in **Appendix A**.

1.1 SITE LOCATION

The Scotchman #35 (herein referred to as the Site) is located at 7162 Market Street in Wilmington, New Hanover County, North Carolina. The topographic vicinity map of the surrounding area is provided as **Figure 1** and **Figure 2** is a site map depicting pertinent structures.

1.2 SITE HISTORY

Presently, the site is an active retail motor fuel outlet and convenience store. There are presently three active USTs located on the property. The property is owned by Entrepreneur Inc., of Wilmington, North Carolina. Available data on the facility's UST systems are tabulated below.

UST #	PRODUCT	CAPACITY (Gallons)	INSTALLATION DATE	CLOSURE DATE
1	Gasoline	6,000	4/16/1961	N/A
2	Gasoline	6,000	4/16/1961	N/A
3	Gasoline	4,000	4/16/1961	N/A
4	Diesel	1,000	4/16/1961	4/25/2004

On and around May 24, 2004, impacted soil was documented through laboratory analysis during activities related to the in-place closure of the diesel UST system. The consultant at the time, SEI Engineering & Geological Services, P.C. (SEI), completed and submitted the UST form *24-Hour Release and UST Leak Reporting Form* to the NCDENR office. UST closure activities conducted in 2004 included the advancement of eight soil borings and the concurrent collection of eight soil samples, SB-1 through SB-8. Documentation of the in-place closure was provided in an *Underground Storage Tank Closure Report,* dated June 15, 2004, which was submitted to the NCDENR Wilmington Regional Office (WiRO) by SEI.

In 2004 SEI provided oversight of the installation of four shallow groundwater monitoring wells (MW-1, MW-3, MW-4, MW-5) and one telescoping monitoring well (MW-2). Additionally, after well installation, groundwater samples were collected from each monitoring well. The groundwater samples were submitted to a North Carolina certified laboratory for analyses. One soil sample (SS-1) was collected for laboratory analysis. The results of these assessment activities were provided in a *Limited Site Assessment (LSA) Report*, dated December 29, 2004.

In a *Notice of Regulatory Requirements (NORR)*, dated January 3, 2007, the NCDENR classified the site as High Risk - H287A and req uested the completion of a comprehensive site assessment (CSA). The *high-risk* classification was assigned due to the presence of a water supply wells located within 1,000 feet of the confirmed release area.

As part of CSA activities in September 2007, Environmental Services and Solutions, PLLC (ESS) supervised and/or advanced over fourteen soil borings (SB-1, SB-1B, SB-2, SB-3, SB-3B, SB-4 through SB-14, and SB-14B) and subsequently collected samples from 14 locations. Laboratory analyses of soil samples collected during assessment activities identified the presence of petroleum-related compounds in soil at SB-1, SB-2 and SB-8. Laboratory analyses of soil samples collected from the borings SS-1, SB-1B, SB-2, SB-4, SB-5, SB-6, SB-9, and SB-13 identified the presence of petroleum-related compounds in excess of Soil-to-Water Maximum Soil Contamination Concentrations (STW-MSCC's). In addition, ESS personnel directed the installation of six Type II monitoring wells (MW-6 through MW-11). Laboratory analyses of groundwater sampled from monitoring wells MW-1, MW-3, MW-4, and MW-5 identified dissolved petroleum-related compounds above their respective standards, as specified within Title 15A of the North Carolina Administrative Code, Chapter 2, Subchapter 2L, Section .0202 (2L Standards). On May 16, 2008 ESS submitted the results of these activities within a *CSA Report.*

In a *NORR*, dated September 2, 2008, NCDENR requested the submittal of a *Corrective Action Plan Report (CAP)*. On May 11, 2009 ESS submitted a *CAP* recommending the installation and operation of soil vapor extraction and air sparging remedial systems to achieve site remediation. The *CAP* was approved by the NCDENR in correspondence dated June 17, 2009.

ESS provided oversight of the remedial system well installations from August 24 to August 26, 2009. The remedial systems were installed and start-up occurred on December 1, 2009. The AS and SVE systems were shut-down on November 15, 2011 following the malfunction of the AS compressor. The system has not been repaired and reactivated due to the absence of target compounds above 2L Standards. System operation and maintenance and results of semi-annual sampling events were summarized in reports previously provided to the NCDENR.

2.0 RECEPTOR PATHWAY INFORMATION

As defined by the North Carolina Department of Environment and Natural Resources (NCDENR), a receptor is "any human, plant or animal that is or has the potential to be adversely affected by the release or migration of contaminants." With respect to the site, the following sections present information regarding potential receptor pathways for the migration of petroleum compounds and pathway relationships to the site. SEI conducted a receptor survey in 2004 during LSA activities. ESS conducted an updated field survey and enhanced the detail of the survey during CSA activities.

2.1 WATER SUPPLY WELLS

In 2004, SEI conducted a survey to determine the location of water supplies located within a 1,500-foot radius of the subject facility. ESS conducted a survey update in 2007. Information was gathered through mail questionnaires, site reconnaissance and conversations with City of Wilmington and New Hanover County personnel.

Information collected during the mail-survey process is detailed below.

- A total of 9 water supply wells were identified within a 1,500-foot radius of the subject site, eight of which occur within a 1000-foot radius.
- All properties can be connected to the Cape Fear Public Utility water supply.
- Five of the nine wells are reportedly used for potable purposes. The well owners were individually contacted to assess the feasibility of well abandonment and connection to the municipal water supply. Some owners did not respond or rejected abandonment of their water supply wells.
- The subject facility is also connected to the municipal water system.

2.2 PUBLIC WATER SUPPLIES

Per conversations with the New Hanover County Engineers Office, public water in the vicinity of the site is furnished by New Hanover County and the City of Wilmington. The county water is furnished to residential developments to the west of Market Street. According to a telephone conversation with Mr. Jim Bonser of the City of Wilmington Public Utility Office and information obtained from that office, the City of Wilmington provides water north on Market Street to the approximate limits of the 1500-foot radius and the majority of properties east of Market Street. Mr. Bonser also indicated that connection to the municipal system is not mandatory but is currently available to all.

2.3 WELLHEAD PROTECTION AREAS

At the time of this assessment, the subject facility is not located within an approved wellhead protection area as defined by 42 USC 300h-7(e).

2.4 SURFACE WATER BODIES

At least four storm water retention ponds are located to the northwest and occur within a 1500-foot radius of the site. In addition, an unnamed tributary of the Howe Creek lies approximately 1,000 feet south of the site. Howe Creek is tidally influenced and drains into the Inter-coastal Waterway.

2.5 SUBSURFACE STRUCTURES

Information gathered by ESS personnel identified the presence several underground utilities in the vicinity of the site. These include water supply lines, sanitary sewer lines, and storm water lines.

The City of Wilmington has an 8-inch PVC water supply line, which services the vicinity of the site and is present on the east side of the Market Street right-of-way extending north through the 1500-foot radius. A branch of that line extends from Market Street to the southern side of the right-of-way of Middle Sound Loop Road. The depth of this line is reportedly at least 2 feet bgs.

Two eight-inch diameter sanitary sewer lines are present in the vicinity of the site with one with one line on each side of Market Street. Both lines are reportedly present in the North Carolina Department of Transportation right-of-way for Market Street but both reportedly terminate south of the site. The sanitary sewer lines are reportedly constructed to a depth ranging from approximately seven to 10 feet bgs.

A reinforced concrete storm water pipe is located approximately 500 hundred feet south of the site and provides storm water control southward. The pipe ranges in diameter from 15 to 24-inches and is constructed with an invert depth of approximately 6 feet below ground surface.

2.6 LAND USE

The Market Street business corridor is primarily zoned by New Hanover County as category B-2. The B-2 Highway Business District is a heavy commercial zoning. Its purpose is to provide for the proper grouping and development of business uses which best accommodate the needs of the motoring public with a regional orientation. Residential developments to the west of Market Street business corridor are zoned residential R-10 and R-15 and to the east are zoned residential R-15 and R-20.

2.7 DEEP AQUIFERS IN THE ATLANTIC COASTAL PLAIN PROVINCE

The subject facility is located within the Atlantic Coastal Plain province. Overall, the Atlantic Coastal Plain slopes eastward at an average rate of less than three feet per mile. The coastal plain is basically flat in interstream areas, but is broken by low escarpments adjacent to stream valleys. New Hanover County is a relatively flat sandy plain with a relief ranging from mean sea level (MSL) to approximately 50 feet above MSL. The subject facility lies approximately 25 feet above mean sea level.

The Atlantic Coastal Plain province consists of two natural subdivisions, the Outer Coastal Plain (Tidewater Region) and the Inner Coastal Plain. The Tidewater Region is defined by land surface being less than 40 to 50 feet above mean sea level and its proximity to the coastline. The surficial aquifer within the Tidewater Region is composed of fine sand, silt, clay, shell, peat beds, and scattered deposits of coarser-grained material. West of the Tidewater Region, within the Inner Coastal Plain, the unconsolidated sediments of the surficial aquifer become coarser-grained and more poorly sorted. The subject facility lies within the Inner Coastal Plain.

Names of the North Carolina aquifers, located within the coastal plain, are generally taken from the predominant geologic formation with which an aquifer is associated. The lithology of each formation is significant with respect to the manner in which it will influence aquifer properties such as groundwater chemistry, hydraulic conductivity, groundwater velocity, and vertical movement.

The formations capable of yielding good water quality (potable water) are those not older than late Cretaceous. The deep, older formations generally contain water too salty for potable use. The potable water aquifers, lying within the late Cretaceous and younger sediments, are generally comprised of imperfectly connected sand beds, limestone, to unconsolidated sediments of the surficial sands. Confining units also may be present, which separate the major aquifers. These confining units consist of clay beds or groups of clay beds and silt with varying amounts of sand. The lithology of a confining unit tends to retard the vertical exchange (movement) of groundwater between upper and lower aquifer systems.

As part of the Atlantic Coastal Plain province, New Hanover County has four predominant aquifer systems in the vicinity of the site. In descending order these include:

- Surficial aquifer comprised of Pleistocene and Pliocene age sediments;

- Castle Hayne aquifer with sediments generally of Eocene age;
- Pedee aquifer which is comprised of Late Cretaceous age sediments; and,
- Black Creek aquifer.

Specific aquifer information was obtained from the publication, *Hydrogeologic Framework of the North Carolina Atlantic Coastal Plain* (U.S. Geological Survey Professional Paper 1404-I. M.D. Winner, Jr. and R.W. Coble, 1996). The geological profiles were obtained from Borings #91 and #111 along cross-section L-L' of the publication. In addition, information provided by the North Carolina Division of Water Resources - Hydrogeologic Framework was also incorporated.

The surficial aquifer and Castle Hayne aquifer are separated by the Castle Hayne confining unit and the Castle Hayne aquifer and Pedee aquifer are separated by the Pedee confining unit.

Generally, the surficial aquifer is of major importance due to its extended coverage throughout the Coastal Plain. Precipitation infiltrating this aquifer is responsible for the bulk of water recharging the Coastal Plain aquifer system. The surficial aquifer transmits water laterally to streams and serves as a source bed holding the water that moves down gradient to the deeper aquifers. The surficial aquifer occurs within approximately 5 to 20 feet below ground surface (bgs) in most areas of the county and yields sufficient water for domestic use.

Surficial aquifer sediments in the Tidewater Region were deposited under shallow marine or estuarine conditions. These consist of fine sand, silt, clay, shell, and peat beds, plus scattered deposits of coarser-grained material in the form of relic beach ridges and floodplain alluvium. The estimated thickness of the surficial aquifer at the site is approximately 33 feet. The aquifer is composed of 79 percent permeable material and has an estimated hydraulic conductivity of 35 feet per day.

The underlying Castle Hayne confining unit is composed of beds of clay, sandy clay, and clay with sandy streaks. Throughout much of the area, the Castle Hayne confining unit is thin, with a thickness of about 13 feet, and contains enough sand to allow significant vertical movement between the surficial aquifer and the underlying Castle Hayne aquifer. The Castle Hayne confining unit contact was not defined in the borings.

The Castle Hayne aquifer is predominantly composed of limestone (including shell, dolomitic, and sandy limestone ranging from loosely consolidated to hard/crystallized) and sand with minor amounts of clay and was deposited under marine conditions. Sand bed intervals have varying carbonate content and range from fine to coarse grains, but are typically composed of fine to medium sand. Clay occurs as marl beds less than 10 feet thick or as a matrix in both sand and limestone beds. Typically, the upper portion of the Castle Hayne aquifer consists of limestone, while the lower portion is mainly sand.

The Castle Hayne aquifer is the most productive in North Carolina. Along its western margin, it occurs near land surface in New Hanover County and is exposed in many streams in the area. The aquifer is approximately 69 feet thick and contains approximately 64 percent permeable material. The estimated hydraulic conductivity is 65 feet per day.

The Peedee confining unit is overlain by the Castle Hayne aquifer in the area. The Peedee confining unit is an estimated 44 feet in thickness and contains sediments with less than 15 percent permeability. The Peedee confining unit is composed of clay, silty clay and sandy clay and represents the Cenozoic-Mesozoic geological boundary.

The Peedee aquifer primarily occurs within the Peedee Formation. The Peedee Formation consists of fine to medium-grained sand interbedded with gray to black marine clay and silt. Glauconitic sand beds and thin beds of consolidated calcareous sandstone and impure limestone are interlayered in the sands in places. The Peedee aquifer is approximately 300 feet thick in the vicinity of the site and has an estimated hydraulic conductivity of 34 feet per day.

The Black Creek confining unit is overlain by the Peedee aquifer. The Black Creek confining unit is approximately 42 feet thick in the Wilmington area and contains sediments having less than 12 percent permeability. The Black Creek aquifer, overlain by the Black Creek confining unit, has a thickness of approximately 334 feet, and the estimated hydraulic conductivity is 25 feet per day.

In general, potable water is not captured from the aquifers located at depths beyond the Black Creek aquifer. These include the Upper Cape Fear and Lower Cape Fear Aquifers.

Based upon the soil boring data reported SEI and observations by ESS during the monitoring well and soil boring advancements, the surficial geology generally of a fine to medium-grained silty sand ranging in color from light gray to dark brown. Based upon the site specific data collected by SEI during the monitoring well installations, including well MW-2, the Type III well did not penetrate the surficial aquifer.

3.0 SOIL SAMPLING ACTIVITIES

On December 19, 2012, ESS personnel supervised the advancement of seven soil borings (i.e. CB-1 through CB-7), to a depth of ten feet. Drilling was performed by personnel with Geologic Exploration, Inc. The soil borings were located adjacent to soil samples collected during the CSA field activities and which reported laboratory results above STW-MSCC's. Four samples were collected from each soil boring at depths of one-foot, three-feet, six to eight feet, and eight to ten feet bgs. The twenty eight samples were field-screened using an RKI Instruments Eagle vapor analyzer. Based upon field observations and field screening results, four samples (i.e. SS-1, SS-2, SS-3, and SS-4) were selected

from discrete soil borings for laboratory analyses. Soil sample SS-1 corresponds to soil boring CB-1, sample SS-2 to boring CB-3, sample SS-3 to boring CB-5, and sample SS-4 to boring CB-6. All samples were collected within the interval of 6 to 8 feet bgs.

All soil samples were placed in laboratory-supplied jars, sealed, labeled, and set on ice for delivery to Environmental Science Corp. of Mt. Juliet, Tennessee, NC Laboratory Certificate Number ENV375. The soil samples were inventoried on the chain-of-custody documents and delivered to the project laboratory for analyses by EPA Methods 8260B, 8270, and MADEP Methods for VPH and EPH. The boring logs are provided in **Appendix B**. The soil sample locations are depicted in **Figure 3**.

The laboratory reports indicated the presence of specific compounds as well as MADEP Methods for VPH and EPH above the STW-MSCC's in sample SS-1. MADEP Methods for VPH exceeded STW-MSCC's and EPH exceeded Residential MSCC's in sample SS-2. The results are summarized in **Table 1** and the laboratory reports are included in **Appendix C**.

4.0 GROUNDWATER SAMPLING ACTIVITIES

4.1 SAMPLING ACTIVITIES

On December 19 and 20, 2012 depth to groundwater measurements and groundwater samples were obtained from monitoring wells MW-1 through MW-11. Depth to groundwater measurements were obtained utilizing an oil/water interface probe, which was properly decontaminated prior to use at each location.

On December 19, 2012, the water levels were recorded for the monitoring wells, the respective well volume was calculated, and a minimum of three well volumes was purged from the well column to ensure replacement of stagnant water with representative formation water.

On December 20, 2012, the samples from the monitoring wells were collected using disposable, polyvinyl chloride (PVC) bailers and nylon cord while donning dedicated disposable latex gloves. The samples were slowly poured from the bailers into laboratory-supplied containers, and the containers were sealed, labeled, and immediately placed on ice for delivery to a North Carolina certified laboratory. All samples were inventoried on the chain-of-custody document and submitted for analyses. The samples were analyzed by EPA Methods 602 for benzene, toluene, ethyl benzene and xylenes (collectively referred to as BTEX), methyl tertiary butyl ether (MTBE), isopropyl ether (IPE) and naphthalene, Method 625 for semi-volatile compounds, Method 504.1 for ethylene dibromide and 6010B for total lead as well as MADEP Methods for VPH and EPH. The analytical results are discussed in Section 4.3.

4.2 GROUNDWATER OCCURRENCE AND FLOW DIRECTION

During the groundwater sampling event on December 19 and 20, 2012, measurements indicated depth to water at levels in the shallow water table ranging from 10.19 feet below the top of casing in well MW-6

to 14.07 feet below the top of casing in well MW-1. Depth to groundwater was observed at a depth of 14.00 feet below the top of casing in the deeper screened well, MW-2, during the recent groundwater sampling event. The groundwater elevations of the deeper well MW-2 and the shallow well MW-1 were identical during this sampling event.

Utilizing the above data, groundwater elevation contours were constructed for the shallow groundwater table which indicated a potential groundwater flow to southwest with a high at well MW-6.

Table 2 provides a summary of monitoring well construction information of each well. **Table 3** provides a summary of groundwater elevation data and **Figure 4** depicts groundwater elevation contours for December 19, 2012.

4.3 GROUNDWATER ANALYTICAL RESULTS

Laboratory results of groundwater samples obtained on December 20, 2012 indicated the presence of target petroleum compounds in wells MW-5 and MW-7 in excess of North Carolina Standards, as specified within Title 15A of the North Carolina Administrative Code, Subchapter 2L, Section .0202 (herein referred to as 2L Standards). Benzene as well as MADEP Method VPH C_5-C_8 Aliphatics exceeded 2L Standards in samples from well MW-5. Naphthalene was present slightly above 2L Standards in samples from well MW-7. The laboratory results also indicated the presence of Bis (2-ethylhexyl) phthalate slightly above 2L Standards in samples from well MW-2.

Petroleum compounds and/or MADEP Methods for VPH and EPH were detected generally as laboratory estimated values in samples collected from the remainder of the wells (i.e. MW-1, MW-3 through MW-6 and MW-8 through MW-11).

Table 4 provides a summary of laboratory results for water samples and **Table 5** summarizes laboratory results for groundwater by risk-based methods. The estimated extents of benzene and naphthalene are provided in **Figures 5** and **6**. The laboratory report and chain-of-custody form are provided in **Appendix C**.

5.0 REMEDIATION SYSTEM INFORMATION

5.1 SYSTEM DESCRIPTION

Remedial systems at the site include one soil vapor extraction (SVE) units and one air sparging (AS) unit. All systems are mounted within an enclosed trailer which has been placed near the southwest corner of the on-site building. The trailer is compartmentalized into two separate areas. One area encloses the AS equipment and controllers and the other compartment encloses the explosion proof SVE system.

The soil vapor extraction (SVE) system utilizes a separate, seven and one-half three horsepower Ametek regenerative blower, model numbers EN808. The SVE system is equipped with a moisture condensate

tank, air filters, vacuum gauges, pressure relief valves, temperature gauges and other appurtenances. The SVE system was designed to operate 24 hours per day.

The SVE system is designed to recover vapor from one main line. The line is designed to provide a vacuum to six vertical SVE wells (SVE-1 through SVE-6) and is equipped with pressure gauges, flow meters and flow regulating valves.

The air sparging (AS) system utilizes a Gardner Denver, Elmo Rietschle, rotary vane compressor, model V-DLT40. From the compressor, air moves through a flow meter as well as pressure and temperature gauges, and then into the main header. The main header provides air to four separate one-inch diameter supply lines which provide air to each of the four separate air sparge wells (As-1 through AS-4). Each supply line is equipped with pressure gauges, flow meters, and flow regulating valves.

5.2 SYSTEM OPERATION AND MAINTENANCE

The AS and SVE systems were shut-down on November 15, 2011 following the malfunction of the AS compressor. A map of the system layout is provided in **Appendix D**.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations have been made based on readily available information and collected field data, as reported herein.

6.1 CONCLUSIONS

- Laboratory results of soil samples obtained on December 19, 2012 indicated the presence of specific compounds as well as MADEP Methods for VPH and EPH above the STW-MSCC's in sample SS-1. MADEP Methods for VPH exceeded STW-MSCC's and EPH exceeded Residential MSCC's in sample SS-2.
- Laboratory results of groundwater samples obtained on December 20, 2012 indicated the presence of target petroleum compounds above 2L standards in wells MW-5 and MW-7. Benzene as well as MADEP Method VPH C_5-C_8 Aliphatics exceeded 2L Standards in samples from well MW-5. Target compounds were not noted in well MW-5 during system operation but were present prior to system activation. Naphthalene was present slightly above 2L Standards in samples from well MW-7. Petroleum compounds have not been historically noted in well MW-7. The laboratory results also indicated the presence of Bis (2-ethylhexyl) phthalate slightly above 2L Standards in samples from well MW-2. Petroleum compounds and/or MADEP Methods for VPH and EPH were detected generally as laboratory estimated values in samples collected from the remainder of the wells (i.e. MW-1, MW-3 through MW-6 and MW-8 through MW-11).
- The remedial systems are currently not activated.

6.2 RECOMMENDATIONS

- The presence of petroleum impacted soil at concentrations above Standards was verified by soil samples SS-1 and SS-2. The impacted soil has likely contributed the occurrence of petroleum in groundwater noted in well MW-5. Naphthalene has been generally ubiquitous prior to system startup which may explain it's occurrence in well MW-7.
- Continue remedial actions to lower petroleum impacted soil and groundwater concentrations to appropriate cleanup standards. Repair or replace the air sparging compressor and restart the remediation systems.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of Worsley Operating Corporation. The opinions included herein are based on information obtained during the study, on our experience in accordance with currently accepted hydrogeologic and engineering practices, and relevant regulatory guidelines at this time and location. Other than this, no warranty is implied or intended.

TABLES

TABLE 1
SUMMARY OF LABORATORY RESULTS FOR SOIL SAMPLES BY RISK-BASED METHODS
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	SS-1	SB-1B	SB-2	SB-3B	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	SB-13	SB-14B	SOIL-TO-WATER MSCCs	RESIDENTIAL MSCCs	INDUSTRIAL/ COMMERCIAL MSCCs
Sample Depth (ft.) →	5 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7	6 - 7			
Sample Date →	9/20/2004	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	9/20/2007	2/29/2008	2/29/2008	2/29/2008	2/29/2008	2/29/2008			
Analyses →	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH			
Detected Compounds ↓	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
EPA METHOD 8260																		
Acetone	<0.028	<26	<26	<0.051	<15	0.077	<66	<0.052	<0.053	<0.058	<0.060	<0.060	<0.060	<150	<0.054	24	14,000	360,000
Benzene	<0.0011	<0.52	<0.53	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.012	<0.012	<0.012	<2.9	<0.0011	0.0056	18	164
n-Butylbenzene	<0.0011	**7.9**	**5.7**	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	4.3	626	16,350
sec-Butyl benzene	<0.0011	2.8	2.6	<0.0010	1.0	0.0024	<1.3	<0.0010	<0.0011	0.011	<0.0012	<0.0012	<0.0012	**3.3**	<0.0011	3.3	626	16,350
1,2-Dichloropropane	<0.0011	**1.3**	<0.53	<0.0010	<0.30	<0.0012	<1.3	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	0.0034	10	92
Ethylbenzene	<0.0011	**5.8**	3.4	<0.0010	**7.0**	0.010	**8.6**	<0.0010	<0.0011	0.026	<0.0012	<0.0012	<0.0012	**33**	<0.0011	4.9	1,560	40,000
Isopropyl benzene	<0.0011	**2.7**	1.6	<0.0010	1.6	0.0026	**2.0**	<0.0010	<0.0011	0.0084	<0.0012	<0.0012	<0.0012	**7.3**	<0.0011	1.7	1,564	40,880
4-Isopropyl toluene	<0.0011	<0.52	<0.53	<0.0010	**2.8**	0.0058	**3.4**	<0.0010	<0.0011	0.031	<0.0012	<0.0012	<0.0012	**7.2**	<0.0011	0.12	100	4,000
Naphthalene	<0.0057	**19**	**19**	<0.0051	**7.4**	0.019	**16.0**	<0.0052	<0.0053	**0.62**	<0.0060	<0.0060	<0.0060	**41**	<0.0054	0.16	313	8,176
n-Propylbenzene	<0.0011	**12**	**6.1**	<0.0010	**6.4**	0.0098	**8.2**	<0.0010	<0.0011	0.041	<0.0012	<0.0012	<0.0012	**24**	<0.0011	1.7	626	16,350
Toluene	<0.0057	<2.6	<2.6	<0.0051	<1.5	0.0064	<6.6	<0.0052	<0.0053	0.022	<0.0060	<0.0060	<0.0060	**25**	<0.0054	4.3	1,200	32,000
Trichloroethene	<0.0011	**0.91**	**0.89**	<0.0010	**0.49**	<0.0012	**2.2**	<0.0010	<0.0011	<0.0012	<0.0012	<0.0012	<0.0012	<2.9	<0.0011	0.002	10	100
1,2,4-Trimethylbenzene	<0.0011	<0.52	<0.53	<0.0010	**56**	0.081	**75**	<0.0010	0.0020	1.0	<0.0012	<0.0012	<0.0012	**230**	<0.0011	8.5	782	20,440
1,2,3-Trimethylbenzene	NA	0.59	0.56	<0.0010	11	0.025	18	<0.0010	<0.0011	0.34	<0.0012	<0.0012	<0.0012	52	<0.0011	NE	NE	NE
1,3,5-Trimethylbenzene	<0.0011	<0.52	<0.53	<0.0010	**14**	0.025	**20**	<0.0010	<0.0011	0.18	<0.0012	<0.0012	<0.0012	**64**	<0.0011	8.3	782	20,440
Total Xylenes	<0.0034	<1.6	<1.6	< 0.0031	**30**	0.067	**57**	<0.0031	<0.0032	0.32	<0.0036	<0.0036	<0.0036	**210**	<0.0032	4.6	3,129	81,760
EPA METHOD 8270																		
Acenaphthene	<0.38	0.27	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	8.2	940	24,000
Benzo (a) anthracene	**1.1**	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	0.35	0.88	8
Benzo (b) fluoranthene	1.2	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	1.2	0.88	8
Benzo (g,h,i) perylene	0.50	<0.038	<0.039	58	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	6,400	469	12,264
Benzo (k) fluoranthene	0.51	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	12	9	78
Benzo (a) pyrene	**1.2**	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	0.096	0.088	0.78
Chrysene	1.2	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	39	88	780
Fluoranthene	2.2	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	276	620	16,400
Fluorene	<0.38	0.46	<0.039	<0.034	<0.039	<0.040	0.046	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	47	620	16,400
Ideno (1,2,3-cd) pyrene	0.48	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	3.4	0.88	8
Naphthalene	<0.38	<0.038	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	**15**	<0.36	0.16	313	8,176
Phenanthrene	0.97	0.76	<0.039	<0.034	<0.039	<0.040	0.051	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	56	469	12,264
Pyrene	1.8	0.089	<0.039	<0.034	<0.039	<0.040	<0.037	<0.034	<0.035	<0.038	<0.39	<0.40	<0.40	<7.8	<0.36	270	469	12,264
MADEP METHODS FOR VPH & EPH																		
C_9-C_{10} Aromatics	<5.7	**370**	**330**	<15	**350**	<15	**390**	<12	<13	<15	<15	<17	<15	**870**	<5.4	34	469	12,264
C_{11}-C_{22} Aromatics	<6.2	**1,600**	**1,200**	<6.7	8.8	**51**	23	27	12	16	<7.8	<7.9	<7.8	**300**	<7.0			
C_5-C_8 Aliphatics	<5.7	**260**	**74**	<15	**190**	<15	**300**	<12	<13	<15	<15	<17	<15	**510**	<5.4	68	939	24,528
C_9-C_{12} Aliphatics	<5.7	**950**	**740**	<15	**760**	20	**880**	<12	<13	<15	<15	<17	<15	**2,000**	<5.4	540	1,500	40,000
C_9-C_{18} Aliphatics	<6.2	**2,900**	**2,500**	<6.7	<7.6	24	47	<6.7	<6.9	<7.5	<7.8	<7.9	<7.8	140	<7.0			
C_{19}-C_{36} Aliphatics	<6.2	790	740	<6.7	<7.6	30	11	8.6	<6.9	<7.5	<7.8	<7.9	<7.8	70	<7.0	#	31,000	810,000

SB - 1B
SB - 2
SB - 13

TABLE 1 (CONTINUED)
SUMMARY OF LABORATORY RESULTS FOR SOIL SAMPLES BY RISK-BASED METHODS
SCOTCHMAN #35
7158 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	SS-1	SS-2	SS-3	SS-4	SOIL-TO-WATER MSCCs	RESIDENTIAL MSCCs	INDUSTRIAL/COMMERCIAL MSCCs
Sample Depth (ft.) →	6 - 8	6 - 8	6 - 8	6 - 8			
Sample Date →	12/19/2012	12/19/2012	12/19/2012	12/19/2012			
Analyses →	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH	EPA Methods 8260 & 8270 & MADEP VPH & EPH			
Detected Compounds ↓	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
EPA METHOD 8260							
n-Butylbenzene	<0.22	<0.049	<0.0012	0.013	4.3	626	16,350
sec-Butyl benzene	0.15J	<0.049	<0.0012	0.011	3.3	626	16,350
tert-Butyl benzene	0.058J	0.011J	<0.0012	0.00069J	3.4	626	16,350
Ethylbenzene	<0.22	<0.049	<0.0012	0.088	4.9	1,560	40,000
Isopropyl benzene	<0.22	<0.049	<0.0012	0.021	1.7	1,564	40,880
4-Isopropyl toluene	**3.2**	<0.049	<0.0012	0.041	0.12	100	4,000
Naphthalene	**2.9**	<0.24	<0.0058	0.16	0.16	313	8,176
n-Propylbenzene	<0.22	<0.049	<0.0012	0.056	1.7	626	16,350
Toluene	<1.1	<0.24	<0.0058	0.049	4.3	1,200	32,000
1,2,4-Trimethylbenzene	1.8	0.011J	<0.0012	0.00054J	8.5	782	20,440
1,2,3-Trimethylbenzene	16	0.029J	<0.0012	<0.0011	NE	NE	NE
1,3,5-Trimethylbenzene	**15**	0.016J	0.00037J	<0.0011	8.3	782	20,440
Total Xylenes	0.44J	<0.15	<0.0035	0.83	4.6	3,129	81,760
EPA METHOD 8270							
Anthracene	<0.75	0.66J	<0.038	<0.036	940	4,600	122,000
Fluorene	0.32J	0.38J	<0.038	<0.036	47	620	16,400
Isophorone	0.68J	0.70J	<0.39	<0.36	NE	NE	NE
Naphthalene	**4.8**	<1.9	0.065	<0.036	0.16	313	8,176
Phenanthrene	0.28J	0.70J	<0.038	<0.036	56	469	12,264
MADEP METHODS FOR VPH & EPH							
C_9-C_{10} Aromatics	**160**	**40**	5.1	<4.9	34	469	12,264
C_{11}-C_{22} Aromatics	**230B**	**1200B**	7.0JB	4.2JB			
C_5-C_8 Aliphatics	6.5J	2.0J	2.0J	0.86J	68	939	24,528
C_9-C_{12} Aliphatics	350	77	12	0.76J	540	1,500	40,000
C_9-C_{18} Aliphatics	500	**3,200**	8.4	5.9J			
C_{19}-C_{36} Aliphatics	44	940	2.7J	10	#	31,000	810,000

Notes:
Samples correspond to borings: SS-1 to CB-1, SS-2 to CB-3, SS-3 to CB-5, and SS-4 to CB-6
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is method detection limit.
- Analytical results are presented in milligrams per kilogram (mg/kg).
- Analytical results exceeding Soil-to-Water Maximum Soil Contaminant Concentrations (MSCCs) are in ***Bold*** type.
- Analytical results exceeding Residential MSCCs are shaded.
- No other compounds were detected at levels above laboratory quantitation limits
- # Considered immobile
- NE denotes narrative standard not available
- J suffix denotes estimated value
-B suffix denotes compound found in both method blank and sample

TABLE 2
SUMMARY OF MONITORING AND REMEDIATION WELL CONSTRUCTION DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Installation Date	Well Diameter (inches)	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)
MW-1	9/20/2004	2	20	5 - 20	94.45 94.95
MW-2	9/20/2004	2	30	25 - 30	94.88
MW-3	9/20/2004	2	20	5 - 20	94.77
MW-4	9/20/2004	2	20	5 - 20	94.79
MW-5	9/20/2004	2	20	5 - 20	94.66
MW-6	9/20/2007	2	15	4.25-14.25	94.68
MW-7	9/20/2007	2	15	5 - 15	94.32
MW-8	9/21/2007	2	18	3 - 18	95.06
MW-9	9/21/2007	2	20	5 - 20	94.34
MW-10	9/21/2007	2	18	3 - 18	94.52
MW-11	9/21/2007	2	18	3 - 18	94.74
OB-1	11/25/2008	2	20	2 - 20	NA
SVE-1	11/25/2008	2	8	2 - 8	NA
SVE-2	8/24/2009	2	9	4 - 9	NA
SVE-3	8/24/2009	2	9	4 - 9	NA
SVE-4	8/24/2009	2	9	4 - 9	NA
SVE-5	8/24/2009	2	9	4 - 9	NA
SVE-6	8/24/2009	2	9	4 - 9	NA
AS-1	8/25/2009	2	30	27 - 30	NA
AS-2	8/25/2009	2	30	27 - 30	NA
AS-3	8/25/2009	2	30	27 - 30	NA
AS-4	8/25/2009	2	29	26 - 29	NA

NOTES:
1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation.
3. Wells installed prior to 2007 completed by others

TABLE 3
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-1	20	5 - 20	94.45	10/4/2004	10.32	--	84.13
			94.95	9/24/2007	15.63	--	79.32
				12/5/2008	12.50	--	82.45
				5/13/2010	13.65	--	81.30
				11/10/2010	11.49	--	83.46
				5/11/2011	14.27	--	80.68
				12/6/2011	14.63	--	80.32
				6/26/2012	15.01	--	79.94
				12/19/2012	14.07	--	80.88
MW-2	30	25 - 30	94.88	10/4/2004	10.47	--	84.41
				9/24/2007	15.57	--	79.31
				12/5/2008	12.71	--	82.17
				5/13/2010	13.33	--	81.55
				11/10/2010	12.51	--	82.37
				5/11/2011	14.23	--	80.65
				12/6/2011	14.54	--	80.34
				6/26/2012	14.94	--	79.94
				12/19/2012	14.00	--	80.88
MW-3	20	5 - 20	94.77	10/4/2004	9.65	--	85.12
				9/24/2007	15.23	--	79.54
				12/5/2008	10.56	--	84.21
				5/13/2010	10.91	--	83.86
				11/10/2010	9.80	--	84.97
				5/11/2011	13.15	--	81.62
				12/6/2011	14.28	--	80.49
				6/26/2012	14.69	--	80.08
				12/19/2012	13.72	--	81.05
MW-4	20	5 - 20	94.79	10/4/2004	9.39	--	85.40
				9/24/2007	11.68	--	83.11
				12/5/2008	9.84	--	84.95
				5/13/2010	10.57	--	84.22
				11/10/2010	9.35	--	85.44
				5/11/2011	13.01	--	81.78
				12/6/2011	13.51	--	81.28
				6/26/2012	13.08	--	81.71
				12/19/2012	12.22	--	82.57

TABLE 3
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-5	20	5 - 20	94.66	10/4/2004	7.28	--	87.38
				9/24/2007	15.25	--	79.41
				12/5/2008	12.12	--	82.54
				5/13/2010	13.19	--	81.47
				11/10/2010	10.18	--	84.48
				5/11/2011	14.03	--	80.63
				12/6/2011	14.34	--	80.32
				6/26/2012	14.75	--	79.91
				12/19/2012	13.63	--	81.03
MW-6	15	4.25-14.25	94.68	9/24/2007	8.21	--	86.47
				12/5/2008	7.73	--	86.95
				5/13/2010	7.97	--	86.71
				11/10/2010	7.44	--	87.24
				5/11/2011	9.58	--	85.10
				12/6/2011	11.20	--	83.48
				6/26/2012	12.32	--	82.36
				12/19/2012	10.19	--	84.49
MW-7	15	5 - 15	94.32	9/24/2007	10.02	--	84.30
				12/5/2008	8.67	--	85.65
				5/13/2010	9.12	--	85.20
				11/10/2010	8.03	--	86.29
				5/11/2011	10.57	--	83.75
				12/6/2011	11.62	--	82.70
				6/26/2012	12.24	--	82.08
				12/19/2012	11.38	--	82.94
MW-8	18	3 - 18	95.06	9/24/2007	15.38	--	79.68
				12/5/2008	10.55	--	84.51
				5/13/2010	11.90	--	83.16
				11/10/2010	12.06	--	83.00
				5/11/2011	13.94	--	81.12
				12/6/2011	14.19	--	80.87
				6/26/2012	12.78	--	82.28
				12/19/2012	12.64	--	82.42
MW-9	20	5 - 20	94.34	9/24/2007	14.79	--	79.55
				12/5/2008	11.89	--	82.45
				5/13/2010	12.77	--	81.57
				11/10/2010	11.43	--	82.91
				5/11/2011	13.38	--	80.96
				12/6/2011	13.72	--	80.62
				6/26/2012	14.08	--	80.26
				12/19/2012	13.17	--	81.17

TABLE 3
SUMMARY OF WELL CONSTRUCTION AND GROUNDWATER ELEVATION DATA
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Well Depth (ft, bgs)	Well Screen Interval (ft, bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft, TOC)	Depth to Free Product (ft, TOC)	Adjusted Groundwater Elevation (ft)
MW-10	18	3 - 18	94.52	9/24/2007	14.55	--	79.97
				12/5/2008	10.32	--	84.20
				5/13/2010	9.98	--	84.54
				11/10/2010	9.09	--	85.43
				5/11/2011	11.11	--	83.41
				12/6/2011	12.25	--	82.27
				6/26/2012	13.18	--	81.34
				12/19/2012	12.11	--	82.41
MW-11	18	3 - 18	94.74	9/24/2007	15.45	--	79.29
				12/5/2008	12.07	--	82.67
				5/13/2010	11.61	--	83.13
				11/10/2010	9.88	--	84.86
				5/11/2011	14.11	--	80.63
				12/6/2011	14.50	--	80.24
				6/26/2012	14.88	--	79.86
				12/19/2012	13.91	--	80.83

NOTES:

1. Well depths represent number of feet from the top-of-casing to bottom of well.
2. Top-of-casing elevations are based on an arbitrary benchmark elevation of 100 feet above mean sea level.
3. The depth to water and depth to free product were measured from the top-of-casing.
4. Adjusted grpoundwater elevations are based on top-of-casing elevations minus the depth to water, whereas
5. (--) denotes free product was not detected in monitoring well at this time.
6. Measurements collected prior to 9/24/07 obtained by others

TABLE 4
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*600*	*600*	*500*	*20*	*70*	*6*
MW-1	10/4/2004	**30**	<100	**760**	**830**	<20	<20	**270**
	9/24/2007	**2.1**	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**42**	12	94	110	5.8	<1.0	**70**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	**83**	81	5.3	110	3.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	0.86J
MW-2	10/4/2004	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<10
	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	**8.3**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-3	10/4/2004	**260**	**1,900**	490	**2,600**	<100	<70	**120**
	9/24/2007	**18**	<50	190	220	<10	<10	<50
	12/5/2008	**41**	550	590	**2,500**	<1.0	<1.0	**170**
	5/13/2010	**13.2**	382	515	**1,921**	<1.0	<1.0	**285**
	11/10/2010	<5.0	25	390	**1,300**	<5.0	<5.0	**160**
	5/11/2011	<1.0	<5.0	69	27	<1.0	<1.0	**23**
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-4	10/4/2004	**23**	220	65	**750**	<10	<10	**12**
	9/24/2007	**3.7**	5.9	56	67	<1.0	<1.0	5.2
	12/5/2008	<1.0	<5.0	1.3	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	2.7	29.8	15.0	<1.0	<1.0	**15.0**
	11/10/2010	<1.0	<5.0	1.8	6.8	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	4.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

TABLE 4
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*600*	*600*	*500*	*20*	*70*	*6*
MW-5	10/4/2004	**12**	<50	<10	<30	**270**	<10	<10
	9/24/2007	<1.0	<5.0	18	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**87**	47	380	**640**	15	<1.0	**170**
	5/13/2010	**28.0**	28.7	1.2	48.3	10.7	<1.0	<2.0
	11/10/2010	**7.3**	14	11	20	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	**140**	220	53	440	1.6	<1.0	<25
MW-6	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-7	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	**7.4**
MW-8	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	**12**
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-9	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

TABLE 4
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES
SCOTCHMAN #35
7162 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Well No.	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Total Xylenes (ug/L)	MTBE (ug/L)	IPE (ug/L)	Naphthalene (ug/L)
2L Standards		*1*	*600*	*600*	*500*	*20*	*70*	*6*
MW-10	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/13/2010	<1.0	<1.0	<1.0	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
MW-11	9/24/2007	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/5/2008	**1.7**	<5.0	18	<3.0	<1.0	<1.0	**6.5**
	5/13/2010	**1.5**	<1.0	2.8	<3.0	<1.0	<1.0	<2.0
	11/10/2010	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	5/11/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/6/2011	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	6/26/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0
	12/20/2012	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<5.0

NOTES:
1. Analytical results expressed in micrograms per liter (ug/L)
2. MTBE is an abbreviation for methyl tertiary butyl ether
3. IPE is an abbreviation for isopropyl ether
4. Analytical result exceeding 2L Standard is in bold type.
5. NA is an abbreviation for not available
6. Measurements obtained prior to 9/24/07 obtained by others

TABLE 5

SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES BY RISK-BASED METHODS

SCOTCHMAN #35

7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	MW-7		MW-8		MW-9		MW-10		MW-11			
Sample Date →	9/24/2007	12/20/2012	9/24/2007	12/20/2012	9/24/2007	12/20/2012	9/24/2007	12/20/2012	9/24/2007	12/20/2012		
Analyses →	EPA 602 & 625, MADEP VPH & EPH	EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH	EPA 602 & 625, MADEP VPH & EPH	EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH	NCAC 2L Groundwater Quality Standards	Gross Contaminant Levels (GCLs)
Detected Compounds ↓	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)	Compound Concentrations (ug/L)
EPA Method 601 and/or 602												
Benzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5,000
Toluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	600	260,000
Ethylbenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	600	84,500
Total Xylenes	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	500	85,500
MTBE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	20	20,000
IPE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	70	70,000
Naphthalene	<5.0	**7.4**	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6	6,000
SM 3030C or 6010B												
Lead	NA	<5.0	NA	<5.0	NA	<5.0	NA	<5.0	NA	<5.0	15	15,000
EPA METHOD 504.1												
EDB	NA	<0.010	NA	<0.010	NA	<0.010	NA	<0.010	NA	<0.010	0.02	50
EPA METHOD 625												
Chrysene	<10	<20	<10	<20	<10	<1.0	<10	<20	<10	<20	5	5
Fluoranthene	<10	<20	<10	<20	<10	<1.0	<10	<20	<10	<20	300	300
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	1,000
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30	12,500
Naphthalene	<10	<20	<10	<20	<10	<1.0	<10	<20	<10	<20	6	6,000
Bis (2-ethylhexyl) phthalate	<10	<20	<10	<20	<10	0.75J	<10	<20	<10	<20	3	170
Dimethyl phthalate	<10	<20	<10	<20	<10	<1.0	<10	<20	<10	<20	NE	NE
Pyrene	<10	<20	<10	<20	<10	<1.0	<10	<20	<10	<20	200	200
4-Chloro-3-methylphenol	<10	<200	<10	<200	<10	<10	<10	<200	<10	<200	NE	NE
2,4-Dimethylphenol	<10	<200	<10	<200	<10	<10	<10	<200	<10	<200	100	100,000
Phenol	<10	<200	<10	<200	<10	<10	<10	<200	<10	<200	30	30,000
MADEP METHODS FOR VPH & EPH												
C_5-C_8 Aliphatics (VPH)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	400	NE
C_9-C_{12} Aliphatics (VPH)	<100	8.4J	<100	<100	<100	<100	<100	8.7J	<100	<100	700	NE
C_9-C_{18} Aliphatics (EPH)	<100	35J	<100	31J	<100	38J	<100	33J	<100	34J		
C_{19}-C_{36} Aliphatics (EPH)	<100	46J	<100	20J	<100	42J	<100	47J	<100	140	10,000	NE
C_9-C_{10} Aromatics (VPH)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	200	NE
C_{11}-C_{22} Aromatics (EPH)	<100	110	<100	38J	<100	26J	<100	40J	<100	28J		

NOTES:

- MW-1 to MW-5 sampled and analyzed by others during Phase II LSA activities
- Analytical results presented in micrograms per liter (ug/L).
- < denotes analytical result below laboratory method detection limit. Number to right of symbol is the method detection limit.
- NE denotes narrative standard has not been established for compound.
- NA denotes that this sample was not analyzed for this compound
- Analytical results exceeding NCAC 2L Groundwater Quality Standards are in **Bold** type.
- All other compounds were below quantitation limits.

TABLE 5

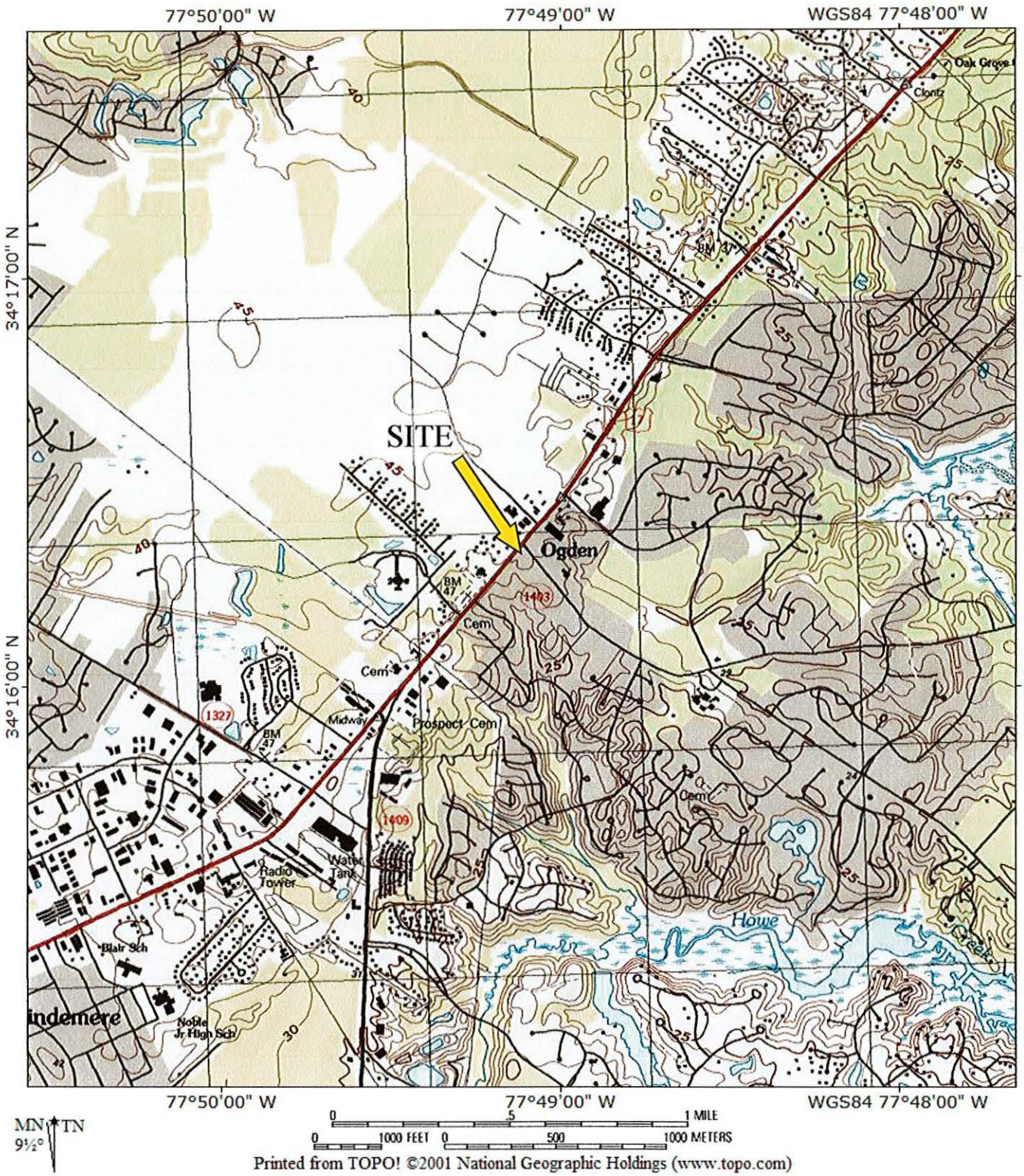
SUMMARY OF LABORATORY RESULTS FOR GROUNDWATER SAMPLES BY RISK-BASED METHODS

SCOTCHMAN #35

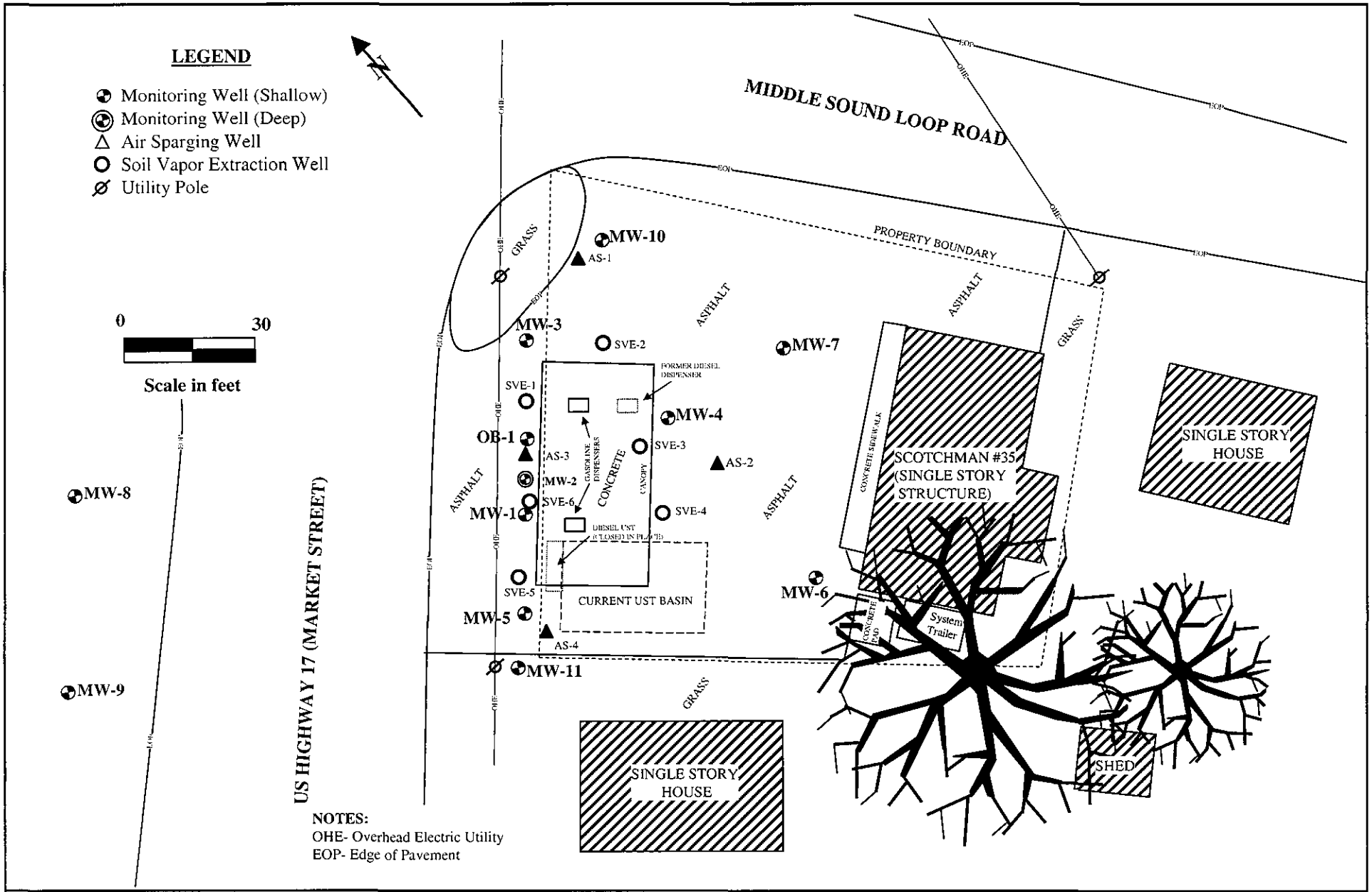
7160 MARKET STREET (US HIGHWAY 17), WILMINGTON, NORTH CAROLINA

Sample ID →	MW-1		MW-2		MW-3		MW-4		MW-5		MW-6			
Sample Date →	10/4/2004	12/20/2012	10/4/2004	12/20/2012	10/4/2004	12/20/2012	10/4/2004	12/20/2012	10/4/2004	12/20/2012	9/24/2007	12/20/2012		
Analyses →	**EPA 601, 602, 625, 504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**EPA 601, 602, 625,504.1 (EDB), MADEP VPH & EPH & SM3030C (Pb)**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**EPA 602 & 625, MADEP VPH & EPH**	**EPA 602, 625, 504.1 (EDB), 6010B (Pb), MADEP VPH & EPH**	**NCAC 2L Groundwater Quality Standards**	**Gross Contaminant Levels (GCLs)**
Detected Compounds ↓	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**	**Compound Concentrations (ug/L)**
EPA METHOD 601 and/or 602														
Benzene	**30**	<1.0	<1.0	<1.0	**260**	<1.0	**23**	<1.0	**12**	**140**	<1.0	<1.0	1	5,000
Toluene	<100	<5.0	<5.0	<5.0	**1,900**	<5.0	220	<5.0	<50	220	<5.0	<5.0	600	260,000
Ethylbenzene	**760**	<1.0	<1.0	<1.0	490	<1.0	65	<1.0	<10	53	<1.0	<1.0	600	84,500
Total Xylenes	**830**	<3.0	<3.0	<3.0	**2,600**	<3.0	**750**	<3.0	<30	440	<3.0	<3.0	500	85,500
MTBE	<20	<1.0	<1.0	<1.0	<100	<1.0	<10	<1.0	**270**	1.6	<1.0	<1.0	20	20,000
IPE	<20	<1.0	<1.0	<1.0	<70	<1.0	<10	<1.0	<10	<1.0	<1.0	<1.0	70	70,000
Naphthalene	NA	0.86J	NA	<5.0	NA	<5.0	NA	<5.0	NA	<25	<5.0	<5.0	6	6,000
SM 3030C or 6010B														
Lead	**34**	<5.0	<5.0	<5.0	6.3	<5.0	7.6	<5.0	7.0	<5.0	NA	<5.0	15	15,000
EPA METHOD 504.1														
EDB	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	0.02	50
EPA METHOD 625														
Chrysene	<50	<1.0	<10	0.30J	<50	<1.0	<10	<20	<10	<1.0	<10	<20	5	5
Fluoranthene	<50	<1.0	<10	0.54J	<50	<1.0	<10	<20	<10	<1.0	<10	<20	300	300
1-Methylnaphthalene	**88**	NA	<10	NA	<50	NA	<10	NA	<10	NA	NA	NA	1	1,000
2-Methylnaphthalene	**140**	NA	<10	NA	<50	NA	<10	NA	<10	NA	NA	NA	30	12,500
Naphthalene	**270**	<1.0	<10	<1.0	**120**	<1.0	**12**	<20	<10	1.7	<10	<20	6	6,000
Bis (2-ethylhexyl) phthalate	<50	0.53J	<10	**4.4**	<50	0.67J	<10	<20	<10	0.56J	<10	<20	3	170
Dimethyl phthalate	<50	<1.0	<10	3.4	<50	<1.0	<10	<20	<10	<1.0	<10	<20	NE	NE
Pyrene	<50	<1.0	<10	0.39J	<50	<1.0	<10	<20	<10	<1.0	<10	<20	200	200
4-Chloro-3-methylphenol	<50	<10	<10	0.51J	<50	<10	<10	<200	<10	<10	<10	<200	NE	NE
2,4-Dimethylphenol	<50	<10	<10	<10	<50	<10	<10	<200	<10	5.4J	<10	<200	100	100,000
Phenol	<50	<10	<10	<10	<50	<10	<10	<200	<10	3.4J	<10	<200	30	30,000
MADEP METHODS FOR VPH & EPH														
C_5-C_8 Aliphatics (VPH)	**1,300**	<100	<100	<100	**6,100**	<100	**570**	<100	370	**630**	<100	<100	400	NE
C_9-C_{12} Aliphatics (VPH)	**6,100**	<100	280	<100	**12,000**	10J	670	11J	210	580	<100	13J	700	NE
C_9-C_{18} Aliphatics (EPH)	<100	34J	260	42J	130	28J	<100	28J	<100	30J	<100	36J		
C_{19}-C_{36} Aliphatics (EPH)	<100	25J	<100	120	<100	27J	<100	25J	<100	33J	<100	29J	10,000	NE
C_9-C_{10} Aromatics (VPH)	**4,700**	<100	150	<100	**5,800**	<100	**280**	<100	<100	120	<100	<100	200	NE
C_{11}-C_{22} Aromatics (EPH)	**330**	48J	<100	34J	120	40J	<100	39J	<100	33J	<100	34J		

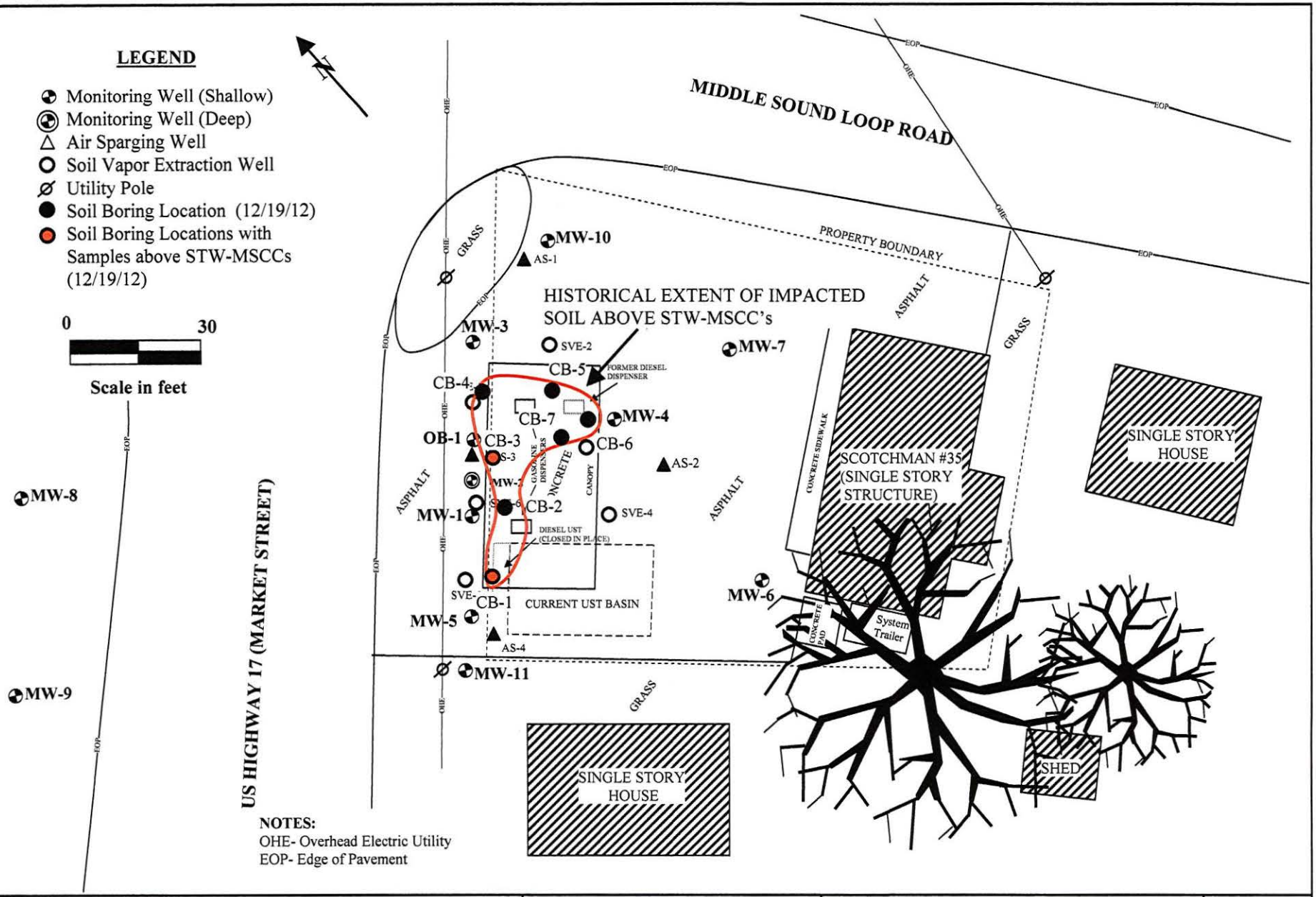
FIGURES



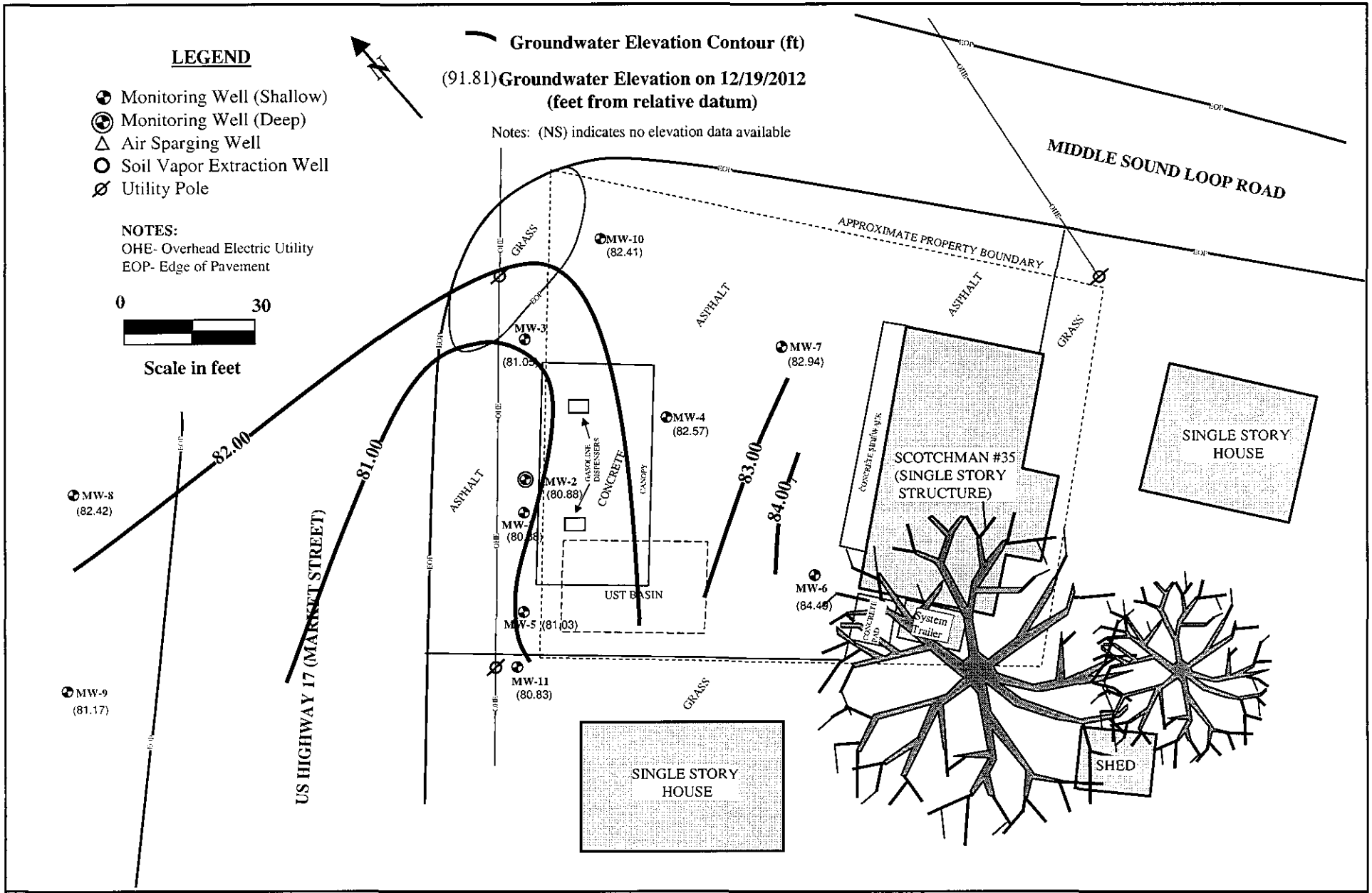
Environmental Services & Solutions, PLLC P.O. Box 12055, Wilmington, NC 28405 Telephone: (910) 392-3050	Title: Topographic Vicinity Map		Figure No. 1
Drawn By: BKL	Date: 5-5-08	Location: Scotchman #35 Wilminmgton, NC	
Checked By: FP	Date: 5-5-08		



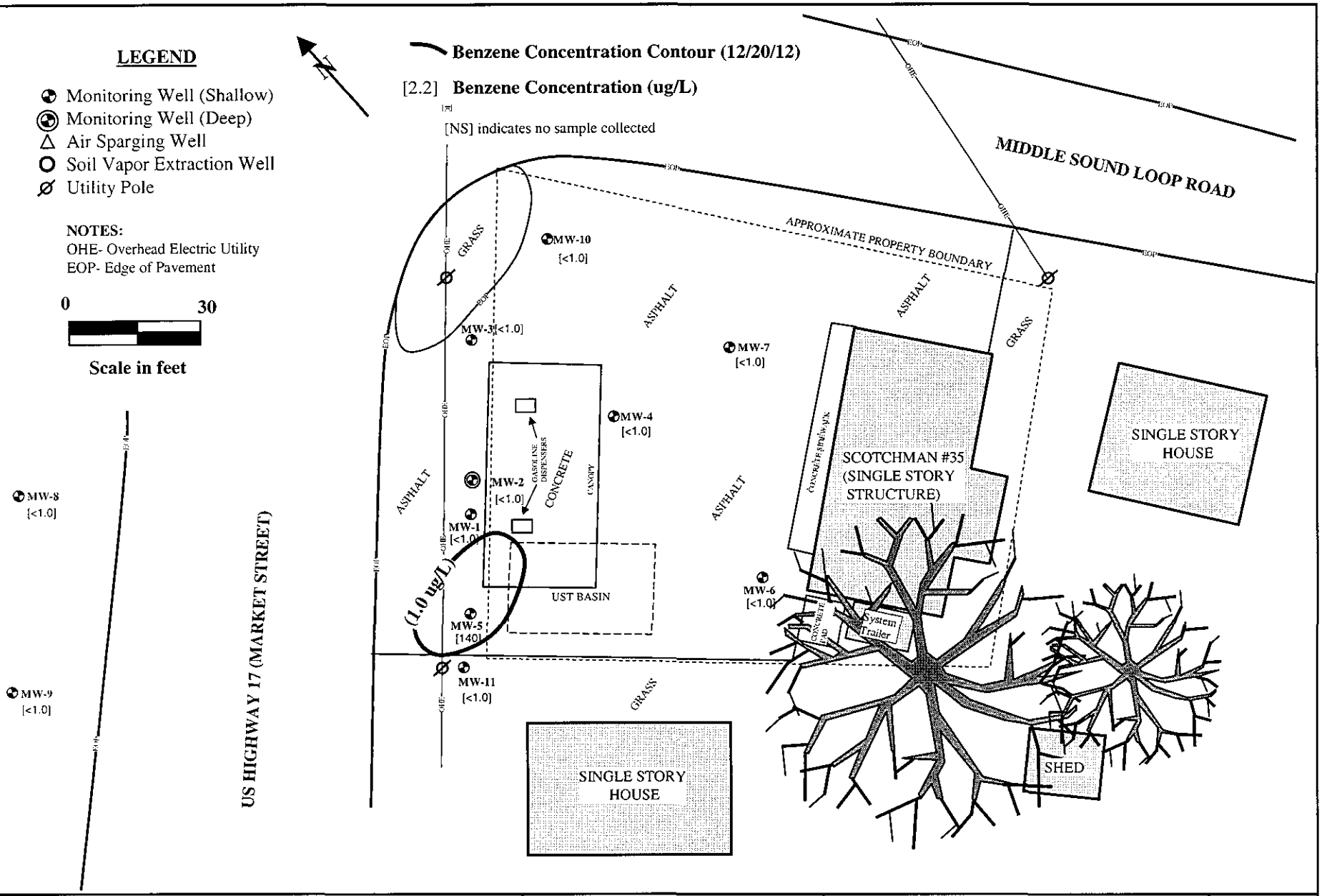
Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 12/26/12	Title: Site Map	Figure No. 2
	Checked By: BKL Date: 12/26/12	Location: Scotchman #35 Wilmington, NC	



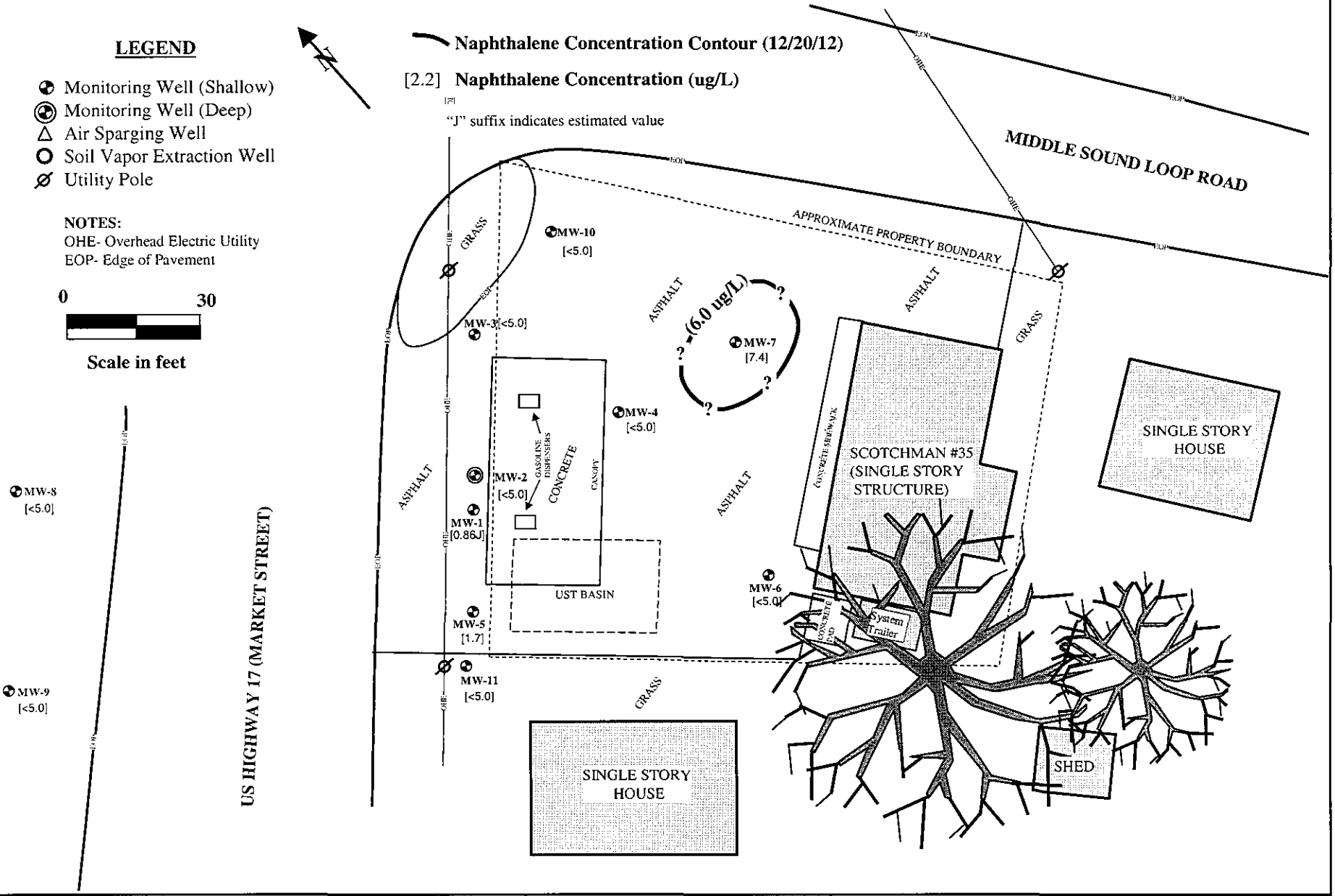
Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 12/26/12	Title: Site Map	Figure No. 3
	Checked By: BKL Date: 12/26/12	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 12/26/12	Title: Groundwater Elevation Contour Map (12/19/12)	Figure No. 4
	Checked By: FP	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 1/8/13	Title: Esimtated Horizontal Extent of Benzene above 2L Standards (12/20/12)	Figure No. 5
	Checked By: FP	Location: Scotchman #35 Wilmington, NC	



Environmental Services & Solutions, PLLC **P.O. Box 12055, Wilmington, NC 28405** **Telephone: (910) 392-3050**	Drawn By: MHH Date: 1/8/13	Title: Esimtated Horizontal Extent of Naphthalene above 2L Standards (12/20/12)	Figure No. 6
	Checked By: FP	Location: Scotchman #35 Wilmington, NC	

APPENDIX A

North Carolina Department of Environment and Natural Resources
Division of Waste Management
Dexter R. Matthews
Director

Beverly Eaves Perdue
Governor

Dee Freeman
Secretary

September 5, 2012

Mr. Kurt Evers
Worsley Operating Corporation
P. O. Box 3227
Wilmington, NC 28406

Re: Review of Remediation Monitoring Report
Scotchman #35
7160 Market Street, New Hanover County
Incident #32152
Risk Classification: high, Ranking: 287A

Dear Mr Evers:

The Remediation Monitoring Report received on August 21, 2012 has been reviewed by the UST Section, Wilmington Regional Office. Levels of groundwater contamination remain below the current groundwater standards. Please conduct one additional groundwater monitoring event in December 2012.

Prior to closure of a high risk site, it must be demonstrated that soil contamination does not exceed the lowest of the soil-to-groundwater and the residential mscc. Data collected in the CSA indicates that soil contamination is above these values in soil boring samples SB-1B, SB-2, SB-4, SB-6 and SB-13. Some values even exceed the residential mscc. This soil must be remediated by some method prior to site closure.

If you have any questions regarding this letter, please contact me at the address or telephone number listed below.

Sincerely,

Deborah Mayo
Hydrogeologist
Wilmington Regional Office

cc: Environmental Services and Solutions –Bryan Lievre
WiRO

UST Regional Offices

Asheville (ARO) – 2090 US Highway 70, Swannanoa, NC 28778 **(828) 296-4500**

Fayetteville (FAY) – 225 Green Street, Suite 714, Systel Building, Fayetteville, NC 28301 **(910) 433-3300**

Mooresville (MOR) – 610 East Center Avenue, Suite 301, Mooresville, NC 28115 **(704) 663-1699**

Raleigh (RRO) – 1628 Mail Service Center, Raleigh, NC 27699 **(919) 791-4200**

Washington (WAS) – 943 Washington Square Mall, Washington, NC 27889 **(252) 946-6481**

Environmental Services & Solutions, PLLC
P.O. Box 12055
Wilmington, North Carolina 28405
Telephone: (910) 392-3050

September 14, 2012

VIA HAND DELIVERY

North Carolina Department of Environment and Natural Resources
Division of Waste Management, UST Section
Attn: Ms. Deborah Mayo
127 Cardinal Drive Extension
Wilmington, North Carolina 28405-3845

Re: Directed Preapproval/Claim Authorization
Scotchman #35
7160 Market Street, Wilmington, North Carolina
Incident No. 32152
Risk Classification: High (287A)

Dear Ms. Mayo:

Please accept this letter and attachments on behalf of our client, Worsley Operating Corporation for your review and approval of proposed activities at the site referenced above, as requested in correspondence from your office dated September 5, 2012. Proposed activities generally include the costs of obtaining soil and groundwater samples and submission of a summary report in hopes of gaining closure for the site.

Attached are a Directed Preapproval/Claim Authorization Form and a summary table, which provides details regarding the proposed costs. Please feel free to contact me at (910) 470-7066 if you have any questions or comments regarding this or other matters.

Respectfully yours,

Bryan K. Lievre, P.E.
President

Enclosures
cc: Mr. Kurt Evers, Worsley Operating Corp., PO Box 3227 Wilmington, NC 28406

PREAPPROVAL TASK AUTHORIZATION FORM

Department of Environment & Natural Resources - Division of Waste Management

Site Name	Scotchman #35	City / County	Wilmington/New Hanover	Incident #	32152
Responsible Party	Worsley Operating Corp	Incident Mgr	Deborah Mayo	Region	WiRO
Type *(Owner/Operator / Landowner / Attorney-in-fact)*	Owner	**TA Supplement / Change Order?**	No	**Prev. TA #**	32152-16
Primary Consultant	Environmental Services & Solutions, PLLC	*(Reserved for Incident Manager)*			
Phone / Fax Number	910-470-7066 / 910-392-3050	*Task Authorization Number:*			
Project Mgr / Email	Bryan Llevre / BKLwithESS@aol.com	*Site Risk / Rank / Abatement:*			
Proposal# / Scope Dates	NA / 9-13-2012	*Type (Comm / NonComm / Both)*			
Has STF Eligibility Been Determined?	YES / NO / Pending	***Site Status** (Active or NFA/Date)*			

Note: This form should be used to receive preapproval from the UST Section. A proposal must be attached to elaborate on the costs for the tasks listed below that describes the scope of work and the rationale for the proposed activities. If you discover that unexpected tasks must be performed, incurring costs that exceed the amount preapproved in this authorization, you must complete and submit a separate preapproval request designated as a "**TA Supplement / Change Order**" in the provided space above. Include a copy of the prior preapproval form as well. Please attach this form to the cover of the corresponding claim when requesting reimbursement. **IMPORTANT:** Only one claim may be submitted during a quarter or 3-month period. All preapprovals submitted within a claim are closed with that claim. Final reimbursement of costs associated with the **Total Claimed** amount below may vary depending on the eligibility status of the site (i.e., deductibles, apportionment, etc.), and the documentary validation of incurred costs as reasonable and necessary expenses per 15A NCAC 2P .0402 and .0404.

With Claim: • **Attach all Main Consultant/Contractor invoices.** • **Attach proof of payment directly to the front of each invoice.**

***Important: The date of reimbursement of costs approved herein is dependent on the balance of funds in the Trust Fund. There may be a delay in the reimbursement of claims for work done.**

PREAPPROVAL / TASK AUTHORIZATION

(See Instructions / RRD for Tasks requiring Preapproval / Task Authorization)

FINAL REIMBURSEMENT

(Must Complete with Claim Submittal)

3rd Pty? (Y)	Task #	Lab Code#	Proposed Units / Type *(Consultant)*	RO Auth	Proposed Rate/Price *(Consultant)*	CO Auth	Proposed Task Subtotal *(Consultant)*	Preapproved Subtotal *(UST Section)*	Dates of Work[1] *(Consultant)* Started / Completed	Claimed Amount[2] *(Consultant)*
	3.101		70 feet		$10.00		$700.00		/	
	3.111		70 feet		$15.00		$1,050.00		/	
	3.398		1 event		$350.00		$350.00		/	
	4.031		11 wells		$155.00		$1,705.00		/	
	4.090	409	4 samples		$97.00		$388.00		/	
	4.090	410	4 samples		$193.00		$772.00		/	
	4.090	421	4 samples		$63.00		$252.00		/	
	4.090	422	4 samples		$111.00		$444.00		/	
	4.090	272	11 samples		$43.00		$473.00		/	
	4.090	301	11 samples		$231.00		$2,541.00		/	
	4.090	341	11 samples		$61.00		$671.00		/	
	4.090	342	11 samples		$111.00		$1,221.00		/	
	4.090	331	11 samples		$15.00		$165.00	$	/	
	4.090	280	11 samples		$49.00		$539.00		/	
	6.101		1 report		$889.00		$889.00		/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	
			/						/	

	Requested	*Preapproved*		*Claimed*[2]
TOTAL:	$12,160.00		**TOTAL:**	
Total Standard Costs (Not Third Party)	$0.00		***Total Standard Costs***	
Total applied as Third Party Deductible/Damage Costs	$0.00		***Total Third Pty Costs***	

Main Consultant — Project Mgr Signature: Bryan K. Llevre — Date: 9/14/12

UST Section — RO Task Authorization: — Date[1]:

CO Rate Authorization: — Date[1]:

1 - **Task Authorization expires one year from the latter of the RO or CO Authorization dates. Note: Tasks must also be claimed within one year of completion. The one-year deadline from the authorization date does not supercede other regulatory deadlines (e.g., NORR's, NOV's, Enforcements, Remissions, etc.)**

2 - **Only Tasks included on this PATA form may be claimed. Do not include other Tasks or claimed costs (i.e., Claim preparation) that were not preapproved.**

Table 1
Cost Estimate for Trust Fund Pre-Approval
Scotchman #35
7158 Market Street, Wilmington, North Carolina

Task	Activity	Unit Cost	# Units	Total	Assumptions/Reasoning
3.101	Drilling Supervision	$10.00 /ft	70	$700.00	
3.111	Drilling - Soil Boring	$15.00 /ft	70	$1,050.00	Est 7 borings at up to 10 feet deep, each
3.398	Drill Rig Mobilization	$350.00 /event	1	$350.00	
4.031	Cost for Sampling Well	$155.00 /well	11	$1,705.00	Sample all monitoring wells in 12/2012 (MW-1 to MW-11)
4.090	Analytical & Shipping				
409	Soil: EPA 8260	$97.00 /sample	4	$388.00	Field screen all soil samples in the field with hand-held FID & submit "hotest" 4 samples to lab for analyses
410	Soil: EPA 8270	$193.00 /sample	4	$772.00	
421	Soil: MADEP VPH	$63.00 /sample	4	$252.00	
422	Soil: MADEP EPH	$111.00 /sample	4	$444.00	
272	GW: EPA 602 w/ MTBE & IPE	$43.00 /sample	11	$473.00	samples from all wells
301	GW: EPA 625 + 10 TICs	$231.00 /sample	11	$2,541.00	
341	GW: MADEP VPH	$61.00 /sample	11	$671.00	
342	GW: MADEP EPH	$111.00 /sample	11	$1,221.00	
330	GW: SM 3030C (Pb)	$15.00 /sample	11	$165.00	
280	GW: EPA 504.1 (EDB)	$49.00 /sample	11	$539.00	
6.101	Monitoring Report	$889.00 /report	1	$889.00	
TOTAL				**$12,160.00**	

State of North Carolina
Department of Environment
and Natural Resources
Wilmington Regional Office
Division of Waste Management
UST Section

Beverly Eaves Perdue, Governor
Dee Freeman, Secretary
Dexter R. Mathews, Director

NCDENR
NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

October 10, 2012

Mr. Kurt Evers
Worsley Operating Corporation
P. O. Box 3227
Wilmington, NC 28406

Subject: Pre-approval Task Authorization 32152-17
Scotchman #35
7160 Market Street
Wilmington, New Hanover County
Incident No. 32152
High 287A

Dear Mr. Smith:

Please see the attached Directed Pre-approval Task Authorization Form for a complete listing of the pre-approved tasks and the dollar amounts allowed for each task. If you have any questions concerning this task authorization, please contact me at (910) 796-7263.

Sincerely,

Deborah Mayo

Deborah Mayo
Hydrogeologist II

cc: Bryan Lievre - Environmental Services and Solutions, PLLC
WiRO- UST

PREAPPROVAL TASK AUTHORIZATION FORM

Department of Environment & Natural Resources - Division of Waste Management

Site Name	Scotchman #35	City / County	Wilmington/New Hanover	Incident #	32152
Responsible Party	Worsley Operating Corp	Incident Mgr	Deborah Mayo	Region	WiRO
RP Type *(Owner/Operator / Landowner / Attorney-in-fact)*	Owner	TA Supplement / Change Order?	No	Prev. TA #	32152-16

Primary Consultant	Environmental Services & Solutions, PLLC	***(Reserved for Incident Manager)***	
Phone / Fax Number	910-470-7066 / 910-392-3050	*Task Authorization Number:*	32152-17
Project Mgr / Email	Bryan Lievre / BKLwithESS@aol.com	*Site Risk / Rank / Abatement:*	H
Proposal# / Scope Dates	NA / 9-13-2012	*Type (Comm / NonComm / Both)*	C
Has STF Eligibility Been Determined?	YES / NO / Pending	***Site Status** (Active or NFA/Date)*	A

Note: This form should be used to receive preapproval from the UST Section. A proposal must be attached to elaborate on the costs for the tasks listed below that describes the scope of work and the rationale for the proposed activities. If you discover that unexpected tasks must be performed, incurring costs that exceed the amount preapproved in this authorization, you must complete and submit a separate preapproval request designated as a "**TA Supplement / Change Order**" in the provided space above. Include a copy of the prior preapproval form as well. Please attach this form to the cover of the corresponding claim when requesting reimbursement. **IMPORTANT:** Only one claim may be submitted during a quarter or 3-month period. All preapprovals submitted within a claim are closed with that claim. Final reimbursement of costs associated with the **Total Claimed** amount below may vary depending on the eligibility status of the site (i.e., deductibles, apportionment, etc.), and the documentary validation of incurred costs as reasonable and necessary expenses per 15A NCAC 2P .0402 and .0404.

With Claim: ◆ Attach all Main Consultant/Contractor invoices. ◆ Attach proof of payment directly to the front of each invoice.

Important: The date of reimbursement of costs approved herein is dependent on the balance of funds in the Trust Fund. There may be a delay in the reimbursement of claims for work done.

PREAPPROVAL / TASK AUTHORIZATION *(See Instructions / RRD for Tasks requiring Preapproval / Task Authorization)*								FINAL REIMBURSEMENT *(Must Complete with Claim Submittal)*	
Task #	Lab Code#	Proposed Units / Type *(Consultant)*	RO Auth	Proposed Rate/Price *(Consultant)*	CO Auth	Proposed Task Subtotal *(Consultant)*	Preapproved Subtotal *(UST Section)*	Dates of Work[1] *(Consultant)* Started / Completed	Claimed Amount[2] *(Consultant)*
3.101		70 feet	✓	$10.00	Cu	$700.00	Cu	/	
3.111		70 feet	✓	$15.00		$1,050.00		/	
3.398		1 event	✓	$350.00		$350.00		/	
4.031		11 wells	✓	$155.00		$1,705.00		/	
4.090	409	4 samples	✓	$97.00		$388.00		/	
4.090	410	4 samples	✓	$193.00		$772.00		/	
4.090	421	4 samples	✓	$63.00		$252.00		/	
4.090	422	4 samples	✓	$111.00		$444.00		/	
4.090	272	11 samples	✓	$43.00		$473.00		/	
4.090	301	11 samples	✓	$231.00		$2,541.00		/	
4.090	341	11 samples	✓	$61.00		$671.00		/	
4.090	342	11 samples	✓	$111.00		$1,221.00		/	
4.090	331	11 samples	✓	$15.00		$165.00	$	/	
4.090	280	11 samples	✓	$49.00		$539.00		/	
6.101		1 report	✓	$889.00		$889.00		/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	
		/						/	

RECEIVED / DENR UST SECTION 2012 SEP 20 AM 11:25

	Requested	Preapproved		Claimed[2]
TOTAL:	$12,160.00	12,160.00	TOTAL:	
Total Standard Costs (Not Third Party)	$0.00		*Total Standard Costs*	
Total applied as Third Party Deductible/Damage Costs	$0.00		*Total Third Pty Costs*	

Consultant	Project Mgr Signature:	Bryan K Lievre	Date: 9/14/12
UST Section	RO Task Authorization:	Deborah Mayo	Date[1]: 9/18/12
	CO Rate Authorization:	[signature]	Date[1]: 10/4/12

1 - Task Authorization expires one year from the latter of the RO or CO Authorization dates. Note: Tasks must also be claimed within one year of completion. The one-year deadline from the authorization date does not supercede other regulatory deadlines (e.g., NORR's, NOV's, Enforcements, Remissions, etc.)

2 - Only Tasks included on this PATA form may be claimed. Do not include other Tasks or claimed costs (i.e., Claim preparation) that were not preapproved.

Table 1
Cost Estimate for Trust Fund Pre-Approval
Scotchman #35
7158 Market Street, Wilmington, North Carolina

Task	Activity	Unit Cost	# Units	Total	Assumptions/Reasoning
3.101	Drilling Supervision	$10.00 /ft	70	$700.00	
3.111	Drilling - Soil Boring	$15.00 /ft	70	$1,050.00	Est 7 borings at up to 10 feet deep, each
3.398	Drill Rig Mobilization	$350.00 /event	1	$350.00	
4.031	Cost for Sampling Well	$155.00 /well	11	$1,705.00	Sample all monitoring wells in 12/2012 (MW-1 to MW-11)
4.090	Analytical & Shipping				
409	Soil: EPA 8260	$97.00 /sample	4	$388.00	Field screen all soil samples in the field with hand-held FID & submit "hotest" 4 samples to lab for analyses
410	Soil: EPA 8270	$193.00 /sample	4	$772.00	
421	Soil: MADEP VPH	$63.00 /sample	4	$252.00	
422	Soil: MADEP EPH	$111.00 /sample	4	$444.00	
272	GW: EPA 602 w/ MTBE & IPE	$43.00 /sample	11	$473.00	samples from all wells
301	GW: EPA 625 + 10 TICs	$231.00 /sample	11	$2,541.00	
341	GW: MADEP VPH	$61.00 /sample	11	$671.00	
342	GW: MADEP EPH	$111.00 /sample	11	$1,221.00	
330	GW: SM 3030C (Pb)	$15.00 /sample	11	$165.00	
280	GW: EPA 504.1 (EDB)	$49.00 /sample	11	$539.00	
6.101	Monitoring Report	$889.00 /report	1	$889.00	
TOTAL				**$12,160.00**	

APPENDIX B

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	CB-1
Location:	7158 Market Street (US Hwy 17)	Construction Date:	12/19/12
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Geoprobe 6620DT
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	MHH
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 3" ASPHALT
					0		
	2.0						3" - 4' Tan fine-grained silty SAND
					0		
	4.0						
							4' - 6' Brown fine-grained silty SAND
faint petroleum odor 6' to 8'	6.0						6' - 7' Dark brown, peaty fine-grained silty SAND, wet
					0		
	8.0						7' - 10' Dark brown, fine-grained silty SAND, loose and dry
					0		
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	CB-2
Location:	7158 Market Street (US Hwy 17)	Construction Date:	12/19/12
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Geoprobe 6620DT
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	MHH
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 8" CONCRETE
					0		8" - 2' Brown/gray fine-grained SAND, loose
	2.0						
					0		2' - 4' White fine-grained SAND, loose
	4.0						
							4' - 6' Dark brown fine-grained silty SAND
faint petroleum odor 6' to 10'	6.0						
					10		6' - 8' Black/dark brown, peaty silty fine-grained SAND, wet
	8.0						
					5		8' - 10' Dark brown silty fine-grained SAND
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: CB-3
Construction Date: 12/19/12
Drilling Contractor: Geologic Exploration
Drilling Method: Geoprobe 6620DT

Logged By: MHH
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 8" CONCRETE
faint or possible petroleum odor 1' to 6'	2.0				5		8" - 2' Brown fine-grained SAND, loose
					10		2' - 4' White fine-grained "sugar" SAND, loose
	4.0						4' - 5' Dark brown, peaty, fine-grained silty SAND
petroleum odor 6' to 10'	6.0						5' - 7' Brown/tan silty fine-grained SAND
					250		7' - 8' Black/dark brown silty fine-grained, peaty silty SAND
	8.0						
					20		8' - 10' Dark brown silty fine-grained SAND, loose
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	CB-4
Location:	7158 Market Street (US Hwy 17)	Construction Date:	12/19/12
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Geoprobe 6620DT
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	MHH
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 1.5" ASPHALT
					0		15" - 2' Brown silty fine-grained SAND
	2.0						
					5		2' - 4' White fine-grained "sugar" SAND, loose
	4.0						
							4' - 4.5' Brown silty fine-grained SAND
							4.5' - 6' Tan/gray silty fine-grained SAND
no petroleum odors throughout profile	6.0						
					0		6' - 8' Brown silty fine-grained SAND, moist at 7'-8'
	8.0						
					10		8' - 9' Black/dark brown silty fine-grained SAND
							9' - 10' Dark brown silty fine-grained SAND
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: CB-5
Construction Date: 12/19/12
Drilling Contractor: Geologic Exploration
Drilling Method: Geoprobe 6620DT
Logged By: MHH
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" CONCRETE
					0		6' - 2' Brown silty fine-grained SAND
	2.0						
					0		2' - 4' White fine-grained "sugar" SAND, loose
	4.0						
							4' - 7' Dark brown silty fine-grained SAND
petroleum odors from 6' to 10'	6.0				200		
							7' - 9' Black/dark brown silty fine-grained SAND, wet
	8.0				470		
							9' - 10' Dark brown silty fine-grained SAND, loose
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name: Scotchman #35
Location: 7158 Market Street (US Hwy 17)
Wilmington, North Carolina
Project No.:
Client: Worsley Companies, Inc.
PO Box 3227
Wilmington, North Carolina

Well/Soil Boring ID: CB-6
Construction Date: 12/19/12
Drilling Contractor: Geologic Exploration
Drilling Method: Geoprobe 6620DT

Logged By: MHH
Top-of-Casing Elev.: NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count n value	Sample Interval/Type	Soil Description
							0 - 6" CONCRETE
					15		6' - 1' Light brown silty fine-grained SAND, loose (fill)
	2.0						1' - 2' Brown sity fin-grained SAND
					10		2' - 4' White fine-grained "sugar" SAND, loose
	4.0						
no petroleum odors throughout profile	6.0				5		4' - 7.5' Dark brown silty fine-grained SAND
	8.0						7.5' - 8' Gray/brown silty fine-grained SAND
					0		8' -8.5' dark brown silty fine-grained SAND, wet
							8.5' - 9' Black/dark brown silty fine-grained SAND
							9' - 10' Dark brown silty fine-grained SAND
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

- ▼ - Groundwater Level @ Time-of-Boring
- ▤ - Hand Auger
- ▥ - Direct Push
- ▭ - Screened Interval
- ■ - Std. Penetration Test (SPT)
- ▩ - Cuttings
- ▒ - Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

Boring Log

Site Name:	Scotchman #35	Well/Soil Boring ID:	CB-7
Location:	7158 Market Street (US Hwy 17)	Construction Date:	12/19/12
	Wilmington, North Carolina	Drilling Contractor:	Geologic Exploration
Project No.:		Drilling Method:	Geoprobe 6620DT
Client:	Worsley Companies, Inc.		
	PO Box 3227	Logged By:	MHH
	Wilmington, North Carolina	Top-of-Casing Elev.:	NA

Comments	Depth bgs (ft.)	Groundwater Level @ Time-of-Boring	Screened Interval (ft.)	Organic Vapor Reading (ppm)	Blow Count / n value	Sample Interval/Type	Soil Description
							0 - 3" CONCRETE
					15		3" - 1' Light brown silty fine-grained SAND, Loose (fill)
	2.0						1' - 4' Brown silty fine-grained SAND
					5		
	4.0						4' - 5' White silty fine-grained SAND
	6.0						5' - 7' Brown silty fine-grained SAND
					10		
	8.0						7' - 8' Brown silty fine-grained, silty SAND, flowing
possible odors from 8' to 10'							8' - 9' Black/dark brown silty fine-grained SAND
					10		9' - 10' Dark brown silty fine-grained SAND
	10.0						
	12.0						
	14.0						
	16.0						
	18.0						
	20.0						

Symbols

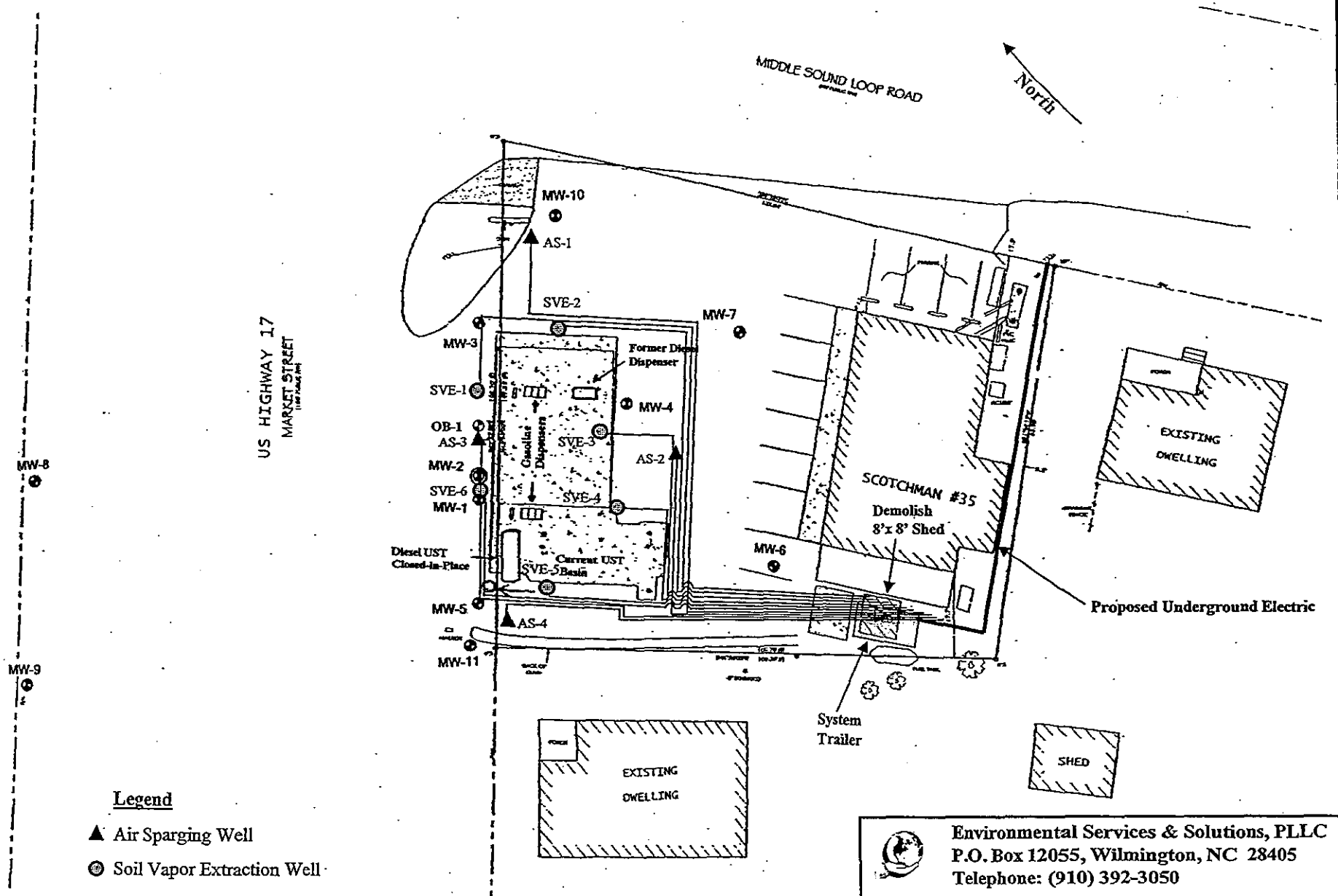
- ▼ - Groundwater Level @ Time-of-Boring
- Hand Auger
- Direct Push
- Screened Interval
- Std. Penetration Test (SPT)
- Cuttings
- Submitted for laboratory analysis

Notes:
Organic Vapor Readings by RKI Instruments Eagle Vapor Analyzer
bgs - below ground surface
ppm - parts per million
EOB - end of boring

Environmental Services & Solutions, PLLC
PO Box 12055
Wilmington, North Carolina 28405

APPENDIX C

APPENDIX D



Environmental Services & Solutions, PLLC
P.O. Box 12055, Wilmington, NC 28405
Telephone: (910) 392-3050

PROJECT MANAGER	SITE/LOCATION	
B. LIEVRE	SCOTCHMAN #35 WILMINGTON, NC	
DATE	DRAWING DESCRIPTION	FIGURE NO.
3/4/09	Proposed Systems Layout	4

APPENDIX B

PYRAMID GEOPHYSICAL REPORT

PYRAMID ENVIRONMENTAL & ENGINEERING, P.C.

PYRAMID ENVIRONMENTAL & ENGINEERING
(PROJECT 2015-154)

GEOPHYSICAL SURVEY

METALLIC UST INVESTIGATION: PARCEL 214 – ENT WORSLEY REAL ESTATE, LLC PROPERTY NCDOT PROJECT U-4751 (WBS 40191.1.2)

7158 MARKET ST., WILMINGTON, NEW HANOVER COUNTY, NC

JUNE 17, 2015

Report prepared for: **Ben Ashba**
Catlin Engineers & Scientists
220 Old Dairy Rd.
Wilmington, North Carolina 28405

Prepared by: _____
Eric C. Cross, P.G.
NC License #2181

Reviewed by: _____
Douglas A. Canavello, P.G.
NC License #1066

503 INDUSTRIAL AVENUE, GREENSBORO, NC 27406
P: 336.335.3174 F: 336.691.0648
C257: GEOLOGY C1251: ENGINEERING

GEOPHYSICAL INVESTIGATION REPORT
Parcel 214 – ENT Worsley Real Estate, LLC Property
Wilmington, New Hanover County, North Carolina

Table of Contents

Figures

Appendices

LIST OF ACRONYMS

CADD	Computer Assisted Drafting and Design
DF	Dual Frequency
EM	Electromagnetic
GPR	Ground Penetrating Radar
GPS	Global Positioning System
NCDOT	North Carolina Department of Transportation
ROW	Right-of-Way
SVE	Soil Vapor Extraction
UST	Underground Storage Tank

EXECUTIVE SUMMARY

Project Description: Pyramid Environmental conducted a geophysical investigation for Catlin Engineers & Scientists (Catlin) at Parcel 214, located at 7158 Market Street, Wilmington, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project U-4751). Catlin directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation as a total take by the NCDOT. Conducted on June 15, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

Geophysical Results: The majority of the EM anomalies were associated with visible cultural features at the ground surface. The three known USTs exhibited a high amplitude EM response, and their locations were verified by the GPR. One probable UST was also evidenced directly northwest of the known USTs. Two of the known USTs were approximately 9 feet wide and 17 feet long, and the third known UST was approximately 8 feet wide and 22 feet long. The probable UST was approximately 8 feet wide and 13 feet long. All known and probable USTs were approximately 4 feet below the ground surface. The remaining GPR scans verified the presence of utilities and conduits crossing the site, and possible buried debris. No evidence of additional USTs was observed. Collectively, the geophysical data recorded evidence of three known and one probable metallic USTs at the property.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for Catlin Engineers & Scientists (Catlin) at Parcel 214, located at 7158 Market Street, Wilmington, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project U-4751). Catlin directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation as a total take by the NCDOT. Conducted on June 15, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included an active service station surrounded primarily by asphalt parking lot. Three known, active USTs were present at the site adjacent to the pump island. Reportedly, a fourth UST was abandoned in place directly adjacent to the three known USTs. During the site visit, a metal cover was observed in the vicinity of the reported abandoned UST. Aerial photographs showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

FIELD METHODOLOGY

The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61 metal detector integrated with a Trimble AG-114 GPS antenna. The integrated GPS system allows the location of the instrument to be recorded in real-time during data collection, resulting in an EM data set that geo-referenced and can be overlain on aerial photographs and CADD drawings. A boundary grid was established around the perimeter of the site with marks every 10 feet to maintain orientation of the instrument throughout the survey and assure complete coverage of the area.

According to the instrument specifications, the EM61 can detect a metal drum down to a maximum depth of approximately 8 feet. Smaller objects (1-foot or less in size) can be detected to a maximum depth of 4 to 5 feet. The EM61 data were digitally collected at approximately 0.8 foot intervals along north-south trending or east-west trending, generally parallel survey lines spaced five feet apart. The data were downloaded to a computer and reviewed in the field and office using the Geonics NAV61 and Surfer for Windows Version 11.0 software programs.

GPR data were acquired across select EM anomalies on June 15, 2015, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in reconnaissance fashion as well as along formal transect lines across EM features. The GPR data were viewed in real time using a vertical scan of 512 samples, at a rate of 48 scans per second. GPR data were viewed down to a maximum depth of approximately 10 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects across specific anomalies were saved to the hard drive of the DF unit for post-processing and figure generation.

Pyramid's classifications of USTs for the purposes of this report are based directly on the geophysical UST ratings provided to us by the NCDOT. These ratings are as follows:

Geophysical Surveys for Underground Storage Tanks
on NCDOT Projects

High Confidence	Intermediate Confidence	Low Confidence	No Confidence
Known UST Active tank - spatial location, orientation, and approximate depth determined by geophysics.	**Probable UST** Sufficient geophysical data from both magnetic and radar surveys that is characteristic of a tank. Interpretation may be supported by physical evidence such as fill/vent pipe, metal cover plate, asphalt/concrete patch, etc.	**Possible UST** Sufficient geophysical data from either magnetic or radar surveys that is characteristic of a tank. Additional data is not sufficient enough to confirm or deny the presence of a UST.	Anomaly noted but not characteristic of a UST. Should be noted in the text and may be called out in the figures at the geophysicist's discretion.

DISCUSSION OF RESULTS

Discussion of EM Results

A contour plot of the EM61 results obtained across the survey area at the property is presented in **Figure 2**. Each EM anomaly is numbered for reference to the figure. The following table presents the list of EM anomalies and the cause of the metallic response, if known:

LIST OF METALLIC ANOMALIES IDENTIFIED BY EM SURVEY

Metallic Anomaly #	Cause of Anomaly	Investigated with GPR
1	Passing vehicle	
2	Reinforced concrete & monitor wells	
3	Metallic debris, utility, and/or interference	
4	Manhole	
5	3 Known and 1 Probable UST	☑
6	Vehicle	
7	Vent pipes	
8	Remediation trailer	
9	Parking barriers	
10	Suspected utility	
11	Power box	☑
12	AC and air canister	☑
13	Sewer manholes and metal pole	☑
14	Air dispenser	
15	Reinforced concrete & monitor wells	
16	Possible debris and/or interference	☑
17	Power pole, guy wires, suspected utility	☑

The majority of the EM anomalies, as described above, were associated with visible cultural features at the ground surface such as vehicles, utilities, manholes, and a large number of monitor wells and SVE wells. Metal-reinforced concrete was present beneath

the pump island canopy, resulting in the observed metallic response surrounding the perimeter of the pump island. The known UST bed caused a large metallic anomaly in the vicinity of the known tanks and the suspected tank that had been abandoned in place. Additionally, an isolated anomaly was recorded on the east side of the parking lot near the road. GPR scans were performed across this feature, the UST bed, an area of suspected utilities on the northeast portion of the survey area, and across the southeast side of the building.

Discussion of GPR Results

Figure 3 presents the locations of the formal GPR transects performed at the property, as well as select transect images. A total of 11 formal GPR transects were performed at the property. GPR transects 1-5 were performed across the known UST bed. These transects recorded clear evidence of the three known USTs, manifested by well-defined hyperbolic reflectors representing the width of each tank, and distinct lateral reflectors representing the length of each tank. Two of the known USTs were approximately 9 feet wide and 17 feet long, and the third known UST was approximately 8 feet wide and 22 feet long. Additionally, transect 1 and transect 5 recorded isolated reflectors to the northwest of the three known USTs that were consistent with a probable UST in this area. It is possible that this tank was not defined as clearly as the known USTs because it may have been filled with sand or some other material when it was abandoned in place, thereby resulting in a less-defined reflective contrast relative to the surrounding soil. GPR scans suggest this probable UST is approximately 8 feet wide and 13 feet long. All known and probable USTs were approximately 4 feet below the ground surface.

Transect 6 and 7 were performed across an area containing suspected utilities and piping for the remediation system. These transects recorded isolated, distinct hyperbolic reflectors that were consistent with a utility line or other conduit.

Transect 8 was performed along the northeast portion of the survey area, across the unknown anomaly. This transect did not record any evidence of large structures such as a

UST. The anomaly at this location is likely due to isolated metallic debris, or possible electrical interference during the survey.

The remaining transects (9-11) were performed across the southeast side of the building in reconnaissance fashion to further investigate any potential subsurface structures in this area. No evidence of any additional metallic USTs was observed.

Collectively, the geophysical data recorded evidence of three known metallic USTs and one probable metallic UST at the property.

SUMMARY & CONCLUSIONS

Our evaluation of the EM61 and GPR data collected at Parcel 214 in Wilmington, New Hanover County, North Carolina, provides the following summary and conclusions:

- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- The majority of the EM anomalies were associated with visible cultural features at the ground surface.
- The three known USTs exhibited a high amplitude EM response, and their locations were verified by the GPR. One probable UST was also evidenced directly northwest of the known USTs.
    - Two of the known USTs were approximately 9 feet wide and 17 feet long, and the third known UST was approximately 8 feet wide and 22 feet long.
    - The probable UST was approximately 8 feet wide and 13 feet long.
    - All known and probable USTs were approximately 4 feet below the ground surface.
- The remaining GPR scans verified the presence of utilities and conduits crossing the site, and possible buried debris. No evidence of additional USTs was observed.

- Collectively, the geophysical data recorded evidence of three known and one probable metallic USTs at the property.

LIMITATIONS

Geophysical surveys have been performed and this report prepared for Catlin Engineers & Scientists in accordance with generally accepted guidelines for EM61 and GPR surveys. It is generally recognized that the results of the EM61 and GPR surveys are non-unique and may not represent actual subsurface conditions. The EM61 and GPR results obtained for this project have not conclusively determined the definitive presence or absence of metallic USTs, but that the evidence collected is sufficient to result in the conclusions made in this report. Additionally, it should be understood that areas containing extensive vegetation, reinforced concrete, or other restrictions to the accessibility of the geophysical instruments could not be fully investigated.

N↑

APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREA

View of Survey Area
(Facing Approximately East)

View of Survey Area
(Facing Approximately Southeast)

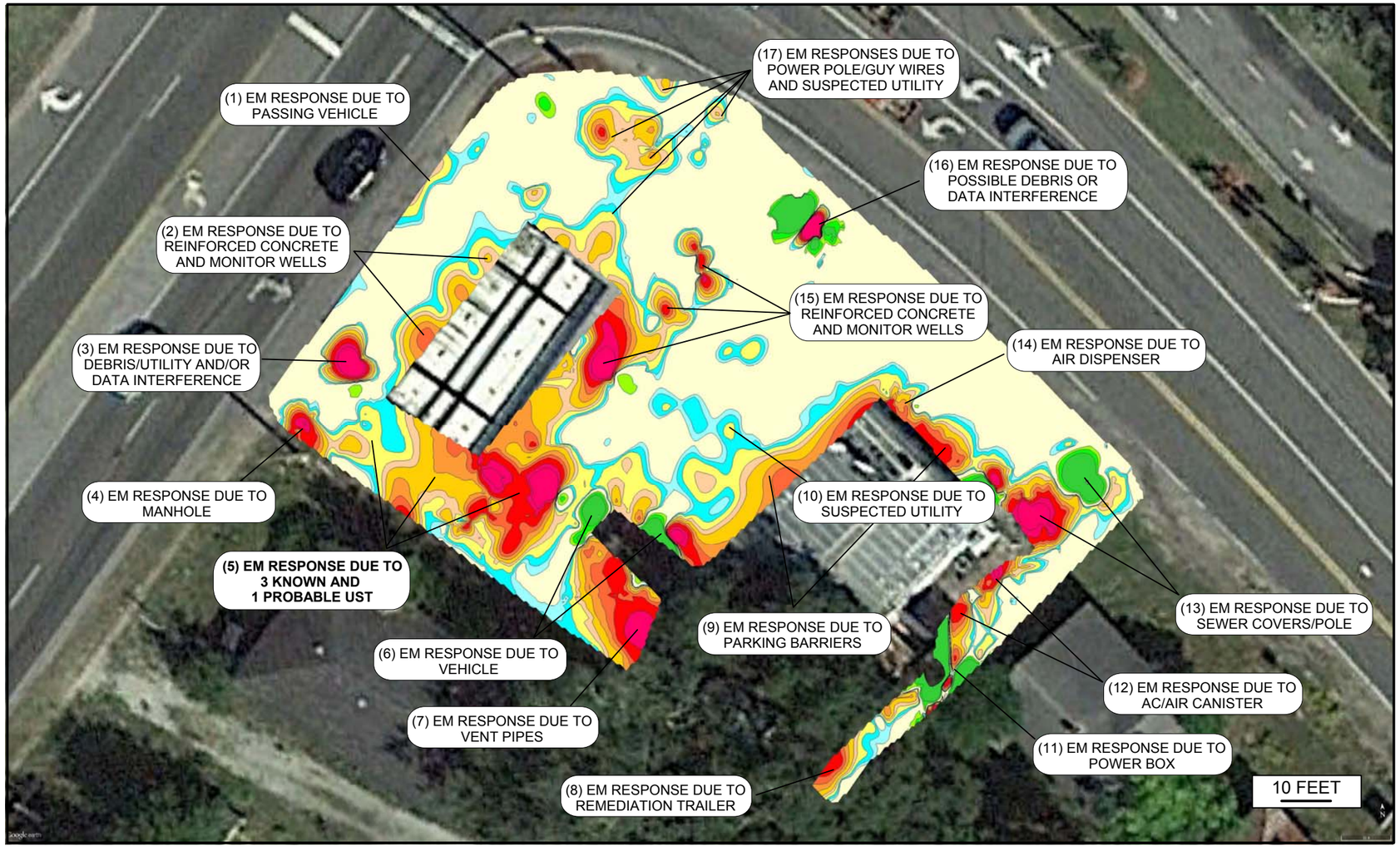
TITLE	PARCEL 214 - 7158 MARKET ST. GEOPHYSICAL SURVEY BOUNDARIES AND SITE PHOTOGRAPHS
PROJECT	METALLIC UST INVESTIGATION NCDOT U-4751, WILMINGTON, NC

PYRAMID ENVIRONMENTAL & ENGINEERING, P.C.
503 INDUSTRIAL AVENUE
GREENSBORO, NC 27460
(336) 335-3174 (p) (336) 691-0648 (f)
License # C1251 Eng. / License # C257 Geology

DATE 6/15/2015	CLIENT CATLIN ENGINEERS
PYRAMID PROJECT #: 2015-154	**FIGURE 1**

N↑

Parcel 214 - EM61 Differential Results



Locations of metallic anomalies detected by the EM61 survey.

EVIDENCE OF THREE KNOWN AND ONE PROBABLE METALLIC USTs OBSERVED

The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The EM61 data were collected on June 15, 2015, using a Geonics EM61 instrument. Ground penetrating radar (GPR) data were collected on June 15, 2015, using a GSSI UtilityScan DF unit with a dual frequency 300/800 MHz antenna.

EM61 Metal Detection Response (millivolts)

TITLE
PARCEL 214 - 7158 MARKET ST.
EM 61 RESULTS CONTOUR MAP

PROJECT
METALLIC UST INVESTIGATION
NCDOT U-4751, WILMINGTON, NC

PYRAMID ENVIRONMENTAL & ENGINEERING, P.C.
503 INDUSTRIAL AVENUE
GREENSBORO, NC 27460
(336) 335-3174 (p) (336) 691-0648 (f)
License # C1251 Eng. / License # C257 Geology

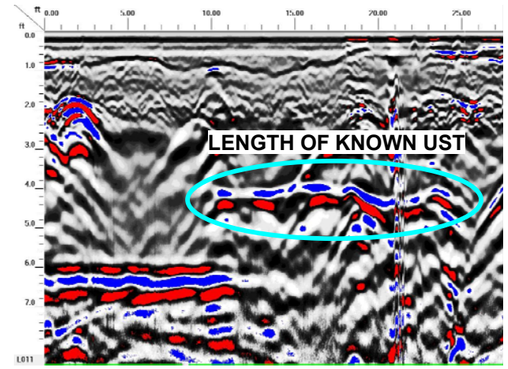
DATE 6/15/2015

CLIENT CATLIN ENGINEERS

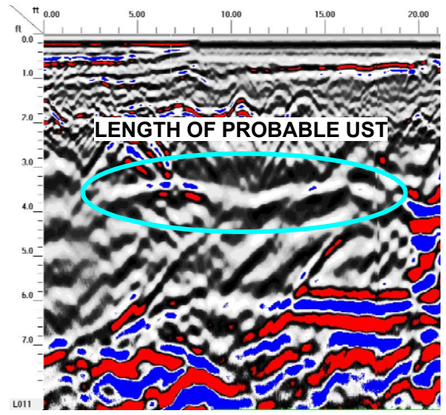
PYRAMID PROJECT #: 2015-154

FIGURE 2

Parcel 214 - Locations of GPR Transects

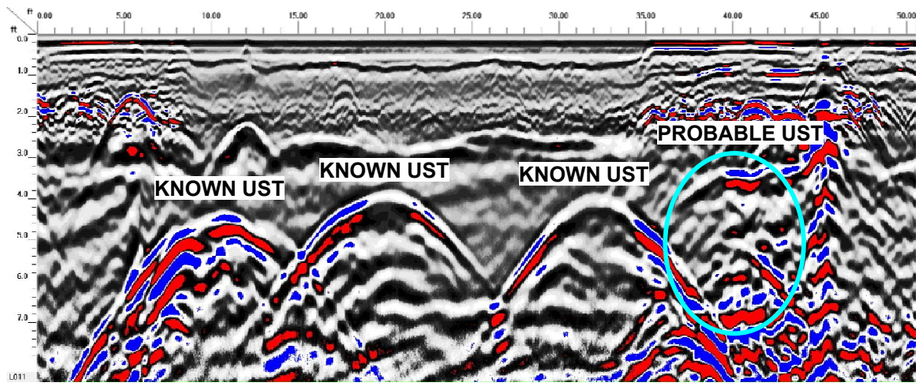


GPR TRANSECT 3 (T3)

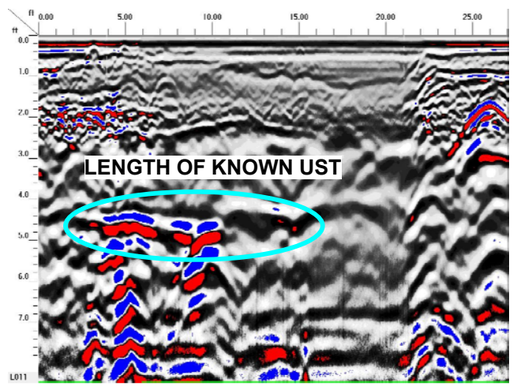


GPR TRANSECT 5 (T5)

N



GPR TRANSECT 1 (T1)



GPR TRANSECT 2 (T2)

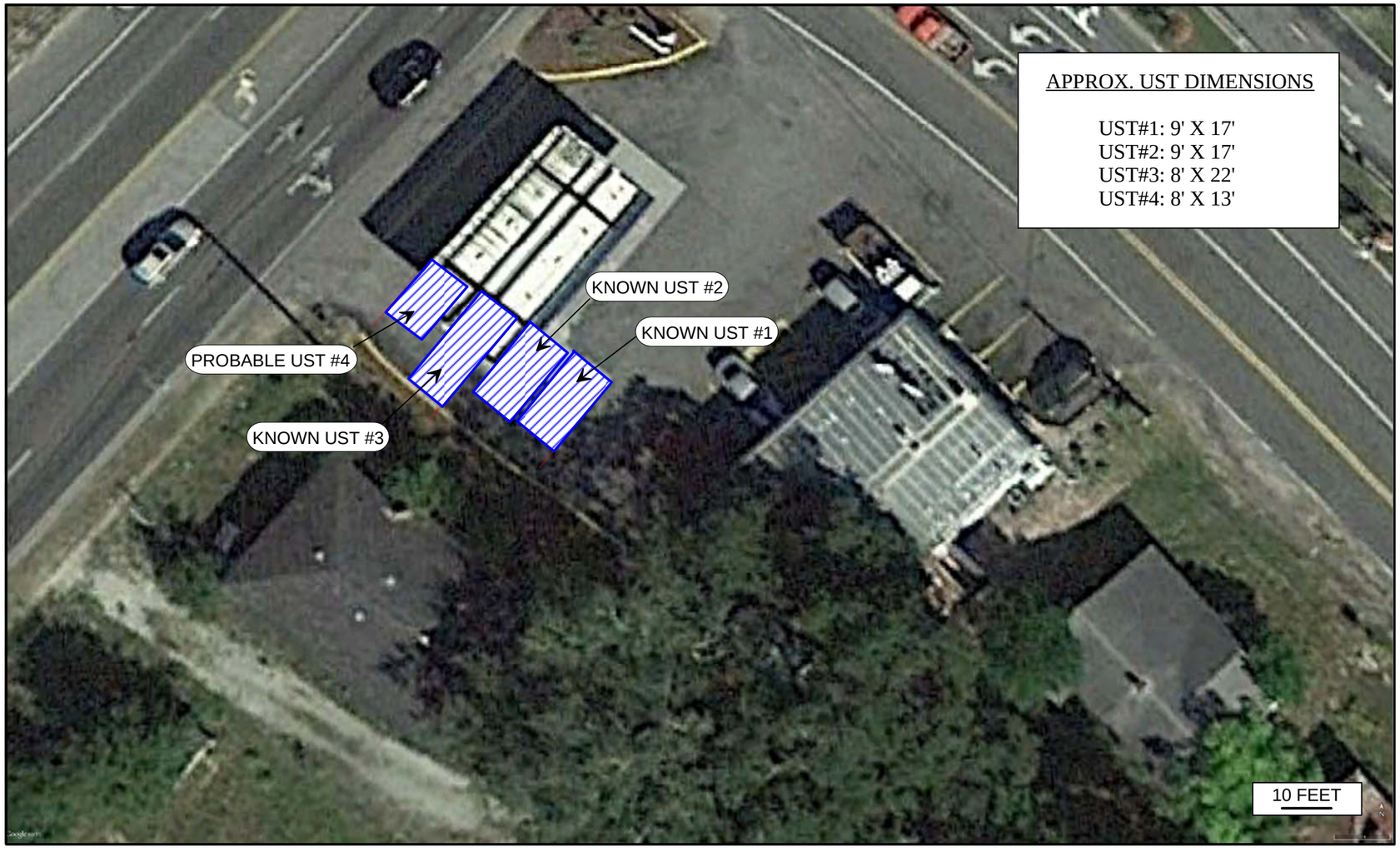
TITLE	PARCEL 214 - 7158 MARKET ST. GPR TRANSECT LOCATIONS AND SELECT IMAGES
PROJECT	METALLIC UST INVESTIGATION NCDOT U-4751, WILMINGTON, NC

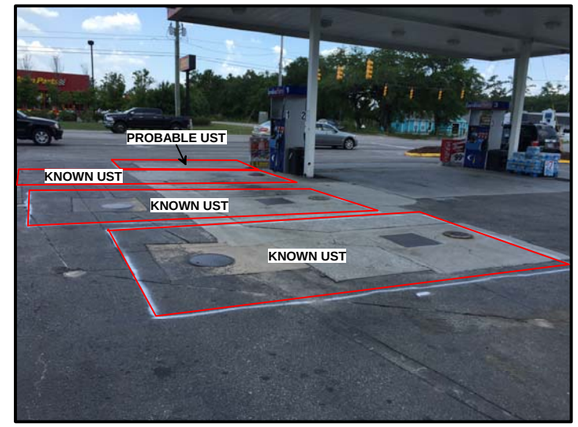
PYRAMID ENVIRONMENTAL & ENGINEERING, P.C.
503 INDUSTRIAL AVENUE
GREENSBORO, NC 27460
(336) 335-3174 (p) (336) 691-0648 (f)
License # C1251 Eng. / License # C257 Geology

DATE 6/15/2015	CLIENT CATLIN ENGINEERS
PYRAMID PROJECT #: 2015-154	**FIGURE 3**

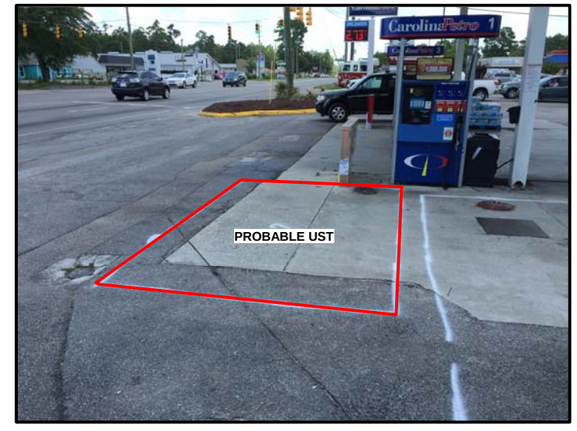
N

Parcel 214 - Approximate Locations of Known/Probable USTs





LOCATIONS OF KNOWN/PROBABLE USTs



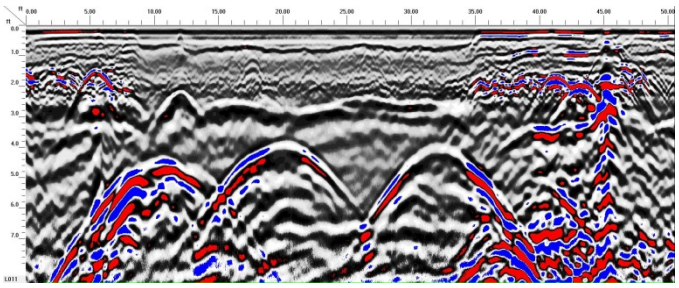
APPROXIMATE LOCATION OF PROBABLE UST

TITLE	PARCEL 214 - 7158 MARKET ST. APPROXIMATE LOCATIONS OF KNOWN & PROBABLE USTs
PROJECT	METALLIC UST INVESTIGATION NCDOT U-4751, WILMINGTON, NC

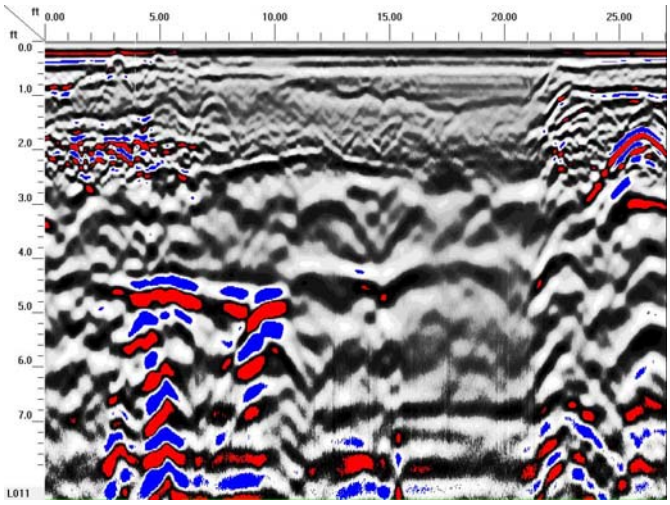
PYRAMID ENVIRONMENTAL & ENGINEERING, P.C.
503 INDUSTRIAL AVENUE
GREENSBORO, NC 27460
(336) 335-3174 (p) (336) 691-0648 (f)
License # C1251 Eng. / License # C257 Geology

DATE 6/15/2015	CLIENT CATLIN ENGINEERS
PYRAMID PROJECT #: 2015-154	**FIGURE 4**

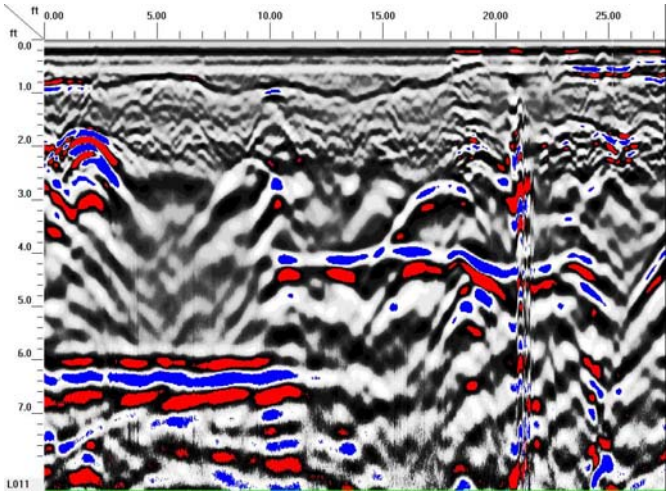
Appendix A – GPR Transects



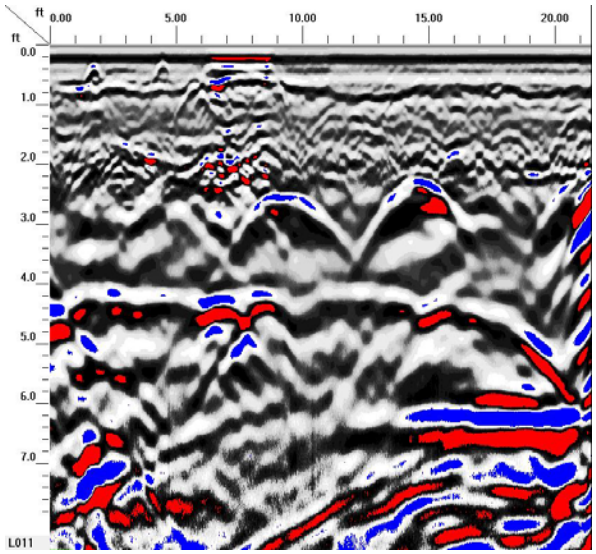
GPR TRANSECT 1



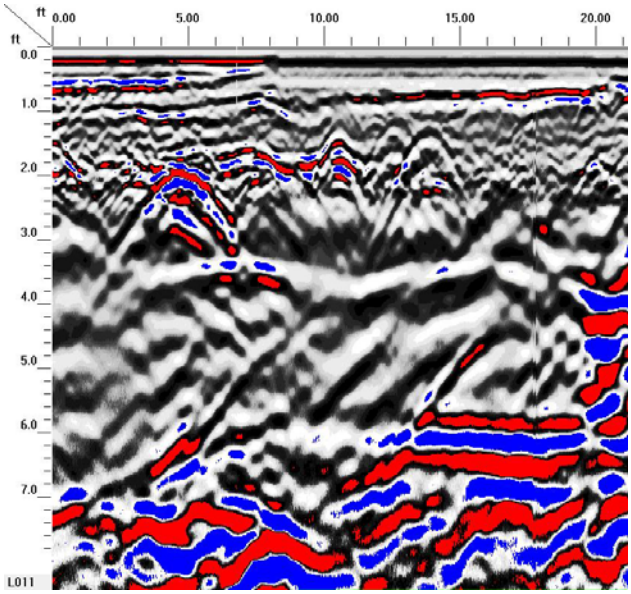
GPR TRANSECT 2



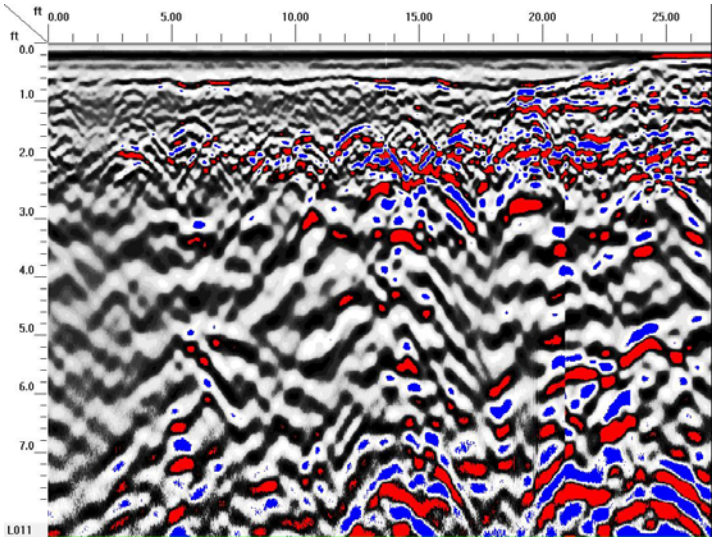
GPR TRANSECT 3



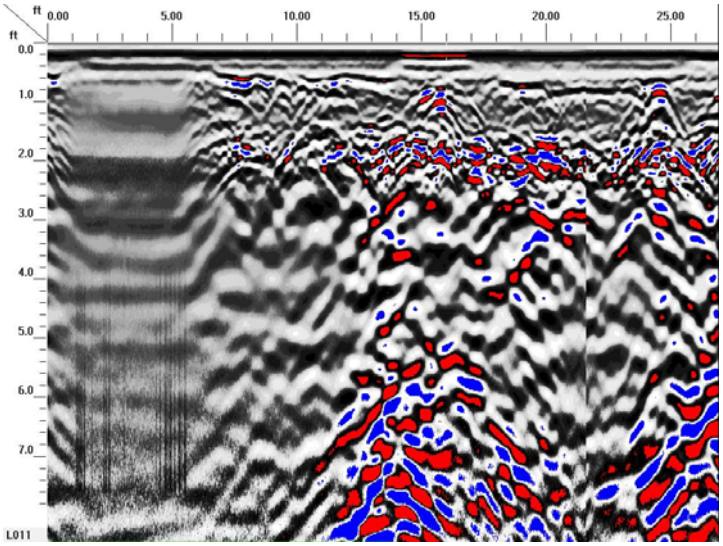
GPR TRANSECT 4



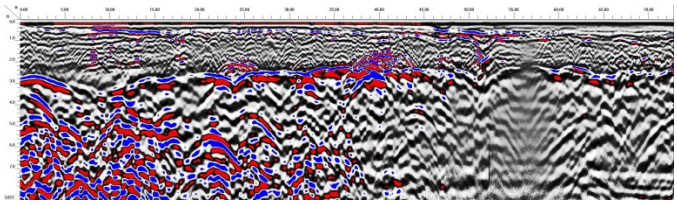
GPR TRANSECT 5



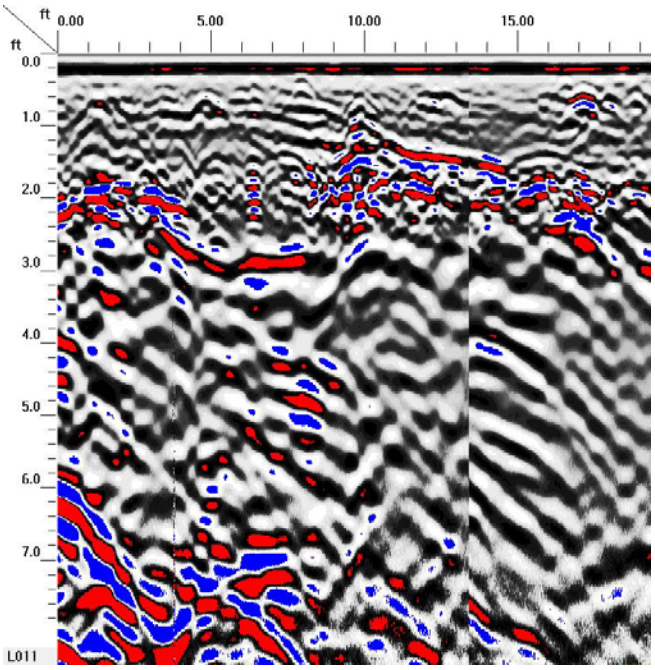
GPR TRANSECT 6



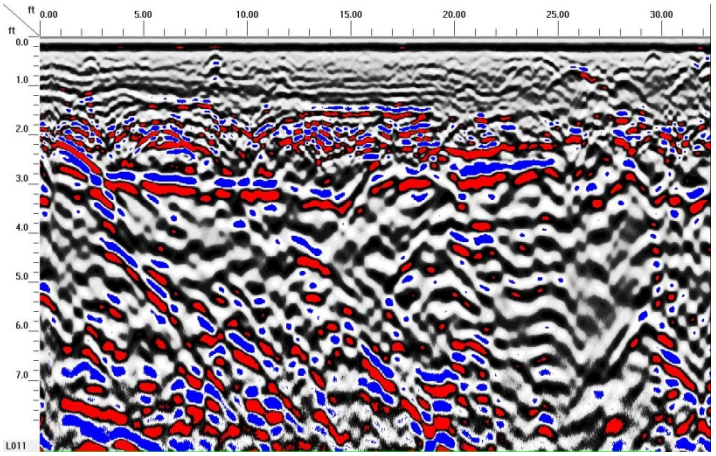
GPR TRANSECT 7



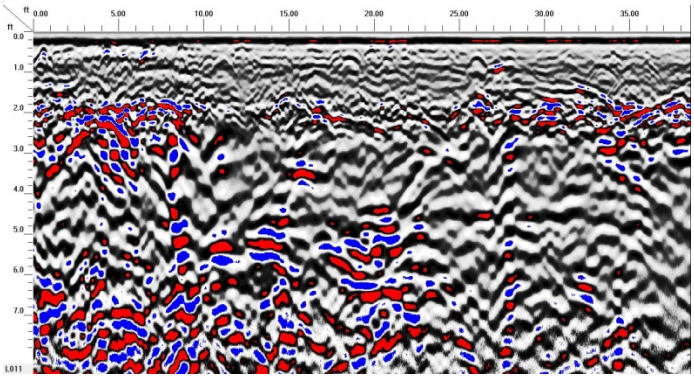
GPR TRANSECT 8



GPR TRANSECT 9



GPR TRANSECT 10



GPR TRANSECT 11

APPENDIX C

BORING LOGS

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-01
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,127	**EASTING:** 2,356,869	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT (0.5 0.5 0.5 0.5)	MOI.	SCREENING RESULTS (ppm) (0 250 500 750 1,000)	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D							
2.0		D							
4.0		D		DPT-01 (6')	SP			Dark gray grading to lt. gray, f. SAND. Dark grays and brown at 6.0' BLS. Wet to saturated at 7.0' BLS.	
6.0		W							
8.0							8.0	Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-02
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,137	**EASTING:** 2,356,855	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0					GW		0.5	Asphalt and Concrete mixture.	
		D							
2.0									
		D						Various grays and brown, f. SAND. Trace red brick at 3.0' BLS. White at 3.5' BLS. Med. brown grading to dark brown at 5.0' BLS. Wet to saturated from 6.0-7.5' BLS. Moist from 7.5-8.0' BLS.	
4.0					SP				
		M		DPT-02 (5')					
6.0									
		W							
8.0							8.0	Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover		**LOCATION:** Wilmington	
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral		**BORING ID:** DPT-03	
		DRILLER: D.T. Chalmers, Jr.			
NORTHING: 192,142	**EASTING:** 2,356,843	**CREW:** Ben Steele			
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**			**LAND ELEV.:** NM	
DRILL MACHINE: Power Probe	**METHOD:** DPT		**0 HOUR DTW:** NM	**BORING DEPTH:** 4.0	
START DATE: 06/18/15	**FINISH DATE:** 06/18/15		**24 HOUR DTW:** NM	**WATER DEPTH:** --	

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D			SP			Dark to med. gray grading to white at 3.0' BLS, f. SAND. Trace rock debris at 1.0' BLS.	
2.0		D		DPT-03 (3')					
4.0							4.0	Boring Terminated at Depth 4.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-04
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,135	**EASTING:** 2,356,835	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 4.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0					GW		0.5	Asphalt	
		D			SP			Med. gray grading to white at 2.5' BLS, f. SAND. Trace staining from 2-3' BLS. Dark brown from 3.5-4.0' BLS.	
2.0		D		DPT-04 (2.5')					
4.0							4.0	Boring Terminated at Depth 4.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-05
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,118	**EASTING:** 2,356,819	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 4.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0					GW		0.5	Asphalt	
		D			SP			Med. brown w/tr. orange staining in top 1.0', f. SAND. Grading to med. gray to med. brown at 1.0-2.5' BLS. White from 2.5-4.0' BLS. Trace staining from 1.0-3.0' BLS.	
2.0		D		DPT-05 (2.5')					
4.0							4.0	Boring Terminated at Depth 4.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG 215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-06
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,103	**EASTING:** 2,356,808	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 4.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT (0.5 0.5 0.5 0.5)	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0					GW		0.7	Asphalt and concrete mixture.	
		D			SP			Med. brown w/tr. staining (2.0-3.5' BLS), f. SAND.	
2.0		D		DPT-06 (2.5')			4.0		
4.0								Boring Terminated at Depth 4.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover		**LOCATION:** Wilmington	
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral		**BORING ID:** DPT-07	
		DRILLER: D.T. Chalmers, Jr.			
NORTHING: 192,074	**EASTING:** 2,356,828	**CREW:** Ben Steele			
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**			**LAND ELEV.:** NM	
DRILL MACHINE: Power Probe	**METHOD:** DPT		**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0	
START DATE: 06/18/15	**FINISH DATE:** 06/18/15		**24 HOUR DTW:** NM	**WATER DEPTH:** --	

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D							
2.0		D		DPT-07 (3')					
4.0		M			SP			Med. gray w/tr. staining from 2.0-3.0' BLS, f. SAND. Dark brown grading to med. brown at 5.0-8.0' BLS.	
6.0		M							
8.0							8.0	Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG 215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-08
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,083	**EASTING:** 2,356,847	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT (0.5 0.5 0.5 0.5)	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D			GW		1.0	Rock and gravel mixture.	
2.0		D			SP			Med. brown w/gray and tr. staining from 1.0-3.0' BLS, f. SAND. Trace rock at 2.5' BLS. Increase in staining from 4.0-8.0' BLS.	
4.0		D		DPT-08 (5')					
6.0		M					8.0		
8.0								Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG 215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-09
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,088	**EASTING:** 2,356,812	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D			SW		1.0	Grass and rock in sand matrix.	
2.0		D		DPT-09 (3')	SP			Lt. brown grading to dark brown to white w/staining throughout, f. SAND White grading to dark brown from 4.0 to 5.0' BLS. Med. to light brown from 5-8' BLS.	
4.0		M							
6.0		M					8.0		
8.0								Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG 215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover		**LOCATION:** Wilmington	
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral		**BORING ID:** DPT-10	
		DRILLER: D.T. Chalmers, Jr.			
NORTHING: 192,103	**EASTING:** 2,356,848	**CREW:** Ben Steele			
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**			**LAND ELEV.:** NM	
DRILL MACHINE: Power Probe	**METHOD:** DPT		**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0	
START DATE: 06/18/15	**FINISH DATE:** 06/18/15		**24 HOUR DTW:** NM	**WATER DEPTH:** --	

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D			SW		1.0	Asphalt and gravel in sand matrix.	
2.0		D			SP			Med. to dark gray and brown w/staining from 2.0-8.0' BLS, f. SAND. Increase in staining at 5.0' BLS.	
4.0		D		DPT-10 (5')					
6.0		D							
8.0							8.0	Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG_215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

BORING LOG

CATLIN Engineers and Scientists

WBS: 40191.1.2
TIP: U-4751

SHEET 1 OF 1

PROJECT NO.: 215050	**STATE:** NC	**COUNTY:** New Hanover	**LOCATION:** Wilmington
PROJECT NAME: SR 1409 (Military Cutoff Road Extension) from SR 1409 to US 17 in Wilmington		**LOGGED BY:** Corey Futral	**BORING ID:** DPT-11
		DRILLER: D.T. Chalmers, Jr.	
NORTHING: 192,113	**EASTING:** 2,356,857	**CREW:** Ben Steele	
SYSTEM: NCSP NAD 83 (USft)	**BORING LOCATION:**		**LAND ELEV.:** NM
DRILL MACHINE: Power Probe	**METHOD:** DPT	**0 HOUR DTW:** NM	**BORING DEPTH:** 8.0
START DATE: 06/18/15	**FINISH DATE:** 06/18/15	**24 HOUR DTW:** NM	**WATER DEPTH:** --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	SCREENING RESULTS (ppm) 0 250 500 750 1,000	LAB. ID.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
							0.0	LAND SURFACE	
0.0		D			SW		1.0	Asphalt and gravel in sand matrix	
2.0		D		DPT-11 (3')	SP			Med. brown grading to dark brown w/staining increasing at depth, f. SAND. Rock fragments from 4.0-4.5' BLS. Med. brown to lt. gray from 4.5-7.0' BLS. Dark brown from 7.0-8.0' BLS. Wet to saturated.	
4.0		M							
6.0		W							
8.0							8.0	Boring Terminated at Depth 8.0 ft	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO_LOG 215050_NCDOT_ILM_PSA.GPJ CATLIN.GDT 07/27/15

APPENDIX D

QROS QED™ REPORT AND CHAIN OF CUSTODY

QED

AQROS

Hydrocarbon Analysis Results

Client: CATLIN ENG. & SCI.
Address:

Samples taken Thursday, June 18, 2015
Samples extracted Thursday, June 18, 2015
Samples analysed Friday, June 19, 2015

Contact: BEN ASHBA

Operator KING

Project: 215050; NCDOT ILM SCOTCHMAN PSA

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios			HC Fingerprint Match
										% light	% mid	% heavy	
s	DPT-01 (6') 0945	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	Background Organics
s	DPT-02 (5') 1005	22.2	<1.1	<0.56	<0.22	<0.56	<0.11	<0.02	<0.011	0	0	100	V.Deg.PHC (FCM) (P)
s	DPT-03 (3') 1015	26.5	<1.3	<0.66	1.9	1.9	1.7	0.19	0.007	0	81	19	V.Deg.PHC (FCM) 78.1%
s	DPT-04 (2.5') 1025	24.5	3.9	3.9	0.65	4.55	0.62	0.07	0.005	86.4	8.7	4.9	Deg.Gas (FCM)
s	DPT-05 (2.5') 1030	26.3	<1.3	<0.66	0.43	0.43	0.41	0.05	<0.013	0	60.3	39.7	V.Deg.PHC (FCM)
s	DPT-06 (2.5') 1045	24.3	<1.2	<0.61	18.9	18.9	18	2.1	0.27	0	74.6	25.4	Pyrogenic HC (FCM) 60.5%
s	DPT-07 (3') 1120	24.1	<1.2	<0.6	3.8	3.8	3.6	0.39	0.018	0	82.7	17.3	V.Deg.PHC (FCM) 89.3%
s	DPT-08 (5') 1130	24.3	<0.61	<0.61	0.5	0.5	0.47	0.04	<0.012	0	0	100	Background Organics (FCM)
s	DPT-09 (3') 1150	23.6	<1.2	<0.59	10.4	10.4	10.2	1.2	0.12	0	81.1	18.9	Pyrogenic HC (FCM) 73.9%
s	DPT-10 (5') 1245	23.6	<1.2	<0.59	4.3	4.3	4.2	0.47	0.024	0	79.8	20.2	V.Deg.PHC (FCM) 69.6%
s	DPT-11 (3') 1300	23.4	<1.2	<0.59	44.2	44.2	42.1	4.8	0.34	0	79.6	20.4	V.Deg.PHC (FCM) 63.6%
	Initial Calibrator QC check			OK					Final FCM QC Check			OK	103.6 %

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values are not corrected for moisture or stone content

Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:- FCM = Results calculated using Fundamental Calibration Mode : % = confidence for sample fingerprint match to library

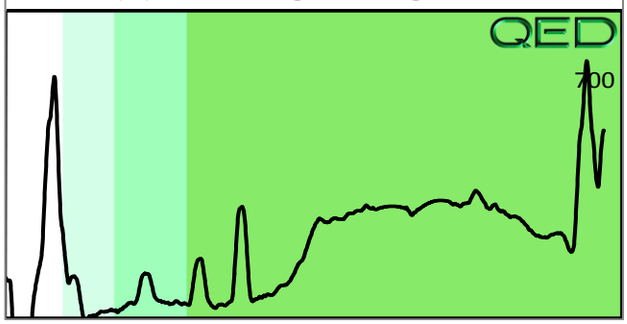
(SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present

QED Hydrocarbon Fingerprints

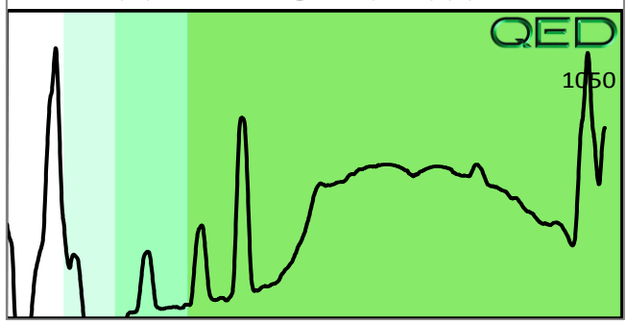
Project: 215050; NCDOT ILM SCOTCHMAN PSA

Friday, June 19, 2015

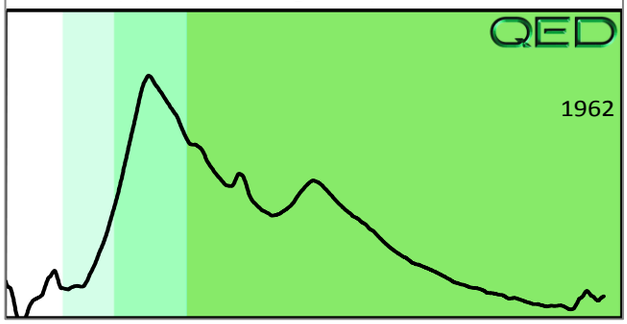
DPT-01 (6') 0945 : Background Organics



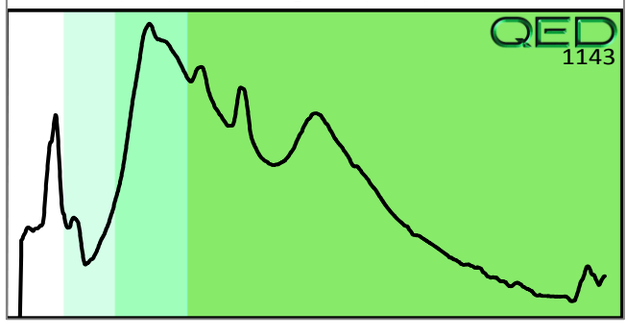
DPT-02 (5') 1005 : V.Deg.PHC (FCM) (P)



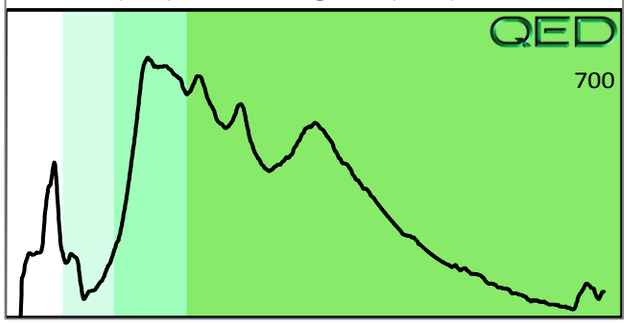
DPT-03 (3') 1015 : V.Deg.PHC (FCM) 78.1%



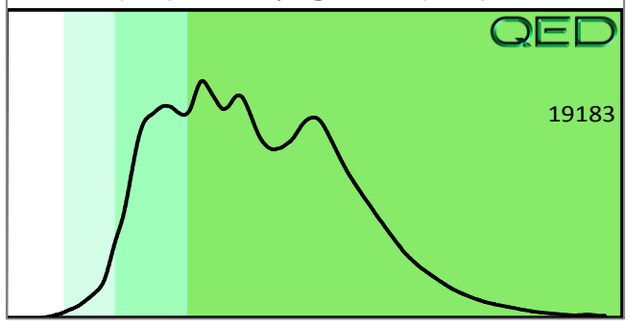
DPT-04 (2.5') 1025 : Deg.Gas (FCM)



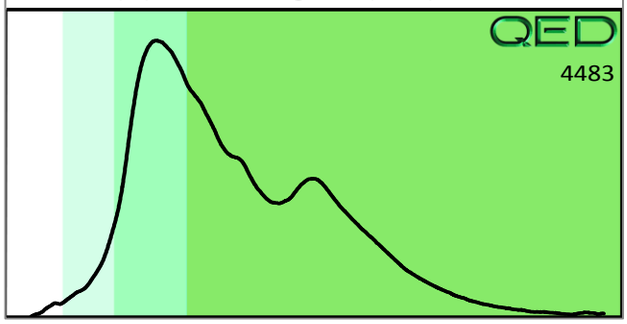
DPT-05 (2.5') 1030 : V.Deg.PHC (FCM)



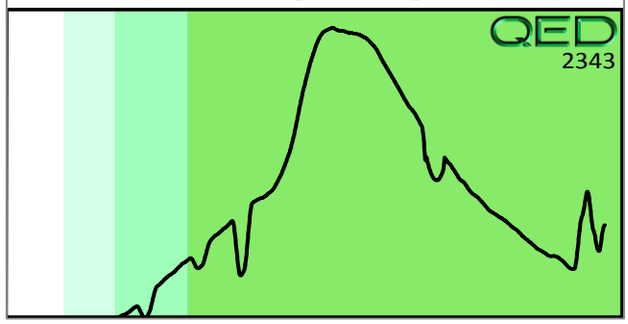
DPT-06 (2.5') 1045 : Pyrogenic HC (FCM) 60.5%



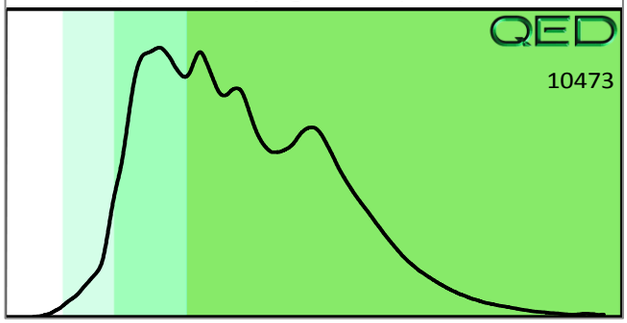
DPT-07 (3') 1120 : V.Deg.PHC (FCM) 89.3%



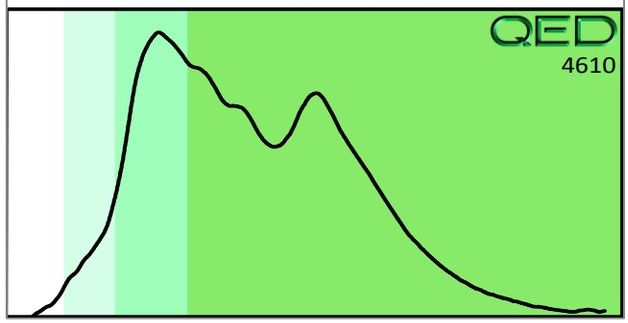
DPT-08 (5') 1130 : Background Organics (FCM)



DPT-09 (3') 1150 : Pyrogenic HC (FCM) 73.9%



DPT-10 (5') 1245 : V.Deg.PHC (FCM) 69.6%



Hydrocarbon Analysis Results

Client: CATLIN ENG. & SCI.
Address:

Samples taken Thursday, June 18, 2015
Samples extracted Thursday, June 18, 2015
Samples analysed Friday, June 19, 2015

Contact: BEN ASHBA

Operator KING

Project: 215050; NCDOT ILM SCOTCHMAN PSA

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios			HC Fingerprint Match
										% light	% mid	% heavy	
s	DPT-11 (3') 1300	23.4	<1.2	<0.59	44.2	44.2	42.1	4.8	0.34	0	79.6	20.4	V.Deg.PHC (FCM) 63.6%

Initial Calibrator QC check OK Final FCM QC Check OK 98 %

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values are not corrected for moisture or stone content

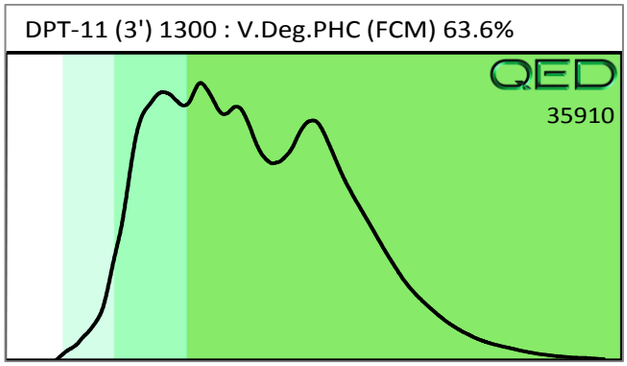
Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:- FCM = Results calculated using Fundamental Calibration Mode : % = confidence for sample fingerprint match to library

(SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present

QED Hydrocarbon Fingerprints

Project: 215050; NCDOT ILM SCOTCHMAN PSA

Friday, June 19, 2015



Chain of Custody Record and Analytical Request Form

Sample ID	Sample Collection			TAT Requested	
QED UVF	Date	Time	Initials	24 Hour	48 Hour
DPT-01 (6')	6-18-15	0945	CF	✓	
DPT-02 (5')		1005		✓	
DPT-03 (3')		1015		✓	
DPT-04 (2.5')		1025		✓	
DPT-05 (2.5')		1030		✓	
DPT-06 (2.5')		1045		✓	
DPT-07 (3')		1120		✓	
DPT-08 (5')		1130		✓	
DPT-09 (3')		1155		✓	
DPT-10 (5')		1245		✓	
DPT-11 (3')		1300		✓	

Client: Cutlin Eng. + Sci.

Contact: Ben Ashba

Phone: (910) 452-5861

Email: ben.ashba@cathinsa.com

Project Reference: 215050; NCDOT ILM Scotchman PSA

Each Sample will be analyzed for total

BTEX, GRO, DRO, TPH, and PAH

Each Sample will generate a fingerprint *representative of the petroleum* product within the sample. Electronic Data will be submitted to the email above.

Relinquished by	Date/time	Accepted by	Date/time
Casey D. Futrell	6-18-15/	Felecia Owen	06/19/15
Relinquished by	Date/time	Accepted by	Date/time
Relinquished by	Date/time	Accepted by	Date/time

SHIP TO: QROS

420 Raleigh Street Suite E

Wilmington, NC 28412

Contact: Leila Tabatabai

leilat@qrosllc.com

910-508-1940