Rp- Cert 1
3 rev

FILE COPY

CATLIN
ENGINEERS and SCIENTISTS

Post Office Box 10279
Wilmington, NC 28404-0279
Telephone: (910) 452-5861
Fax: (910) 452-7563

June 10, 2005

Mr. David T. Cleland, P.G.
NAVFAC Atlantic, Code: OPCEV4
North Carolina/Caribbean IPT
6506 Hampton Blvd.
Norfolk, VA 23508-1278

Re: **FINAL Report of Findings – AS-1 through AS-4**
Marine Corps Air Station
New River, North Carolina
CATLIN Project No. 205-027

Dear Mr. Cleland:

CATLIN Engineers and Scientists (CATLIN) is pleased to submit the FINAL Report of Findings document for the subject site. We have reviewed the comments to the referenced draft report and offer the following responses to the comments/concerns offered by Ms. Hall.

Comment #1

Just change reference in the exec sum and throughout report to just MCAS New River, Jacksonville, North Carolina. The MCAS is separate from MCB. Also, in the limitations section you reference the report as a CSA.

Acknowledged. Text has been changed.

CATLIN Engineers and Scientists appreciate the opportunity to continue to provide services to NAVFAC Atlantic and the Marine Corps Base Camp Lejeune on your environmental projects.

Sincerely,

Michael E. Mason, P.E.
CATLIN Program Manager

Shane A. Chasteen
Project Scientist

Attachments: FINAL Report of Findings

cc: Mr. Michael J. Cree, Osage of Virginia (1 copy)
Commanding General, Attn: Director I&E/EMD/EQB (2 copies)

205027_Final_ltr.doc

REPORT OF FINDINGS

FORMER USTs AS-1 thru AS-4

MARINE CORPS AIR STATION
NEW RIVER, NORTH CAROLINA

NCDENR UST INCIDENT NOs. 20067, 20071, 20068
RISK CLASSIFICATION: INTERMEDIATE
LAND USE CLASSIFICATION: RESIDENTIAL

JUNE 10, 2005

CATLIN PROJECT NO. 205-027

PREPARED BY:

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

TABLE OF CONTENTS

		PAGE
LIST OF ACRONYMS		**i**
EXECUTIVE SUMMARY		**1**
1.0	**INTRODUCTION**	**2**
2.0	**SITE HISTORY AND SOURCE CHARACTERIZATION**	**3**
2.1	***SITE OPERATIONS AND HISTORY***	***3***
2.2	***CONTAMINANT SOURCE INVENTORY***	***3***
2.3	***RELEASE INCIDENT HISTORY***	***3***
2.4	***PREVIOUS INVESTIGATIONS***	***3***
2.5	***HISTORY OF CORRECTIVE ACTIONS***	***6***
3.0	**SITE RECEPTOR INFORMATION**	**6**
4.0	**SITE SOIL SAMPLING**	**7**
4.1	***SOIL SAMPLING – UST CLOSURES***	***7***
4.2	***SOIL SAMPLING – PHASE I LSA***	***7***
4.3	***SOIL SAMPLING – PHASE II LSA***	***8***
4.4	***SOIL SAMPLING – J.A. JONES PIPING REMOVAL***	***8***
4.5	***SOIL SAMPLING – SHAW PIPING REMOVAL***	***9***
5.0	**SITE GROUNDWATER SAMPLING**	**9**
5.1	***GROUNDWATER SAMPLING – UST CLOSURES***	***9***
5.2	***GROUNDWATER SAMPLING – PHASE I LSA***	***9***
5.3	***GROUNDWATER SAMPLING – PHASE II LSA***	***10***
5.4	***GROUNDWATER SAMPLING – J.A. JONES PIPING REMOVAL***	***10***
6.0	**DISCUSSION**	**11**
7.0	**CONCLUSIONS AND RECOMMNEDATIONS**	**12**
7.1	***CONCLUSIONS***	***12***
7.2	***RECOMMENDATIONS***	***12***
8.0	**LIMITATIONS**	**13**
9.0	**REFERENCES**	**14**

TABLE OF CONTENTS (cont.)

FIGURES

FIGURE 1 SITE VICINITY MAP

APPENDICES

APPENDIX A DRAFT PHASE II LSA
APPENDIX B FIGURES FROM MARCH 2005 SHAW PIPE REMOVAL REPORT

LIST OF ACRONYMS

2000 Guidelines	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater.
2001 Guidelines	Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section (Effective July 1, 2001)
2L GWQS	NCAC T15A:02L Groundwater Quality Standards
ARO	Asheville Regional Office
AS	Air Sparge
AST	Aboveground Storage Tank
BDL	Below Detection Limit
BN	Base/Neutral (extractables)
BNA	Base/Neutral/Acid (extractables)
BQL	Below Quantitation Limit
BLS	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAP	Corrective Action Plan
CATLIN	CATLIN Engineers and Scientists (Formerly RC&A)
CFR	Code of Federal Regulations
Cr	Chromium
CSA	Comprehensive Site Assessment
CNP	Carbon Nitrogen Phosphorous
CPT	Cone Penetrometer Test
DEM	Division of Environmental Management
DIPE	Diisopropyl Ether
DO	Dissolved Oxygen
DOD	Department of Defense
DPT	Direct Push Technology
DWQ	Division of Water Quality
DWM	Division of Waste Management
DTW	Depth to Water
EAD	Environmental Affairs Department
EDB	Ethylene di-bromide
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
EQB	Environmental Quality Branch
Fe	Iron
FID	Flame Ionization Detector
FOD	Foreign Object Debris
FRO	Fayetteville Regional Office
FT	Feet

GCL	Gross Contaminant Level
GIS	Geographic Information System
GPS	Global Positioning System
Guidelines Vol. I	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater, Volume I, Sources Other Than Petroleum Underground Storage Tanks (May 1998)
Guidelines Vol. II	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater, Volume II, Petroleum Underground Storage Tanks (January 2, 1998)
HDPE	High Density Polyethylene
I/C	Industrial/Commercial
ID	Identification
I&E	Installations and Environment Department
IGWQS	Interim Groundwater Quality Standards
IPE	Isopropyl Ether
LANTDIV	Atlantic Division
LSA	Limited Site Assessment
LUST	Leaking Underground Storage Tank
m-	meta
m	meter
MADEP	Massachusetts Department of Environmental Protection
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps Outlying Landing Field
MDL	Method Detection Limit
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
MRO	Mooresville Regional Office
MSCC	Maximum Soil Contaminant Concentration
MSL	Mean Sea Level
MTBE	Methyl tertiary butyl ether
µg/Kg	Micrograms per Kilogram
µg/L	Micrograms per Litre
NA	Not Analyzed
N/A	Not Applicable
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOC	North Carolina Department of Corrections
NCDOT	North Carolina Department of Transportation
NCSP	North Carolina State Plane
NCSPA	North Carolina State Ports Authority
NE	None Established
NM	Not Measured
NMT	No Measurable Thickness
NS	Not Sampled

o-	ortho
OVA	Organic Vapor Analyzer
p-	para
PAH	Polynuclear Aromatic Hydrocarbons
Pb	Lead
PPB	Parts Per Billion
PPM	Parts Per Million
PID	Photo Ionization Detector
PQL	Practical Quantitation Limit
PVC	Polyvinyl chloride
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
Res	Residential
ROI	Radius of Influence
RRO	Raleigh Regional Office
SOW	Scope of Work
STGW	Soil-to-Groundwater
SVE	Soil Vapor Extraction
SVOC	Semi Volatile Organic Compound
TDHF	Toxicologically Defined Hydrocarbons Fractions
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
US	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WaRO	Washington Regional Office
WiRO	Wilmington Regional Office
WSRO	Winston-Salem Regional Office

FORMER USTs AS-1 thru AS-4
REPORT OF FINDINGS (ROF)

MARINE CORPS AIR STATION
NEW RIVER, NORTH CAROLINA

JUNE 10, 2005

EXECUTIVE SUMMARY

USTs AS-1 through AS-4 and the associated piping system was located at the MCAS New River, North Carolina. USTs AS-1 through AS-4 and the associated piping system was installed in the early 1940s. This system was referred to as the Aqua System (AS) and was a landing field aviation fuel distribution system for sea planes. The AS consisted of four, 30,000-gallon USTs (two low octane gasoline and two high octane gasoline) and associated 2-inch, 3-inch, 4-inch, and 6-inch piping. The four USTs were located east of Curtis Road in an open grassy area and approximately 250 feet of piping connected the USTs to two truck unloading areas and one truck loading platform located just west of the USTs. Additionally, 6-inch piping ran from the UST system to two "Warming Up Platforms", one located approximately 500 feet north of the USTs and one located approximately 1,600 feet east-northeast of the USTs. The AS was reportedly used from the early 1940s to the 1960s at which time the system was decommissioned.

A number of environmental investigations have been performed at the subject site which include tank closure activities, a Phase I and Phase II LSA, and two pipe removal projects. As part of these investigations soil and groundwater sampling was conducted to assess any impacts from the USTs and their associated piping. The results from these investigations indicated soil contamination above the Residential Maximum Soil Contaminant Concentrations (MSCCs) remains at only one isolated location. Findings from the groundwater sampling conducted revealed groundwater contamination above the 2L or interim Groundwater Quality Standards (GWQS) remains in the vicinity of former USTs AS-1 and AS-2 and at the Warming Up Platform approximately 500 feet north of the former USTs.

Based on review of all available information for the AS-1 through AS-4 site, CATLIN recommends a Corrective Action Plan (CAP) be prepared to address the groundwater contamination identified in the vicinity of former USTs AS-1 and AS-2. As part of the CAP, resampling of all on-site monitoring wells for risk-based analysis is recommended.

CATLIN also recommends additional groundwater assessment activities be conducted at the Warming Up Platform. Specifically, a Limited Site Assessment should be performed at each of two former temporary well locations which revealed groundwater contamination in excess of the 2L or interim GWQS.

FORMER USTs AS-1 thru AS-4
REPORT OF FINDINGS

MARINE CORPS AIR STATION
NEW RIVER, NORTH CAROLINA

1.0 INTRODUCTION

Date Of Report: June 10, 2005
Facility ID: N/A Groundwater Incident Number(s): 20067,20071,20068
Site Name: Former USTs AS-1 thru AS-4
Site Location: Marine Corps Air Station, New River
Nearest City/Town: Jacksonville County: Onslow
Risk Classification: Intermediate Land Use Classification: Residential

UST Owner: Commanding General – MCB Camp Lejeune
Attn: Director I&E/EMD/EQB
Address: PSC 20004
MCB Camp Lejeune, NC 28542-0004 Phone: (910) 451-5068

UST Operator: Same as above
Address: Same as above Phone: Same as above

Property Owner: Same as above
Address: Same as above Phone: Same as above

Property Occupant: Marine Corps personnel
Address: Marine Corps Air Station, New River Phone: Unknown

Consultant/Contractor: CATLIN Engineers and Scientists
Address: 220 Old Dairy Road, Wilmington, North Carolina 28405 Phone: (910) 452-5861

Release Information

Date Discovered: Identified in January 1999 after removal of USTs AS-1 through AS-4
Longitude: 77° 26.070' W **Latitude:** 34° 42.539' N

Estimated Quantity of Release: Unknown
Cause of Release: Unknown, leaks from piping associated with USTs are suspected
Source of Release (e.g. Piping/UST):
Unknown, leaks from piping associated with USTs are suspected

Sizes and contents of UST system from which the release occurred:
The former USTs were 30,000 gallons in capacity and contained low-octane and high-octane gasoline. Approximately 3,000 linear feet of piping was associated with the four USTs.

I, **Michael E. Mason** a Professional Engineer/Licensed Geologist **(circle one)** for CATLIN Engineers and Scientists, do certify that the information contained in this report is correct and accurate to the best of my knowledge.

(Please Affix Seal and Signature)

2.0 SITE HISTORY AND SOURCE CHARACTERIZATION

USTs AS-1 through AS-4 and the associated piping system was located at the MCAS New River, North Carolina (see Figure 1).

2.1 SITE OPERATIONS AND HISTORY

USTs AS-1 through AS-4 and the associated piping system was installed in the early 1940s at MCAS New River. This system was referred to as the Aqua System and was a landing field aviation fuel distribution system for sea planes. The Aqua System consisted of four, 30,000-gallon USTs (two low octane gasoline and two high octane gasoline) and associated 2-inch, 3-inch, 4-inch, and 6-inch piping. The four USTs were located east of Curtis Road in an open grassy area and approximately 250 feet of piping connected the USTs to two adjacent truck unloading areas and one truck loading platform located just west of the USTs. Additionally, 6-inch piping ran from the UST system to two "Warming Up Platforms", one located approximately 500 feet north of the USTs and one located approximately 1,600 feet east-northeast of the USTs. The Aqua System was reportedly used from the early 1940s to the 1960s at which time the system was decommissioned.

2.2 CONTAMINANT SOURCE INVENTORY

The four USTs and associated piping of the Aqua System appears to be the contaminant source at the subject site.

2.3 RELEASE INCIDENT HISTORY

Date released discovered: January 1999 during tank closure activities

Amount of release: Unknown

Method of discovery: During tank closure activities soil discoloration and petroleum odors were noted within soils beneath USTs. Soil and Groundwater samples collected during tank closure activities confirmed a release had occurred at AS-1 through AS-3.

2.4 PREVIOUS INVESTIGATIONS

Previous environmental activities and investigations at the site include: tank closure activities, a Phase I and Phase II LSA investigation, and two pipe removal actions (one in 2001-2002 and another in 2004). Findings from these activities and investigations can be found in the following documents:

TITLE	AUTHOR
GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-1, MCAS New River, dated February 22, 1999	J.A. Jones
GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-2, MCAS New River, dated March 16, 1999	J.A. Jones
GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-3, MCAS New River, dated March 16, 1999	J.A. Jones
GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-4, MCAS New River, dated March 16, 1999	J.A. Jones
Phase I Limited Site Assessment, Former USTs AS-1 through AS-3, MCAS New River, dated July 13, 1999	Law Engineering
Draft Phase II Limited Site Assessment, Former USTs AS-1 through AS-3, MCAS New River, dated March 3, 2000	Law Engineering
AS 1-4 Underground Fuel Pipe Removal Report, MCB Camp Lejeune, dated March 17, 2005	Shaw Environmental

The results of these investigations indicate the following:

- In January 1999, J.A. Jones removed four USTs at the subject site. The top of the tanks were buried to a depth of approximately five feet below land surface (BLS) and the bottom of the tanks were approximately 16-18' BLS. The piping associated with the tanks was drained and flushed, but left in the ground and was not plugged or capped. Discolored soils and petroleum odors were observed beneath all four tanks at the bottom of the excavations. Five soil samples were collected from the bottom of each tank basin and analyzed per EPA Methods 3550 and 5030. As stated by J.A. Jones, soil samples from the tank basins of USTs AS-1 through AS-3 revealed detections above the action level of 10 mg/Kg. While open, groundwater seeped into the excavations at AS-1 and AS-2, therefore a grab groundwater sampled was collected and analyzed per EPA Methods 601 and 602. Analytical results revealed Benzene above the 2L Standard in each of the groundwater samples collected from AS-1 and AS-2. The findings during the tank closure activities triggered Phase I LSA activities at the locations of former USTs AS-1 through AS-3.

- In April 1999, Law Engineering installed three Type II monitoring wells, one at each of the locations of former USTs AS-1 through AS-3 (Appendix A contains the Draft Phase II LSA which includes figures illustrating well locations). Soil and groundwater samples were collected at each well location; in addition, a

receptor survey was also conducted to classify the risk and the appropriate land use category. Law reported that the analytical results from the soil samples revealed no soil contamination in excess of the Residential MSCCs. The groundwater samples collected from USTAS1-MW01 and USTAS2-MW01 revealed two compound concentrations greater than 10 times the 2L GWQS, but no groundwater contamination in excess of any established Gross Contaminant Levels (GCLs). The findings from the receptor survey prompted Law to recommend an Intermediate risk classification and a Residential land use category. The results of the Phase I LSA investigation initiated Phase II LSA activities.

- In November 1999, Law Engineering installed four additional monitoring wells (three Type II monitoring wells and one deep, Type III monitoring well) at the subject site (Appendix A contains the Draft Phase II LSA which includes figures illustrating well locations). Soil and groundwater samples were collected at each well location, for laboratory analysis. As stated by Law, analytical results from the soil samples collected during installation of the four additional monitoring wells revealed no soil contamination in excess of the Residential MSCCs. The groundwater samples collected from each of the four new monitoring wells installed indicated no compound concentrations above the 2L GWQS. The information collected as part of the Phase II LSA activities was not submitted to NCDENR for review because a November 16, 1999 letter from NCDENR indicated that the entire piping system needed to be assessed as part of the Phase II activities. Therefore, the report was not submitted, as this additional assessment had not yet been conducted. Refer to Appendix B for the draft copy of the Phase II LSA Report.

- In response to the November 1999 letter from the NCDENR, J.A. Jones conducted underground piping removal activities from August 2001 to March 2002. Approximately 2500 feet of piping was removed or abandoned which ran from the former USTs AS-1 through AS-4 to the two Warming Up Platforms (Appendix B contains figures illustrating piping and sampling locations). Soil and groundwater samples were collected during removal/abandonment activities. J.A. Jones stated, analytical results revealed no soil contamination in excess of the Residential MSCCs. Groundwater contamination above the 2L or interim GWQS was detected in four of the six samples collected; however, no contaminants were detected in excess of any established GCLs.

- In October and November 2004, Shaw removed additional underground piping in the immediate vicinity of the former USTs AS-1 through AS-4 (Appendix B contains figures illustrating piping and sampling locations). As stated by Shaw, piping removal activities excavated approximately 665 feet of trench to a depth of five to six feet and 423 feet of piping was removed. Two rounds of soil samples were collected during removal activities and final analysis revealed only one soil sample with contaminant concentrations in excess of the Residential MSCCs.

2.5 HISTORY OF CORRECTIVE ACTIONS

In January 1999 the four USTs at the subject site were removed. No overexcavation was conducted when the tanks were removed, as the final depth of the basins were approximately 18' BLS. J.A. Jones excavated/abandoned approximately 2500 feet of fuel piping from August 2001 to March 2002 (Piping under the Warming Up Platform was plugged and abandoned in place. Piping in the grassy areas was removed). Shaw conducted additional piping removal activities in October and November 2004 by excavating approximately 665 feet of trench to a depth of five to six feet. No other corrective actions have been conducted at the subject site to the best of CATLIN's knowledge.

3.0 SITE RECEPTOR INFORMATION

As defined by NCDENR in NCAC 15A 02L .0102(19) "receptors" include any human, plant, animal or structure with the potential to be adversely affected by the release or migration of contaminants. Guidance documents issued by the regulatory agency indicate that structures may include items such as utility lines, basements, and elevator shafts. Although not specifically included in Section .0102 of 2L GWQS, regulatory officials typically consider potential receptors to include environmental resources such as water supply wells, surface waters, drinking water supplies, and "regions of groundwater that have been identified for planned resource development." Receptor information was documented in the Phase I and Phase II LSAs conducted by LAW (A copy of the Draft Phase II LSA is included in Appendix A). The above information, in conjunction with additional research conducted by CATLIN reveal the following:

Potable or Non-potable Water Wells within 1,000 feet of Source Area

- No potable or non-potable water wells are located within 1,500 feet of the subject site.
- Groundwater within 500 feet of the subject site is unlikely to be utilized in the future as a source of water supply as there are other adequate areas for future water supply wells.

Public Water Supplies

- Water is provided to buildings within 1,500 feet of the subject site by water mains from the water treatment plant located on Curtis Road.

Surface Water Bodies within 1,500 feet of Source Area

- A manmade drainage ditch is located approximately 200 feet to the northeast, this drainage ditch eventually discharges to the New River which is located approximately 1,200 feet east of the subject site.

Wellhead Protection Areas

- Camp Lejeune has identified proposed wellhead protection areas on the MCAS. According to available information (Wellhead Protection Plan – 2002 Update, August 2002), the subject site is not located within a proposed wellhead protection area.

Deep Aquifers in the Coastal Plain Physiographic Region

- As stated in the 2000 Draft Phase II LSA, the site is located within a potential recharge area to the semi-confined Castle Hayne Aquifer. The MCAS New River currently obtains water for drinking from the Castle Hayne Aquifer. However, water supply wells are not located within a 1,500 feet radius of the subject site and there are no plans to install new water supply wells within this radius. Also, petroleum-related compounds were not detected in the samples collected from the deep, Type III monitoring well USTAS1-MW05 at the subject site. Therefore, it is unlikely that the release in this area would affect the portion of the deeper aquifer.

Underground Utilities at the Subject Site

- The subject site is currently undeveloped, however underground pits associated with the former USTs and distribution system may remain on-site.
- An underground water line lies across the site of former USTs AS-1 to AS-4 in a north-south orientation.
- An electrical line is located approximately 80 feet to the northeast of the subject site.

Adjoining Property Owners and Occupants within 1,500 feet of the Source Area

- The nearest primary or secondary residence is located approximately 200 feet to the southeast of the subject site.
- A playground is located approximately 400 feet south of the subject site.

4.0 SITE SOIL SAMPLING

Various soil investigations have been conducted at the subject site from 1999 to 2004. The results of these investigations are summarized below.

4.1 SOIL SAMPLING – UST CLOSURES

In January 1999, J.A. Jones conducted tank removal actions at the subject site. The four USTs were removed and five soil samples were collected from the bottom of each tank basin at a depth of approximately 16-18' BLS. The soil samples were analyzed per EPA Methods 3550 and 5030. As indicated by J.A. Jones, soil samples from three of the four tank basins revealed detections above the action level of 10 mg/Kg. The soil samples collected from the basin of UST AS-4 did not indicate levels of TPH-Diesel or TPH-Gasoline above the laboratory method detection limits. Based on the results from the soil sampling conducted during the closure activities, additional environmental investigations were recommended.

4.2 SOIL SAMPLING – PHASE I LSA

Law conducted field activities in April 1999 during a Phase I LSA which included the collection of three soil samples (one from each monitoring well boring) for offsite laboratory analysis. In the Phase I LSA Report Law stated, soil samples USTAS1-

MW01 and USTAS2-MW01 were collected from 4-6' BLS and sample USTAS3-MW01 from 6-8' BLS. The samples were analyzed per EPA Methods 8260, 8270 and MADEP VPH/EPH. Laboratory results indicated detections for C_5-C_8 Aliphatics, C_9-C_{18} Aliphatics, C_{19}-C_{36} Aliphatics, and C_9-C_{22} Aromatics hydrocarbon fractions in sample USTAS1-MW01. Naphthalene was detected in soil sample USTAS2-MW01. None of the compound concentrations detected were in excess of the Residential MSCCs (Appendix A contains the Draft Phase II LSA which includes tables and figures illustrating sampling locations and results).

4.3 SOIL SAMPLING – PHASE II LSA

In November 1999, Law Engineering installed four additional borings at the subject site as part of Phase II LSA activities. As reported by Law, one soil sample was collected at each boring location for laboratory analysis. Soil samples USTAS1-MW04 through USTAS1-MW06 were collected from 5-7' BLS and sample USTAS1-MW07 from 6-8' BLS. Soil samples were analyzed per EPA Method 8260, 6010 (Chromium and Lead) and MADEP VPH. Analytical results from the soil samples collected during installation of the four additional monitoring wells revealed no detections above the laboratory method detection limits for EPA Method 8260 and MADEP VPH. Chromium and Lead was detected in all four of the samples submitted, however, none of the concentrations were above the Residential MSCCs (Appendix A contains the Draft Phase II LSA which includes tables and figures illustrating sampling locations and results).

4.4 SOIL SAMPLING – J.A. JONES PIPING REMOVAL

In November 1999 a letter from the NCDENR indicated that the LSA activities conducted were incomplete as they did not assess the soil and groundwater conditions along the fuel piping associated with USTs AS-1 through AS-4. In response to this letter J.A. Jones initiated piping removal activities. J.A. Jones conducted removal of the underground piping that ran from the general vicinity of UST AS-4 to the two Warming Up Platforms from August 2001 to March 2002. As stated by Shaw in the 2005 Pipe Removal Report, soil samples were collected approximately every 20 feet from beneath the former piping (Appendix B contains figures illustrating piping and sampling locations). One hundred and twenty five (125) soil samples were obtained from along the former piping and were analyzed per EPA Methods 3550 and 5030. Analytical results indicated that 24 of the 125 soil samples contained levels of TPH-Diesel and/or TPH-Gasoline above the action level of 10 mg/Kg. Therefore, additional confirmation samples were collected at 20 of the 24 locations which exceeded the action level. These confirmation samples were analyzed per EPA Methods 8260, 8270 and MADEP VPH/EPH. Laboratory results indicated detections of several compounds, however, none of the detections were at levels above the Residential MSCCs.

4.5 SOIL SAMPLING – SHAW PIPING REMOVAL

In October and November 2004, Shaw removed additional underground piping in the immediate vicinity of the former USTs AS-1 through AS-4. Shaw indicated that, 13 confirmation soil samples (AS1-4-001 to AS1-4-013) were collected at the bottom of the piping excavation at a depth of five to six feet and were analyzed per EPA Methods 3550 and 5030 (Appendix B contains figures illustrating piping and sampling locations). Eight of the 13 samples revealed TPH-Gasoline at concentrations above the action level of 10 mg/Kg. Therefore, an additional one foot of soil was excavated from these areas and a second soil sample was obtained. These second confirmation samples were analyzed per EPA Methods 8260, 8270 and MADEP VPH/EPH. At only one of the eight resampled locations was soil contamination detected above the applicable MSCCs. Analytical results for sample AS1-4-001 revealed C_5-C_8 Aliphatics and Benzo(a)pyrene at concentrations of 1,920 mg/Kg and 0.143 mg/Kg, respectively, both of which exceeded their established Residential MSCCs. All other compounds where either undetected or were detected at concentrations below the Residential MSCCs.

5.0 SITE GROUNDWATER SAMPLING

Various groundwater investigations have been conducted at the subject site from 1999 to 2002. The findings from these investigations are summarized below.

5.1 GROUNDWATER SAMPLING – UST CLOSURES

J.A. Jones removed USTs AS-1 through AS-4 in January 1999. After the tanks were removed, groundwater seeped into the excavations at AS-1 and AS-2, therefore a grab groundwater sampled was collected with a bailer and analyzed per EPA Methods 601 and 602. As reported by J.A. Jones, analytical results revealed Benzene above the 2L Standard in each of the samples collected from AS-1 and AS-2.

5.2 GROUNDWATER SAMPLING – PHASE I LSA

Based on the findings from the UST closures, three, Type II monitoring wells were installed in April 1999 by Law during Phase I LSA field activities. One well was installed at the former locations of USTAS-1, USTAS-2 and USTAS-3; a monitoring well was not installed at the former location of UST AS-4. Law indicated, the wells were properly purged and groundwater samples were collected and analyzed per EPA Methods 602, 625 and MADEP VPH/EPH. Analytical results for sample USTAS1-MW01 indicated concentrations of Benzene (0.004 mg/L) and the C_9-C_{22} Aromatics hydrocarbon fraction (2.3 mg/L) in excess of the 2L or interim GWQS. Analytical results for sample USTAS2-MW01 revealed concentrations of Benzene (0.482 mg/L), Toluene (1.25 mg/L), Ethylbenzene (0.042 mg/L), the C_5-C_8 Aliphatics hydrocarbon fraction (3.5 mg/L), and the C_9-C_{22} Aromatics hydrocarbon fraction (2.7 mg/L) in

excess of the 2L or interim GWQS. All other compounds were either undetected or detected at concentrations below the 2L or interim GWQS (Appendix A contains the Draft Phase II LSA which includes tables and figures illustrating sampling locations and results).

5.3 GROUNDWATER SAMPLING – PHASE II LSA

The results from the Phase I LSA investigation triggered the installation of four additional monitoring wells (three Type II monitoring wells and one deep, Type III monitoring well) in November 1999 by Law at the subject site. The locations of the four new monitoring wells are illustrated on figures in the Draft Phase II LSA Report which is found in Appendix B. As stated by Law, each of the new wells were properly purged and groundwater samples were collected and analyzed per EPA Methods 6210D, 6010 (Chromium and Lead) and MADEP VPH. Analytical results indicated the only compound detected above any of the laboratory method detection limits was Chloromethane. This compound was detected in samples USTAS1-MW04 and USTAS1-MW07 at concentrations of 0.0009 mg/L and 0.001 mg/L, respectively, both of which were below the 2L Standard of 0.0026 mg/L for this compound (Appendix A contains the Draft Phase II LSA which includes tables and figures illustrating sampling locations and results).

5.4 GROUNDWATER SAMPLING – J.A. JONES PIPING REMOVAL

In November 1999 a letter from the NCDENR indicated that the LSA activities conducted were incomplete as they did not assess the soil and groundwater conditions along the fuel piping associated with USTs AS-1 through AS-4. In response to this letter J.A. Jones initiated piping removal/abandonment activities during 2001 and 2002. During the removal/abandonment of the piping, six temporary wells were installed along the former fuel lines. The locations of the temporary wells are illustrated on figures found in Appendix B. As stated by Shaw in the 2005 Pipe Removal Report, groundwater samples were collected from each of the temporary wells and analyzed per EPA Methods 601, 602, 625, 6010 (Lead) and MADEP VPH/EPH. The groundwater sample TW-01 revealed concentrations of Bis(2-ethylhexyl)phthalate (15 ug/L) and Lead (50 ug/L) above their respective 2L Standard. Benzene (130 ug/L), Ethylbenzene (41 ug/L), Bis(2-ethylhexyl)phthalate (21 ug/L), Lead (120 ug/L), and the C_5-C_8 Aliphatics hydrocarbon fraction (3,300 ug/L) were all detected at concentrations above their respective 2L or interim GWQS in groundwater sample TW-02. Analytical results from groundwater sample TW-03 indicated concentrations of Benzene (850 ug/L), Ethylbenzene (330 ug/L), and Lead (67 ug/L) above their respective 2L Standard. The C_5-C_8 Aliphatics hydrocarbon fraction (12,000 ug/L) and C_9-C_{22} Aromatics hydrocarbon fraction (1,300 ug/L) were both detected at concentrations in excess of the interim GWQS in groundwater sample TW-04. All other compounds were either undetected or detected at concentrations below the 2L or interim GWQS.

6.0 DISCUSSION

Several soil assessments have been conducted at the subject site. Initially soil samples were collected from the bottom of each of the four tank basins after the tanks were removed. Analytical results from these tank closure samples revealed soil contamination above the applicable state action level at three of the four former tank locations. It should be noted that the tank closure samples collected were obtained from approximately 16-18' BLS which may not be indicative of vadose zone soil conditions as the depth to groundwater during subsequent investigations generally ranged between five to nine feet BLS in the vicinity of the former USTs.

Based on the results of the tank closure activities additional soil sampling was conducted during the installation of three monitoring wells as part of Phase I LSA field activities. These soil samples were collected from the vadose zone and were analyzed per the risk-based methods specified in the 2001 Guidelines. Analytical results revealed no soil contamination in excess of the Residential MSCCs. Subsequent to the initial three monitoring wells, four new monitoring wells were installed in the vicinity of the former USTs AS-1 through AS-3 during Phase II LSA field activities. One vadose zone soil sample was collected from each of the four new monitoring well borings. Soil contamination in excess of the Residential MSCCs was not identified in any of the samples analyzed.

The soil sampling conducted during the tank closure and LSA activities concentrated in the vicinity of the former USTs. However, a letter from the NCDENR stated that assessment in the vicinity of the other parts of the UST system must be conducted to complete the Phase II LSA activities. Therefore, two separate excavations of the associated UST piping was conducted, one by J.A. Jones in 2001 and 2002 and the other by Shaw in 2004. During both of these removal operations soil samples were collected at approximately 20 foot intervals from below the former piping and were analyzed for TPH-Diesel and TPH-Gasoline. Analytical results from the above sampling revealed several locations were the state action level was exceeded. Therefore, at those locations a second sample was collected and analyzed per the risk-based methods specified in the 2001 Guidelines. Laboratory results from the risk-based sampling conducted indicated exceedance of the Residential MSCCs at only one location (AS1-4-001). Sample AS1-4-001 was collected by Shaw in November 2004 at a depth of 7 feet BLS and was located approximately 40 feet west of former UST AS-3 and approximately 15 feet south and west of former fuel lines associated with the UST system.

Petroleum-related groundwater contamination was first identified during tank closure activities in January 1999 by J.A. Jones. Groundwater infiltrated two of the four excavations during tank removal, therefore a groundwater sample was collected and analyzed from these two locations. Analytical results revealed groundwater contamination in excess of the 2L Standards.

The findings from the tank closure activities trigger installation of three monitoring wells by Law in April 1999 as part of Phase I LSA activities. Groundwater samples were collected and analyzed from each of the three wells installed. Analytical results revealed groundwater contamination in excess of the 2L or interim GWQS at two of the three monitoring wells sampled. Based on the results from the Phase I LSA sampling, four additional monitoring wells were installed and sampled. Groundwater contamination was not identified above the 2L or interim GWQS in any of the samples collected from the four additional monitoring wells.

The groundwater sampling conducted during the tank closure and LSA activities concentrated in the vicinity of the former USTs. However, NCDENR deemed the assessment incomplete as the areas of the piping associated with the USTs needed to be addressed. Therefore, in 2001 and 2002 J.A. Jones conducted a removal/abandonment of a portion of the associated UST piping. During removal/abandonment activities, six temporary monitoring wells were installed and sampled. Analytical results from the four samples collected from the temporary monitoring wells at the Warming Up Platform located approximately 500 feet north of the former USTs all revealed compound concentrations in excess of the 2L or interim GWQS, but no contaminant concentrations in excess of the established GCLs. The groundwater samples collected and analyzed from the two other temporary wells located along the former pipeline did not reveal compound concentrations above the 2L or interim GWQS.

7.0 CONCLUSIONS AND RECOMMNEDATIONS

7.1 CONCLUSIONS

No soil or groundwater sampling activities were conducted by CATLIN as part of this ROF. CATLIN has reviewed all available information for activities and investigations conducted for the subject site to compile this report. Based on an evaluation of the historical soil data collected, it appears soil contamination above the applicable MSCCs (Residential) remains in the vicinity of former soil sample location AS1-4-001.

Evaluation of the historical groundwater data indicates contamination in excess of the 2L or interim GWQS in the vicinity of former USTs AS-1 and AS-2. In addition, the groundwater at the Warming Up Platform located 500 feet north of the former USTs is contaminated at levels in excess of the 2L or interim GWQS. To CATLIN's knowledge, groundwater contamination has not been identified in excess of established GCLs during any of the investigations conducted at the subject site.

7.2 RECOMMENDATIONS

Based on review of all available information for the AS-1 through AS-4 site, CATLIN recommends a Corrective Action Plan (CAP) be prepared to address the groundwater contamination identified in the vicinity of former USTs AS-1 and AS-2. As part of the

CAP, resampling of all on-site monitoring wells for risk-based analysis is recommended.

CATLIN also recommends additional groundwater assessment activities be conducted at the Warming Up Platform. Specifically, a Limited Site Assessment should be performed at each of the former temporary well locations TW02 and TW04.

8.0 LIMITATIONS

The field, soil, and groundwater data evaluated as part of this investigation only provides isolated data points and may not represent conditions at every location in the project area. Analyses and conclusions of this report, being based on interpolation between data points at the project area, may not be completely representative of all site conditions. Conclusions and recommendations of this investigation and report are based on the best available data in an effort to comply with current regulatory requirements.

9.0 REFERENCES

AH Environmental Consultants, *Wellhead Protection Plan – 2002 Update*, Marine Corps Base, Camp Lejeune. Dated August 2002.

J.A. Jones Environmental Services, *GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-1, MCAS New River,* Dated February 22, 1999.

J.A. Jones Environmental Services, *GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-2, MCAS New River,* Dated March 16, 1999.

J.A. Jones Environmental Services, *GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-3, MCAS New River,* Dated March 16, 1999.

J.A. Jones Environmental Services, *GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-4, MCAS New River,* Dated March 16, 1999.

Law Engineering and Environmental Services, Inc., *Phase I Limited Site Assessment, Former USTs AS-1 through AS-3, MCAS New River,* Dated July 13, 1999.

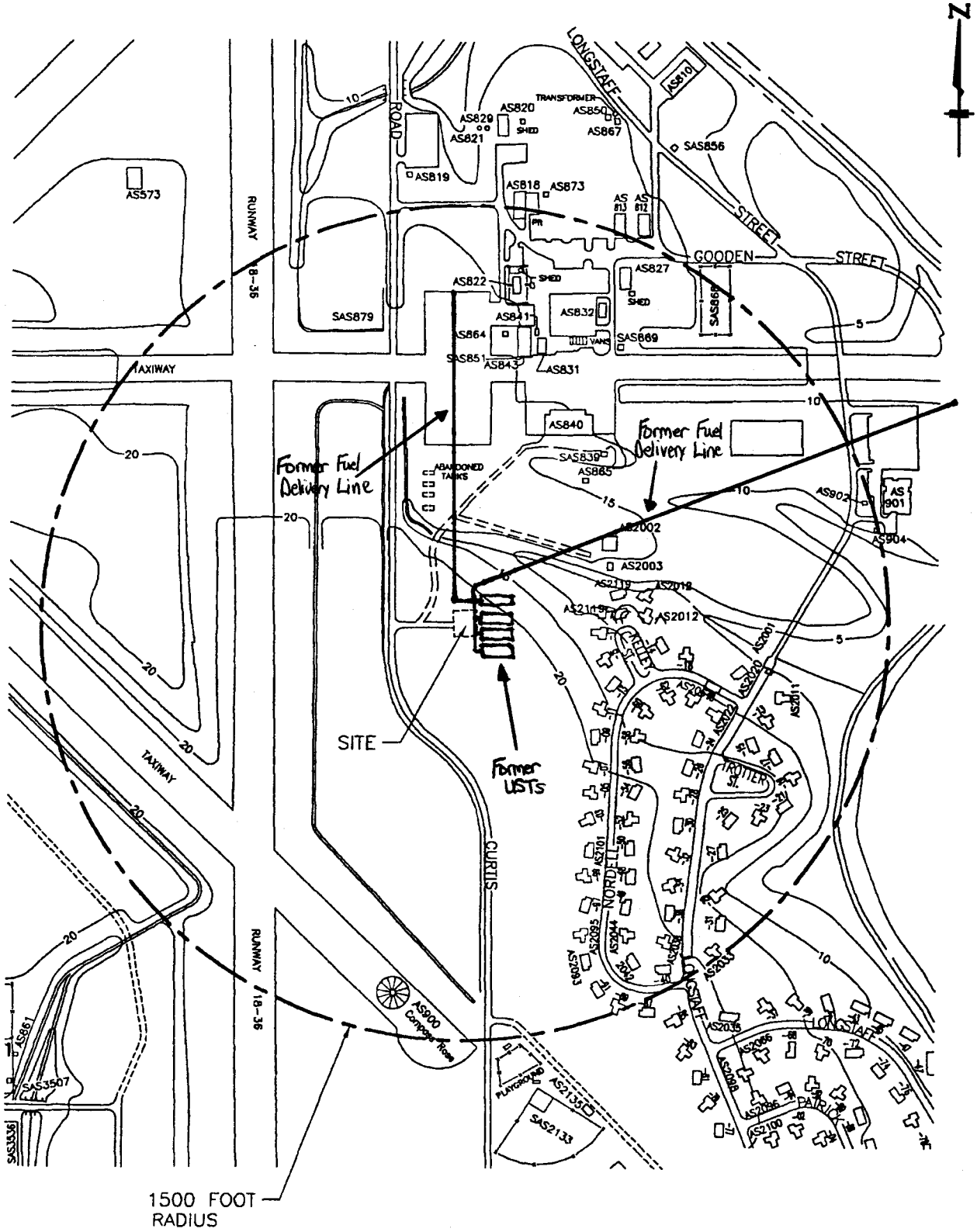
Law Engineering and Environmental Services, Inc., *Draft Phase II Limited Site Assessment, Former USTs AS-1 through AS-3, MCAS New River,* Dated March 3, 2000.

North Carolina Department of Natural Resources and Community Development, 1985, Geologic Map of North Carolina.

North Carolina Department of Environment and Natural Resources, *Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section* (Effective July 1, 2001).

Shaw Environmental, Inc., *AS 1-4 Underground Fuel Pipe Removal Report, MCB Camp Lejeune,* Dated March 17, 2005.

FIGURES



NOTES:

1. MAP ADAPTED FROM CAMP LEJEUNE DATABASE.

GRAPHIC SCALE – IN FEET

500 250 0 500 1000

CATLIN ENGINEERS and SCIENTISTS WILMINGTON, NORTH CAROLINA	PROJECT: REPORT OF FINDINGS FORMER UST's AS-1 THRU AS-4 MARINE CORPS AIR STATION NEW RIVER, NORTH CAROLINA	TITLE: SITE VICINITY MAP			FIGURE 1
	JOB NO: 205027	DATE: MAY 2005	SCALE: AS SHOWN	DRAWN BY: WHW	CHECKED BY: MEM

205027-MAY05-01

APPENDIX A

DRAFT PHASE II LSA

DRAFT

March 3, 2000

Commander
Naval Facilities Engineering Command
Atlantic Division
1510 Gilbert Street
Norfolk, Virginia 23511-6287

Attention: Code 18215, Ms. Lori P. Reuther

Subject: **PHASE II LIMITED SITE ASSESSMENT**
FORMER UNDERGROUND STORAGE TANKS AS-1, AS-2, AS-3
PARACHUTE TROOPS LANDING FIELD GASOLINE STORAGE AND DISTRIBUTION FACILITY
NEW RIVER AIR STATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA
NAVY CONTRACT NO. N62470-95-D-6009
LAW JOB NO. 30740-6-0600-0055

Dear Ms. Reuther:

Law Engineering and Environmental Services, Inc. (LAW) is pleased to submit the attached Limited Site Assessment (LSA) to the Naval Forces Engineering Command, Atlantic Division (LANTDIV). LAW installed a groundwater monitoring well at each of the former UST locations, collected soil and groundwater samples for laboratory analyses, and determined site risk information. These activities were performed in order to comply with the Risk Based Corrective Action (RBCA) rules established on January 2, 1998.

LAW appreciates the opportunity to continue to provide services to LANTDIV and the MCB on your environmental projects. We look forward to hearing from you soon.

Sincerely,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Tana M. Jones
Staff Environmental Scientist

Brian J. Bellis, L.G.
Principal Hydrogeologist

Attachments: Report

cc: Christine Foskey - Contracts, correspondence only
N. Neal Paul -Installation Restoration Division, EMD, MCB Camp Lejeune
Michael E. Mason, P.E., Program Manager, Catlin Engineers & Scientists, Inc.

PHASE II
LIMITED SITE ASSESSMENT

FORMER USTS AS-1 THROUGH AS-3
GASOLINE STORAGE AND DISTRIBUTION FACILITY
PLATOON TROOPS LANDING FIELD
NEW RIVER AIR STATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

Issued: March 3, 2000

Navy Contract No. N62470-95-D-6009
LAW Job No. 30740-6-0600-0055

Law Engineering and Environmental Services, Inc.
3301 Atlantic Avenue
Raleigh, North Carolina 27604

PHASE II LIMITED SITE ASSESSMENT

FORMER USTs AS-1 THROUGH AS-3
GASOLINE STORAGE AND DISTRIBUTION FACILITY
PLATOON TROOPS LANDING FIELD
NEW RIVER AIR STATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

Coordinates in Decimal Degrees:
Lattitude: N 34 degrees, 42.539 minutes
Longitude: W 77 degrees, 26.070 minutes

Issued: March 3, 2000

Navy Contract No. N62470-95-D-6009, Delivery Order 0055
LAW Job No. 30740-6-0600 Phase 0055 Task 92

Groundwater Incident Number: Not established.

Facility Identification Number: Not applicable.

Current UST owner, UST operator:

Commanding General
(ATTN AC/S, END/IRD)
Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004
ATTN: Mr. Neal Paul, Installation Restoration Division, EMD
Phone: (910) 451-5068

Release Information:

- Date: Identified in January 1999 after removal of USTs AS-1 through AS-3
- Estimated Quantity: Not known
- Cause of Release (piping/UST): Not known, however leaks from the piping are suspected.
- Size and Contents of UST: The former USTs were 30,000 gallons in capacity and contained low-octane and high-octane gasolines.

Law Engineering and Environmental Services, Inc.
3301 Atlantic Avenue
Raleigh, NC 27604
(919) 876-0416

Tana M. Jones
Staff Environmental Scientist

Brian J. Bellis, L.G.
Principal Hydrogeologist

TABLE OF CONTENTS

		PAGE
1.0	INTRODUCTION	1
2.0	BACKGROUND	2
3.0	SITE CHARACTERIZATION	5
4.0	RISK CHARACTERIZATION	10
5.0	RECEPTOR INFORMATION	14
6.0	SITE GEOLOGY AND HYDROGEOLOGY	16
7.0	SAMPLING RESULTS, PHASE II INVESTIGATION	18
8.0	CONCLUSIONS AND RECOMMENDATIONS	20
9.0	REFERENCES CITED	21

TABLES

Table 1: J.A. Jones Environmental Services Co., Summary of Laboratory Results, Soil
Table 2: J.A. Jones, Summary of Laboratory Results, Groundwater
Table 3: Summary of Laboratory Results (April 1999), Soil
Table 4: Summary of Laboratory Results (MADEP-VPH/EPH, April 1999), Groundwater
Table 5: Summary of Laboratory Results (VOCs/SVOCs, April 1999), Groundwater Samples
Table 6: Summary of Headspace Screening Results
Table 7: Summary of Laboratory Results (November 1999), Soil Samples
Table 8: Summary of Laboratory Results (MADEP-VPH), Groundwater Samples
Table 9: Summary of Laboratory Results (VOCs), Groundwater Samples

FIGURES

Figure 1: Topographic Location Map
Figure 2: Utility and Former Gasoline UST Location Map
Figure 3: Water Supply Well Location Map
Figure 4: Groundwater Elevation Contour Map
Figure 5: Soil Sample Results
Figure 6: VPH and EPH Results, Groundwater Samples
Figure 7: VOC and SVOC Results, Groundwater Samples

APPENDICES

Appendix A: Monitoring Well Construction Records and Soil Boring Test Records
Appendix B: Monitoring Well Development Worksheets
Appendix C: Monitoring Well Casing and Water Elevation Worksheets
Appendix D: Laboratory Reports, Soil Samples
Appendix E: Monitoring Well Sampling Worksheets
Appendix F: Laboratory Reports, Groundwater Samples

EXECUTIVE SUMMARY

Law Engineering and Environmental Services, Inc. (LAW) has performed a Phase II Limited Site Assessment (LSA) of the former UST AS-1 through AS-3 site, located at the New River Air Station, Marine Corps Base (MCB), Camp Lejeune, North Carolina. Former USTs AS-1, AS-2, and AS-3 were each 30,000-gallons in capacity, contained gasoline products for refueling of aircraft, and were removed in January 1999. During this Phase II LSA, LAW installed four additional groundwater monitoring wells; one upgradient of the contaminant source, two downgradient of the contaminant source, and one vertical-extent well immediately downgradient of the source but within the contaminant plume. We also collected groundwater samples from the wells for laboratory analyses and gathered information regarding site-specific risk factors.

During this Phase II LSA, we did not identify petroleum-contaminated soils within the unsaturated zone at the UST AS1 to AS-3 site. J.A. Jones, the contractor that removed the tanks and performed UST closure assessments, identified petroleum-contaminated soil below tanks AS-1, AS-2 and AS-3. However, those soils appear to occur below the water table and are not indicative of vadose zone contamination. Concrete anchor pads are also reported to remain in the subsurface at the project site.

During the Phase I investigation, benzene, ethylbenzene, toluene, C5 to C8 aliphatic VPH compounds, and C11 to C22 aromatic EPH compounds were identified within the groundwater sample obtained from AS1-MW01 at concentrations exceeding established and interim North Carolina groundwater standards by a factor of 10. Benzene and C11 to C22 aromatic EPH compounds were identified in groundwater sample AS1-MW01 at concentrations exceeding established and interim North Carolina groundwater standards by a factor of 10. Because of these results, and because the AS-1, AS-2, and AS-3 were commercial UST's, completion of a Phase II LSA was required.

During the Phase II investigation, petroleum-related compounds were not identified in the groundwater samples obtained from the new monitoring wells (AS1-MW04, AS1-MW05, AS1-MW06 andAS1-MW07) at concentrations in excess of established and interim North Carolina groundwater standards.

Review of Section 4.3 ("Risk Classifications") of the Guidelines, suggests that the UST AS-1 to AS-3 site should be classified as Intermediate Risk because of the following factors:

- Surface water within ditches that drain the airfield is located within 500 feet of the source area.
- The maximum concentration of toluene identified during the Phase I assessment (1.250 mg/L) exceeds the surface water quality standard for toluene (.011 mg/L) by more than a factor of 10.
- The site is located within the Coastal Plain physiographic province, within a possible recharge area to the underlying, semi-confined Castle Hayne Aquifer. However, the absence of petroleum-related compounds within the sample from the vertical extent will suggests that the underlying Castle Hayne Aquifer should not be adversely affected by the release.

LAW recommends that a copy of this Phase II LSA be provided to the North Carolina Division of Waste Management UST Section as required by the RBCA rules.

1.0 INTRODUCTION

Law Engineering and Environmental Services, Inc. (LAW) was authorized to perform this work by the Commander of the Atlantic Division (LANTDIV), Naval Facilities Engineering Command (NAVFACENGCOM) in accordance with the Order for Supplies Contract No. N62470-95-6009, Delivery Order 0055. This report and the scope of work completed during this project is in general accordance with Delivery Order 0055 and procedures for Phase I and Phase II Limited Site Assessments contained in the *Groundwater Section Guidelines for the Investigation and Remediation of Soil and Groundwater, Volume II: Petroleum Underground Storage Tanks, January 2, 1998* (hereafter the "Guidelines"). CATLIN Engineers and Scientists (CATLIN), the Prime Contractor under contract N62470-95-6009, received approval from LANTDIV on March 25, 1999 and subcontracted with LAW to perform the Phase I and subsequently, the Phase II Limited Site Assessments.

1.1 Purpose of Investigation

The purpose of the Phase I and Phase II Limited Site Assessments (LSA) is to identify site specific factors that will allow the North Carolina Department of Environment and Natural Resources (DENR), Division of Waste Management, UST Section (DWM) to assign a risk classification to the site. This work was performed in order to comply with Risk Based Corrective Action (RBCA) rules[1] established by the Environmental Management Commission on January 2, 1998.

1.2 Scope of Work

The scope of work for this project included: installation of three source area monitoring wells within the former UST pits; installation of four additional groundwater monitoring wells, one upgradient of the contaminant source, two downgradient of the contaminant source, and one vertical-extent well immediately downgradient of the source but within the contaminant plume; collection and analysis of the groundwater samples from the monitoring wells; and the evaluation of site-specific risk information. The sampling and evaluation of risk information was required in order to satisfy RBCA requirements. Recommended procedures for meeting the RBCA requirements are contained in the Guidelines. This report generally follows the outline presented on pages 138 through 147 of the Guidelines, under section "D: Limited Site Assessment Report."

[1] Codified at 15A NCAC 2L .0115

2.0 BACKGROUND

2.1 Site Name:

Former USTs AS-1, AS-2, and AS-3, Parachute Troops Gasoline Storage and Distribution Facility, New River Air Station, Marine Corps Base (MCB), Camp Lejeune, NC. (Figure 1)

2.2 Latitude and Longitude of Incident Site (Decimal Degrees):

Latitude: N 34 degrees, 42.539 minutes
Longitude: W 77 degrees, 26.070 minutes

Source: DeLorme, Inc. Street Atlas USA, Version 6.0

2.3 Groundwater Incident Number:

Not established as of this writing. On February 9, 1999, Mr. Bruce Markwick of the Camp Lejeune Environmental Management Division (EMD) submitted an Incident Reporting Form to Ms. Patricia Coughlin of the DWM, Wilmington Regional Office.

2.4 Facility Identification Number:

Our review of a December 2, 1998 UST registration list for Onslow County indicates that USTs AS-1, AS-2 and AS-3 were not listed. According to information provided by MCB personnel, the USTs at the site were decommissioned in the 1960's.

2.5 Date of Report: January 10, 2000

2.6 Current UST owner, UST operator, and/or other persons responsible for release or discharge:

Commanding General
(ATTN AC/S, EMD/IRD)
Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004
ATTN: Mr. N. Neal Paul, Installation Restoration Division, EMD
Phone: (910) 451-9461

2.7 Consultants:

Law Engineering and Environmental Services, Inc.
3301 Atlantic Avenue
Raleigh, NC 27604
ATTN: Mr. Brian J. Bellis, L.G.
(919) 876-0416

2.8 Release Information:

Date: Release identified after USTs were removed in January 1999

Estimated Quantity: Not known

Cause of Release (piping/UST): Leaks from the piping are suspected. The UST closure contractor indicated that holes were not observed on the exterior of the tanks after they were removed. Petroleum-contaminated soil was identified beneath the tanks after they were removed.

Size and Contents of UST: The former USTs were 30,000-gallons in capacity and contained gasoline (see Table in Section 2.10), according to the UST closure reports prepared by the tank removal contractor. An as-built drawing of the fuel storage facility, MCB Drawing 162069, dated February 3, 1943, indicates that each tank was of 25,000-gallon capacity. Within the remainder of this report, we will refer to the tanks as 30,000-gallon capacity tanks, based upon the UST closure reports for tanks AS-1, AS-2 and AS-3.

2.9 UST System owner since installation:

Commanding General
(ATTN AC/S, EMD/IRD)
Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004

2.10 Summary Table:

UST SYSTEM ID	PRODUCT	CAPACITY (Gallons)	DATE INSTALLED (I) DATE REMOVED (R)	RELEASE DISCOVERED
AS-1	Low Octane Gasoline	30,000*	(I) 1943[+] (R) 01/15/99	Yes, After UST Removal
AS-2	Low Octane Gasoline	30,000*	(I) 1943[+] (R) 01/21/99	Yes, After UST Removal
AS-3	High Octane Gasoline	30,000*	(I) 1943[+] (R) 01/22/99	Yes, After UST Removal

*Source: UST Closure Report. As-built Drawing No. 162069 of the fuel storage facility indicates four tanks of 25,000 gallons capacity each. J.A. Jones removed a fourth UST, AS-4, in early 1999. Contaminated soil was not identified beneath UST AS-4.

[+] Based on review of as-built drawing No. 162069, dated February 3, 1943. MCB personnel indicate that the tanks were decommissioned in the 1960's.

3.0 SITE CHARACTERIZATION

3.1 Background Information

Incident Number: Not Established

Previous Site Ranking: Not established by the DWM.

Based upon information provided to LAW by the Marine Corps Base, the site has not been ranked to date in accordance with the March 1997 or January 1998 editions of the Guidelines.

Our opinion of the appropriate risk classification for the USTAS-1 through AS-3 site, based upon the results of this Phase I and Phase II LSA, is contained in Section 8.0.

Contaminant type: Gasoline

Source (tank, piping include size):

As previously stated, USTs AS-1, AS-2 and AS-3 were each 30,000-gallons in capacity. Approximately 250 feet of 3-inch, 4-inch and 6-inch diameter piping connected the three tanks to two truck unloading areas and one truck-loading platform (Figure 2). Additional 6-inch diameter piping led from the gasoline storage tanks to service pits located at a "warming-up" platform adjacent to Building AS-843, and a second seaplane warming-up platform located adjacent to the New River. The platforms were situated approximately 500 feet north and 1,600 feet east-northeast of the UST site. The UST facility and pipelines were reportedly decommissioned in the 1960's.

Quantity released: Not known

Date of release discovery: February 1999

Cause of release:

Leakage from piping and/or overfills is suspected. The tank closure contractor indicated that no holes were observed on the exterior of USTs AS-1, AS-2 and AS-3.

Summary of initial abatement/remedial actions:

J.A. Jones Environmental Services Company, Charlotte, North Carolina (J.A. Jones), removed USTs AS-1, AS-2 and AS-3 on January 15, January 21 and January 22, 1999, respectively. Soils were excavated in order to uncover and remove each tank. The tops of the tanks were encountered at a depth of 5 to 6 feet below land surface (bls). Excavation backfill material was obtained from an on base borrow area to return the ground surface to grade.

According to "Site Investigation Report for Permanent Closure or Change-In-Service of UST" forms (DWQ form GWUST-2) completed by J.A. Jones, pipes leading into the tank were drained and flushed, the tanks were cleaned and inspected, and purged of flammable vapors/product prior to removal. Piping leading to the tanks was left in-place and lines were not plugged or capped. The tanks were disposed at Jacksonville Scrap and Metal Company.

J.A. Jones indicated within their closure reports that residual product was not observed in the tanks, however water was present. Water within the tanks was removed and transported first to an air station oil/water separator and then to an MCB wastewater treatment facility.

Upon removal of the tanks, J.A. Jones personnel noted discolored soil and petroleum odor within soils beneath the USTs. After the tanks were removed, J.A. Jones did not conduct further soil excavation because of reported unstable soil conditions due to the depth of the excavation (approximately 16 feet).

Summary of assessment and additional remedial activities:

Subsequent to removal of each UST, J.A. Jones personnel obtained five soil samples from beneath each tank. These samples were obtained from a reported depth of 16 to 18 feet below land surface (bls). Each soil sample was analyzed in the laboratory for volatile and semi-volatile total petroleum hydrocarbons (TPH) by EPA preparation methods 3550 and 5030 with testing method 8015. The results of the soil sample analyses are indicated in Table 1. TPH concentrations in excess of the 10 mg/Kg action level were identified beneath the western one-half of UST AS-1, beneath the eastern three-fourths of UST AS-2, and beneath the eastern one-half of UST AS-3.

Following removal of the tanks, groundwater seeped into the UST AS-1 and AS-2 excavations. Therefore, J.A. Jones obtained water samples from the floor of the UST AS-1 and AS-2 excavations with a polyethylene bailer. The samples were tested for purgeable halocarbon and purgeable aromatic compounds by EPA methods 601 and 602, respectively. The results of the analyses are included in Table 2. Benzene was identified in both groundwater samples at concentrations exceeding the North Carolina Groundwater Quality standard of .001 mg/L. No other contaminants were identified in excess of the North Carolina Groundwater Quality standards.

On April 13, 1999, LAW advanced three borings within or adjacent to each of the three former tank basins for the purpose of installing groundwater monitoring wells (Figure 4). The borings and wells are identified as USTAS1-MW01, USTAS2-MW01 and USTAS3-MW01 (hereafter referred to as borings/wells AS1-MW01, AS1-MW02 and AS1-MW03). The soil borings were extended to a depth of 14 to 15 feet bls. Soil samples were obtained during drilling with a stainless steel split spoon sampling device. Each soil sample was classified as to its color and texture, screened with an organic vapor analyzer (OVA) field screening instrument, and inspected for physical evidence (staining, odor) of petroleum contamination.

Soils encountered during drilling consisted mostly of fine sand and silt. We did not observe petroleum-contaminated soils or identify petroleum odors within the three monitoring well borings. A concrete pad was encountered at a depth of 14 feet bls at boring AS1-MW02. Wet soils were noted below a depth of 8 feet bls in boring AS1-MW01, 5.75 feet bls in boring AS1-MW02, and 4 feet bls in boring AS1-MW03. The soils encountered from 0 to 14 feet bls at boring AS1-MW02 and 0 to 7 feet at boring

AS1-MW03 were loosely compacted, fine sand and silt backfill. Therefore, the shallower depth of wet soil at locations AS1-MW02 and AS1-MW03 may be due to the entrapment of surface water within post-UST closure backfill. LAW identified static water level depths of 5.64 feet bls for well AS1-MW02 and 8.2 feet bls for well AS1-MW03 on April 21, 1999, eight days after well installation.

LAW submitted soil samples from the unsaturated zone for laboratory testing. These samples included soils from a depth of 4 to 6 feet bls at boring AS1-MW01, 4 to 6 feet bls at boring AS1-MW02, and 6 to 8 feet bls at boring AS1-MW03. A duplicate soil sample was also obtained from 6 to 8 feet at boring AS1-MW03. Laboratory analyses performed on the soil samples included total volatile and extractable petroleum hydrocarbons (VPH, EPH) by the Massechusetts Department of Environmental Protection (MADEP) methods; volatile organic compounds (VOCs) plus xylenes by EPA method 8260; and semi-volatile organic compounds by EPA method 8270. Paradigm Analytical Laboratories, Inc. (PAL) performed the MADEP analyses while LAW National Laboratories (LENL) performed the EPA method 8260 and EPA method 8270 analyses. Based upon the laboratory results, detectable concentrations of VPH and EPH were identified in the AS1-MW01, 4 to 6 foot soil sample and naphthalene was identified in the AS1-MW02, 4 to 6 foot soil sample (Table 3). The VPH and EPH concentrations for the C5 to C8 aliphatic petroleum hydrocarbon compounds (PHC) and C9 to C22 aromatic PHCs identified in soil sample USTAS1-MW01 were in excess of soil to groundwater maximum soil contaminant concentration (MSCC) but were below the residential and industrial/commercial MSCCs.

LAW installed wells AS1-MW01, AS1-MW02 and AS1-MW03 each to a depth of 14 feet bls. These wells are screened from 4 to 14 feet bls, and the static water level was measured by LAW at a depth of approximately 9.2 feet bls at well AS1-MW01, 5.64 feet at well AS1-MW02 and 8.2 feet at well AS1-MW03. The higher static water level at well AS1-MW02 may be attributable to the loosely compacted soils used as backfill and the concrete pad encountered at a depth of 14 feet bls at this location.

On April 22, 1999, LAW purged and then sampled the three groundwater monitoring wells. The three groundwater monitoring well samples, in addition to a duplicate sample from well AS1-MW02, were tested for VPH and EPH by the MADEP methods, purgeable aromatic compounds plus xylenes (EPA Method 602) and base neutral/acid extractable semi-volatile organic compounds (EPA Method 625). For the EPA 625 analyses, the ten largest peaks were also identified.

Based upon the laboratory analyses for the MADEP methods, VPH concentrations were identified for the C5 to C8 aliphatic petroleum hydrocarbon class in groundwater samples obtained from all three groundwater monitoring wells. VPH concentrations were identified in excess of State interim groundwater standards at wells AS1-MW01 and AS1-MW02 (Table 4). EPH concentrations were identified in groundwater samples obtained from wells AS1-MW01 and AS1-MW02, at concentrations exceeding State interim groundwater standards. The results of the EPA method 602 analyses indicated benzene at concentrations exceeding the .001 mg/L groundwater standard at wells AS1-MW01 and AS1-MW02 (Table 5). Ethylbenzene and toluene were identified at concentrations exceeding the groundwater standards at well AS1-MW02. The results of the EPA 625 analyses indicated six semi-volatile organic compounds at concentrations below their respective North Carolina Groundwater Standards, and between five and eighteen tentatively identified compounds (TICs) in the groundwater sample for which the State has not established groundwater standards.

A trip blank was submitted for analysis of VPH by MADEP, purgeable aromatic compounds by EPA 602 and semi-VOC compounds by EPA method 625. The laboratory did not identify VPH or EPA method 602 compounds within the trip blank. One semi-volatile organic compound, N,N-dimethyl-Formamide, was identified in the trip blank according to the results of the EPA method 625 analyses.

3.2 List of Previous Environmental Reports

REPORT NO.	REPORT TITLE	AUTHOR	DATE
1	GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-1, MCAS New River	J.A. Jones Environmental Services Company, Charlotte, NC	February 22, 1999
2	GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-2, MCAS New River	J.A. Jones Environmental Services Company, Charlotte, NC	March 16, 1999
3	GW/UST-12, Underground Storage Tank Closure Report, UST No. AS-3, MCAS New River	J.A. Jones Environmental Services Company, Charlotte, NC	March 16, 1999
4	Phase I, Limited Site Assessment, Former USTs AS-1 Through AS-3 MCAS New River	Law Engineering and Environmental Services, Inc. Raleigh, NC	July 12,1999

3.3 Free Product

LAW personnel did not identify the presence of free product within any of the site monitoring wells during the Phase I or Phase II LSA field activities.

4.0 RISK CHARACTERIZATION

Risk characterization must be performed to demonstrate that the site meets the requirements for Low risk classification prior to Site Closure. The following information has been provided to support determination of a risk classification for the site.

4.1 Part I – Groundwater, Surface water and Subsurface Vapor Migration Impacts

High Risk Category

1) *Has the discharge or release contaminated any water supply well including any used for non-drinking purposes? If yes, explain.* **No.**

2) *Is a water supply well used for drinking water located within 1000 feet of the source area of the discharge or release?*

No, based upon our correspondence with MCB personnel. Figure 3 indicates nearby facilities and development within 1,500 feet of the UST AS-1 through AS-3 site and does not indicate the presence of water-supply wells within this radius.

3) *Is a water supply well used for any purpose (e.g. irrigation, washing cars, industrial cooling water, filling swimming pools) located within 250 feet of the source area of the release or discharge?* **No.**

4) *Does groundwater within 500 feet of the source area of the discharge or the release have the potential for future use in that there is no other source of water supply other than groundwater? Explain.*

No. The Marine Corps Air Station (MCAS) utilizes groundwater for the base water supply, however, MCAS New River water plant and EMD personnel report that no active or known inactive wells are located within a 500 foot radius of the subject site. According to the EMD, most future wells at the base will be installed within undeveloped areas in order to protect the water supply.

5) *Do vapors from the discharge or release pose a threat of explosion because of accumulation of the vapors in a confined space or pose any other serious threat to public health, public safety, or the environment? If yes, explain.* **No.**

6) *Are there any other factors that would cause the discharge or release to pose an imminent danger to public health, public safety, or the environment? If yes, explain.* **No.**

Intermediate Risk Category

7) *Is a surface water body located within 500 feet of the source area of the discharge or release? If yes, does the maximum groundwater contaminant concentration exceed the surface water quality standards and criteria found in 15A NCAC 2B .0200 by a factor of 10?*

Yes. The USGS Jacksonville South topographic quadrangle (Figure 1) indicates a perennial surface water feature (manmade drainage ditch) approximately 200 feet to the northeast of the UST AS-1 through AS-3 site. A protion of the runoff from the airfield is collected in this ditch, which drains to the east towards the New River. The maximum concentration of toluene (1.250 mg/L) detected in site groundwater exceeds the .011 mg/L surface water standard listed in 15A NCAC 2B .0200 by more than a factor of 10.

8) *Is the source area of the discharge or release located within a designated wellhead protection area as defined in 42 USC 300h-7(e)? If yes, explain.* **No.**

9) *Is the discharge or release located in the Coastal Plain physiographic region as designated on a map entitled "Geology of North Carolina" published by the Department in 1985? If yes, is the source area of the discharge or release located in an area in which there is a recharge to an unconfined or semi-confined deeper aquifer that is being used or may be used as a source of drinking water? If yes, explain.*

Yes. The source area at the subject site is located within an interstream area, which was identified by Cardinell and Others[2] as a potential recharge area to the semi-confined Castle Hayne Aquifer. The MCB currently obtains all water for the drinking water supply from the Castle Hayne Aquifer. However, water supply wells are not located within a 1500 feet radius of the subject site and there are no plans to develop the water supply within this radius. Additionally, petroleum-related compounds were not detected in the groundwater sample from vertical extent well USR AS1-MW05. Therefore it does not appear that the release at the subject site poses an unacceptable risk to the Castle Hayne Aquifer.

10) *Do the levels of groundwater contamination for any contaminant exceed the gross contaminant levels established (see Table 7) by the Department?* **No.**

4.2 Part II – Current Land Use

1) *Does the property contain one or more primary or secondary residences (permanent or temporary? If yes explain.* **No.**

[2] Alex P. Cardinell and Others, Hydrogeological Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina, U.S. Geological Survey Water Resources Investigation Report 93-4049 (Raleigh, N.C.: USGS, [1993], p. 29.

2) *Does the property contain a school, daycare center, hospital, playground, park, recreation area, church, nursing home, or other place of public assembly? If yes, explain.* **No.**

3) *Does the property contain a commercial (e.g., retail, warehouse, office/business space, etc.) or industrial (e.g., manufacturing, utilities, industrial research and development, chemical/petroleum bulk storage, etc.) enterprise, an inactive commercial or industrial enterprise, or is the land undeveloped? If yes, explain.* **No.** The site is undeveloped and consists of a grassed area between a residential community and Curtis Road.

4) *Do children visit the property?*

Not to our knowledge. However, houses are located approximately 400 feet to the east and fences or signage does not restrict access to the site.

5) *Is access to the property reliably restricted consistent with its use (e.g., fences, security personnel or both)? If yes, explain.* **No.**

6) *Do pavement, buildings, or other structures cap the contaminated soil? If yes, explain what mechanisms are in place or can be put into place to ensure that the contaminated soil will remain capped in the foreseeable future.* **No.**

7) *What is the zoning status of the property?*

MCAS New River is not subject to local or County zoning requirements. The site is undeveloped and consists of a grassed area between a residential community and Curtis Road.

8) *Is the use of the property likely to change in the next 20 years? Explain*

No. The UST AS-1 through AS-3 site is located within a greenway buffer area between a housing development and the taxiways/runways of the airfield. The subject site will most likely remain undeveloped, as long as the air station remains in operation.

The following questions pertain to the area within 1500 feet of the source area of the discharge or release (excludes the property containing the release source area)

9) *What is the distance from the source area of the release to the nearest primary or secondary residence (permanent or temporary)?*

Approximately 400 feet.

10) What is the distance from the source area of the release to the nearest school, daycare center, hospital, playground, park, recreation area, church, nursing home or other place of public assembly?

A playground is located approximately 200 to 300 feet to the south.

11) What is the zoning status of properties in the surrounding area?

MCAS New River is not subject to local or County zoning requirements. However the site is undeveloped and consists of a grassed area between a residential community and Curtis Road.

12) Briefly characterize the use and activities of the land in the surrounding area.

Taxiways and runways of the New River Air Station are located to the north and west of the former UST AS-1 through AS-3 site. Residences and a playground are located to the east and south, respectively. Curtis Road is located approximately 320 feet to the west of the site, between the airfield runways and the subject site.

5.0 RECEPTOR INFORMATION

5.1 Water-Supply Wells

Based upon our review of the Wellhead Protection Plan Update for the MCB Camp LeJeune (Triangle Environmental, 1999), there are no active water-supply wells located within a 1,500 foot radius of the UST AS-1 through AS-3 site. The Wellhead Protection Plan Update report identifies wellhead protection areas for all active water-supply wells at the Marine Corps Base.

5.2 Public Water Supplies

Public water is provided to buildings within 1,500 feet of the site by water mains which carry treated potable water. An active water line passes to the east of the former tank locations (Figure 2) and appears to have been connected to the underground fuel storage and distribution facility. MCB Drawing 162069 indicates that pressurized water was used to aid in distribution of the gasoline formerly stored in USTs AS-1, AS-2 and AS-3.

The potable water supply used in the area is obtained from a water treatment plant located on Curtis Road. Groundwater obtained from the Castle Hayne Aquifer beneath MCAS New River and Camp Geiger is the raw water source that is treated at the plant.

5.3 Surface Water

The closest surface water body to the source area is shown on the USGS topographic map as a perennial drainage ditch located 200 to 300 feet to the northeast (Figure 1). This surface water body is located within a man-made drainage ditch used to drain surface water from the airfield. The drainage ditch continues eastward and leads to a small tributary of the New River.

5.4 Wellhead Protection Areas

The source area is not located within a proposed or designated wellhead protection area, according to Mr. Gary Davis of EMD.

5.5 Deep Aquifers in the Coastal Plain Physiographic Region

Aquifers below the surficial aquifer in the area of former USTs AS-1 through AS-3 include the Castle Hayne Aquifer, the Beaufort Aquifer and the Peedee Aquifer, in order of increasing depth. Both the Beaufort and Peedee aquifers contain saltwater in the Camp Lejeune area and are not used for water supply. The Castle Hayne Aquifer contains freshwater and is the principal aquifer used in the area for water supply.

5.6 Subsurface Structures

The subject site is currently undeveloped, however underground pits associated with the former UST storage and distribution system may remain (Figure 2).

An inactive underground sewer line is located between the location of former USTs AS-2 and AS-3. Active and inactive water lines may also be present in the area, as indicated on Figure 2. Electrical lines are located near former UST AS-4 and were reportedly severed during removal of the tank. These utility trenches are typically located at depths of less than five feet bls.

5.7 Land Use

Land in the vicinity is used for a residential neighborhood and the MCAS New River airfield, as previously discussed.

5.8 Property Owners and Occupants

The U.S. Government owns the UST AS-1 through UST AS-3 property and adjacent properties within MCAS New River.

6.0 GEOLOGY AND HYDROGEOLOGY

Regional Geology/Hydrogeology

The MCB Camp Lejeune lies within the Tidewater Region of the Coastal Plain Physiographic province (Stuckey, 1965). The North Carolina Coastal Plain is approximately 90 to 150 miles wide from the Atlantic Ocean westward to its boundary with the Piedmont Province. The Tidewater region consists of the eastern coastal area of the physiographic province, where large streams and many of their tributaries are affected by ocean tides (Winner and Coble, 1989).

In the Camp Lejeune area, sediments deposited in marine or near-marine environments are about 1,500 feet thick and overlie igneous and metamorphic basement rocks. The MCB is situated on an eastward thickening wedge consisting of interfingering sands, silts, clays, calcareous clays, shell beds, sandstone, and limestone which were deposited in marine or near shore environments (Cardinell and others, 1993).

Seven of the ten aquifers identified to date in the North Carolina Coastal Plain are present beneath the MCB. In order of increasing depth, these aquifers include the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and upper and lower Cape Fear aquifers. They consist of predominantly permeable sand or limestone beds and are separated by less-permeable clay and silt beds (confining units) that serve to impede the flow of groundwater between the aquifers (Cardinell and others, 1993; Harned, 1989). The surficial and Castle Hayne aquifers thicken from the northern to the southern portion of the base.

The surficial aquifer is a series of sand, clay, sandy clay, and silt beds with occasional peat and shells. Beds of clay, sandy clay, and silt which occur in the surficial aquifer are typically thin, discontinuous, and of limited lateral extent. Cardinell and others (1993) report the thickness of the surficial aquifer to range from 0 to 73 feet with an average of approximately 25 feet over most of the MCB. In the northwestern portion of the MCB, which includes Camp Geiger, the surficial aquifer is less than 10 feet thick. The surficial aquifer is reportedly the thickest in the southeastern portion of the base (Cardinell and others, 1993). Groundwater is not withdrawn from the surficial aquifer for water-supply purposes at the MCB.

The principal water-supply aquifer for the Base is the series of sand and limestone beds that occur between 50 and 300 feet below land surface. This series of sediments generally is known as the Castle Hayne aquifer. The Castle Hayne aquifer is about 150 to 350 feet thick in the MCB area and is the most productive aquifer in North Carolina. It is a critical water-supply source, not only for Camp Lejeune but also for the southern coast and east-central Coastal Plain of North Carolina. Recharge of the Castle Hayne aquifer is via downward percolation from the surficial aquifer in interstream areas (Cardinell and others, 1993).

Site Geology and Hydrogeology

Cardinell and Others (1993) includes a listing of thicknesses for the aquifers and confining units located beneath several water-supply wells and exploratory wells at MCAS New River. The researchers, employed by the USGS, interpreted geophysical and lithological logs from the wells in an effort to identify the boundaries of the surficial aquifer, the Castle Hayne confining unit (CHCU) and the Castle Hayne aquifer (CHA). The closest well to the UST AS-1 through AS-3 site is USGS-14, a well formerly drilled by the USGS approximately 1,300 to 2,000 feet to the north. Based upon review of geophysical and lithological logs for well USGS-14, Cardinell and Others interpreted the surficial aquifer to be present from a depth of 0 to 8 feet bls, the CHCU from 8 to 12 feet bls, and the CHA from 12 to 215 feet bls. Well USGS-14 was located at an elevation of 8 feet above mean sea level (msl), while the UST AS-1 through AS-3 site is located at an elevation of approximately 19 feet msl. Based on the higher elevation

for the AS-1 to AS-3 site, we would anticipate that the thickness of the surficial aquifer would be greater than 8 feet.

To date, shallow monitoring wells have been installed to depths of 15 to 16 feet bls, and a deep Type III well has been installed to a depth of 33 feet. Based upon our review of the soil boring data for wells USTAS1-MW01 through USTAS1-MW07, soils at the site consist largely of fine sand, silty sand, and silt.

Depth to groundwater measurements were obtained on November 11, 1999, and were found to range in depth from 5.84 to 9.08 feet bls in the Type II monitoring wells. The depth to groundwater measurements in Type II monitoring wells were obtained in order to determine the elevation of the water table. These data are provided in Appendix C. The water-table elevations were used to determine the groundwater elevation contours from which directions of groundwater flow can be estimated (Figure 4).

The water table elevation at well USTAS1-MW02 is approximately 2.0 feet higher than the elevations observed in the other monitoring wells on the site. The higher water table elevation may be due to the accumulation of infiltrating precipitation within the porous backfill and the slow movement of this water into the surrounding natural fine-grained soil. The higher water-table elevation in the vicinity of former USTAS2 appears to give rise to a radial pattern of groundwater flow, away from the location of former USTAS2 (Figure 4).

The Type III monitoring well (USTAS1-MW05) exhibited a groundwater elevation approximately 5 feet lower than that of the Type II wells (Appendix C). This indicates a downward component of groundwater flow within the surficial aquifer.

7.0 SAMPLING RESULTS, PHASE II INVESTIGATION

On November 1 through 3, 1999, LAW advanced four additional soil borings; one shallow upgradient; two shallow downgradient of the contaminant source, and one deep boring immediately downgradient of the contaminant source area (Figure 4). Monitoring wells installed within the area are identified as USTAS1-MW04, USTAS1-MW05 (Type III well), USTAS1-MW06 and USTAS1-MW07. The shallow soil borings were extended to deep depths of 15 to 16 feet bls (AS1-MW04, MW06, MW07), and the deep boring extended to 33 feet bls for the Type III well (AS1-MW05). Soil samples were obtained during drilling with a stainless steel split spoon sampling device from depths of 1 to 3, 3 to 5, 5 to 7 and 8 to 10 feet bls. Each soil sample was classified as to its color and texture, screened with a flame ionizing detector (FID) field screening instrument, and inspected for physical evidence (staining, odor) of petroleum contamination. Boring records for the monitoring well borings are contained in Appendix A. Table 6 lists the FID readings obtained from headspace screening of the soil samples.

Soils encountered during drilling consisted mostly of fine sand and silt. We did not observe petroleum-contaminated soils or identify petroleum odors within the monitoring well borings. Wet soils were noted below a depth of 8 feet bls in all soil borings AS1-MW04 to AS1-MW07.

LAW submitted soil samples from the unsaturated zone for laboratory testing. These samples included soils from a depth of 5 to 7 feet bls at borings AS1-MW04, AS1-MW05 and AS1-MW06, and 3 to 5 feet bls at boring AS1-MW07. Laboratory analyses performed on the soil samples included VPH by the MADEP method; VOCs plus methyl-tert-butyl-ether (MTBE) and isopropyl ether (IPE) by EPA method 8260, and metals (chromium and lead) by EPA method 6010. Paradigm Analytical Laboratories, Inc. performed the analyses. Based upon the laboratory results, detectable concentrations of VPH or VOCs were not identified in any of the soil samples (Table 7). Laboratory results for metals revealed detectable concentrations of chromium and lead in each of the soil samples above laboratory method detection limits (MDL) but below the lower of soil to groundwater or residential maximum soil contaminant concentrations (MSCC) (Table 7). The laboratory reports for the soil samples are contained in Appendix D.

On November 10 and 11, 1999, LAW purged and then sampled the four new groundwater monitoring wells. Monitoring well sampling worksheets are contained in Appendix E. The four groundwater monitoring well samples were tested for VPH by the MADEP method, VOCs plus MTBE and IPE by EPA method 6210D and metals (chromium and lead) by EPA method 6010.

Based upon the laboratory analyses for the MADEP methods, VPH concentrations were not identified for any of the samples from the four new groundwater monitoring wells (Table 8). The results of the EPA method 6210D analyses indicated chloromethane at concentrations of 0.0009 mg/L at monitoring well AS1-MW04 and 0.001 mg/L at monitoring well AS1-MW07, which does not exceed the state groundwater standard of 0.0026 mg/L for chloromethane (Table 9). Laboratory results for metals by EPA method 6010 did not indicate the presence of chromium or lead above the laboratory method detection limits for any of the groundwater samples. The laboratory reports for the groundwater samples are contained in Appendix F.

A rinse blank was submitted for analysis of VPH by MADEP. The laboratory did not identify VPH compounds within the rinse blank (Table 8).

8.0 CONCLUSIONS AND RECOMMENDATIONS

During this Phase II LSA, we did not identify petroleum-contaminated soils within the unsaturated zone at the UST AS1 to AS-3 site. J.A. Jones, the contractor that removed the tanks and performed UST closure assessments, identified petroleum-contaminated soil below tanks AS-1, AS-2 and AS-3. However, those soils appear to occur below the water table which are not indicative of vadose zone contamination. Concrete anchor pads are also reported to remain in the subsurface at the project site.

During the Phase I investigation, benzene, ethylbenzene, toluene, C5 to C8 aliphatic VPH compounds, and C11 to C22 aromatic EPH compounds were identified within the groundwater sample obtained from AS1-MW01 at concentrations exceeding established and interim North Carolina groundwater standards by a factor of 10. Benzene and C11 to C22 aromatic EPH compounds were identified in groundwater sample AS1-MW01 at concentrations exceeding established and interim North Carolina groundwater standards by a factor of 10. Because of these results, and because the AS-1, AS-2, and AS-3 were commercial UST's, completion of a Phase II LSA was required.

During the Phase II investigation, petroleum-related compounds were not identified in the groundwater samples obtained from the new monitoring wells (AS1-MW04, AS1-MW05, AS1-MW06 andAS1-MW07) at concentrations in excess of established and interim North Carolina groundwater standards, but below Gross Contaminant Levels for these compounds.

Review of Section 4.3 ("Risk Classifications") of the Guidelines, suggests that the UST AS-1 to AS-3 site should be classified as Intermediate Risk because of the following factors:

- Surface water within ditches that drain the airfield is located within 500 feet of the source area.

- The maximum concentration of toluene identified during the Phase I assessment (1.250 mg/L) exceeds the surface water quality standard for toluene (.011 mg/L) by more than a factor of 10.

- The site located within the Coastal Plain physiographic province, within a possible recharge area to the underlying, semi-confined Castle Hayne Aquifer. However, the absence of petroleum-related compounds within the sample from the vertical extent will suggests that the underlying Castle Hayne Aquifer should not be adversely affected by the release.

LAW recommends that a copy of this Phase II LSA be provided to the North Carolina Division of Waste Management UST Section for determination of a site specific risk classification as required by the RBCA rules.

9.0 REFERENCES CITED

Cardinell, A.P. and Others, 1993, *Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina; U.S. Geological Survey Water-Resources Investigation Report 93-4049*, U.S. Geological Survey, Raleigh, North Carolina.

Groundwater Section, North Carolina Department of Environment and Natural Resources, *Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater, Volume II: Petroleum Underground Storage Tanks*, Raleigh, North Carolina, January 2, 1998.

Harned, D.A. and others, 1989. *Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina; U.S. Geological Survey Water-Resources Investigations Report 89-4096.* USGS in cooperation with the Department of the Navy, U.S. Marine Corps, Camp, North Carolina.

J.A. Jones Environmental Services Company, Inc., 1999, *GW/UST-12, Underground Storage Tank Closure Report,, UST No. AS-1, MCAS New River*, J.A. Jones Environmental Services Company, Charlotte, North Carolina, February 22, 1999. Unpublished Professional Report.

J.A. Jones Environmental Services Company, Inc., 1999, *GW/UST-12, Underground Storage Tank Closure Report,, UST No. AS-2, MCAS New River*, J.A. Jones Environmental Services Company, Charlotte, North Carolina, March 16, 1999. Unpublished Professional Report.

J.A. Jones Environmental Services Company, Inc., 1999, *GW/UST-12, Underground Storage Tank Closure Report,, UST No. AS-3, MCAS New River*, J.A. Jones Environmental Services Company, Charlotte, North Carolina, March 16, 1999. Unpublished Professional Report.

Stuckey, J.L., 1965, North Carolina – its geology and mineral resources, Raleigh, North Carolina: Department of Conservation and Development, 550 p.

Triangle Environmental Inc., 1999, *Wellhead Protection Plan Update, Camp Lejeune, Onslow County, North Carolina*, Triangle Environmental Inc., Raleigh, North Carolina, March 1999. Unpublished Professional Report.

United States Geological Survey, 1952 (photorevision 1988). Jacksonville South, N.C. 7.5 minute Topographic Quadrangle. U.S. Government Printing Office, Washington D.C.

Winner, M.D., Jr., and Coble, R.W., 1989, Hydrogeologic framework of the North Carolina Coastal Plain aquifer system: U.S. Geological Survey Open-File Report 87-690, 155 p.

TABLES

TABLE 1

J.A. JONES ENVIRONMENTAL SERVICES COMPANY
SUMMARY OF LABORATORY RESULTS, SOIL SAMPLES
TOTAL PETROLEUM HYDROCARBONS
CLOSURE OF USTS AS-1 THROUGH AS-3, JANUARY 1999
NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA

Sample Identification	Volatile TPH (Gasoline range) EPA Method 5030 and 8015	*Semi-volatile TPH (Diesel Fuel range)* EPA Method 3550 and 8015
AS-1-A	ND	ND
AS-1-B	ND	ND
AS-1-C	ND	20
AS-1-D	48	68
AS-1-E	ND	38
AS-2-A	ND	21
AS-2-B	40	750
AS-2-C	15	ND
AS-2-D	18	ND
AS-2-E	1.3	ND
AS-3-A	ND	40
AS-3-B	ND	68
AS-3-C	ND	ND
AS-3-D	ND	ND
AS-3-E	1.2	ND

Shaded Cells = Soil Sample concentrations exceed the North Carolina corrective action limit
Sample Locations are indicated in the figure below (from J.A. Jones, 1999)

TABLE 2

J.A. JONES ENVIRONMENTAL SERVICES COMPANY
SUMMARY OF LABORATORY RESULTS, GROUNDWATER SAMPLES
PURGEABLE HALOCARBONS AND AROMATICS (EPA METHODS 601 AND 602)
CLOSURE OF USTS AS-1 THROUGH AS-3, JANUARY 1999
NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA

PARAMETER	GROUNDWATER SAMPLE ID	AS-1 (Bottom of Excavation)	AS-2 (Bottom of Excavation)	N.C. GROUNDWATER STANDARDS (mg/L)
	SAMPLE DEPTH (FEET)	16	16	
	SAMPLE DATES	1/21/99	1/21/99	
EPA Methods 601 & 602 (mg/L)				
Benzene		.002	.047	.001
Toluene		.002	.830	1.000
Ethylbenzene		ND (.001)	.020	.029
Xylenes		ND (.003)	.076	.530
Methyl-tert-butyl-ether		ND (.005)	ND (.005)	.200
Ethylene Dibromide		ND (.001)	ND (.001)	4.0×10^{-7}
Isopropyl Ether		ND (.005)	ND (.005)	.07
Total EPA 601/602 compounds		.004	.973	--

Concentrations shown are in mg/L
Shaded Area indicates concentrations above NC Groundwater Quality Standard
ND = No compounds detected above the laboratory Method Detection Limit (MDL). The MDL is indicated in parentheses.
-- = Not Applicable

TABLE 3
SUMMARY OF LABORATORY ANALYTICAL RESULTS (April 1999), SOIL SAMPLES
PHASE I LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	SOIL SAMPLE ID	USTAS1-MW01-03	USTAS2-MW01-03	USTAS3-MW01-04	USTAS3-MW01-04 DUPL.	LOWER OF: SOIL TO GROUNDWATER OR RESIDENTIAL MAXIMUM SOIL CONTAMINANT CONCENTRATION (MSCC) (mg/Kg)
	SAMPLE LOCATION	USTAS1-MW01	USTAS1-MW02	USTAS1-MW03	USTAS1-MW03	
	SAMPLE DEPTH	4 to 6 feet	4 t0 6 feet	6 to 8 feet	6 to 8 feet	
	SAMPLE DATES	04/13/99	04/13/99	04/13/99	04/13/99	
MADEP VPH AND EPH – LAB RESULTS BY TOXICOLOGICALLY DEFINED HYDROCARBON FRACTION (mg/Kg)*						
C5-C8 Aliphatics		0.6	ND	ND	--	72
C9-C18 Aliphatics		22	ND	ND	--	3,255
C19-C36 Aliphatics		14	ND	ND	--	93,860
C9-C22 Aromatics		61	ND	ND	--	34
EPA METHOD 8260 + MTBE + ISOPROPYL ETHER – VOLATILE ORGANIC COMPOUNDS (mg/Kg)						
Naphthalene		ND	.015	ND	ND	.58
EPA METHOD 8270 – SEMIVOLATILE ORGANIC COMPOUNDS (mg/Kg)						
No Compounds Identified		ND	ND	ND	ND	Compound Specific

*For a breakdown of laboratory results by MADEP Analytical Hydrocarbon Fraction (AHF) see table in Appendix C. LAW combined the AHF results in order to compare the UST AS-1 to AS-3 results with DENR-specified MSCCs. These MSCC values correspond with Toxicologically Defined Hydrocarbon Fractions.

Abbreviations:

MADEP=Massachusetts Department of Environmental Protection
ND=Not Detected at Laboratory Method Detection Limit (see Lab Report)
EPH = Extractable Petroleum Hydrocarbons
MTBE=Methyl-Tert-Butyl-Ether
VPH = Volatile Petroleum Hydrocarbons

TABLE 4

SUMMARY OF LABORATORY ANALYTICAL RESULTS, GROUNDWATER SAMPLES
(MADEP VPH AND EPH, APRIL 1999)
PHASE I LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	GROUNDWATER SAMPLE ID	USTAS1-GW01-99B	USTAS2-GW01-99B	USTAS3-GW01-99B	TRIP BLANK	MADEP CARBON CLASS RANGE TOTALS (if concentration identified)	INTERIM GROUNDWATER STANDARD (VPH and EPH Class Ranges)
	SAMPLE DEPTH (FEET)	4-14	4-14	4-14	NA		
	SAMPLE DATES	4/22/99	4/22/99	4/22/99	4/22/99		
MADEP, Total Volatile Petroleum Hydrocarbon Compounds (VPH), mg/L							
C5-C8 Aliphatics		.230	**3.500**	.015	ND	C5 to C8 Aliphatics At Left	C5 to C8 Aliphatics .42
C9-C12 Aliphatics		ND	.490	ND	ND	AS2-GW01: C9 to C18 Aliphatics = .49	C9 to C18 Aliphatics 4.2
C9-C10 Aromatics		ND	ND	ND	ND		
MADEP, Total Extractable Petroleum Hydrocarbon Compounds (EPH), µg/mL*							
C9-C18 Aliphatics		ND	ND	ND	--		
C19-C36 Aliphatics		ND	ND	ND	--	C19 to C36 Aliphatics At Left	C19 to C36 Aliphatics 42
C11-C22 Aromatics		**2.3**	**2.7**	ND	--	C9 to C32 Aromatics AS1-GW01: 2.3 AS2-GW01:2.7	C9 to C32 Aromatics .21

* Equivalent to mg/L or parts per million
Shaded cells indicates groundwater concentration in excess of State Groundwater Standards
MADEP = Massachusetts Department of Environmental Protection
NA = Not Applicable
ND = No compounds detected above the laboratory practical quantitation limit (PQL). See laboratory reports

TABLE 5
SUMMARY OF LABORATORY ANALYTICAL RESULTS, GROUNDWATER SAMPLES
(VOCs /SVOCs, April 1999)
PHASE II LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	GROUNDWATER SAMPLE ID	USTAS1-GW01-99B	USTAS2-GW01-99B	USTAS3-GW01-99B	USTAS2-GW01-99B (Duplicate)	N.C. GROUNDWATER STANDARDS (mg/L)
	SAMPLE DEPTH (FEET)	4-14	4-14	4-14	4-14	
	SAMPLE DATES	4/22/99	4/22/99	4/22/99	4/22/99	
EPA Method 602, Including Xylenes, Isopropyl Ether (IPE), mg/L						
Benzene		.004	.482	ND	.443	.001
Toluene		.008	1.250	ND	.941	1.000
Ethylbenzene		ND	.042	ND	.040	.029
Xylenes		ND	.116	ND	.099	.530
Methyl-tert-butyl-ether		ND	ND	ND	ND	.200
Isopropyl Ether		ND	ND	ND	ND	.0004
Total EPA 602 Compounds		.012	1.890	--	1.523	--
EPA Method 625 plus ten Largest Tentatively Identified Compounds (TICS) mg/L						
Acenaphthene		ND	.004	ND	--	.08
2,4 Dimethylphenol		ND	.003	ND	--	.140
Flourene		ND	.001	ND	--	.25
Napthalene		ND	.014	ND	--	.021
Phenanthrene		ND	.001	ND	--	.21
Phenol		ND	.028	ND	--	.30
Total EPA 625		--	.051	--	--	--
Number of Known TICs, [Total Concentration]		0	9 [.202]	3 [.020]	--	--
Number of Unknown TIC [Total Concentration]		0	9 [.247]	02 [.042]	--	--

No EPA Method 602 and 625 compounds were identified in the Trip Blank submitted to the lab with the groundwater samples. One TIC, N,N dimethyl-Formamide was identified at a concentration of .006 mg/l

ND = No compounds detected above the laboratory practical quantitation limit (PQL). See laboratory reports

Shaded Cells = Groundwater Contaminant Concentration exceeds the N.C. Groundwater Standard

TABLE 6
SUMMARY OF HEADSPACE SCREENING RESULTS
PHASE II LIMITED SITE ASSESSMENT REPORT
FORMER UST AS-1 THROUGH AS-3
NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA
LAW ENGINEERING JOB NO. 30740-6-0600 0055

SAMPLE LOCATION I.D.	SAMPLE DEPTH (FT.)	FID READING (PPM)	SAMPLE SELECTED FOR LABORATORY ANALYSIS/COMMENTS
USTAS1-MW04	1 to 3	11.4	
	3 to 5	10.4	
	5 to 7	97.9	Submitted to Lab
	8 to 10	3406	Wet soils below 8 feet
USTAS1-MWO5 (Type III Well)	1 to 3	17.5	
	3 to 5	924	
	5 to 7	1690	Submitted to Lab
	8 to 10	11.3	Wet soils below 8 feet
USTAS1-MWO6	1 to 3	0.4	
	3 to 5	1.0	
	5 to 7	4.1	Submitted to Lab
USTAS1-MW07	1 to 3	1.8	
	3 to 5	2.1	Submitted to Lab
	5 to 7	2.0	
	8 to 10	-	Wet soils below 8 feet

FID = Flame Ionization Detector

TABLE 7
SUMMARY OF LABORATORY ANALYTICAL RESULTS (November 1999), SOIL SAMPLES
PHASE II LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	SOIL SAMPLE ID	UST AS1-MW4	UST AS1-MW5	UST AS1-MW6	UST AS1-MW7	TRIP BLANK	*LOWER OF: SOIL TO GROUNDWATER OR RESIDENTIAL MAXIMUM SOIL CONTAMINANT CONCENTRATION (MSCC)* (mg/Kg)
	SAMPLE LOCATION	USTAS1-MW04	USTAS1-MW05	USTAS1-MW06	USTAS1-MW07	-	
	SAMPLE DEPTH	5 to 7 feet	5 to 7 feet	5 to 7 feet	3 to 5 feet	-	
	SAMPLE DATES	11/02/99	11/03/99	11/02/99	11/02/99	11/02/99	
MADEP – TOTAL VOLATILE PETROLEUM HYDROCARBON COMPOUNDS (VPH), mg/Kg							
C5-C8 Aliphatics		ND	ND	ND	ND	ND	72
C9-C12 Aliphatics		ND	ND	ND	ND	ND	3,255
C9-C10 Aromatics		ND	ND	ND	ND	ND	34
EPA METHOD 8260 + MTBE + ISOPROPYL ETHER – VOLATILE ORGANIC COMPOUNDS (mg/Kg)							
No Compounds Identified		ND	ND	ND	ND	NT	--
EPA METHOD 6010 – METALS (mg/Kg)							
Chromium		25.6	11.5	23.2	5.48	NT	27
Lead		10.0	65.2	9.62	4.05	NT	270

Abbreviations:

MADEP = Massachusetts Department of Environmental Protection
ND = Not Detected at Laboratory Method Detection Limit (see Lab Report)
MTBE = Methyl-Tert-Butyl-Ether
NT = Not Tested

TABLE 8

SUMMARY OF LABORATORY ANALYTICAL RESULTS, GROUNDWATER SAMPLES
(MADEP – VPH, NOVEMBER 1999)
PHASE II LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	GROUNDWATER SAMPLE ID	USTAS1-GW04-99D	USTAS1-GW05-99D	USTAS1-GW06-99D	USTAS1-GW07-99D	RINSE BLANK	INTERIM GROUNDWATER STANDARD (VPH and EPH Class Ranges)
	SAMPLE DATES	11/11/99	11/11/99	11/11/99	11/11/99	11/10/99	
MADEP, Total Volatile Petroleum Hydrocarbon Compounds (VPH), mg/L							
C5-C8 Aliphatics		ND	ND	ND	ND	ND	0.42
C9-C12 Aliphatics		ND	ND	ND	ND	ND	Not Established
C9-C10 Aromatics		ND	ND	ND	ND	ND	Not Established

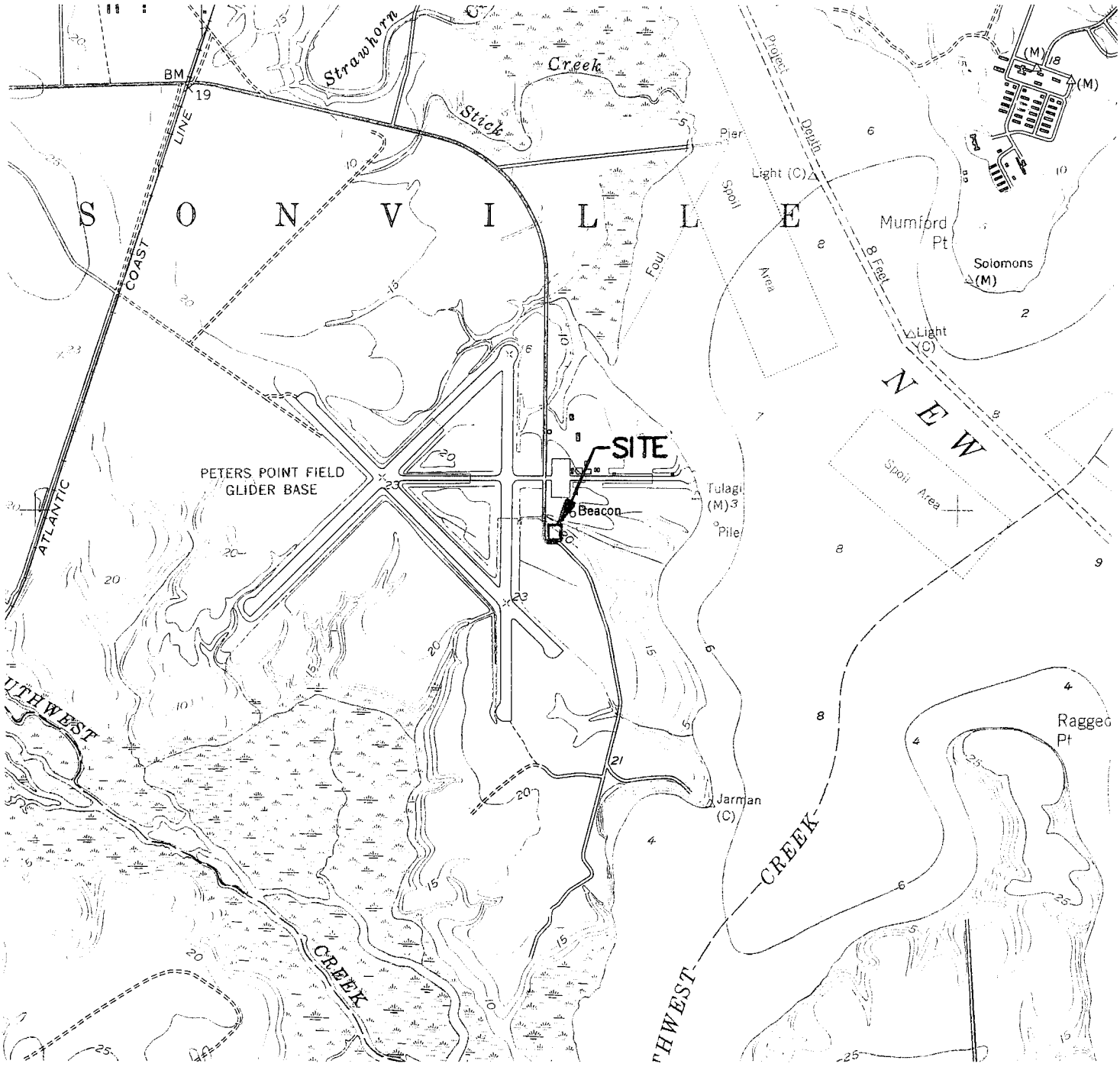
MADEP = Massachusetts Department of Environmental Protection
ND = No compounds detected above the laboratory practical quantitation limit (PQL). See laboratory reports

TABLE 9
SUMMARY OF LABORATORY ANALYTICAL RESULTS, GROUNDWATER SAMPLES
(VOCs NOVEMBER 1999)
PHASE II LIMITED SITE ASSESSMENT REPORT
FORMER USTs AS-1 THROUGH AS-3, NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE, NORTH CAROLINA
LAW JOB NO. 30740-6-0600-0055

PARAMETER	GROUNDWATER SAMPLE ID	USTAS1-GW04-99D	USTAS1-GW05-99D	USTAS1-GW06-99D	USTAS1-GW07-99D	RINSE BLANK	N.C. GROUNDWATER STANDARDS (mg/L)
	SAMPLE DATES	11/11/99	11/11/99	11/11/99	11/11/99	11/10/99	
EPA Method 6210D + MTBE + Isopropyl Ether (IPE), mg/L							
Chloromethane		.0009	ND	ND	.001	NT	.0026
Total EPA 602 Compounds		.0009	--	--	.001	--	--
EPA Method 6010- Metals (mg/kg)							
Chromium		ND	ND	ND	ND	NT	0.05
Lead		ND	ND	ND	ND	NT	0.015

ND = No compounds detected above the laboratory practical quantitation limit (PQL). See laboratory reports
NT = Not Tested

FIGURES



NORTH

JACKSONVILLE SOUTH, N.C.
NW/4 NEW RIVER 15' QUADRANGLE
34077-F4-TF-024
PHOTOINSPECTED 1988
1952
DMA 5553 III NW-SERIES V842

QUADRANGLE LOCATION

CONTOUR INTERVAL 10 FEET
GRAPHIC SCALE FEET

2000 1000 0 2000 4000

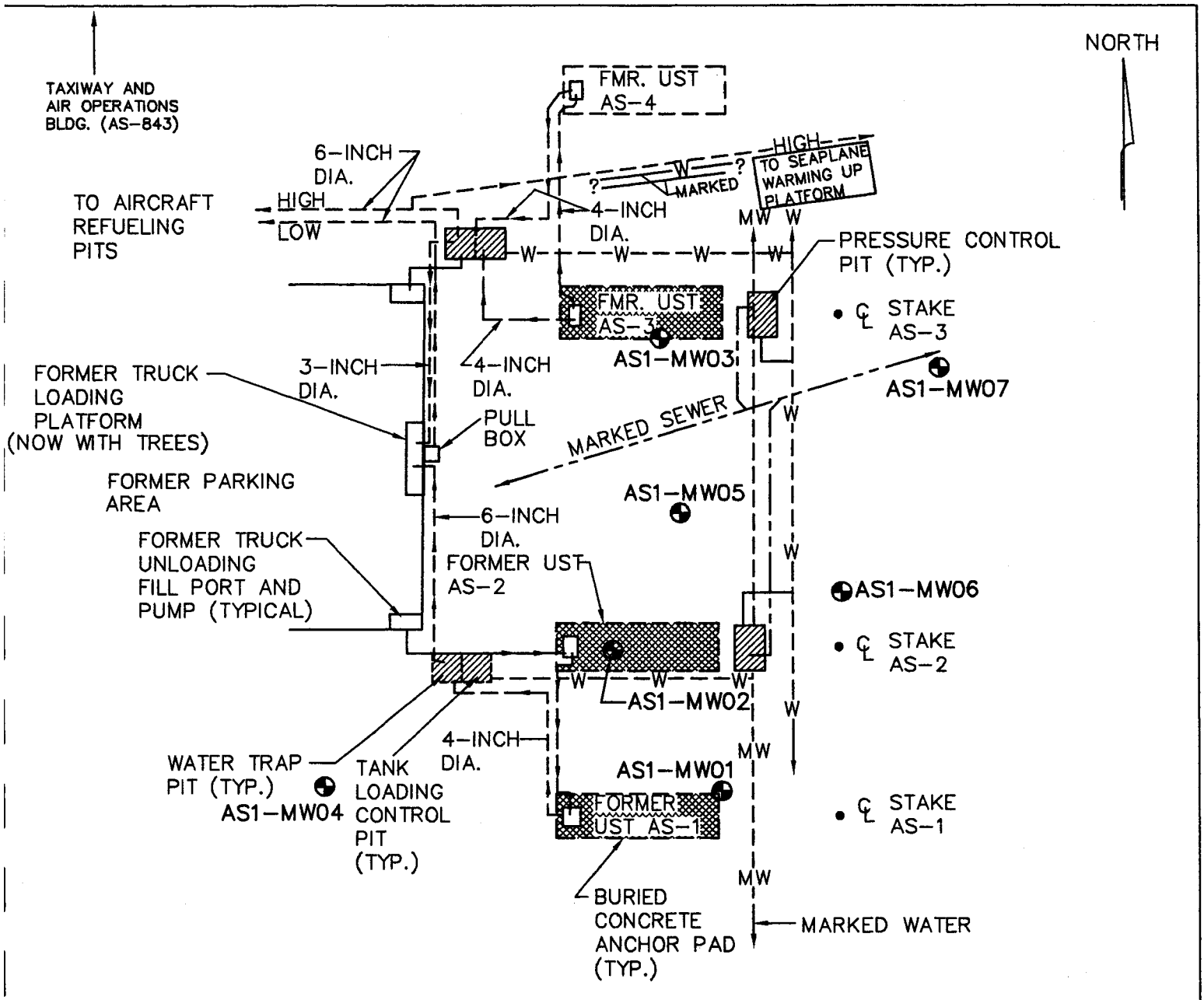
NOTE: SITE LOCATION IS APPROXIMATE.

JACK S.-TOP

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

PROJECT	TITLE	FIGURE
LIMITED SITE ASSESSMENT MARINE CORPS BASE CAMP LEJEUNE, N.C.	TOPOGRAPHIC LOCATION MAP FORMER USTS AS-1M THROUGH AS-3	1

JOB NO:	DATE:	SCALE:	DRAWN BY:	CHECKED BY:
30740-8-0600/0055	DEC. 1999	1"=2000'	BTS	



OTES:

FUEL SYSTEM LAYOUT OBTAINED FROM MCB DRAWING 162069 (AS-BUILT), DATED 2/3/43. LAW DID NOT OBSERVE THE FEATURES SHOWN, EXCEPT FOR THE FORMER TRUCK LOADING PLATFORM.

LEGEND

- AS1-MW01 — MONITORING WELL LOCATIONS
- LOCATION OF FORMER USTS AND CONCRETE ANCHOR PADS (STILL PRESENT)
- LOCATION OF FUEL SYSTEM PITS
- FUEL DELIVERY LINES DIAMETER OF PIPE LISTED LOW=LOW OCTANE HIGH=HIGH OCTANE FLOW DIRECTION SHOWN
- ——MW—— MARKED WATER LINE (IDENTIFIED DURING UTILITY CLEARANCE)
- ———W——— WATER LINE SHOWN ON UST SYSTEM DRAWING (SEE REFERENCE)
- ———— SEWER LINES (MARKED LINES INDICATED)
- • ℄ CENTER LINE STAKES FOR USTS EMPLACED BY TANK REMOVAL CONTRACTOR

GRAPHIC SCALE – IN FEET

40 20 0 40 80

6080072

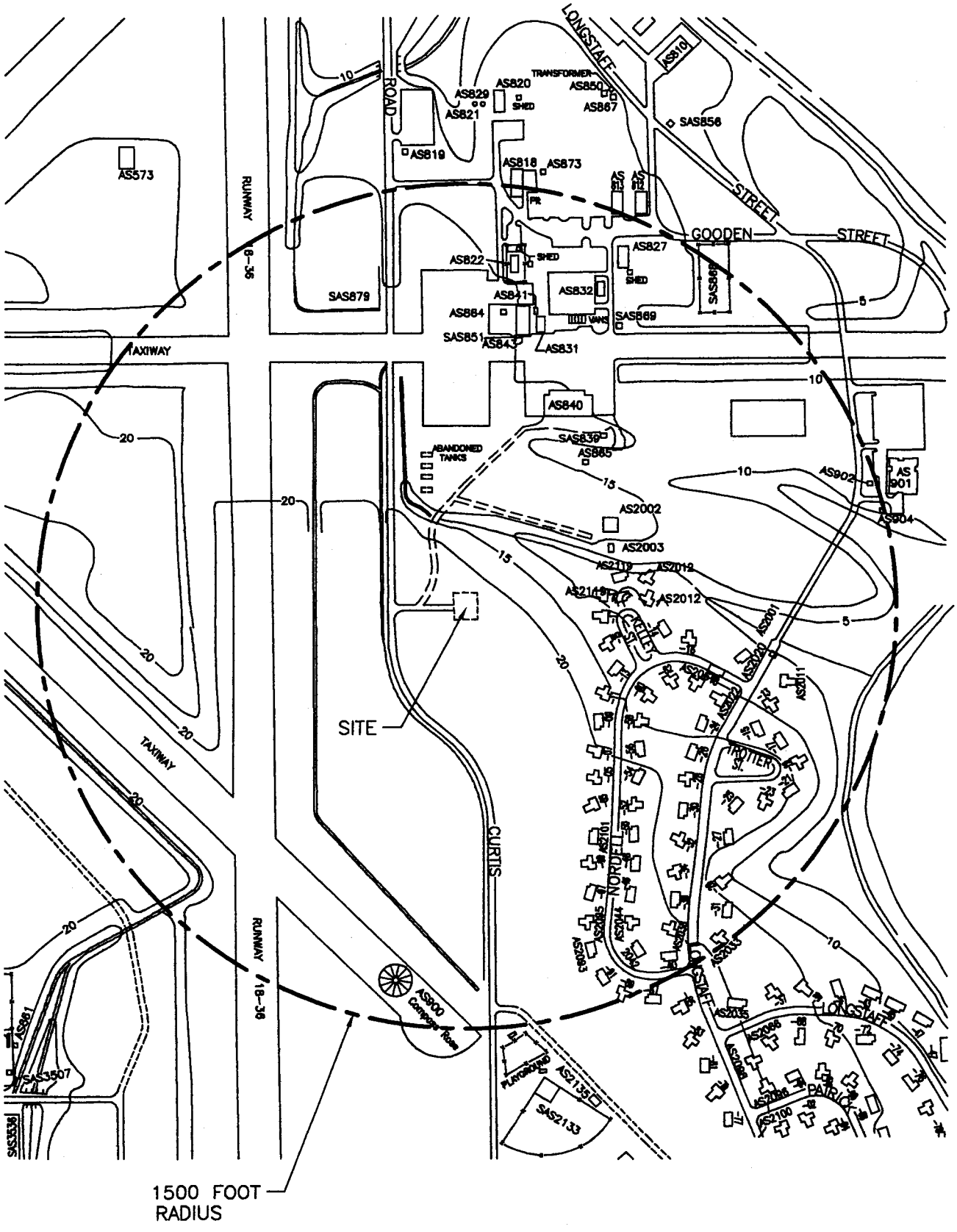
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. RALEIGH, NORTH CAROLINA

PROJECT: LIMITED SITE ASSESSMENT NEW RIVER AIR STATION CAMP LEJEUNE, N.C.

TITLE: UTILITY AND FORMER GASOLINE UST LOCATION MAP USTS AS-1 THROUGH AS-3

FIGURE 2

JOB NO: 30740-6-0600/0055 | DATE: DEC. 1999 | SCALE: 1"=40' | DRAWN BY: KRT | CHECKED BY:



NOTES:

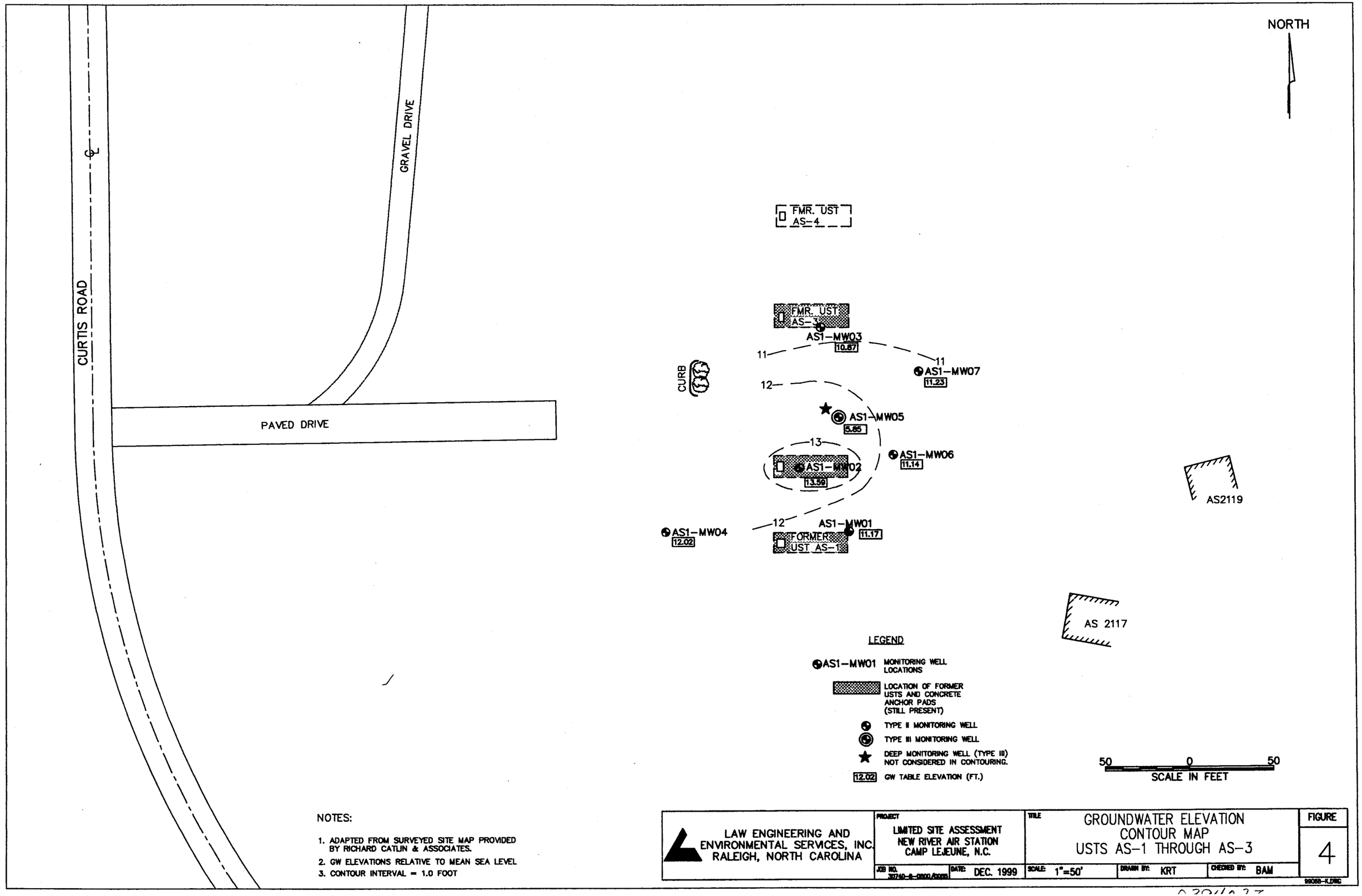
1. MAP ADAPTED FROM CAMP LEJEUNE DATABASE.

GRAPHIC SCALE – IN FEET

500 250 0 500 1000

6-0800-55

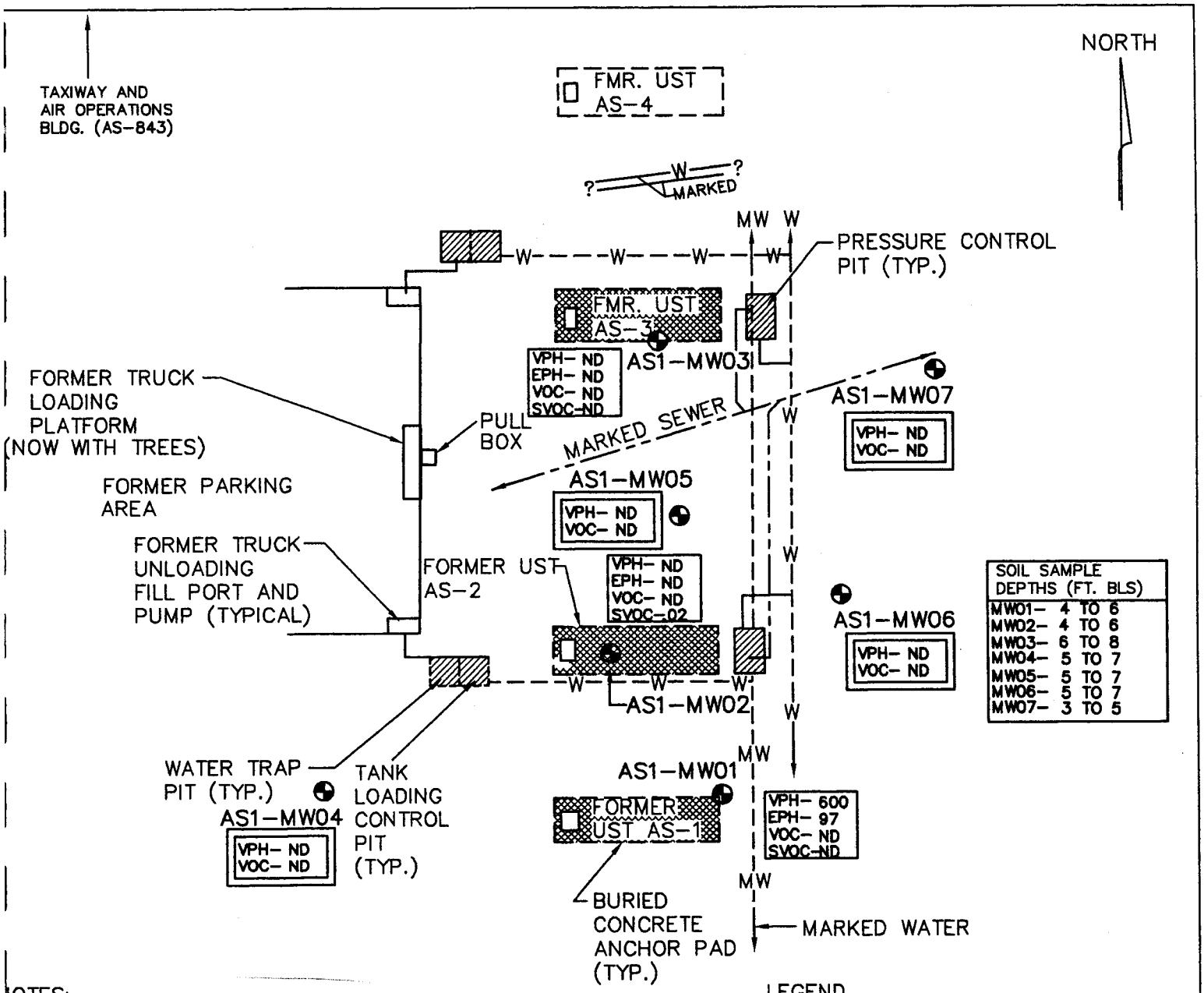
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. RALEIGH, NORTH CAROLINA	PROJECT: LIMITED SITE ASSESSMENT NEW RIVER MCAS CAMP LEJEUNE, N.C.	TITLE: WATER SUPPLY WELL LOCATION MAP FORMER USTS AS-1 THROUGH AS-3	FIGURE 3
	JOB NO: 30740-6-0800/0056 DATE: DEC. 1999	SCALE: 1"=500' DRAWN BY: BTS CHECKED BY:	



NOTES:

1. ADAPTED FROM SURVEYED SITE MAP PROVIDED BY RICHARD CATLIN & ASSOCIATES.
2. GW ELEVATIONS RELATIVE TO MEAN SEA LEVEL
3. CONTOUR INTERVAL = 1.0 FOOT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. RALEIGH, NORTH CAROLINA	PROJECT: LIMITED SITE ASSESSMENT NEW RIVER AIR STATION CAMP LEJEUNE, N.C.	TITLE: GROUNDWATER ELEVATION CONTOUR MAP USTS AS-1 THROUGH AS-3	FIGURE 4
	JOB NO. 30740-9-0800/0099 DATE: DEC. 1999	SCALE: 1"=50' DRAWN BY: KRT CHECKED BY: BAM	99088-K.DWG



NOTES:

1. SEE FIGURE 3 FOR LOCATION OF FUEL LINES.
2. THE MONITORING WELL LOCATIONS AND PHYSICAL FEATURES ON THE FORMER TRUCK LOADING PLATFORM WERE LOCATED BY TAYLOR, WISEMAN & TAYLOR, P.A. OTHER LOCATIONS ARE APPROXIMATE.

VPH=VOLATILE PETROLEUM HYDROCARBONS
EPH=EXTRACTABLE PETROLEUM HYDROCARBONS
MADEP=MASSACHUSETTS DEPT. OF ENV. PROTECTION
8260=VOLATILE ORGANIC COMPOUNDS
8270=SEMI-VOLATILE ORGANIC COMPOUNDS
VOC=VOLATILE ORGANIC COMPOUNDS
SVOC=SEMI-VOLATILE ORGANIC COMPOUNDS
)=NOT DETECTED AT OR ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT FOR ANALYSIS. (SEE LABORATORY REPORT FOR PQL)

GRAPHIC SCALE - IN FEET

40 20 0 40 80

LEGEND

AS1-MW01 MONITORING WELL LOCATIONS

LAB RESULTS (mg/kg)

VPH- 0.6 — MADEP VPH RESULTS
EPH- 97 — MADEP EPH RESULTS
VOC- ND — EPA 8260 RESULTS
SVOC-ND — EPA 8270 RESULTS
(SAMPLED APRIL 1999)

VPH- ND — MADEP VPH RESULTS
VOC- ND — EPA 8260 RESULTS
(SAMPLED NOVEMBER 1999)

LOCATION OF FORMER USTS AND CONCRETE ANCHOR PADS (STILL PRESENT)

LOCATION OF FUEL SYSTEM PITS

---MW--- MARKED WATER LINE (IDENTIFIED DURING UTILITY CLEARANCE)

---W--- WATER LINE SHOWN ON UST SYSTEM DRAWING (MCB 162069)

SEWER LINES (MARKED LINES INDICATED)

8060073

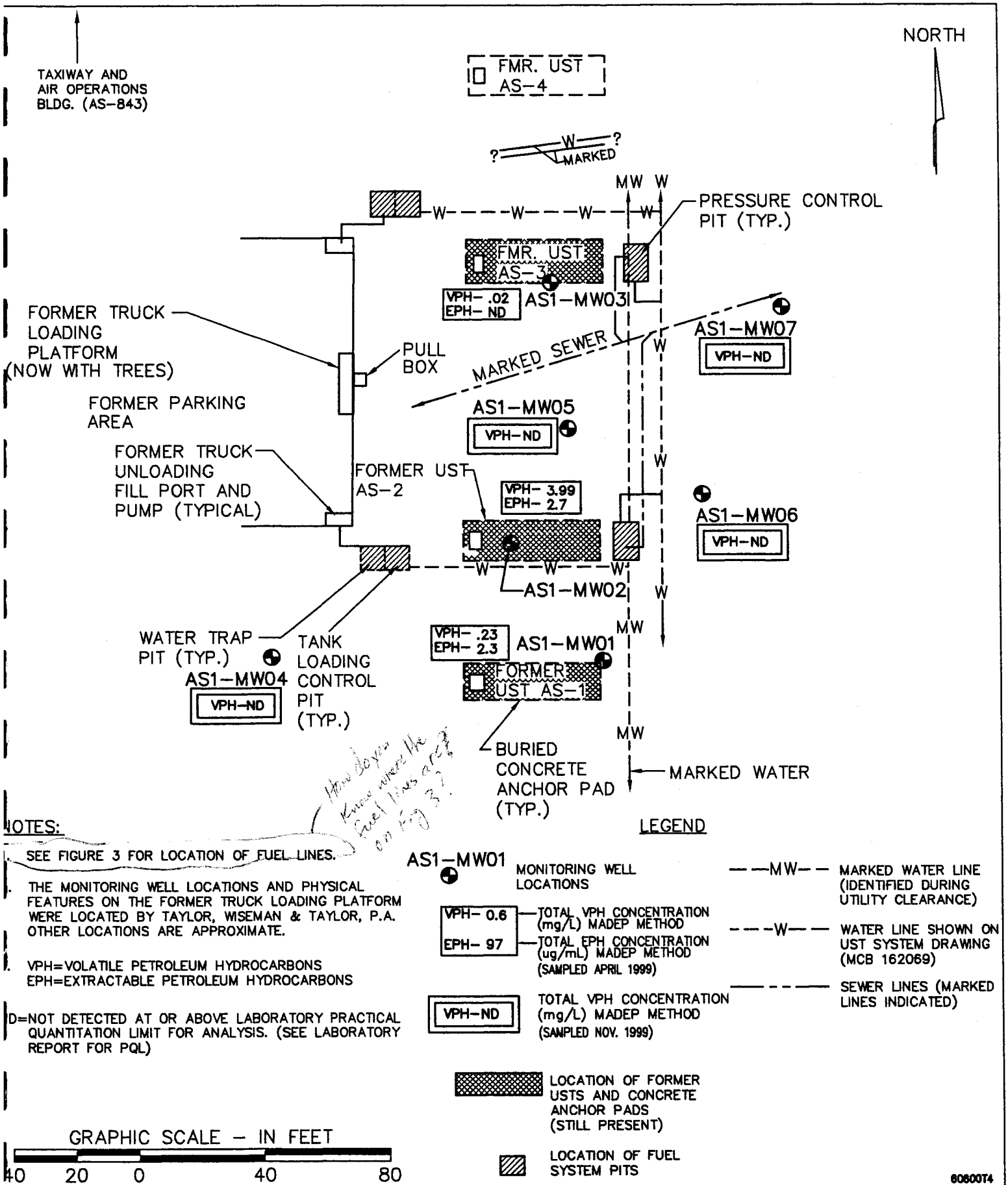
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

PROJECT: LIMITED SITE ASSESSMENT
NEW RIVER AIR STATION
CAMP LEJEUNE, N.C.

TITLE: SOIL SAMPLE RESULTS
USTS AS-1 THROUGH AS-3

FIGURE 5

JOB NO: 30740-6-0600/0055 | DATE: DEC. 1999 | SCALE: 1"=40' | DRAWN BY: KRT | CHECKED BY:



NOTES:

1. SEE FIGURE 3 FOR LOCATION OF FUEL LINES.
2. THE MONITORING WELL LOCATIONS AND PHYSICAL FEATURES ON THE FORMER TRUCK LOADING PLATFORM WERE LOCATED BY TAYLOR, WISEMAN & TAYLOR, P.A. OTHER LOCATIONS ARE APPROXIMATE.
3. VPH=VOLATILE PETROLEUM HYDROCARBONS
   EPH=EXTRACTABLE PETROLEUM HYDROCARBONS
4. ND=NOT DETECTED AT OR ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT FOR ANALYSIS. (SEE LABORATORY REPORT FOR PQL)

LEGEND

- AS1-MW01 — MONITORING WELL LOCATIONS
- VPH- 0.6 — TOTAL VPH CONCENTRATION (mg/L) MADEP METHOD
- EPH- 97 — TOTAL EPH CONCENTRATION (ug/mL) MADEP METHOD (SAMPLED APRIL 1999)
- VPH-ND — TOTAL VPH CONCENTRATION (mg/L) MADEP METHOD (SAMPLED NOV. 1999)
- ---MW--- MARKED WATER LINE (IDENTIFIED DURING UTILITY CLEARANCE)
- ---W--- WATER LINE SHOWN ON UST SYSTEM DRAWING (MCB 162069)
- ——— - - ——— SEWER LINES (MARKED LINES INDICATED)
- LOCATION OF FORMER USTS AND CONCRETE ANCHOR PADS (STILL PRESENT)
- LOCATION OF FUEL SYSTEM PITS

GRAPHIC SCALE – IN FEET

40 20 0 40 80

60600T4

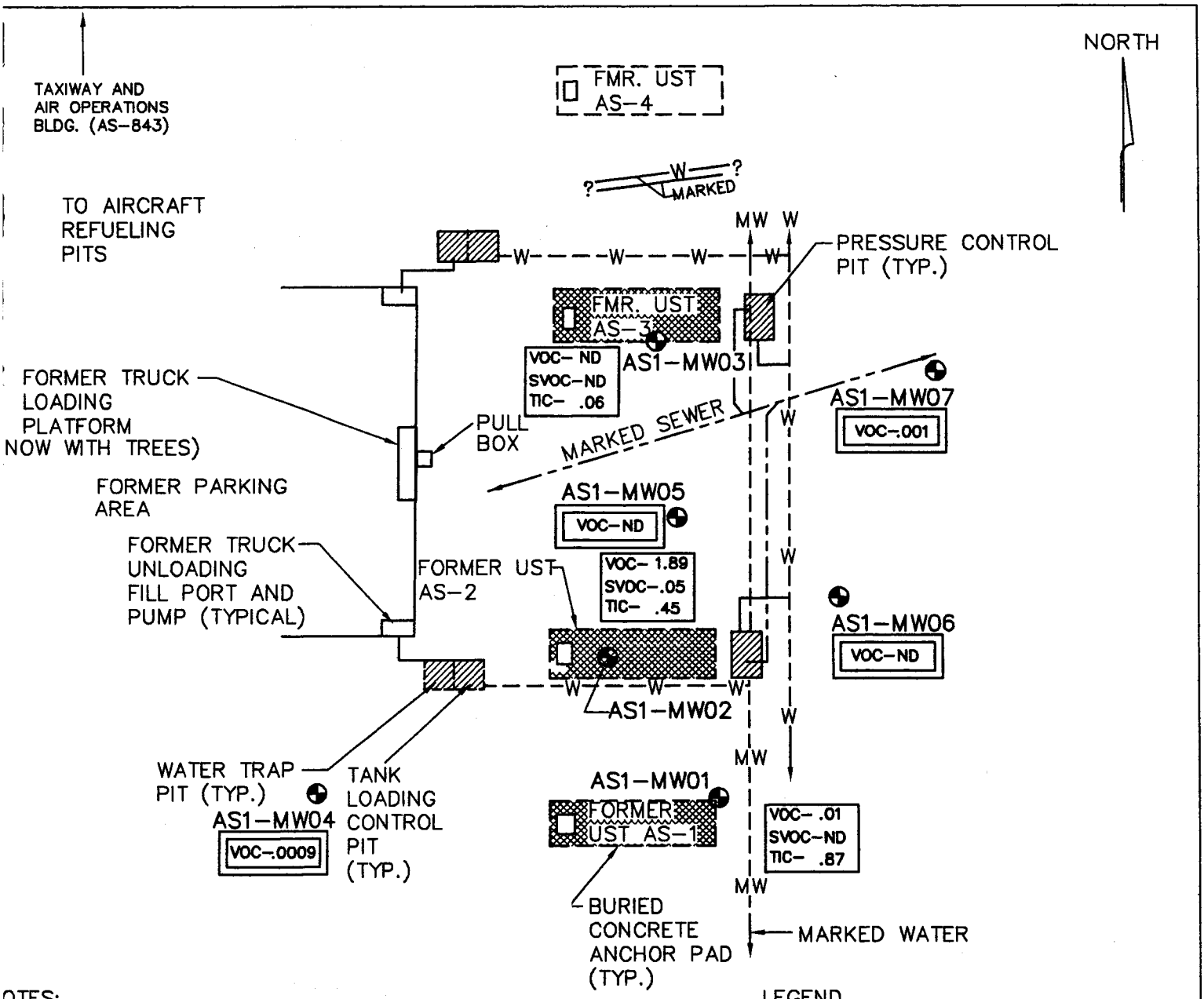
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

PROJECT: LIMITED SITE ASSESSMENT
NEW RIVER AIR STATION
CAMP LEJEUNE, N.C.

TITLE: VPH AND EPH RESULTS
GROUNDWATER SAMPLES
USTS AS-1 THROUGH AS-3

FIGURE 6

JOB NO: 30740-6-0600/0055 | DATE: DEC. 1999 | SCALE: 1"=40' | DRAWN BY: KRT | CHECKED BY:



OTES:

SEE FIGURE 3 FOR LOCATION OF FUEL LINES.

ND=NOT DETECTED AT OR ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT FOR ANALYSIS. (SEE LABORATORY REPORT FOR PQL)
VOC=SEMI-VOLATILE ORGANIC COMPOUNDS
TICS=TENTATIVELY IDENTIFIED COMPOUNDS
VOC=VOLATILE ORGANIC COMPOUNDS

THE MONITORING WELL LOCATIONS AND PHYSICAL FEATURES ON THE FORMER TRUCK LOADING PLATFORM WERE LOCATED BY TAYLOR, WISEMAN & TAYLOR, P.A. OTHER LOCATIONS ARE APPROXIMATE.

LEGEND

AS1-MW01 MONITORING WELL LOCATIONS

VOC- .01
SVOC-ND
TIC- .88

TOTAL VOC CONCENTRATION (mg/L) EPA METHOD 602 + XYLENES
TOTAL SVOC CONCENTRATION (mg/L), EPA METHOD 625
TOTAL TICS, IF FOUND (mg/L) (SAMPLED APRIL 1999)

VOC-ND TOTAL VOC CONCENTRATION (mg/L) EPA METHOD 6210+ MTBE+IPE (SAMPLED NOV. 1999)

LOCATION OF FORMER USTS AND CONCRETE ANCHOR PADS (STILL PRESENT)

LOCATION OF FUEL SYSTEM PITS

—MW— MARKED WATER LINE (IDENTIFIED DURING UTILITY CLEARANCE)

—W— WATER LINE SHOWN ON UST SYSTEM DRAWING (MCB 162069)

SEWER LINES (MARKED LINES INDICATED)

GRAPHIC SCALE – IN FEET

0 20 0 40 80

60800T5

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. RALEIGH, NORTH CAROLINA

PROJECT: LIMITED SITE ASSESSMENT NEW RIVER AIR STATION CAMP LEJEUNE, N.C.

TITLE: VOC AND SVOC RESULTS GROUNDWATER SAMPLE RESULTS USTS AS-1 THROUGH AS-3

FIGURE 7

JOB NO: 30740-6-0800/0055 | DATE: DEC. 1999 | SCALE: 1"=40' | DRAWN BY: KRT | CHECKED BY:

APPENDIX A

GROUNDWATER MONITORING WELL CONSTRUCTION RECORDS AND SOIL BORING TEST RECORDS

North Carolina - Department of Environmental, Health, and Natural Resources
Division of Water Quality - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO_____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent.

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Superior Drilling Inc.

DRILLER REGISTRATION NUMBER: 1769

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Camp Lejeune, N.C. County: Onslow
   Former USTs AS-1 to AS-3, New River Air Station
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Commanding General
   ADDRESS Camp Lejeune Marine Corps Base
   (Street or Route No.)
   Camp Lejeune, (City or Town) N.C. (State) 28542-004 (Zip Code)
3. DATE DRILLED 11/2/99 USE OF WELL Monitoring
4. TOTAL DEPTH 16.0
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 9.05 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*

* **Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118**

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): _____
11. CHLORINATION: Type N/A Amount _____
12. CASING

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0	To 5.0	Ft.	2.0 in.	Sch 40	PVC
From	To	Ft.			
From	To	Ft.			

13. GROUT

	Depth		Material	Method
From 0.0	To 2.0	Ft.	Neat Cement	Cast-in-place
From 2.0	To 4.0	Ft.	Bentonite Pellets	Pour

14. SCREEN

	Depth		Diameter		Slot Size		Material
From 5.0	To 15.0	Ft.	2.0	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4.0	To 16.0	Ft.	No. 2	Torpedo Sand
From	To	Ft.		

16. REMARKS: Flushmount wellhead installed in accordance with MCB policy, within 3'x3' concrete pad

DEPTH From	To	DRILLING LOG Formation Description
SEE ATTACHED		
BORING LOG		
USTAS1-MW04		

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

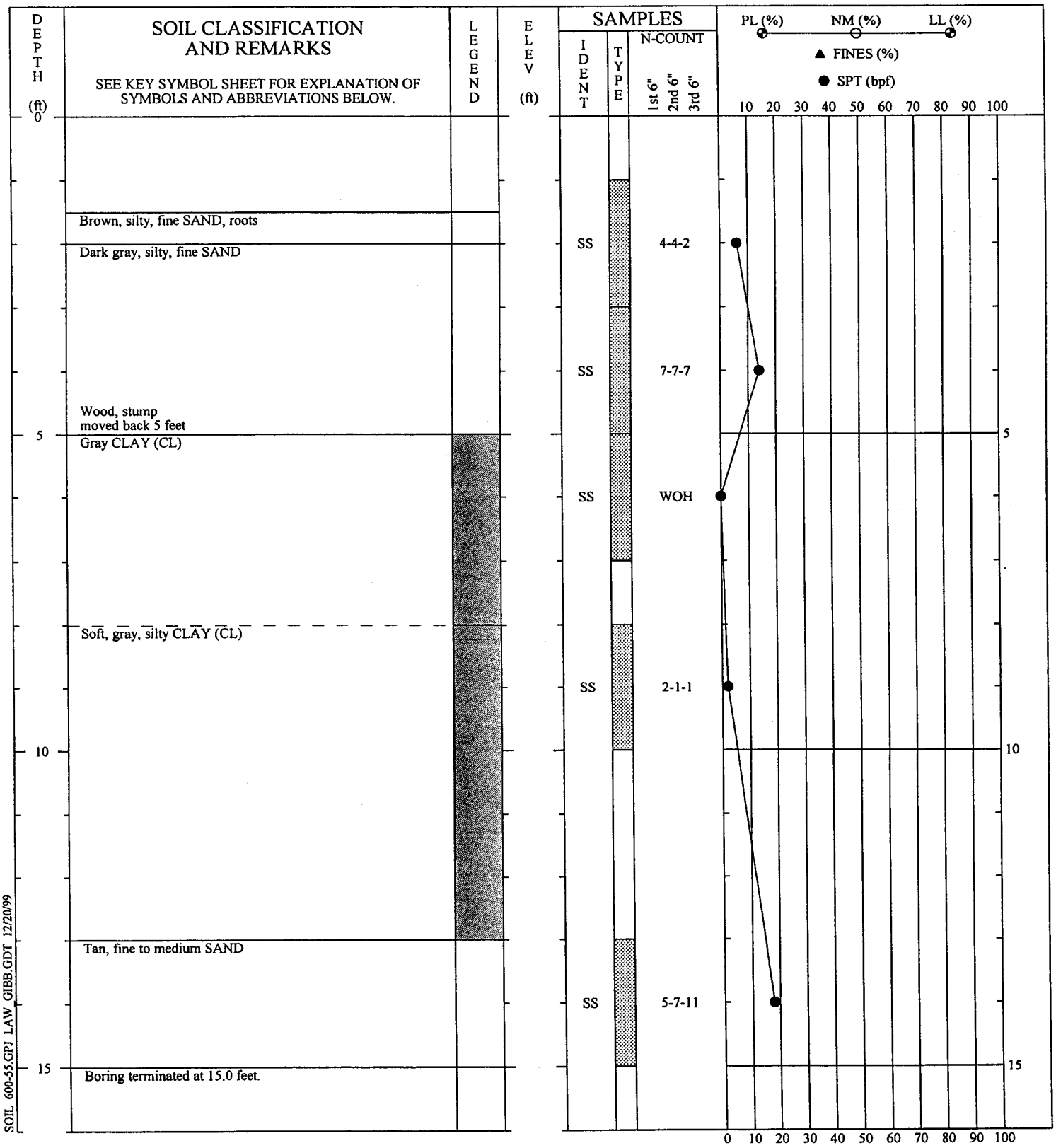
SEE FIGURES 3 & 4

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.

Daniel T. Bellis 01-06-00

SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Water Quality and copy to well owner.



SOIL 600-55.GPJ LAW_GIBB.GDT 12/20/99

DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** USTAS1-MW04
Coord N:
Coord E:
Drilled: November 2, 1999
Project #: 30740-6-0600/0055 **Page** 1 **of** 1

LAW
LAWGIBB Group Member

North Carolina - Department of Environmental, Health, and Natural Resources
Division of Water Quality - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Superior Drilling Inc.

DRILLER REGISTRATION NUMBER: 1769

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Camp Lejeune, N.C. County: Onslow
   Former USTs AS-1 to AS-3, New River Air Station
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Commanding General
   ADDRESS Camp Lejeune Marine Corps Base
   (Street or Route No.)
   Camp Lejeune, (City or Town) N.C. (State) 28542-004 (Zip Code)
3. DATE DRILLED 11/3/99 USE OF WELL Monitoring
4. TOTAL DEPTH 33.0
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 8.31 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*

* **Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118**

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): _____
11. CHLORINATION: Type N/A Amount _____
12. CASING

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0	To 30.0	Ft.	2.0 in.	Sch 40	PVC
From 0.0	To 25.0	Ft.	6.0 in.	Sch 40	PVC
From	To	Ft.			

13. GROUT

	Depth		Material	Method
From 0.0	To 23.0	Ft.	Neat Cement	Cast-in-place
From 23.0	To 29.0	Ft.	Bentonite Pellets	Pour

14. SCREEN

	Depth		Diameter		Slot Size		Material
From 30.0	To 33.0	Ft.	2.0	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	
From	To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 29.0	To 33.0	Ft.	No. 2	Torpedo Sand
From	To	Ft.		

16. REMARKS: Flushmount wellhead installed in accordance with MCB policy, within 3'x3' concrete pad

DEPTH From	DEPTH To	DRILLING LOG Formation Description
SEE ATTACHED		
BORING LOG		
USTAS1-MW05		

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

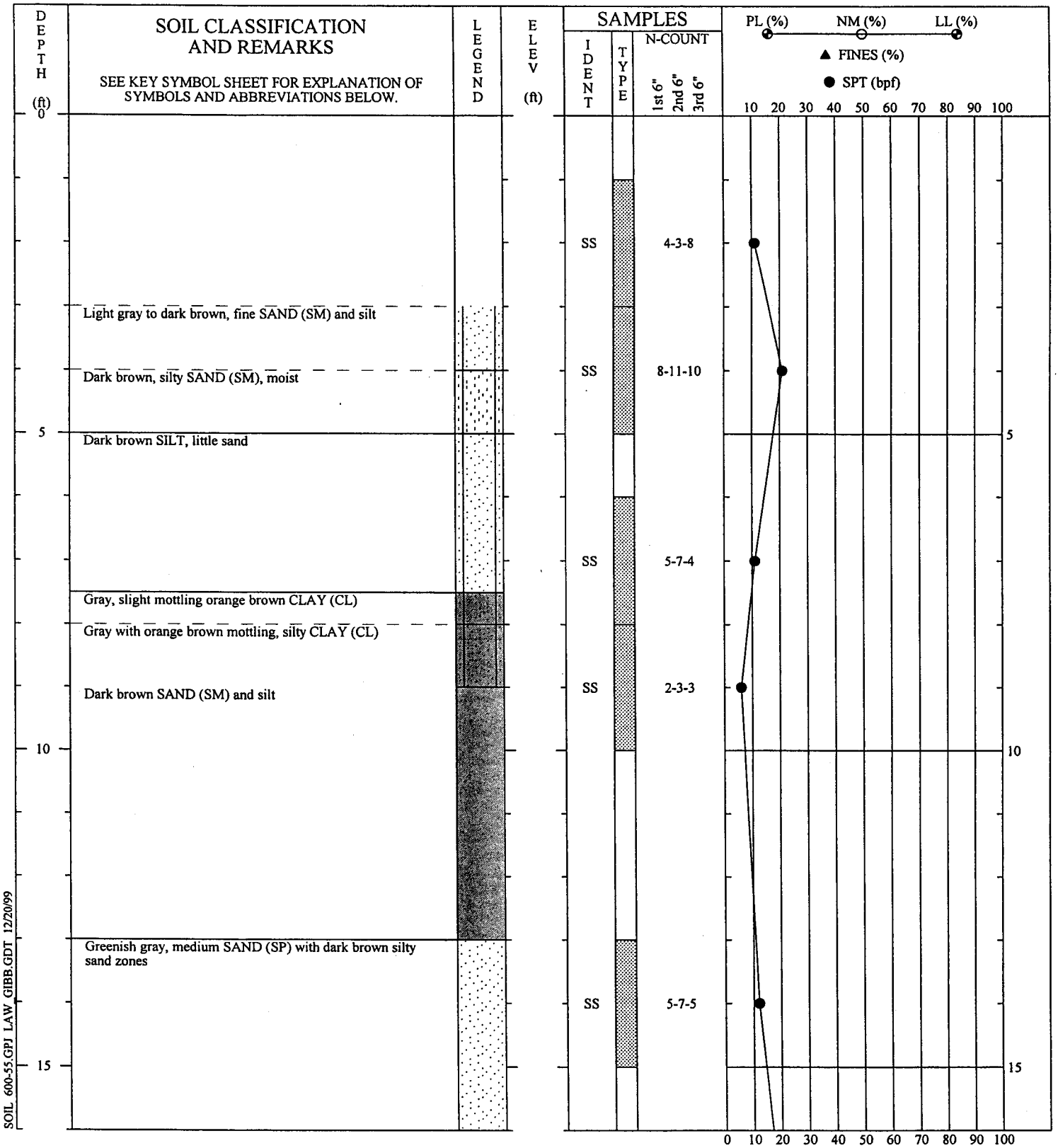
SEE FIGURES 3 & 4

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.

Brian A. Bellis — 01-06-00

SIGNATURE OF CONTRACTOR OR AGENT — DATE

Submit original to Division of Water Quality and coy to well owner.



SOIL 600-55.GPJ LAW GIBB.GDT 12/20/99

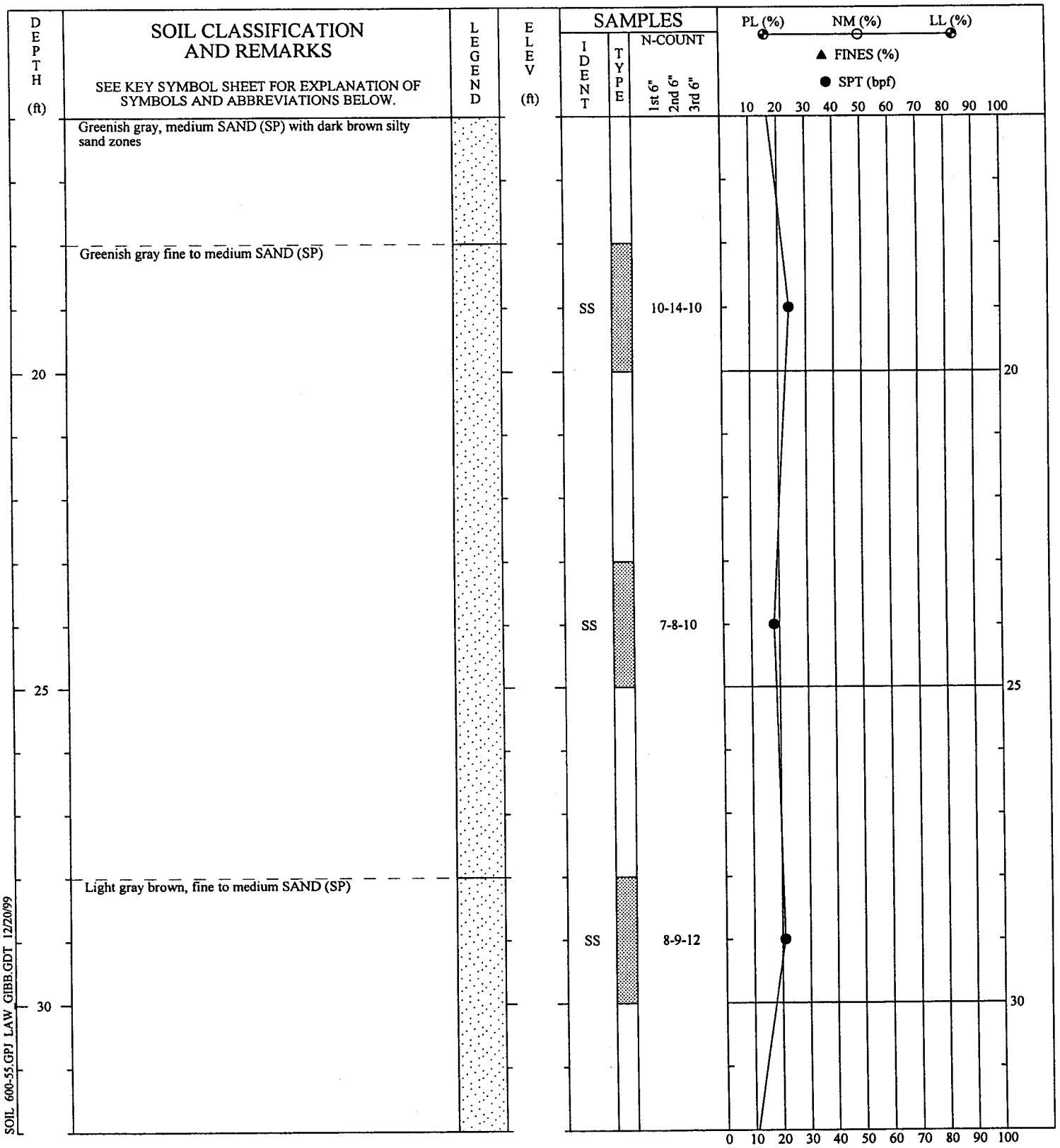
DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS: Pilot boring drilled approximately 20. 0 feet north of Type III location in order to avoid spreading potential groundwater cont.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** Pilot for AS1-MW05
Coord N:
Coord E:
Drilled: November 1, 1999
Project #: 30740-6-0600/0055 **Page 1 of 3**

LAW
LAWGIBB Group Member



SOIL 600-55.GPJ LAW_GIBB.GDT 12/20/99

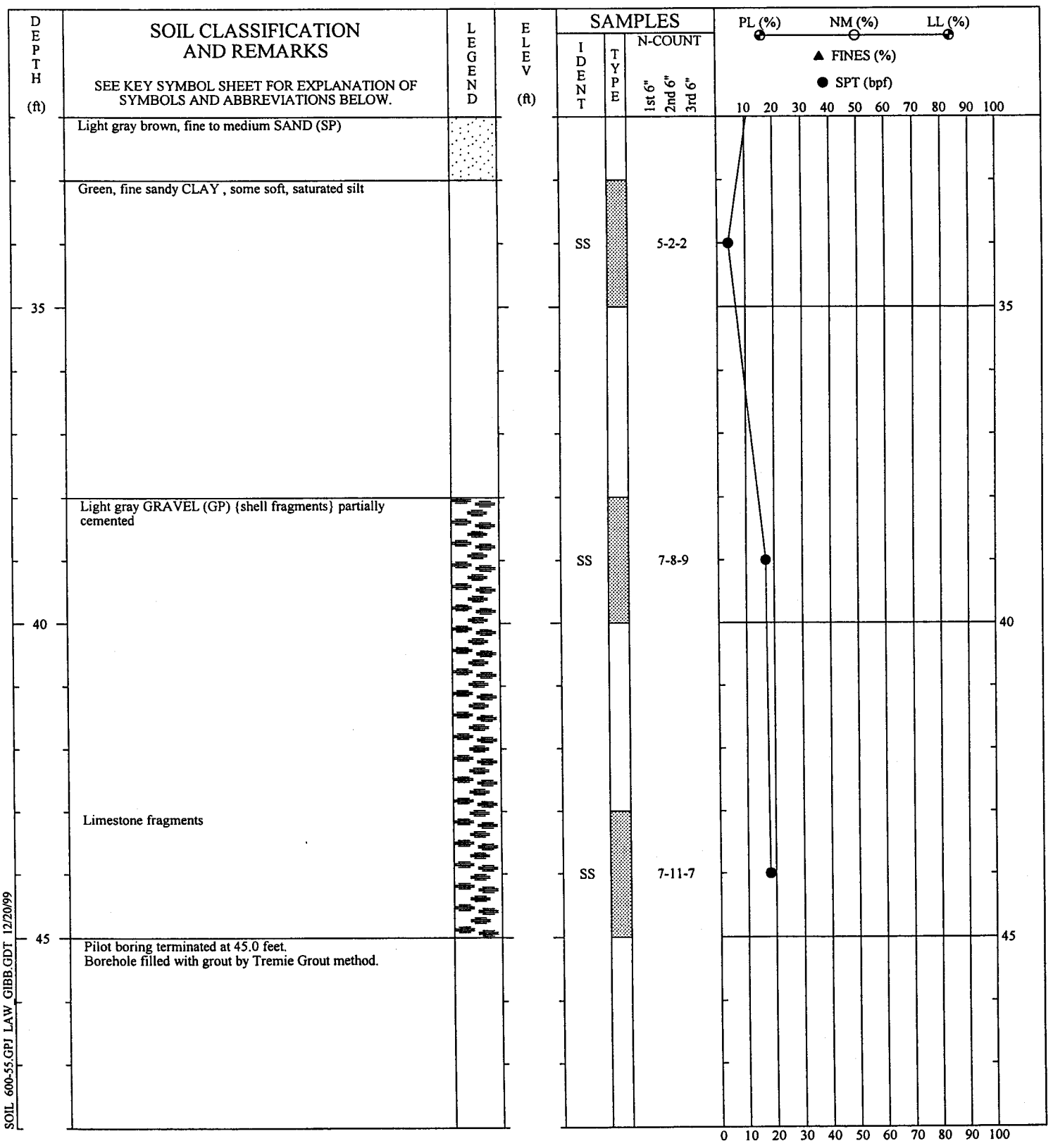
DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS: Pilot boring drilled approximately 20. 0 feet north of Type III location in order to avoid spreading potential groundwater cont.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** Pilot for AS1-MW05
Coord N:
Coord E:
Drilled: November 1, 1999
Project #: 30740-6-0600/0055

LAW
LAWGIBB Group Member



DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS: Pilot boring drilled approximately 20. 0 feet north of Type III location in order to avoid spreading potential groundwater cont.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** Pilot for AS1-MW05
Coord N:
Coord E:
Drilled: November 1, 1999
Project #: 30740-6-0600/0055 **Page** 3 **of** 3

LAW
LAWGIBB Group Member

North Carolina - Department of Environmental, Health, and Natural Resources
Division of Water Quality - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Superior Drilling Inc.

DRILLER REGISTRATION NUMBER: 1769

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Camp Lejeune, N.C. County: Onslow
   Former USTs AS-1 to AS-3, New River Air Station
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Commanding General
   ADDRESS Camp Lejeune Marine Corps Base
   (Street or Route No.)
   Camp Lejeune, (City or Town) N.C. (State) 28542-004 (Zip Code)
3. DATE DRILLED 11/2/99 USE OF WELL Monitoring
4. TOTAL DEPTH 15.0
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 7.78 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*

* **Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118**

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): _____
11. CHLORINATION: Type N/A Amount _____
12. CASING

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0	To 4.0	Ft.		2.0 in.	Sch 40	PVC
From _____	To _____	Ft.		_____	_____	_____
From _____	To _____	Ft.		_____	_____	_____

13. GROUT

	Depth			Material	Method
From 0.0	To 1.5	Ft.		Neat Cement	Cast-in-place
From 1.5	To 3.0	Ft.		Bentonite Pellets	Pour

14. SCREEN

	Depth			Diameter		Slot Size		Material
From 4.0	To 14.0	Ft.		2.0	in.	0.01	in.	PVC
From _____	To _____	Ft.		_____	in.	_____	in.	_____
From _____	To _____	Ft.		_____	in.	_____	in.	_____

15. SAND/GRAVEL PACK:

	Depth			Size	Material
From 3.0	To 15.0	Ft.		No. 2	Torpedo Sand
From _____	To _____	Ft.		_____	_____

16. REMARKS: Flushmount wellhead installed in accordance with MCB policy, within 3'x3' concrete pad

DEPTH From	DEPTH To	DRILLING LOG Formation Description
SEE ATTACHED		
BORING LOG		
USTAS1-MW06		

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

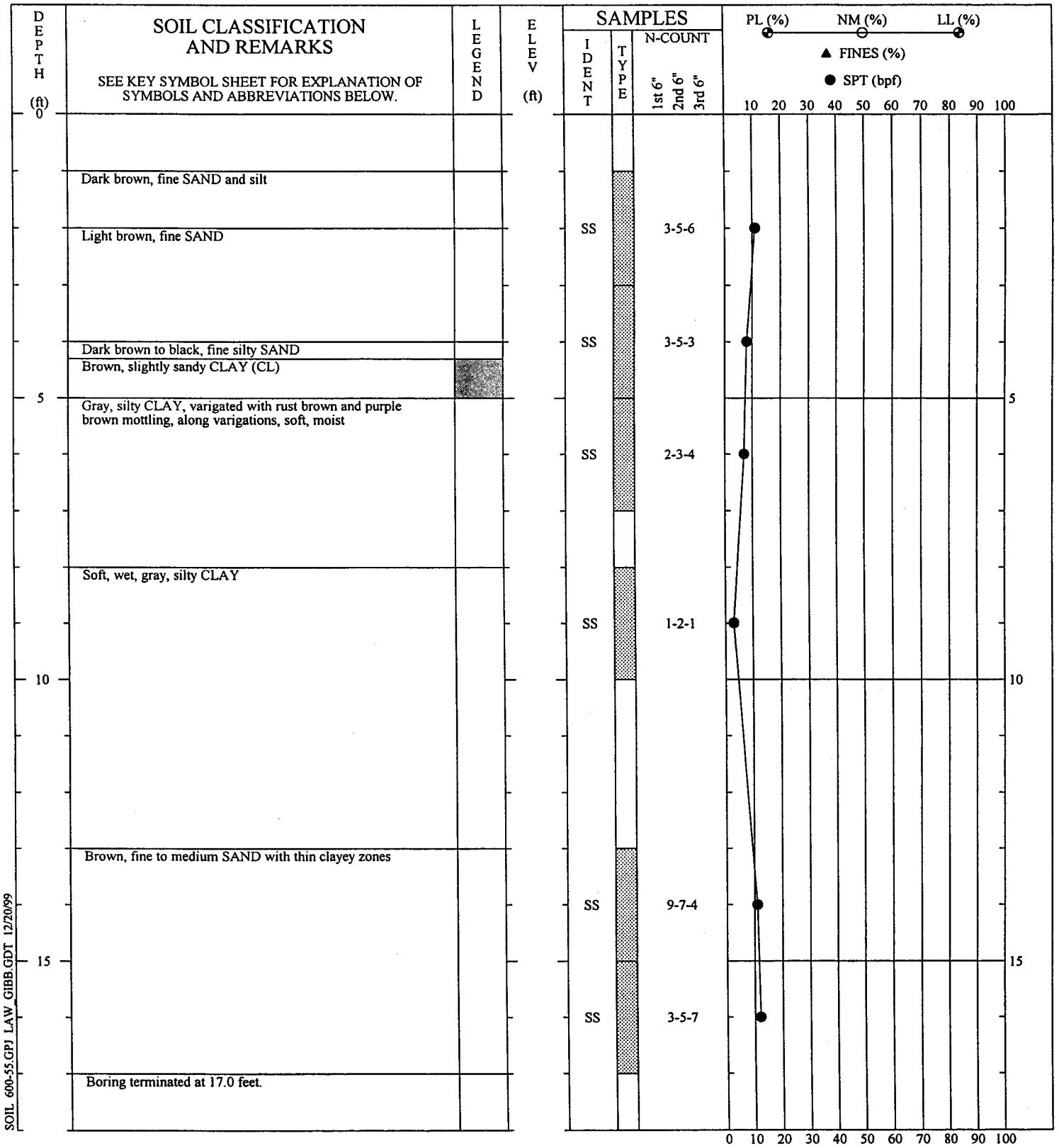
SEE FIGURES 3 & 4

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.

Brian A. Bell — 01-06-00

SIGNATURE OF CONTRACTOR OR AGENT — DATE

Submit original to Division of Water Quality and coy to well owner.



SOIL 600-55.GPJ LAW_GIBB.GDT 12/20/99

DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** USTAS1-MW06
Coord N:
Coord E:
Drilled: November 2, 1999
Project #: 30740-6-0600/0055 **Page 1 of 1**

LAW
LAWGIBB Group Member

North Carolina - Department of Environmental, Health, and Natural Resources
Division of Water Quality - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Superior Drilling Inc.

DRILLER REGISTRATION NUMBER: 1769

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Camp Lejeune, N.C. County: Onslow
   Former USTs AS-1 to AS-3, New River Air Station
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Commanding General
   ADDRESS Camp Lejeune Marine Corps Base
   (Street or Route No.)
   Camp Lejeune, (City or Town) N.C. (State) 28542-004 (Zip Code)
3. DATE DRILLED 11/2/99 USE OF WELL Monitoring
4. TOTAL DEPTH 15.0
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing 7.57 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*

* **Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118**

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): _____
11. CHLORINATION: Type N/A Amount _____
12. CASING

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0	To 4.3	Ft.	2.0 in.	Sch 40	PVC
From _____	To _____	Ft.	_____	_____	_____
From _____	To _____	Ft.	_____	_____	_____

13. GROUT

	Depth		Material	Method
From 0.0	To 2.0	Ft.	Neat Cement	Cast-in-place
From 2.0	To 3.3	Ft.	Bentonite Pellets	Pour

14. SCREEN

	Depth		Diameter		Slot Size		Material
From 4.3	To 14.3	Ft.	2.0	in.	0.01	in.	PVC
From _____	To _____	Ft.	_____	in.	_____	in.	_____
From _____	To _____	Ft.	_____	in.	_____	in.	_____

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 3.3	To 15.0	Ft.	No. 2	Torpedo Sand
From _____	To _____	Ft.	_____	_____

16. REMARKS: Flushmount wellhead installed in accordance with MCB policy, within 3'x3' concrete pad

DEPTH From	DEPTH To	DRILLING LOG Formation Description
SEE ATTACHED		
BORING LOG		
USTAS1-MW07		

If additional space is needed use back of form

LOCATION SKETCH

(Show direction and distance from at least two State Roads, or other map reference points)

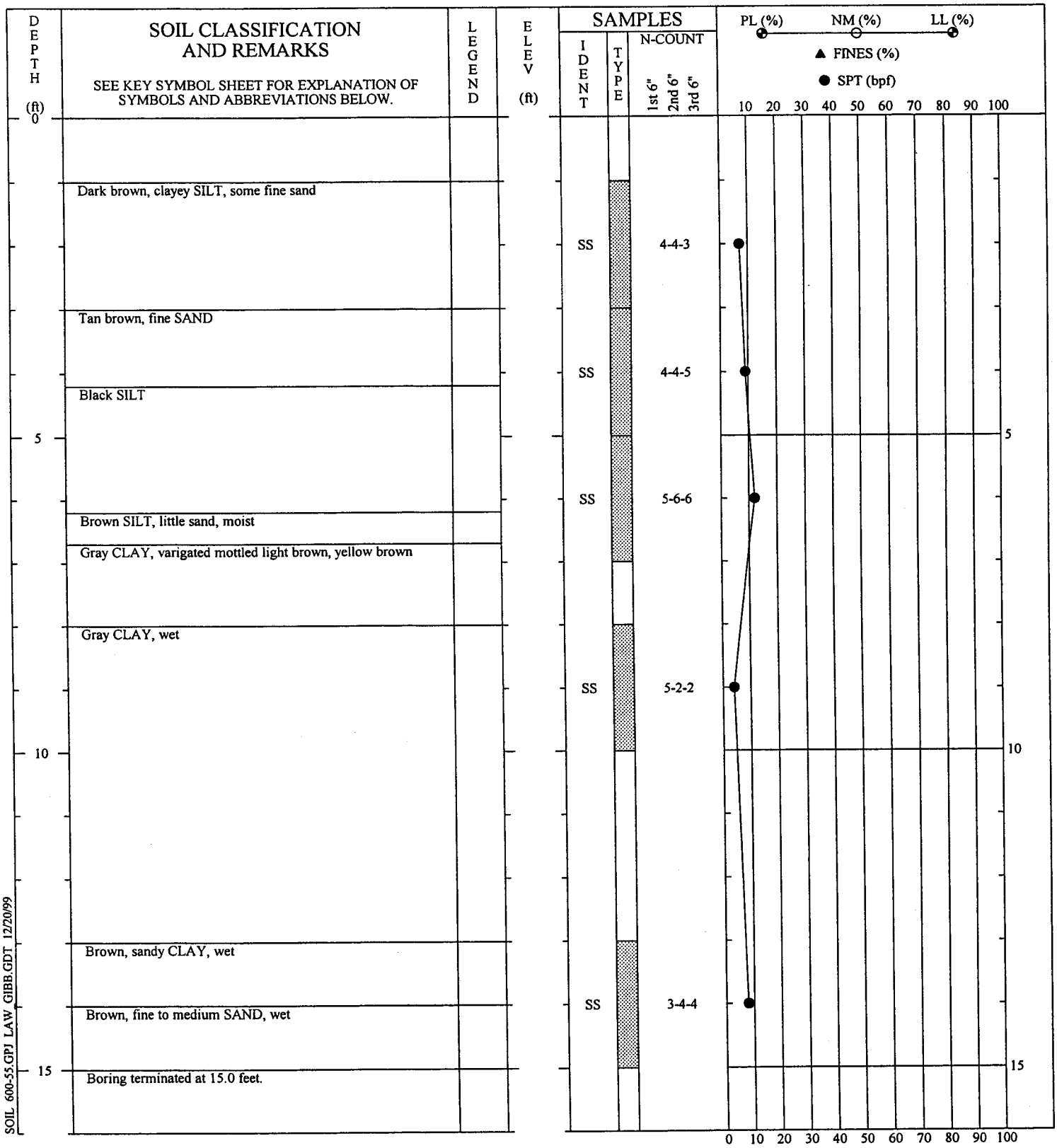
SEE FIGURES 3 & 4

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.

Brian J. Bellis — 01-06-00

SIGNATURE OF CONTRACTOR OR AGENT — DATE

Submit original to Division of Water Quality and coy to well owner.



DRILLER:
EQUIPMENT:
METHOD:
HOLE DIA.:
REMARKS:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Phase II LSA **Boring No:** USTAS1-MW07
Coord N:
Coord E:
Drilled: November 2, 1999
Project #: 30740-6-0600/0055 **Page** 1 **of** 1

LAW
LAWGIBB Group Member

APPENDIX B

MONITORING WELL DEVELOPMENT WORKSHEET

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL DEVELOPMENT WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW04**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/03/99** TIME (MILITARY) **0730**

FIELD PERSONNEL **Eric Aufderhaar**

WEATHER CONDITIONS **Sunny, 50's**

TOTAL WELL DEPTH (TWD) **16.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **9.05** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **12.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **5.0-15.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☒ NO ☐ COMMENTS

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☒

NONPOTABLE LABEL YES ☒ NO ☐

ID PLATE YES ☒ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☐ MODERATE ☐ HIGH ☒ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	2.0	4.0	6.0	9.0	12.0	
pH (S.U.)	5.74	5.64	5.60	5.46	5.46	
SP. COND. (µMHOS/CM)	178	185	277	245	133	
WATER TEMP. (°C)	19.5	19.5	19.5	19.5	19.5	
TURBIDITY*	4	4	4	3	2	

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL DEVELOPMENT WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW05**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/10/99** TIME (MILITARY) **1330**

FIELD PERSONNEL **Tana Jones**

WEATHER CONDITIONS **Sunny, 70's**

TOTAL WELL DEPTH (TWD) **33.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **8.31** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **20.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **30.0-33.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS	
LOCKING CAP	YES ☒	NO ☐		
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒		
NONPOTABLE LABEL	YES ☒	NO ☐		
ID PLATE	YES ☒	NO ☐		
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐		

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	4.0	8.0	12.0	16.0	20.0	
pH (S.U.)	9.20	6.58	6.25	5.95	5.88	
SP. COND. (µMHOS/CM)	450	260	191	163	145	
WATER TEMP. (°C)	21.7	20.9	21.0	20.9	20.7	
TURBIDITY*	3	3	2	2	3	

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL DEVELOPMENT WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW06**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/03/99** TIME (MILITARY) **0900**

FIELD PERSONNEL **Eric Aufderhaar**

WEATHER CONDITIONS **Sunny, 50's**

TOTAL WELL DEPTH (TWD) **15.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **7.78** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **12.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **5.0-15.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS	
LOCKING CAP	YES ☒	NO ☐		
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒		
NONPOTABLE LABEL	YES ☒	NO ☐		
ID PLATE	YES ☒	NO ☐		
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐		

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	3.0	6.0	8.0	10.0	12.0
pH (S.U.)	5.40	5.51	5.71	5.74	5.68
SP. COND. (µMHOS/CM)	428	414	475	468	442
WATER TEMP. (°C)	20.9	20.7	20.1	20.7	21.1
TURBIDITY*	4	4	3	3	3

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL DEVELOPMENT WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW07**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/03/99** TIME (MILITARY) **1115**

FIELD PERSONNEL **Eric Aufderhaar**

WEATHER CONDITIONS **Sunny, 50's**

TOTAL WELL DEPTH (TWD) **15.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **7.57** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **12.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **4.3-14.3** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS
LOCKING CAP	YES ☒	NO ☐	
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒	
NONPOTABLE LABEL	YES ☒	NO ☐	
ID PLATE	YES ☒	NO ☐	
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐	

WELL YIELD LOW ☐ MODERATE ☐ HIGH ☒ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	2.5	6.0	9.0	12.0
pH (S.U.)	4.74	5.22	5.22	5.36
SP. COND. (µMHOS/CM)	276	346	288	310
WATER TEMP. (°C)	21.4	21.2	21.3	21.4
TURBIDITY*	4	4	3	3

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

APPENDIX C

MONITORING WELL CASING AND WATER ELEVATION WORKSHEET

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

MONITORING WELL CASING AND WATER ELEVATION WORKSHEET

PROJECT NAME AS1 TO AS3 LSA, NEW RIVER AIR STATION JOB NUMBER 30740-6-0600\0055

LOCATION Marine Corps Base, Camp Lejeune, NC DATE November 11, 1999
DESCRIPTION OF SURVEY DATUM Marked point on Horizontal and Vertical Information based on monuments "NR-9 and NR-10", as published.

FIELD PERSONNEL Tana Jones

MEASURING DEVICE(S) Solinst water level indicator

WELL NUMBER	MEASURING POINT CALCULATIONS			DEPTH TO WATER (FT)	ELEV OF WATER (FT)	PRODUCT THICKNESS (FT)	COMMENTS (ODOR, WELL COND., PROTECTIVE COVER CONDITION)
	ROD HEIGHT (FT)	INSTRUMENT HEIGHT (FT)	ELEV. OF MEASURING POINT (1) (FT)				
USTAS1-MW1			19.33	8.16	11.17	ND	Good Condition
USTAS1-MW2			19.43	5.84	13.59	ND	Good Condition
USTAS1-MW3 Type III Well			18.78	7.91	10.87	ND	Good Condition
USTAS1-MW4			21.10	9.08	12.02	ND	Good Condition
USTAS1-MW5			19.42	12.57	5.85	ND	Good Condition
USTAS1-MW6			19.06	7.92	11.14	ND	Good Condition
USTAS1-MW7			18.63	7.40	11.23	ND	Good Condition

(1) Measuring point top of casing unless otherwise noted.
ND = LAW did not identify a measurable thickness of Free Product.

APPENDIX D

LABORATORY REPORTS
SOIL SAMPLES

PARADIGM ANALYTICAL LABORATORIES, INC.
2627 Northchase Parkway S.E.
Wilmington, North Carolina 28405
(910) 350-1903
Fax (910) 350-1557

Mr. Dan Nielsen
LAW Engineering
3301 Atlantic Ave.
Raleigh,NC 27604

November 19, 1999

Report Number: G132-581

Client Project ID: Phase 2 LSA, ASI to AS3

Dear Mr. Nielsen,

Enclosed are the results of the analytical services performed under the referenced project. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or the services performed during this project, please call for assistance. We will be happy to answer any questions or concerns which you may have.

Thank you for using Paradigm Analytical Labs for your analytical services. We look forward to working with you again on any additional analytical needs which you may have.

Sincerely,

Paradigm Analytical Laboratories, Inc.

Laboratory Director
Mark Randall

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase 2 LSA, ASI to AS3

Sample Information and Analytical Results	
Sample Identification	ASI-MW4
Sample Matrix	Soil
Collection Option (for Soil)*	3
Date Collected	11/02/99
Date Received	11/03/99
Date Extracted	11/02/99
Date Analyzed	11/10/99
Dry Weight	57
Dilution Factor	1
C_5-C_8 Aliphatics**	< 500 (µg/Kg)
C_9-C_{12} Aliphatics**	< 500 (µg/Kg)
C_9-C_{10} Aromatics**	< 500 (µg/Kg)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	120

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-581-75168

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

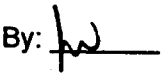
Project Name: Phase 2 LSA, ASI to AS3

Sample Information and Analytical Results	
Sample Identification	ASI-MW5
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/03/99
Date Received	11/03/99
Date Extracted	11/04/99
Date Analyzed	11/12/99
Dry Weight	72
Dilution Factor	1
C_5-C_8 Aliphatics**	< 500 (µg/Kg)
C_9-C_{12} Aliphatics**	< 500 (µg/Kg)
C_9-C_{10} Aromatics**	< 500 (µg/Kg)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	120

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-581-75169

Reviewed By: 

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase 2 LSA, ASI to AS3

Sample Information and Analytical Results	
Sample Identification	ASI-MW6
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/02/99
Date Received	11/03/99
Date Extracted	11/04/99
Date Analyzed	11/10/99
Dry Weight	66
Dilution Factor	1
C_5-C_8 Aliphatics**	< 500 (µg/Kg)
C_9-C_{12} Aliphatics**	< 500 (µg/Kg)
C_9-C_{10} Aromatics**	< 500 (µg/Kg)
Surrogate % Recovery - PID	120
Surrogate % Recovery - FID	120

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-581-75170

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase 2 LSA, ASI to AS3

Sample Information and Analytical Results	
Sample Identification	ASI-MW7
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/02/99
Date Received	11/03/99
Date Extracted	11/04/99
Date Analyzed	11/10/99
Dry Weight	82
Dilution Factor	1
C_5-C_8 Aliphatics**	< 500 (µg/Kg)
C_9-C_{12} Aliphatics**	< 500 (µg/Kg)
C_9-C_{10} Aromatics**	< 500 (µg/Kg)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	120

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-581-75171

Reviewed By: \w

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase 2 LSA, ASI to AS3

Sample Information and Analytical Results	
Sample Identification	Trip Blank
Sample Matrix	Soil
Collection Option (for Soil)*	3
Date Collected	11/02/99
Date Received	11/03/99
Date Extracted	11/04/99
Date Analyzed	11/10/99
Dry Weight	100
Dilution Factor	1
C_5-C_8 Aliphatics**	< 500 (µg/Kg)
C_9-C_{12} Aliphatics**	< 500 (µg/Kg)
C_9-C_{10} Aromatics**	< 500 (µg/Kg)
Surrogate % Recovery - PID	100
Surrogate % Recovery - FID	100

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-58-75172

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 10/31/99 PID Initial Calibration Date: 10/31/99

Calibration Ranges and Limits

Range	MDL (µg/L)	MDL (µg/Kg)	ML (µg/L)	ML (µg/Kg)	RL (µg/L)	RL (µg/Kg)
C_5-C_8 Aliphatics	2.4	120	7.5	380	10	500
C_9-C_{12} Aliphatics	1.3	65	4.0	210	10	500
C_9-C_{10} Aromatics	0.5	25	1.6	80	10	500

Calibration Concentration Levels

Range	Levels (µg/L)	Levels (µg/Kg)	%RSD or CCC	Method of Quantitation
C_5-C_8 Aliphatics	40	2000	12.0	Calibration Factor
	160	8000		
	400	20000		
	1600	80000		
	4000	200000		
C_9-C_{12} Aliphatics	30	1500	0.987	Linear Regression
	120	6000		
	300	15000		
	1200	60000		
	3000	150000		
C_9-C_{10} Aromatics	65	3250	22.1	Calibration Factor
	260	13000		
	650	32500		
	2600	130000		
	6500	325000		

Calibration Check Date: 11/10/99

Calibration Check

Range	Levels (µg/L)	Levels (µg/Kg)	RPD
C_5-C_8 Aliphatics	400	20000	15.6
C_9-C_{12} Aliphatics	300	15000	9.7
C_9-C_{10} Aromatics	650	32500	-3.3

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit
RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Reviewed By: 

PARADIGM ANALYTICAL LABORATORIES, INC.

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 10/31/99 PID Initial Calibration Date: 10/31/99

Calibration Ranges and Limits

Range	MDL (µg/L)	MDL (µg/Kg)	ML (µg/L)	ML (µg/Kg)	RL (µg/L)	RL (µg/Kg)
C_5-C_8 Aliphatics	2.4	120	7.5	380	10	500
C_9-C_{12} Aliphatics	1.3	65	4.0	210	10	500
C_9-C_{10} Aromatics	0.5	25	1.6	80	10	500

Calibration Concentration Levels

Range	Levels (µg/L)	Levels (µg/Kg)	%RSD or CCC	Method of Quantitation
C_5-C_8 Aliphatics	40	2000	12.0	Calibration Factor
	160	8000		
	400	20000		
	1600	80000		
	4000	200000		
C_9-C_{12} Aliphatics	30	1500	0.987	Linear Regression
	120	6000		
	300	15000		
	1200	60000		
	3000	150000		
C_9-C_{10} Aromatics	65	3250	22.1	Calibration Factor
	260	13000		
	650	32500		
	2600	130000		
	6500	325000		

Calibration Check Date: 11/11/99

Calibration Check

Range	Levels (µg/L)	Levels (µg/Kg)	RPD
C_5-C_8 Aliphatics	400	20000	-22.5
C_9-C_{12} Aliphatics	300	15000	4.0
C_9-C_{10} Aromatics	650	32500	-10.0

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit
RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW4
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75168
Lab Project ID: G132-581
Matrix: Soil %Solids: 56.8

Date Analyzed: 11/11/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
Acetone	88	BQL
Acrolein	180	BQL
Acrylonitrile	180	BQL
Benzene	8.8	BQL
Bromobenzene	8.8	BQL
Bromochloromethane	8.8	BQL
Bromodichloromethane	8.8	BQL
Bromoform	8.8	BQL
Bromomethane	8.8	BQL
2-Butanone	44	BQL
n-Butylbenzene	8.8	BQL
sec-Butylbenzene	8.8	BQL
tert-Butylbenzene	8.8	BQL
Carbon disulfide	8.8	BQL
Carbon tetrachloride	8.8	BQL
Chlorobenzene	8.8	BQL
Chloroethane	8.8	BQL
2-Chloroethyl vinyl ether	8.8	BQL
Chloroform	8.8	BQL
Chloromethane	8.8	BQL
2-Chlorotoluene	8.8	BQL
4-Chlorotoluene	8.8	BQL
Dibromochloromethane	8.8	BQL
1,2-Dibromo-3-chloropropane	8.8	BQL
Dibromomethane	8.8	BQL
1,2-Dibromoethane (EDB)	8.8	BQL
1,2-Dichlorobenzene	8.8	BQL
1,3-Dichlorobenzene	8.8	BQL
1,4-Dichlorobenzene	8.8	BQL
trans-1,4-Dichloro-2-butene	8.8	BQL
1,1-Dichloroethane	8.8	BQL
1,1-Dichloroethene	8.8	BQL
1,2-Dichloroethane	8.8	BQL
cis-1,2-Dichloroethene	8.8	BQL
trans-1,2-dichloroethene	8.8	BQL
1,2-Dichloropropane	8.8	BQL
1,3-Dichloropropane	8.8	BQL
2,2-Dichloropropane	8.8	BQL
1,1-Dichloropropene	8.8	BQL
cis-1,3-Dichloropropene	8.8	BQL
trans-1,3-Dichloropropene	8.8	BQL
Dichlorodifluoromethane	8.8	BQL
Diisopropyl ether (DIPE)	8.8	BQL
Ethylbenzene	8.8	BQL
Hexachlorobutadiene	8.8	BQL
2-Hexanone	8.8	BQL
Iodomethane	8.8	BQL
Isopropylbenzene	8.8	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW4
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75168
Lab Project ID: G132-581
Matrix: Soil %Solids: 56.8

Date Analyzed: 11/11/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
4-Isopropyltoluene	8.8	BQL
Methylene chloride	35	BQL
4-Methyl-2-pentanone	8.8	BQL
Methyl-tert-butyl ether (MTBE)	8.8	BQL
Naphthalene	8.8	BQL
n-Propyl benzene	8.8	BQL
Styrene	8.8	BQL
1,1,1,2-Tetrachloroethane	8.8	BQL
1,1,2,2-Tetrachloroethane	8.8	BQL
Tetrachloroethene	8.8	BQL
Toluene	8.8	BQL
1,2,3-Trichlorobenzene	8.8	BQL
1,2,4-Trichlorobenzene	8.8	BQL
Trichloroethene	8.8	BQL
1,1,1-Trichloroethane	8.8	BQL
1,1,2-Trichloroethane	8.8	BQL
Trichlorofluoromethane	8.8	BQL
1,2,3-Trichloropropane	8.8	BQL
1,2,4-Trimethylbenzene	8.8	BQL
1,3,5-Trimethylbenzene	8.8	BQL
Vinyl chloride	8.8	BQL
m-,p-Xylene	18	BQL
o-Xylene	8.8	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/KG)	Surrogate Result (ug/KG)	%Rec
Bromofluorobenzene	50	48.5	97
1,2-Dichloroethane-d4	50	54.6	109
Toluene-d8	50	49.5	99

Comments:
All results are corrected for dilution.

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW5
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75169
Lab Project ID: G132-581
Matrix: Soil %Solids: 72.0

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/3/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
Acetone	69	BQL
Acrolein	140	BQL
Acrylonitrile	140	BQL
Benzene	6.9	BQL
Bromobenzene	6.9	BQL
Bromochloromethane	6.9	BQL
Bromodichloromethane	6.9	BQL
Bromoform	6.9	BQL
Bromomethane	6.9	BQL
2-Butanone	35	BQL
n-Butylbenzene	6.9	BQL
sec-Butylbenzene	6.9	BQL
tert-Butylbenzene	6.9	BQL
Carbon disulfide	6.9	BQL
Carbon tetrachloride	6.9	BQL
Chlorobenzene	6.9	BQL
Chloroethane	6.9	BQL
2-Chloroethyl vinyl ether	6.9	BQL
Chloroform	6.9	BQL
Chloromethane	6.9	BQL
2-Chlorotoluene	6.9	BQL
4-Chlorotoluene	6.9	BQL
Dibromochloromethane	6.9	BQL
1,2-Dibromo-3-chloropropane	6.9	BQL
Dibromomethane	6.9	BQL
1,2-Dibromoethane (EDB)	6.9	BQL
1,2-Dichlorobenzene	6.9	BQL
1,3-Dichlorobenzene	6.9	BQL
1,4-Dichlorobenzene	6.9	BQL
trans-1,4-Dichloro-2-butene	6.9	BQL
1,1-Dichloroethane	6.9	BQL
1,1-Dichloroethene	6.9	BQL
1,2-Dichloroethane	6.9	BQL
cis-1,2-Dichloroethene	6.9	BQL
trans-1,2-dichloroethene	6.9	BQL
1,2-Dichloropropane	6.9	BQL
1,3-Dichloropropane	6.9	BQL
2,2-Dichloropropane	6.9	BQL
1,1-Dichloropropene	6.9	BQL
cis-1,3-Dichloropropene	6.9	BQL
trans-1,3-Dichloropropene	6.9	BQL
Dichlorodifluoromethane	6.9	BQL
Diisopropyl ether (DIPE)	6.9	BQL
Ethylbenzene	6.9	BQL
Hexachlorobutadiene	6.9	BQL
2-Hexanone	6.9	BQL
Iodomethane	6.9	BQL
Isopropylbenzene	6.9	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW5
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75169
Lab Project ID: G132-581
Matrix: Soil %Solids: 72.0

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/3/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
4-Isopropyltoluene	6.9	BQL
Methylene chloride	28	BQL
4-Methyl-2-pentanone	6.9	BQL
Methyl-tert-butyl ether (MTBE)	6.9	BQL
Naphthalene	6.9	BQL
n-Propyl benzene	6.9	BQL
Styrene	6.9	BQL
1,1,1,2-Tetrachloroethane	6.9	BQL
1,1,2,2-Tetrachloroethane	6.9	BQL
Tetrachloroethene	6.9	BQL
Toluene	6.9	BQL
1,2,3-Trichlorobenzene	6.9	BQL
1,2,4-Trichlorobenzene	6.9	BQL
Trichloroethene	6.9	BQL
1,1,1-Trichloroethane	6.9	BQL
1,1,2-Trichloroethane	6.9	BQL
Trichlorofluoromethane	6.9	BQL
1,2,3-Trichloropropane	6.9	BQL
1,2,4-Trimethylbenzene	6.9	BQL
1,3,5-Trimethylbenzene	6.9	BQL
Vinyl chloride	6.9	BQL
m-,p-Xylene	14	BQL
o-Xylene	6.9	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/KG)	Surrogate Result (ug/KG)	%Rec
Bromofluorobenzene	50	46.1	92
1,2-Dichloroethane-d4	50	59.0	118
Toluene-d8	50	50.1	100

Comments:
All results are corrected for dilution.

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW6
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75170
Lab Project ID: G132-581
Matrix: Soil %Solids: 66.1

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
Acetone	76	BQL
Acrolein	150	BQL
Acrylonitrile	150	BQL
Benzene	7.6	BQL
Bromobenzene	7.6	BQL
Bromochloromethane	7.6	BQL
Bromodichloromethane	7.6	BQL
Bromoform	7.6	BQL
Bromomethane	7.6	BQL
2-Butanone	38	BQL
n-Butylbenzene	7.6	BQL
sec-Butylbenzene	7.6	BQL
tert-Butylbenzene	7.6	BQL
Carbon disulfide	7.6	BQL
Carbon tetrachloride	7.6	BQL
Chlorobenzene	7.6	BQL
Chloroethane	7.6	BQL
2-Chloroethyl vinyl ether	7.6	BQL
Chloroform	7.6	BQL
Chloromethane	7.6	BQL
2-Chlorotoluene	7.6	BQL
4-Chlorotoluene	7.6	BQL
Dibromochloromethane	7.6	BQL
1,2-Dibromo-3-chloropropane	7.6	BQL
Dibromomethane	7.6	BQL
1,2-Dibromoethane (EDB)	7.6	BQL
1,2-Dichlorobenzene	7.6	BQL
1,3-Dichlorobenzene	7.6	BQL
1,4-Dichlorobenzene	7.6	BQL
trans-1,4-Dichloro-2-butene	7.6	BQL
1,1-Dichloroethane	7.6	BQL
1,1-Dichloroethene	7.6	BQL
1,2-Dichloroethane	7.6	BQL
cis-1,2-Dichloroethene	7.6	BQL
trans-1,2-dichloroethene	7.6	BQL
1,2-Dichloropropane	7.6	BQL
1,3-Dichloropropane	7.6	BQL
2,2-Dichloropropane	7.6	BQL
1,1-Dichloropropene	7.6	BQL
cis-1,3-Dichloropropene	7.6	BQL
trans-1,3-Dichloropropene	7.6	BQL
Dichlorodifluoromethane	7.6	BQL
Diisopropyl ether (DIPE)	7.6	BQL
Ethylbenzene	7.6	BQL
Hexachlorobutadiene	7.6	BQL
2-Hexanone	7.6	BQL
Iodomethane	7.6	BQL
Isopropylbenzene	7.6	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW6
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75170
Lab Project ID: G132-581
Matrix: Soil %Solids: 66.1

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
4-Isopropyltoluene	7.6	BQL
Methylene chloride	30	BQL
4-Methyl-2-pentanone	7.6	BQL
Methyl-tert-butyl ether (MTBE)	7.6	BQL
Naphthalene	7.6	BQL
n-Propyl benzene	7.6	BQL
Styrene	7.6	BQL
1,1,1,2-Tetrachloroethane	7.6	BQL
1,1,2,2-Tetrachloroethane	7.6	BQL
Tetrachloroethene	7.6	BQL
Toluene	7.6	BQL
1,2,3-Trichlorobenzene	7.6	BQL
1,2,4-Trichlorobenzene	7.6	BQL
Trichloroethene	7.6	BQL
1,1,1-Trichloroethane	7.6	BQL
1,1,2-Trichloroethane	7.6	BQL
Trichlorofluoromethane	7.6	BQL
1,2,3-Trichloropropane	7.6	BQL
1,2,4-Trimethylbenzene	7.6	BQL
1,3,5-Trimethylbenzene	7.6	BQL
Vinyl chloride	7.6	BQL
m-,p-Xylene	15	BQL
o-Xylene	7.6	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/KG)	Surrogate Result (ug/KG)	%Rec
Bromofluorobenzene	50	45.0	90
1,2-Dichloroethane-d4	50	56.7	113
Toluene-d8	50	49.6	99

Comments:
All results are corrected for dilution.

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW7
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75171
Lab Project ID: G132-581
Matrix: Soil %Solids: 82.1

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
Acetone	61	BQL
Acrolein	120	BQL
Acrylonitrile	120	BQL
Benzene	6.1	BQL
Bromobenzene	6.1	BQL
Bromochloromethane	6.1	BQL
Bromodichloromethane	6.1	BQL
Bromoform	6.1	BQL
Bromomethane	6.1	BQL
2-Butanone	30	BQL
n-Butylbenzene	6.1	BQL
sec-Butylbenzene	6.1	BQL
tert-Butylbenzene	6.1	BQL
Carbon disulfide	6.1	BQL
Carbon tetrachloride	6.1	BQL
Chlorobenzene	6.1	BQL
Chloroethane	6.1	BQL
2-Chloroethyl vinyl ether	6.1	BQL
Chloroform	6.1	BQL
Chloromethane	6.1	BQL
2-Chlorotoluene	6.1	BQL
4-Chlorotoluene	6.1	BQL
Dibromochloromethane	6.1	BQL
1,2-Dibromo-3-chloropropane	6.1	BQL
Dibromomethane	6.1	BQL
1,2-Dibromoethane (EDB)	6.1	BQL
1,2-Dichlorobenzene	6.1	BQL
1,3-Dichlorobenzene	6.1	BQL
1,4-Dichlorobenzene	6.1	BQL
trans-1,4-Dichloro-2-butene	6.1	BQL
1,1-Dichloroethane	6.1	BQL
1,1-Dichloroethene	6.1	BQL
1,2-Dichloroethane	6.1	BQL
cis-1,2-Dichloroethene	6.1	BQL
trans-1,2-dichloroethene	6.1	BQL
1,2-Dichloropropane	6.1	BQL
1,3-Dichloropropane	6.1	BQL
2,2-Dichloropropane	6.1	BQL
1,1-Dichloropropene	6.1	BQL
cis-1,3-Dichloropropene	6.1	BQL
trans-1,3-Dichloropropene	6.1	BQL
Dichlorodifluoromethane	6.1	BQL
Diisopropyl ether (DIPE)	6.1	BQL
Ethylbenzene	6.1	BQL
Hexachlorobutadiene	6.1	BQL
2-Hexanone	6.1	BQL
Iodomethane	6.1	BQL
Isopropylbenzene	6.1	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 8260B

Client Sample ID: ASI-MW7
Client Project ID: Phase 2 LSA, ASI to AS3
Lab Sample ID: 75171
Lab Project ID: G132-581
Matrix: Soil %Solids: 82.1

Date Analyzed: 11/10/99
Analyzed By: RNP
Date Collected: 11/2/99
Date Received: 11/3/99
Dilution: 1

Compound	Quantitation Limit (ug/KG)	Result (ug/KG)
4-Isopropyltoluene	6.1	BQL
Methylene chloride	24	BQL
4-Methyl-2-pentanone	6.1	BQL
Methyl-tert-butyl ether (MTBE)	6.1	BQL
Naphthalene	6.1	BQL
n-Propyl benzene	6.1	BQL
Styrene	6.1	BQL
1,1,1,2-Tetrachloroethane	6.1	BQL
1,1,2,2-Tetrachloroethane	6.1	BQL
Tetrachloroethene	6.1	BQL
Toluene	6.1	BQL
1,2,3-Trichlorobenzene	6.1	BQL
1,2,4-Trichlorobenzene	6.1	BQL
Trichloroethene	6.1	BQL
1,1,1-Trichloroethane	6.1	BQL
1,1,2-Trichloroethane	6.1	BQL
Trichlorofluoromethane	6.1	BQL
1,2,3-Trichloropropane	6.1	BQL
1,2,4-Trimethylbenzene	6.1	BQL
1,3,5-Trimethylbenzene	6.1	BQL
Vinyl chloride	6.1	BQL
m-,p-Xylene	12	BQL
o-Xylene	6.1	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/KG)	Surrogate Result (ug/KG)	%Rec
Bromofluorobenzene	50	44.1	88
1,2-Dichloroethane-d4	50	61.4	123
Toluene-d8	50	49.1	98

Comments:
All results are corrected for dilution.

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	ASI-MW4	Analyzed By:	JMF
Client Project ID:	Phase 2 LSA, ASI to AS3	Date Collected:	11/2/99
Lab Sample ID:	75168	Date Received:	11/3/99
Lab Project ID:	G132-581	Matrix:	Soil
	Solids 56.80		

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	**25.6**	1.76	MG/KG	6010B	11/16/99
Lead	**10.0**	1.76	MG/KG	6010B	11/16/99

Comments
BQL = Below Quantitation Limits

Reviewed By: _____

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	ASI-MW5	Analyzed By:	JMF
Client Project ID:	Phase 2 LSA, ASI to AS3	Date Collected:	11/3/99
Lab Sample ID:	75169	Date Received:	11/3/99
Lab Project ID:	G132-581	Matrix:	Soil
	Solids 72.01		

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	**11.5**	1.35	MG/KG	6010B	11/16/99
Lead	**65.2**	1.35	MG/KG	6010B	11/16/99

Comments
BQL = Below Quantitation Limits

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	ASI-MW6	Analyzed By:	JMF
Client Project ID:	Phase 2 LSA, ASI to AS3	Date Collected:	11/2/99
Lab Sample ID:	75170	Date Received:	11/3/99
Lab Project ID:	G132-581	Matrix:	Soil
	Solids 66.05		

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	**23.2**	1.44	MG/KG	6010B	11/16/99
Lead	**9.62**	1.44	MG/KG	6010B	11/16/99

Comments
BQL = Below Quantitation Limits

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	ASI-MW7	Analyzed By:	JMF
Client Project ID:	Phase 2 LSA, ASI to AS3	Date Collected:	11/2/99
Lab Sample ID:	75171	Date Received:	11/3/99
Lab Project ID:	G132-581	Matrix:	Soil
	Solids 82.08		

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	**5.48**	1.16	MG/KG	6010B	11/16/99
Lead	**4.05**	1.16	MG/KG	6010B	11/16/99

Comments
BQL = Below Quantitation Limits

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.
627 Northchase Parkway SE, Wilmington, NC 28405
Phone: (910)-350-1903 FAX: (910)-350-1557

SOIL SAMPLES
Chain-of Custody Record & Analytical Request

COC# 11626

Page 1 **of** 1

Client: Law Engineering & Env. Services
Address: 3301 Atlantic Ave.
Address: Raleigh, NC 27604
Quote #: 1085

Project ID: Phase 2 LSA, AS1 to AS3
P.O. Number: PCF #307-00205, 99
Contact: Dan Nielsen
Phone: 919-876-0416

Date: 11-3-99
Turnaround: standard
Job Number: 30740606001/0055

Report To: Dan Nielsen, Law Engineering (Address at Left)
Invoice To: Law Corporate

Sample ID	Date	Time	Matrix	Preservatives: Methanol				Analyses: MADEP VPH-Encore	MADEP VPH-40ml	~~EPH~~	EPA 8260 +IPE+MTBE	Metals Cr & Pb						Comments: Please specify any special reporting requirements
																		G132-581
AS1-MW4	11/2/99	1030	SO	2					2		1	1						
AS1-MW5	11/3/99	1130	SO					2			1	1						
AS1-MW6	11/2/99	1545	SO					2	~~2~~ EA		1	1						
AS1-MW7	11/2/99	1715	SO	1				1	1		1	1						Use Soil in 40ml VOA Only if "Encore" Sample is insufficient.

Relinquished By	Date	Time	Received By	Date	Time	Temperature	Sampled By	Airbill #
[signature]	11/3/99	1715	Erin [signature]	11/3/99	510		Walkin on ice	

ORIGINAL

APPENDIX E

MONITORING WELL SAMPLING WORKSHEETS

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL SAMPLING WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW04**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/11/99** TIME (MILITARY) **1120**

FIELD PERSONNEL **Tana Jones**

WEATHER CONDITIONS **Sunny, 70's**

TOTAL WELL DEPTH (TWD) **15.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **9.08** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Disposable Bailer**

TOTAL VOLUME OF WATER REMOVED **3.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **5.0-15.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS
LOCKING CAP	YES ☒	NO ☐	
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒	
NONPOTABLE LABEL	YES ☒	NO ☐	
ID PLATE	YES ☒	NO ☐	
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐	

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	1.0	2.0	3.0
pH (S.U.)	4.97	5.35	5.41
SP. COND. (µMHOS/CM)	200	192	158
WATER TEMP. (°C)	21.4	21.2	21.2
TURBIDITY*	4	4	4

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL SAMPLING WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW05**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/11/99** TIME (MILITARY) **1000**

FIELD PERSONNEL **Tana Jones**

WEATHER CONDITIONS **Sunny, 70's**

TOTAL WELL DEPTH (TWD) **33.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **12.57** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **20.0**** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **30.0-33.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS	
LOCKING CAP	YES ☒	NO ☐	** Well was developed on 11/10/99 at 1330, 20.0-	
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒	gallons were removed. Well was sampled	
NONPOTABLE LABEL	YES ☒	NO ☐	on 11/11/99 at 1000. For Field Analyses	
ID PLATE	YES ☒	NO ☐	readings from 11/10/99 see Well Development	
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐	Worksheet (Appendix B)	

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	**0.0**		
pH (S.U.)	**5.94**		
SP. COND. (µMHOS/CM)	**144**		
WATER TEMP. (°C)	**21.8**		
TURBIDITY*	**1**		

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL SAMPLING WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW06**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/11/99** TIME (MILITARY) **0930**

FIELD PERSONNEL **Tana Jones**

WEATHER CONDITIONS **Sunny, 70's**

TOTAL WELL DEPTH (TWD) **15.0** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **7.92** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Whale Submersible Pump**

TOTAL VOLUME OF WATER REMOVED **4.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **4.0-14.0** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS	
LOCKING CAP	YES ☒	NO ☐	**Purged 11/10/99 at 1200, sampled 11/11/99 at 0930	
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒		
NONPOTABLE LABEL	YES ☒	NO ☐		
ID PLATE	YES ☒	NO ☐		
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐		

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	0.0	2.0	4.0	**11/11/99-0.0
pH (S.U.)	4.68	5.15	5.47	4.33
SP. COND. (µMHOS/CM)	211	205	222	193
WATER TEMP. (°C)	22.8	22.1	22.4	21.2
TURBIDITY*	4	4	2	2

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

LAW ENGINEERING
3301 ATLANTIC AVENUE
RALIEGH, NORTH CAROLINA 27605

MONITORING WELL SAMPLING WORKSHEET

LAW JOB NUMBER **30740-6-0600-0055** MONITORING WELL NUMBER **USTAS1-MW07**

SITE NAME **Former USTs AS-1 to AS-3, New River Air Station**

DATE (MO/DAY/YR) **11/11/99** TIME (MILITARY) **1145**

FIELD PERSONNEL **Tana Jones**

WEATHER CONDITIONS **Sunny, 70's**

TOTAL WELL DEPTH (TWD) **14.5** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **0.0** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **7.40** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION TEFLON BAILER ☐ OTHER: **Disposable Bailer**

TOTAL VOLUME OF WATER REMOVED **3.5** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **4.5-14.5** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING	YES ☒	NO ☐	COMMENTS
LOCKING CAP	YES ☒	NO ☐	
PROTECTIVE POST/ABUTMENT	YES ☐	NO ☒	
NONPOTABLE LABEL	YES ☒	NO ☐	
ID PLATE	YES ☒	NO ☐	
WELL INTEGRITY SATISFACTORY	YES ☒	NO ☐	

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

FIELD ANALYSES

VOLUME (GAL.)	1.15	2.30	3.45
pH (S.U.)	4.66	4.69	4.66
SP. COND. (µMHOS/CM)	215	215	212
WATER TEMP. (°C)	21.9	21.9	21.8
TURBIDITY*	4	4	4

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

APPENDIX F

LABORATORY REPORTS
GROUNDWATER SAMPLES

PARADIGM ANALYTICAL LABORATORIES, INC.
2627 Northchase Parkway S.E.
Wilmington, North Carolina 28405
(910) 350-1903
Fax (910) 350-1557

December 6, 1999

Mr. Dan Nielsen
LAW Engineering
3301 Atlantic Ave.
Raleigh,NC 27604

Report Number: G132-585

Client Project ID: Phase II LSA, AS1-AS3

Dear Mr. Nielsen,

Enclosed are the results of the analytical services performed under the referenced project. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or the services performed during this project, please call for assistance. We will be happy to answer any questions or concerns which you may have.

Thank you for using Paradigm Analytical Labs for your analytical services. We look forward to working with you again on any additional analytical needs which you may have.

Sincerely,

Paradigm Analytical Laboratories, Inc.

Laboratory Director
Mark Randall

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase II LSA, AS1-AS3

Sample Information and Analytical Results	
Sample Identification	USTASI-GW04-99D
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/11/99
Date Received	11/11/99
Date Extracted	11/15/99
Date Analyzed	11/15/99
Dry Weight	
Dilution Factor	1
C_5-C_8 Aliphatics**	< 10 (µg/L)
C_9-C_{12} Aliphatics**	< 10 (µg/L)
C_9-C_{10} Aromatics**	< 10 (µg/L)
Surrogate % Recovery - PID	88
Surrogate % Recovery - FID	92

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-585-75872

Reviewed By: _____

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase II LSA, AS1-AS3

Sample Information and Analytical Results	
Sample Identification	USTASI-GW05-99D
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/11/99
Date Received	11/11/99
Date Extracted	11/15/99
Date Analyzed	11/15/99
Dry Weight	
Dilution Factor	1
C_5-C_8 Aliphatics**	< 10 (µg/L)
C_9-C_{12} Aliphatics**	< 10 (µg/L)
C_9-C_{10} Aromatics**	< 10 (µg/L)
Surrogate % Recovery - PID	86
Surrogate % Recovery - FID	90

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-585-75873

Reviewed By: [signature]

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase II LSA, AS1-AS3

Sample Information and Analytical Results	
Sample Identification	USTASI-GW06-99D
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/11/99
Date Received	11/11/99
Date Extracted	11/15/99
Date Analyzed	11/15/99
Dry Weight	
Dilution Factor	1
C_5-C_8 Aliphatics**	< 10 (µg/L)
C_9-C_{12} Aliphatics**	< 10 (µg/L)
C_9-C_{10} Aromatics**	< 10 (µg/L)
Surrogate % Recovery - PID	100
Surrogate % Recovery - FID	110

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-585-75874

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: LAW ENGINEERING

Project Name: Phase II LSA, AS1-AS3

Sample Information and Analytical Results	
Sample Identification	USTASI-GW07-99D
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/11/99
Date Received	11/11/99
Date Extracted	11/15/99
Date Analyzed	11/15/99
Dry Weight	
Dilution Factor	1
C_5-C_8 Aliphatics**	< 10 (µg/L)
C_9-C_{12} Aliphatics**	< 10 (µg/L)
C_9-C_{10} Aromatics**	< 10 (µg/L)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	110

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: G132-585-75875

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 10/31/99 PID Initial Calibration Date: 10/31/99

Calibration Ranges and Limits

Range	MDL (µg/L)	MDL (µg/Kg)	ML (µg/L)	ML (µg/Kg)	RL (µg/L)	RL (µg/Kg)
C_5-C_8 Aliphatics	2.4	120	7.5	380	10	500
C_9-C_{12} Aliphatics	1.3	65	4.0	210	10	500
C_9-C_{10} Aromatics	0.5	25	1.6	80	10	500

Calibration Concentration Levels

Range	Levels (µg/L)	Levels (µg/Kg)	%RSD or CCC	Method of Quantitation
C_5-C_8 Aliphatics	40	2000	12.0	Calibration Factor
	160	8000		
	400	20000		
	1600	80000		
	4000	200000		
C_9-C_{12} Aliphatics	30	1500	0.987	Linear Regression
	120	6000		
	300	15000		
	1200	60000		
	3000	150000		
C_9-C_{10} Aromatics	65	3250	22.1	Calibration Factor
	260	13000		
	650	32500		
	2600	130000		
	6500	325000		

Calibration Check Date: 11/16/99

Calibration Check

Range	Levels (µg/L)	Levels (µg/Kg)	RPD
C_5-C_8 Aliphatics	400	20000	-2.7
C_9-C_{12} Aliphatics	300	15000	22.0
C_9-C_{10} Aromatics	650	32500	5.3

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit
RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Reviewed By: [signature]

PARADIGM ANALYTICAL LABORATORIES, INC.

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 10/31/99 PID Initial Calibration Date: 10/31/99

Calibration Ranges and Limits

Range	MDL (µg/L)	MDL (µg/Kg)	ML (µg/L)	ML (µg/Kg)	RL (µg/L)	RL (µg/Kg)
C_5-C_8 Aliphatics	2.4	120	7.5	380	10	500
C_9-C_{12} Aliphatics	1.3	65	4.0	210	10	500
C_9-C_{10} Aromatics	0.5	25	1.6	80	10	500

Calibration Concentration Levels

Range	Levels (µg/L)	Levels (µg/Kg)	%RSD or CCC	Method of Quantitation
C_5-C_8 Aliphatics	40	2000	12.0	Calibration Factor
	160	8000		
	400	20000		
	1600	80000		
	4000	200000		
C_9-C_{12} Aliphatics	30	1500	0.987	Linear Regression
	120	6000		
	300	15000		
	1200	60000		
	3000	150000		
C_9-C_{10} Aromatics	65	3250	22.1	Calibration Factor
	260	13000		
	650	32500		
	2600	130000		
	6500	325000		

Calibration Check Date: 11/15/99

Calibration Check

Range	Levels (µg/L)	Levels (µg/Kg)	RPD
C_5-C_8 Aliphatics	400	20000	-10.9
C_9-C_{12} Aliphatics	300	15000	23.6
C_9-C_{10} Aromatics	650	32500	6.2

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit
RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Reviewed By: [signature]

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW04-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75872
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Benzene	0.5	BQL
Bromobenzene	0.5	BQL
Bromochloromethane	0.5	BQL
Bromodichloromethane	0.5	BQL
Bromoform	0.5	BQL
Bromomethane	0.5	BQL
n-Butylbenzene	0.5	BQL
sec-Butylbenzene	0.5	BQL
tert-Butylbenzene	0.5	BQL
Carbon tetrachloride	0.5	BQL
Chlorobenzene	0.5	BQL
Chloroethane	0.5	BQL
Chloroform	0.5	BQL
Chloromethane	0.5	**0.9**
2-Chlorotoluene	0.5	BQL
4-Chlorotoluene	0.5	BQL
Dibromochloromethane	0.5	BQL
1,2-Dibromo-3-chloropropane	5	BQL
Dibromomethane	0.5	BQL
1,2-Dibromoethane (EDB)	0.5	BQL
1,2-Dichlorobenzene	0.5	BQL
1,3-Dichlorobenzene	0.5	BQL
1,4-Dichlorobenzene	0.5	BQL
1,1-Dichloroethane	0.5	BQL
1,1-Dichloroethene	0.5	BQL
1,2-Dichloroethane	0.5	BQL
cis-1,2-Dichloroethene	0.5	BQL
trans-1,2-dichloroethene	0.5	BQL
1,2-Dichloropropane	0.5	BQL
1,3-Dichloropropane	0.5	BQL
2,2-Dichloropropane	0.5	BQL
1,1-Dichloropropene	0.5	BQL
Dichlorodifluoromethane	5	BQL
Diisopropyl ether (DIPE)	0.5	BQL
Ethylbenzene	0.5	BQL
Hexachlorobutadiene	0.5	BQL
Isopropylbenzene	0.5	BQL
4-Isopropyltoluene	0.5	BQL
Methylene chloride	5	BQL
Methyl-tert-butyl ether (MTBE)	0.5	BQL
Naphthalene	0.5	BQL
n-Propyl benzene	0.5	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW04-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75872
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Styrene	0.5	BQL
1,1,1,2-Tetrachloroethane	0.5	BQL
1,1,2,2-Tetrachloroethane	0.5	BQL
Tetrachloroethene	0.5	BQL
Toluene	0.5	BQL
1,2,3-Trichlorobenzene	0.5	BQL
1,2,4-Trichlorobenzene	0.5	BQL
Trichloroethene	0.5	BQL
1,1,1-Trichloroethane	0.5	BQL
1,1,2-Trichloroethane	0.5	BQL
Trichlorofluoromethane	0.5	BQL
1,2,3-Trichloropropane	0.5	BQL
1,2,4-Trimethylbenzene	0.5	BQL
1,3,5-Trimethylbenzene	0.5	BQL
Vinyl chloride	0.5	BQL
m-,p-Xylene	1	BQL
o-Xylene	0.5	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/L)	Surrogate Result (ug/L)	%Rec
Bromofluorobenzene	10.0	10.1	101
1,2-Dichloroethane-d4	10.0	9.5	95
Toluene-d8	10.0	9.9	99

Comments:

All results are corrected for dilution.

Reviewed by: _____

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW05-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75873
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Benzene	0.5	BQL
Bromobenzene	0.5	BQL
Bromochloromethane	0.5	BQL
Bromodichloromethane	0.5	BQL
Bromoform	0.5	BQL
Bromomethane	0.5	BQL
n-Butylbenzene	0.5	BQL
sec-Butylbenzene	0.5	BQL
tert-Butylbenzene	0.5	BQL
Carbon tetrachloride	0.5	BQL
Chlorobenzene	0.5	BQL
Chloroethane	0.5	BQL
Chloroform	0.5	BQL
Chloromethane	0.5	BQL
2-Chlorotoluene	0.5	BQL
4-Chlorotoluene	0.5	BQL
Dibromochloromethane	0.5	BQL
1,2-Dibromo-3-chloropropane	5	BQL
Dibromomethane	0.5	BQL
1,2-Dibromoethane (EDB)	0.5	BQL
1,2-Dichlorobenzene	0.5	BQL
1,3-Dichlorobenzene	0.5	BQL
1,4-Dichlorobenzene	0.5	BQL
1,1-Dichloroethane	0.5	BQL
1,1-Dichloroethene	0.5	BQL
1,2-Dichloroethane	0.5	BQL
cis-1,2-Dichloroethene	0.5	BQL
trans-1,2-dichloroethene	0.5	BQL
1,2-Dichloropropane	0.5	BQL
1,3-Dichloropropane	0.5	BQL
2,2-Dichloropropane	0.5	BQL
1,1-Dichloropropene	0.5	BQL
Dichlorodifluoromethane	5	BQL
Diisopropyl ether (DIPE)	0.5	BQL
Ethylbenzene	0.5	BQL
Hexachlorobutadiene	0.5	BQL
Isopropylbenzene	0.5	BQL
4-Isopropyltoluene	0.5	BQL
Methylene chloride	5	BQL
Methyl-tert-butyl ether (MTBE)	0.5	BQL
Naphthalene	0.5	BQL
n-Propyl benzene	0.5	BQL

Reviewed by: _____

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW05-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75873
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Styrene	0.5	BQL
1,1,1,2-Tetrachloroethane	0.5	BQL
1,1,2,2-Tetrachloroethane	0.5	BQL
Tetrachloroethene	0.5	BQL
Toluene	0.5	BQL
1,2,3-Trichlorobenzene	0.5	BQL
1,2,4-Trichlorobenzene	0.5	BQL
Trichloroethene	0.5	BQL
1,1,1-Trichloroethane	0.5	BQL
1,1,2-Trichloroethane	0.5	BQL
Trichlorofluoromethane	0.5	BQL
1,2,3-Trichloropropane	0.5	BQL
1,2,4-Trimethylbenzene	0.5	BQL
1,3,5-Trimethylbenzene	0.5	BQL
Vinyl chloride	0.5	BQL
m-,p-Xylene	1	BQL
o-Xylene	0.5	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/L)	Surrogate Result (ug/L)	%Rec
Bromofluorobenzene	10.0	10.0	100
1,2-Dichloroethane-d4	10.0	9.5	95
Toluene-d8	10.0	9.9	99

Comments:

All results are corrected for dilution.

Reviewed by: _____

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW06-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75874
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Benzene	0.5	BQL
Bromobenzene	0.5	BQL
Bromochloromethane	0.5	BQL
Bromodichloromethane	0.5	BQL
Bromoform	0.5	BQL
Bromomethane	0.5	BQL
n-Butylbenzene	0.5	BQL
sec-Butylbenzene	0.5	BQL
tert-Butylbenzene	0.5	BQL
Carbon tetrachloride	0.5	BQL
Chlorobenzene	0.5	BQL
Chloroethane	0.5	BQL
Chloroform	0.5	BQL
Chloromethane	0.5	BQL
2-Chlorotoluene	0.5	BQL
4-Chlorotoluene	0.5	BQL
Dibromochloromethane	0.5	BQL
1,2-Dibromo-3-chloropropane	5	BQL
Dibromomethane	0.5	BQL
1,2-Dibromoethane (EDB)	0.5	BQL
1,2-Dichlorobenzene	0.5	BQL
1,3-Dichlorobenzene	0.5	BQL
1,4-Dichlorobenzene	0.5	BQL
1,1-Dichloroethane	0.5	BQL
1,1-Dichloroethene	0.5	BQL
1,2-Dichloroethane	0.5	BQL
cis-1,2-Dichloroethene	0.5	BQL
trans-1,2-dichloroethene	0.5	BQL
1,2-Dichloropropane	0.5	BQL
1,3-Dichloropropane	0.5	BQL
2,2-Dichloropropane	0.5	BQL
1,1-Dichloropropene	0.5	BQL
Dichlorodifluoromethane	5	BQL
Diisopropyl ether (DIPE)	0.5	BQL
Ethylbenzene	0.5	BQL
Hexachlorobutadiene	0.5	BQL
Isopropylbenzene	0.5	BQL
4-Isopropyltoluene	0.5	BQL
Methylene chloride	5	BQL
Methyl-tert-butyl ether (MTBE)	0.5	BQL
Naphthalene	0.5	BQL
n-Propyl benzene	0.5	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles

by GCMS 6210D

Client Sample ID: USTASI-GW06-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75874
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/16/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Styrene	0.5	BQL
1,1,1,2-Tetrachloroethane	0.5	BQL
1,1,2,2-Tetrachloroethane	0.5	BQL
Tetrachloroethene	0.5	BQL
Toluene	0.5	BQL
1,2,3-Trichlorobenzene	0.5	BQL
1,2,4-Trichlorobenzene	0.5	BQL
Trichloroethene	0.5	BQL
1,1,1-Trichloroethane	0.5	BQL
1,1,2-Trichloroethane	0.5	BQL
Trichlorofluoromethane	0.5	BQL
1,2,3-Trichloropropane	0.5	BQL
1,2,4-Trimethylbenzene	0.5	BQL
1,3,5-Trimethylbenzene	0.5	BQL
Vinyl chloride	0.5	BQL
m-,p-Xylene	1	BQL
o-Xylene	0.5	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/L)	Surrogate Result (ug/L)	%Rec
Bromofluorobenzene	10.0	10.1	101
1,2-Dichloroethane-d4	10.0	9.5	95
Toluene-d8	10.0	9.9	99

Comments:

All results are corrected for dilution.

Reviewed by: _____

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 6210D

Client Sample ID: USTASI-GW07-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75875
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/17/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Benzene	0.5	BQL
Bromobenzene	0.5	BQL
Bromochloromethane	0.5	BQL
Bromodichloromethane	0.5	BQL
Bromoform	0.5	BQL
Bromomethane	0.5	BQL
n-Butylbenzene	0.5	BQL
sec-Butylbenzene	0.5	BQL
tert-Butylbenzene	0.5	BQL
Carbon tetrachloride	0.5	BQL
Chlorobenzene	0.5	BQL
Chloroethane	0.5	BQL
Chloroform	0.5	BQL
Chloromethane	0.5	1
2-Chlorotoluene	0.5	BQL
4-Chlorotoluene	0.5	BQL
Dibromochloromethane	0.5	BQL
1,2-Dibromo-3-chloropropane	5	BQL
Dibromomethane	0.5	BQL
1,2-Dibromoethane (EDB)	0.5	BQL
1,2-Dichlorobenzene	0.5	BQL
1,3-Dichlorobenzene	0.5	BQL
1,4-Dichlorobenzene	0.5	BQL
1,1-Dichloroethane	0.5	BQL
1,1-Dichloroethene	0.5	BQL
1,2-Dichloroethane	0.5	BQL
cis-1,2-Dichloroethene	0.5	BQL
trans-1,2-dichloroethene	0.5	BQL
1,2-Dichloropropane	0.5	BQL
1,3-Dichloropropane	0.5	BQL
2,2-Dichloropropane	0.5	BQL
1,1-Dichloropropene	0.5	BQL
Dichlorodifluoromethane	5	BQL
Diisopropyl ether (DIPE)	0.5	BQL
Ethylbenzene	0.5	BQL
Hexachlorobutadiene	0.5	BQL
Isopropylbenzene	0.5	BQL
4-Isopropyltoluene	0.5	BQL
Methylene chloride	5	BQL
Methyl-tert-butyl ether (MTBE)	0.5	BQL
Naphthalene	0.5	BQL
n-Propyl benzene	0.5	BQL

Reviewed by:

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Volatiles
by GCMS 6210D

Client Sample ID: USTASI-GW07-99D
Client Project ID: Phase II LSA, AS1-AS3
Lab Sample ID: 75875
Lab Project ID: G132-585
Matrix: Water

Date Analyzed: 11/17/99
Analyzed By: CKC
Date Collected: 11/11/99
Date Received: 11/11/99
Dilution: 1.0

Compound	Quantitation Limit (ug/L)	Result (ug/L)
Styrene	0.5	BQL
1,1,1,2-Tetrachloroethane	0.5	BQL
1,1,2,2-Tetrachloroethane	0.5	BQL
Tetrachloroethene	0.5	BQL
Toluene	0.5	BQL
1,2,3-Trichlorobenzene	0.5	BQL
1,2,4-Trichlorobenzene	0.5	BQL
Trichloroethene	0.5	BQL
1,1,1-Trichloroethane	0.5	BQL
1,1,2-Trichloroethane	0.5	BQL
Trichlorofluoromethane	0.5	BQL
1,2,3-Trichloropropane	0.5	BQL
1,2,4-Trimethylbenzene	0.5	BQL
1,3,5-Trimethylbenzene	0.5	BQL
Vinyl chloride	0.5	BQL
m-,p-Xylene	1	BQL
o-Xylene	0.5	BQL

Surrogate Spike Recoveries Compound	Spike Added (ug/L)	Surrogate Result (ug/L)	%Rec
Bromofluorobenzene	10.0	10.1	101
1,2-Dichloroethane-d4	10.0	9.4	94
Toluene-d8	10.0	9.9	99

Comments:
All results are corrected for dilution.

Reviewed by: JN

Flags: BQL = Below Quantitation Limit

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	USTASI-GW04-99D	Analyzed By:	JMF
Client Project ID:	Phase II LSA, AS1-AS3	Date Collected:	11/11/99
Lab Sample ID:	75872	Date Received:	11/11/99
Lab Project ID:	G132-585	Matrix:	Water

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	BQL	0.0100	MG/L	6010B	11/17/99
Lead	BQL	0.0100	MG/L	6010B	11/17/99

Comments
BQL = Below Quantitation Limits
Comments
Sample was extracted by SM 3030C prior to analysis.

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	USTASI-GW05-99D	Analyzed By:	JMF
Client Project ID:	Phase II LSA, AS1-AS3	Date Collected:	11/11/99
Lab Sample ID:	75873	Date Received:	11/11/99
Lab Project ID:	G132-585	Matrix:	Water

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	BQL	0.0100	MG/L	6010B	11/17/99
Lead	BQL	0.0100	MG/L	6010B	11/17/99

Comments
BQL = Below Quantitation Limits
Comments
Sample was extracted by SM 3030C prior to analysis.

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	USTASI-GW06-99D	Analyzed By:	JMF
Client Project ID:	Phase II LSA, AS1-AS3	Date Collected:	11/11/99
Lab Sample ID:	75874	Date Received:	11/11/99
Lab Project ID:	G132-585	Matrix:	Water

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	BQL	0.0100	MG/L	6010B	11/17/99
Lead	BQL	0.0100	MG/L	6010B	11/17/99

Comments
BQL = Below Quantitation Limits
Comments
Sample was extracted by SM 3030C prior to analysis.

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.

Results for Inorganics

Client Sample ID:	USTASI-GW07-99D	Analyzed By:	JMF
Client Project ID:	Phase II LSA, AS1-AS3	Date Collected:	11/11/99
Lab Sample ID:	75875	Date Received:	11/11/99
Lab Project ID:	G132-585	Matrix:	Water

Metals	Result	Quantitation Limit	Units	Procedure	Date Analyzed
Chromium	BQL	0.0100	MG/L	6010B	11/17/99
Lead	BQL	0.0100	MG/L	6010B	11/17/99

Comments
BQL = Below Quantitation Limits
Comments
Sample was extracted by SM 3030C prior to analysis.

Reviewed By:

PARADIGM ANALYTICAL LABORATORIES, INC.
627 Northchase Parkway SE, Wilmington, NC 28405
Phone: (910)-350-1903 FAX: (910)-350-1557

Chain-of Custody Record & Analytical Request

COC# 11627
Page 1 of 1

Client: Law Eng. & Env. Services
Address: 3301 Atlantic Ave
Address: Raleigh, NC 27604
Quote #: 1085

Project ID: Phase II LSA, AS1→AS3
P.O. Number: PCF#307-00205.99
Contact: Dan Nielsen
Phone: 919-876-0416

Date: 11/11/99
Turnaround: Standard
Job Number: 307406060/0055/92

Report To: Dan Nielsen (Address at Left)
Invoice To: Law Corporate

Sample ID	Date	Time	Matrix	Preservatives: HCL	HCL	HNO_3		Analysis: MADEP VPH (Water)	EPA 6210D +1PE+MTBE	Metals Cr, Pb 3030C Prep								Comments: Please specify any special reporting requirements
~~STAS1-MW04~~ → 99D																		Electronic Data Deliverable Requested for Groundwater Samples, Camp Lejeune Format
~~STAS1-MW05~~ → 99D																		6132-585
STAS1-GW04 → -99D	11/11/99	1120	W	2	3	1		2	3	1								
STAS1-GW05 → 99D	"	1000	W	2	3	1		2	3	1								
STAS1-GW06 → -99D	"	930 1120	W	2	3	1		2	3	1								
STAS1-GW07 → -99D	"	1145	W	2	3	1		2	3	1								
Rinse Blank ⊕	11/10/99	1200	W	1	3			1	3									⊕ Run, Do not report, per Ashley.

Relinquished By	Date	Time	Received By	Date	Time	Temperature	Sampled By	Airbill #
[signature]	11/11/99	1420	[signature]	11/12/99	14:20	ON ICE		

APPENDIX B

FIGURES FROM MARCH 2005 SHAW PIPE REMOVAL REPORT

	Residential SCL	Industrial SCL	Soil to GW MCC	001	002	003	004	005
C9-C18 ALIPHATICS	9,386	245,280	3,255	48.4	<9.7	<8.4	<8.5	<7.2
C19-C36 ALIPHATICS	93,860	#	#	<8.2	<9.7	<8.4	<8.5	<7.2
C9-C22 AROMATICS	469	12,264	34	420.4	<9.7	<8.4	<8.5	<7.2
C19-C36 ALIPHATICS	939	24,528	72	**1920**	<5.2	<8.4	4.27J	3.23J

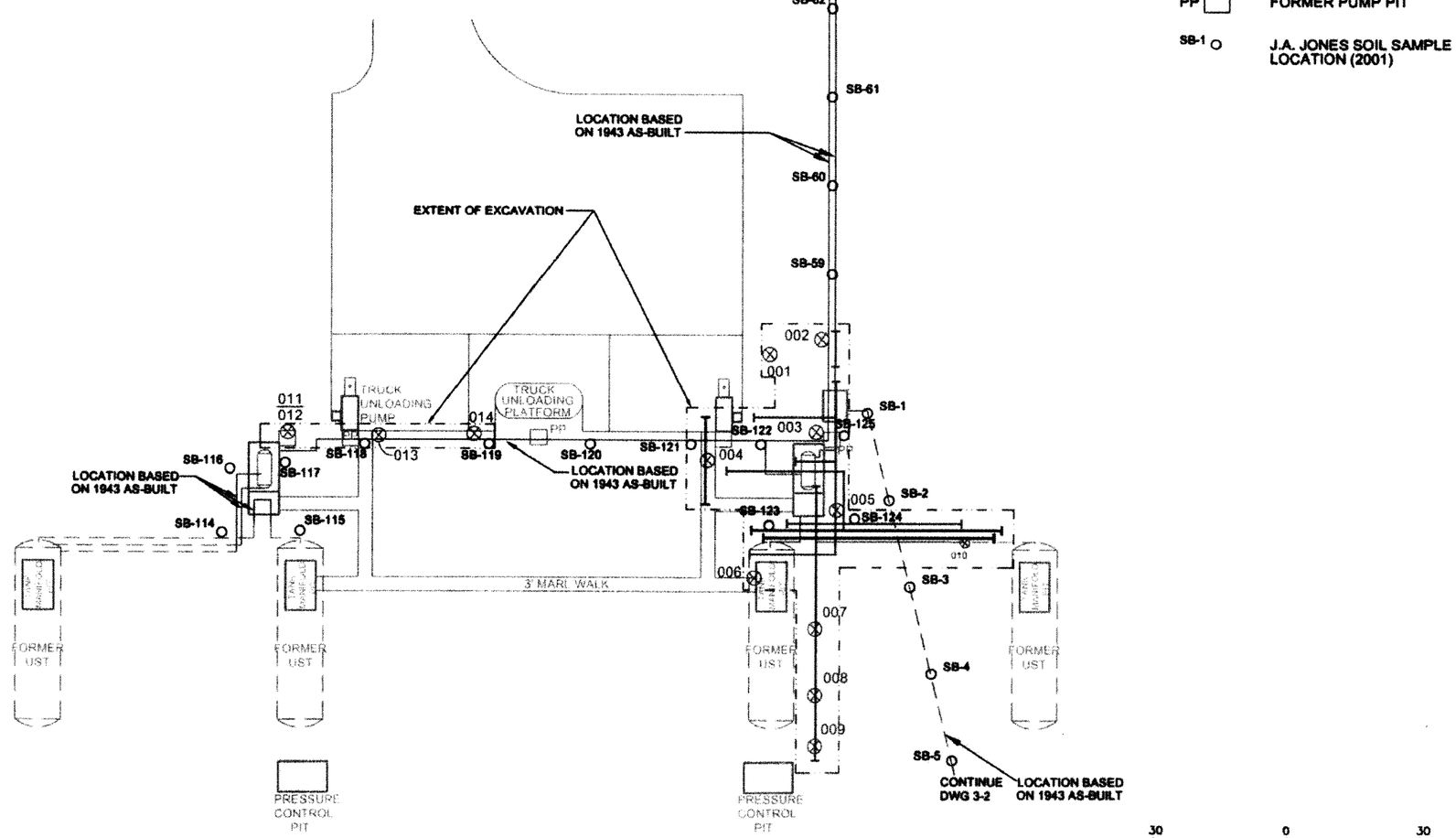
	Residential SCL	Industrial SCL	Soil to GW MCC	006	011	013
C9-C18 ALIPHATICS	9,386	245,280	3,255	<7.6	<11	<11
C19-C36 ALIPHATICS	93,860	#	#	<7.6	<11	<11
C9-C22 AROMATICS	469	12,264	34	<7.6	<11	<11
C19-C36 ALIPHATICS	939	24,528	72	<4.6	<5.4	<5.4

Soil Sample	GRO	DRO
001	**12.3**	<12
002	**114**	**26.1**
003	**412**	<10
004	**16.7**	<12
005	**78.8**	<12
006	**108**	9.11
007	3.8	<9.8
008	<5.5	6.5
009	<5.6	8.41
010	<5.8	<9.6
011	**48.6**	<9.5
012*	**384**	**10.1**
013	**35.2**	<9.9
014	<8.2	<12

ALL RESULTS ARE IN mg/kg (ppm)

BOLD INDICATES: EXCEEDS RESIDENTIAL SCL

*** FIELD DUPLICATE SAMPLE TO 011.**



LEGEND:

- 001 ⊗ SOIL SAMPLE LOCATION
- 2" O.D. (REMOVED NOV. - 04)
- 4" O.D. (REMOVED NOV. - 04)
- 6" O.D. (REMOVED NOV. - 04)
- REMOVED BY J. A. JONES
- PP ☐ FORMER PUMP PIT
- SB-1 ○ J.A. JONES SOIL SAMPLE LOCATION (2001)

NOTE: ASSUMED LAYOUT OF THE AQUA SYSTEM COMPONENTS AND PIPE BASED ON 1943 AS-BUILT DRAWING.

REVISIONS

REV	DATE	BY	CHK'D/APP'VD	DESCRIPTION/ISSUE

Shaw Shaw Environmental, Inc.

DESIGNED BY	RBK	5/19/05
DRAWN BY	TFR	5/19/05
CHECKED BY	RBK	5/19/05
APPROVED BY		

PROJECT NO. 845845

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
NAVAL STATION
MCB CAMP LEJEUNE
ATLANTIC DIVISION
JACKSONVILLE, N.C.

FORMER LANDING FIELD
GASOLINE DISTRIBUTION AQUA SYSTEM

AQUA SYSTEM PIPE REMOVAL

SCALE: AS SHOWN
SIZE: D
DELIVERY ORDER NO. 0012
CONTR. CONTRACT NO. N62470-02-D-3260
NAVFAC DRAWING NO. ?
SHEET I.D. 3-1

IMAGE ---
X-REF ---
OFFICE Atlanta, GA
DRAWING NUMBER 845845-fig-3-1rev

PLOT DATE: 10/06/03
FORMAT REVISION

IMAGE	X-REF	OFFICE	DRAWING NUMBER
---	---	Atlanta, GA	

LEGEND
DIESEL = TPH-DIESEL RANGE CONCENTRATION (mg/kg)
GAS = TPH-GASOLINE RANGE CONCENTRATION (mg/kg)
SB01 = SOIL BORING LOCATION
TW01 = TEMPORARY WELL GROUNDWATER SAMPLE LOCATION
TWS01 = TEMPORARY WELL SOIL SAMPLE LOCATION
● = SOIL AND/OR GROUNDWATER SAMPLE LOCATION

TW06 TW05 SB67 SB97 SB68 SB69 SB70 SB88 SB71 — DIESEL = 56 mg/kg
C_9-C_{18} <40 mg/Kg
$C_{19}-C_{36}$ <20 mg/Kg
C_9-C_{22} <20 mg/Kg
C_5-C_8 <7 mg/Kg
SB72 SB73 SB74 SB75 SB76 SB77 SB78 SB79 SB80 SB81 SB82 SB83 SB84 SB99 SB85

SB66
SB65 — C_9-C_{18} 550 mg/Kg; $C_{19}-C_{36}$ 230 mg/Kg; C_9-C_{22} 291 mg/Kg; C_5-C_8 15 mg/Kg
SB64 — DIESEL = 53 mg/kg, GAS = 2.4 mg/kg
SB63
SB62
SB61 — C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 21 mg/Kg
SB60
SB59 — DIESEL = 16 mg/kg, GAS = 1200 mg/kg

TW04 / TWS04: BENZENE = 850 ug/L; ETHYLBENZENE = 330 ug/L; TOLUENE = 130 ug/L; C5-C8 ALIPHATICS = 12,000 ug/L; C9-C12 ALIPHATICS = 1300 ug/L; C9-C10 AROMATICS = 240 ug/L
BENZENE = 3200 ug/kg; SEC-BUTYLBENZENE = 720 ug/kg; ETHYLBENZENE = 13,000 ug/kg; ISOPROPYLBENZENE = 15,000 ug/kg; NAPHTHALENE = 500 ug/kg; N-PROPYLBENZENE = 3500 ug/kg; 1,2,4-TRIMETHYLBENZENE = 13,000 ug/kg; 1,3,5-TRIMETHYLBENZENE = 8200 ug/kg; TOTAL XYLENES = 23,000 ug/kg; C5-C8 ALIPHATICS = 600 mg/kg; C9-C12 ALIPHATICS = 83 mg/kg; C9-C10 AROMATICS = 27 mg/kg

WARMING UP PLATFORM

TW03 / TWS03: LEAD = 67 ug/L

TW02 / TWS02: BENZENE = 130 ug/L; ETHYLBENZENE = 41 ug/L; TOTAL XYLENES = 66 ug/L; ACENAPHTHENE = 16 ug/L; BIS(2-ETHYLHEXYL)PHALATE = 21 ug/L; FLUORANTHENE = 13 ug/L; NAPHTHALENE = 19 ug/L; PHENANTHRENE = 21 ug/L; PYRENE = 10 ug/L; C5-C8 ALIPHATICS = 3300 ug/L; C9-C12 ALIPHATICS = 180 ug/L; LEAD = 120 ug/L

TW01 / TWS01: BENZENE = 79 ug/kg; ETHYLBENZENE = 7.2 ug/kg; NAPHTHALENE = 83 ug/kg; C5-C8 ALIPHATICS = 190 mg/kg; BIS(2-ETHYLHEXYL)PHALATE = 15 ug/L; LEAD = 50 ug/L

SCALE: 1" = 40'

A

SB18 SB19 SB20 — DIESEL = 11 mg/kg
SB21 SB22 SB23 SB24 — DIESEL = 14 mg/kg
SB25 — DIESEL = 15 mg/kg
SB26 — DIESEL = 14 mg/kg
SB27 SB28 SB29 SB30 SB31 SB32
SB33 — DIESEL = 13 mg/kg
SB34
SB35 — DIESEL = 12 mg/kg
TREES — DITCH PIPE ON BENTS
SB36 — DIESEL = 13 mg/kg
SB37 SB38 SB39 SB40 SB41 SB42

C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 27 mg/Kg
SB01 — DIESEL = 1700 mg/kg, GAS = 2.7 mg/kg
SB02 — GAS = 6.5 mg/kg
SB03
SB04
SB05 — DIESEL = 16 mg/kg
SB06
SB07 — DIESEL = 18 mg/kg
DITCH PIPE ON BENTS (~40' ACROSS)
TREE
SB08 — DIESEL = 12 mg/kg
SB09 — DIESEL = 13 mg/kg
SB10
SB11 — DIESEL = 11 mg/kg
SB12 SB13 SB14 SB15 SB16 SB17 SB18

C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 <7 mg/Kg
C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 21 mg/Kg
C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ 22 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 <7 mg/Kg
C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 27 mg/Kg

B

C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 <7 mg/Kg

C

SB42 SB43 SB44 SB45 SB46 — DIESEL = 15 mg/kg SB47 SB48 SB49 SB50 SB51 SB52 SB53 SB54 SB55 SB56 SB57 SB58 SB86 SB87 SB88 SB89

C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 <7 mg/Kg

SCALE: 1" = 40'

D

SB89 SB90 SB91 — GAS = 1.3 mg/kg SB92 — DIESEL = 140 mg/kg SB93 SB94 SB95 SB96 SB101 SB102 SB103 — DIESEL = 25 mg/kg, GAS = 1.0 mg/kg SB104 SB105 SB106 SB107 AS844 SB108 SB109 AS SB110 SB111 SB112 SB113 — DIESEL = 440 mg/kg

C_9-C_{18} <40 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} <20 mg/Kg; C_5-C_8 <7 mg/Kg
C_9-C_{18} 120 mg/Kg; $C_{19}-C_{36}$ <20 mg/Kg; C_9-C_{22} 55.5 mg/Kg; C_5-C_8 <7 mg/Kg

REFERENCE

A
B
C
D

SCALE: 1" = 250'

REFERENCE: BASE MAP INFORMATION WAS PROVIDED BY J. A. JONES

DESCRIPTION/ISSUE	CHK'D	APPR'D	BY	DATE	REV
REVISIONS					

PROJECT NO. 845845
CHECKED BY RBK
APPROVED BY

Shaw Shaw Environmental, Inc.
DESIGNED BY RBK
DRAWN BY JEL

NAVAL FACILITIES ENGINEERING COMMAND
DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NORFOLK, VIRGINIA
JACKSONVILLE, N.C.
NAVAL STATION
MCB CAMP LEJEUNE
AS1-4 LINE ADANDONMENT
MARINE CORPS AIR STATION
ANALYTICAL RESULTS

SCALE: AS SHOWN
SIZE: D
DELIVERY ORDER NO. 0012
CONSTR. CONTRACT NO. N62470-02-D-3260
NAVFAC DRAWING NO. ?
SHEET I.D. 3.2

PLOT DATE: 10/06/03
FORMAT REVISION

J:\LANTDIV\LEJEUNE\AS1-4 LINE ABANDOMENT\ANALYTICAL RESULTS