

Y1/06-00979

Final

**Site Screening Assessment Closeout Report**  
**SWMUs 5, 6, 13 and Site 6**  
Naval Amphibious Base Little Creek  
Virginia Beach, Virginia



Prepared for  
**Department of the Navy Atlantic Division**  
Naval Facilities Engineering Command  
Norfolk, Virginia

Contract No N62470-02-D-3052  
CTO-0048

January 2006

Prepared by  
**CH2MHILL**

Final

**Site Screening Assessment Closeout Report  
SWMUs 5, 6, 13 and Site 6**

**Naval Amphibious Base Little Creek  
Virginia Beach, Virginia**

Contract Task Order 048

January 2006

Prepared for

**Department of the Navy Atlantic Division  
Naval Facilities Engineering Command  
Norfolk, Virginia**

Under the

**LANTDIV CLEAN III Program  
Contract N62470-02-D-3052**

Prepared by



**CH2MHILL**

**Virginia Beach, Virginia**

# SIGNATURE PAGE

## CONCURRENCE FOR NO FURTHER ACTION

---

SWMU 5 - Port Ops Boat Painting Area  
SWMU 6 - SeaBee Area - CB 124  
SWMU 13 - Former Pesticide Shop  
Site 6 - Special Boat Unit Battery Storage Yard

In 2005, in partnership with the U.S. Environmental Protection Agency (EPA) Region III and the Virginia Department of Environmental Quality (VDEQ), the Navy conducted desktop evaluations, site visits, reviews of aerial photographs, and Site Screening Assessment sampling and analysis for the above-referenced Solid Waste Management Units (SWMUs) and Site 6 at Naval Amphibious Base (NAB) Little Creek, Virginia Beach, Virginia.

Based on the site reviews and evaluations, it is the consensus of the Navy (Naval Facilities Engineering Command), in partnership with the EPA Region III, and the VDEQ, that these SWMUs and Site 6 require No Further Action (NFA) and the land use will be unrestricted at each site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. Documentation and justification for NFA is summarized in this Site Screening Assessment (SSA) Closeout Report, and is based on the evaluation of field sampling data, risk screening, and professional judgment. These SWMUs and Site 6 will be identified for NFA in the annual update (Fiscal Years 2007 through 2011) of the Site Management Plan as part of the Federal Facilities Agreement (FFA) between the Navy and EPA. In the event contamination posing an unacceptable risk to human health or the environment is discovered after execution of this consensus agreement, the Partnership agrees to reevaluate the sites as deemed necessary.

---

 19 Jan 2006  
\_\_\_\_\_  
Date  
Maria Pino  
Remedial Project Manager  
EPA Region III

 1-19-06  
\_\_\_\_\_  
Date  
Paul Herman  
Remedial Project Manager  
Virginia DEQ

 1/19/06  
\_\_\_\_\_  
Date  
Scott Park  
Remedial Project Manager  
Naval Facilities Engineering Command

# Contents

---

<b>Acronyms and Abbreviations .....</b>	<b>vii</b>
<b>1. Introduction .....</b>	<b>1-1</b>
<b>2. Facility Background .....</b>	<b>2-1</b>
2.1 Facility Description.....	2-1
2.2 Environmental History .....	2-1
<b>3. Background, Field Activities, and Data Evaluation.....</b>	<b>3-1</b>
3.1 SWMU 5– Building 3896 – Port Ops Boat-Painting Area.....	3-1
3.1.1 Site Description and History .....	3-1
3.1.2 Field Activities and Data Evaluation .....	3-2
3.2 SWMU 6 - SeaBee Area – CB 124.....	3-2
3.2.1 Site Description and History .....	3-2
3.2.2 Field Activities and Data Evaluation .....	3-3
3.3 SWMU 13 - Former Pesticide Shop .....	3-3
3.3.1 Site Description and History .....	3-3
3.3.2 Field Activities and Data Evaluation .....	3-4
3.4 Site 6 - Special Boat Unit Battery Storage Yard .....	3-4
3.4.1 Site Description and History .....	3-4
3.5 Field Activities.....	3-5
<b>4. Conclusions and Recommendations.....</b>	<b>4-1</b>
<b>5. References .....</b>	<b>5-1</b>

## Appendixes

A	Relative Risk Ranking Detections and Exceedances of Screening Criteria
B	Soil Boring and Well Installation Logs
C	Site Screening Assessment Analytical Results
D	Data Validation Report

**Tables (Tables are located at the end of each section.)**

- 3-1 SWMU 5 SSA Groundwater Detections and Exceedances of Screening Criteria
- 3-2 SWMU 6 Groundwater Detections and Exceedances of Screening Criteria
- 3-3 SWMU 13 Soil Detections and Exceedances of Screening Criteria
- 3-4 Site 6 Groundwater Detections and Exceedances of Screening Criteria

**Figures (Figures are located at the end of each section.)**

- 2-1 Base Location Map
- 3-1 SWMU 5 Sampling Locations
- 3-2 SWMU 6 Sampling Locations
- 3-3 SWMU 13 Sampling Locations
- 3-4 Site 6 Sampling Locations

# Acronyms and Abbreviations

---

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CTO	Contract Task Order
DO	dissolved oxygen
DPT	Direct Push Technology
EPA	United States Environmental Protection Agency
FFA	Federal Facilities Agreement
ft	feet
IAS	Initial Assessment Study
IR	Installation Restoration
MCL	Maximum Contaminant Level
MS/MSD	Matrix Spike / Matrix Spike Duplicate
NAB	Naval Amphibious Base
NACIP	Naval Assessment and Control of Installation Pollutants
NAVFAC	Naval Facilities Engineering Command
NFA	no further action
NPL	National Priorities List
ORP	Oxidation Reduction Potential
PCB	polychlorinated biphenyls
QA/QC	quality assurance/quality control
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RRRS	Relative Risk Ranking System
SARA	Superfund Amendment and Reauthorization Act
SBU	Special Boat Unit
SSA	Site Screening Assessment
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
UTL	upper tolerance limit
µg/L	micrograms per liter

VDEQ      Virginia Department of Environmental Quality  
VOC        volatile organic compound  
VSI        Visual Site Inspection

## SECTION 1

# Introduction

---

This Site Screening Assessment (SSA) Closeout Report presents the results of the field sampling activities at Solid Waste Management Units (SWMUs) 5, 6, and 13, and Site 6 at Naval Amphibious Base (NAB) Little Creek, Virginia Beach, Virginia. The Federal Facilities Agreement (FFA) between the Navy, the United States Environmental Protection Agency (EPA), and the Virginia Department of Environmental Quality (VDEQ), establishes requirements for screening level assessments to determine if a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) release has occurred at these sites. During a site visit May 9, 2005, the Navy, in partnership with EPA Region III and VDEQ, concluded that further sampling was necessary at these sites to verify that they pose no potential threat to human health and the environment.

This SSA Closeout Report is prepared for Naval Facilities Engineering Command (NAVFAC) Atlantic Division, under Comprehensive Long-Term Environmental Action Navy (CLEAN) III Contract N26470-02-D-3052, Contract Task Order (CTO) 048, for submittal to NAVFAC Atlantic Division, EPA, and VDEQ. The SSA Closeout Report comprises the following:

- No Further Action Consensus Signature Page
- Section 1 - Introduction
- Section 2 - Facility Background
- Section 3 -Background, Field Activities, Data Evaluation
- Section 4 - Conclusions and Recommendations
- Section 5 - References

Figures and tables are located at the end of each section. The Appendixes referenced throughout the text are provided following Section 5.

# Facility Background

---

## 2.1 Facility Description

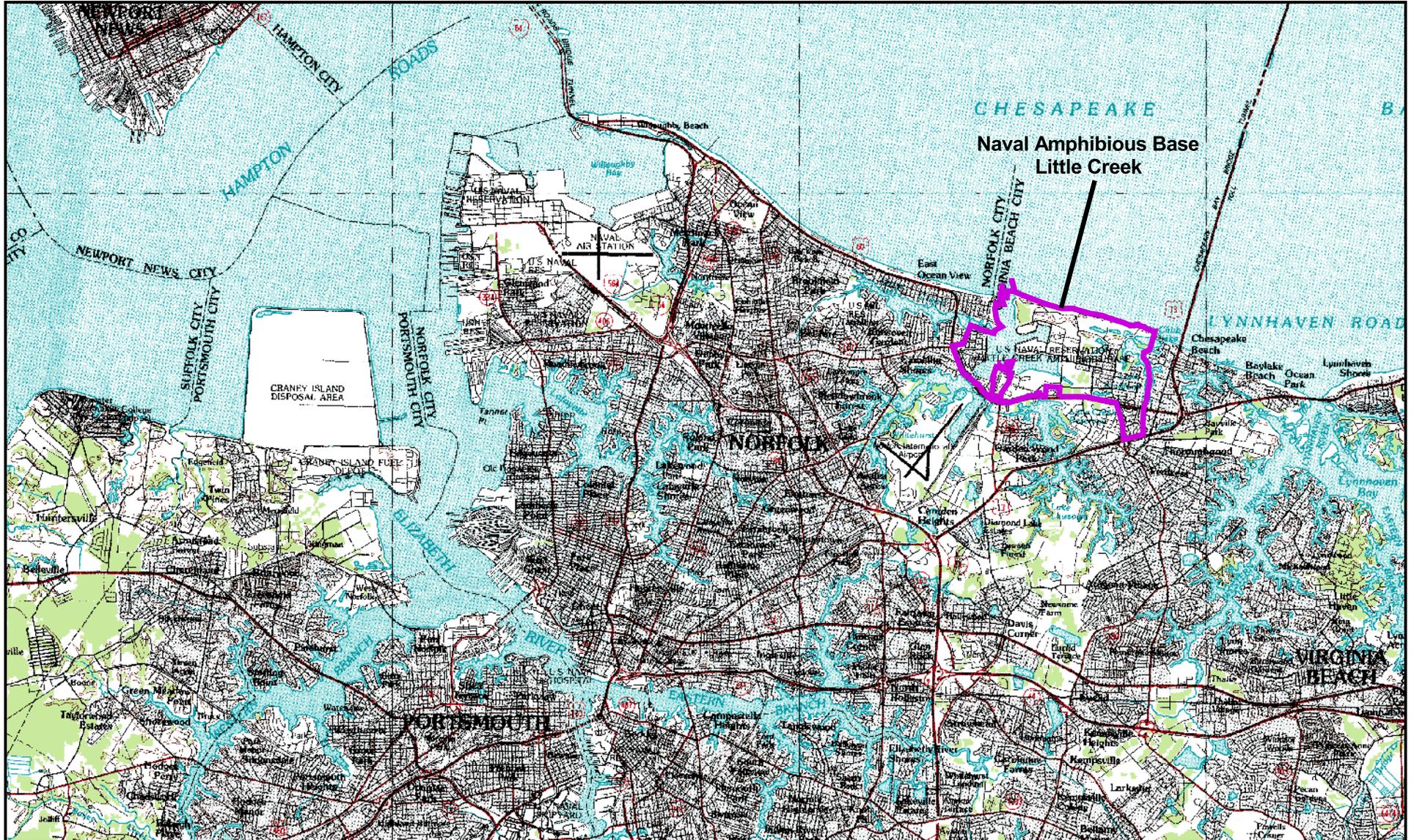
NAB Little Creek encompasses 2,215 acres in the northwest corner of Virginia Beach, Virginia, adjacent to the Chesapeake Bay (Figure 2-1). The facility is primarily industrial, with personnel providing logistics and support services for local commands, organizations, home-ported ships, and other United States and allied units to meet amphibious warfare-training requirements of the Armed Forces of the United States. Ancillary activities that have occurred at NAB Little Creek with potential for contaminant release include: vehicle and boat maintenance, boat painting and sandblasting, construction and repair of buildings and piers, mixing and application of pesticides, electroplating of musical instruments, laundry and dry cleaning operations, historical land filling of waste and construction debris, medical and dental treatment, and the generation of steam for heat. NAB Little Creek is also used for recreational, commercial, and residential purposes.

Land development surrounding the base is residential, commercial, and industrial. The surrounding area is low-lying and relatively flat, with several freshwater lakes (Chubb Lake, Lake Bradford, Little Creek Reservoir/Lake Smith, and Lake Whitehurst) located on or adjacent to the base. NAB Little Creek centers around four saltwater bodies: Little Creek Harbor, Little Creek Cove, Desert Cove, and the Little Creek Channel, which connects the coves and harbor with the Chesapeake Bay. Little Creek Reservoir/Lake Smith, located north of the base, serves as a secondary supply of drinking water for parts of the city of Norfolk.

## 2.2 Environmental History

Comprehensive environmental restoration activities at NAB Little Creek began in 1984 under the Navy Assessment and Control of Installation Pollutants (NACIP) and Installation Restoration (IR) programs. The purpose of the NACIP and IR programs was to identify, assess, characterize, and clean up or control contamination from past waste management activities at Navy and Marine Corps facilities. Environmental assessment efforts at NAB Little Creek began under the NACIP program with an initial assessment study (IAS) in 1984, and continuing with the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) in 1989. The NACIP program was changed in 1986 to reflect the requirements of CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA).

On May 10, 1999, NAB Little Creek was placed on the National Priorities List (NPL), and the FFA, negotiated between the Navy, EPA, and VDEQ, was signed in October 2003. In accordance with the FFA, all past and future work at IR Sites and SWMUs will be reviewed, and a course of action for future work requirements at each site will be developed. SWMU 5, 6, and 13, and Site 6 are identified as "Appendix A Sites" in the FFA, requiring a field screening assessment prior to site closure.



**LEGEND**

 Activity Boundary



Figure 2-1  
Base Location Map  
SWMUs 5, 6, 13 and Site 6  
Site Screening Assessment  
NAB Little Creek  
Virginia Beach, Virginia

# Background, Field Activities, and Data Evaluation

---

Each SSA site description, environmental history, field activities, and analytical results are presented in this section. The rationale for sampling locations and analytical parameters was discussed and agreed upon by the Navy, EPA, and VDEQ during the May 2005 site visit. All field sampling and data evaluation were conducted in accordance with the *Final Work Plan Site Screening Assessment SWMUs 5, 6, 13 and Site 6, NAB Little Creek, Virginia Beach, Virginia* (CH2M HILL, July 2005) and the *NAB Little Creek Master Project Plan* (CH2M HILL, August 2000).

## 3.1 SWMU 5— Building 3896—Port Ops Boat-Painting Area

SWMU 5 is the former Boat Painting Area located east of Little Creek Channel near former Building 3896 ([Figure 3-1](#)).

### 3.1.1 Site Description and History

Building 3896, Boat-Painting Area, was initially referred to as SWMU 130 in the RFA, and is now identified as SWMU 5. The startup date of operations at SWMU 5 is unknown. Operations included grinding of boat hulls (on raised stands) in preparation of their being painted and painting of boats over bare ground. No release controls were present, and metal grindings and paint overspray were allowed to fall to the ground. Bilge water, metal grindings, paints, and thinners were also reportedly released to the soil. The site was paved with concrete and/or asphalt in 1994. An area northeast of the boat maintenance area and along the compound fence is currently unpaved and has little vegetative cover. Access to SWMU 5 is restricted. The area is fenced off and kept locked during non-working hours. Little Creek Channel/Cove is located south of the site and receives surface water and groundwater discharge from the site. Boat painting and storage have been discontinued at SWMU 5.

In October 1995, in support of risk characterization of IR sites at NAB Little Creek, referred to as the Relative Risk Ranking System (RRRS), three surface soil samples and one groundwater sample were collected using direct push technology (DPT) in the vicinity of Building 3896 ([Figure 3-1](#)) and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total (unfiltered) metals. The analytical results from the RRRS are presented in Tables A-1 and A-2 of [Appendix A](#). Although benzo(a)pyrene exceeded the residential RBC in one RRR sample, based on the overall absence of elevated constituent concentrations in the RRRS soil samples, the Navy, in partnership with the EPA and VDEQ, determined that NFA was warranted for soil at the site. However, additional groundwater sampling was recommended for the SSA based on the total arsenic, chromium, and lead concentrations in the RRRS groundwater sample that were above the Federal Maximum Contaminant Level (MCL).

### 3.1.2 Field Activities and Data Evaluation

One permanent shallow groundwater monitoring well (LW05-MW01) was installed to a depth of 22 feet (ft) and sampled for target analyte list (TAL) total and dissolved metals/cyanide, using contract laboratory program (CLP) OLM04. Detected constituents are identified in [Table 3-1](#). The boring log and well construction diagram for this well is provided in [Appendix B](#).

Sampling was conducted using a peristaltic pump and low-flow sampling protocol in accordance with the Final Work Plan (CH2M HILL, July 2005). Standard water quality parameters (pH, conductivity, turbidity, dissolved oxygen [DO], oxidation reduction potential [ORP], and salinity) were measured in the field using a Horiba U-22 water quality meter. Quality Assurance/Quality Control (QA/QC) samples collected included a field blank, equipment blank, a duplicate, and a matrix spike/matrix spike duplicate (MS/MSD). A summary of analytical results for the SSA sites, including water quality data and QA/QC results, are provided in [Appendix C](#). The laboratory results were validated by an independent, third-party data validation contractor ([Appendix D](#)).

SWMU 5 SSA analytical results were compared to MCLs and background upper tolerance limits (UTLs) established for NAB Little Creek (CH2M HILL, March 2003). There were no constituents detected at concentrations above the MCL. Eleven (11) total metals (aluminum, barium, calcium, cobalt, copper, iron, magnesium, manganese, potassium, sodium, and zinc) and 12 dissolved metals (antimony, barium, calcium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, sodium, and zinc) were detected in the groundwater. These metals were detected at concentrations generally at or below background UTLs. Although copper in groundwater exceeded background, the concentration was below the MCL and copper was not detected in soil from the RRRs at the site. Therefore there is no indication of a CERCLA release or potentially unacceptable risk. Therefore, NFA is recommended for SWMU 5.

## 3.2 SWMU 6 - SeaBee Area—CB 124

SWMU 6 is the SeaBee Area located east of Desert Cove ([Figure 3-2](#)).

### 3.2.1 Site Description and History

“New” SWMU 6 (formerly identified in the RFA as SWMUs 131, 132, and 133) is the SeaBee area and consists of three separate waste management areas: Former SWMU 131, Satellite Accumulation Point for Paint Wastes; Former SWMU 132, Inoperative Wire Degreaser; and Former SWMU 133, Excess Material Storage Area. An asphalt road surrounds the perimeter of CB 124. Concrete slabs indicate the locations of former structures. The remainder of the site is soil, with little to no vegetative cover. The site is not fenced. Former SWMU 131 included a 55-gallon drum and several smaller cans stored on a wooden pallet over bare soil. Wastes stored there included paints and thinners. Former SWMU 132 was an elevated trough 20 ft long and 12 inches deep that had been filled with JP-5 aircraft fuel to degrease wires. The degreaser has been taken out of service. Former SWMU 133 was a gravel yard used to store excess paints and cables. The paints were stored on wooden pallets and covered with canvas tarps. No release controls were present and soil staining was evident during a 1998 Visual Site Inspection (VSI).

In October 1995, in support of the RRRS, six surface soil and four groundwater samples were collected (Figure 3-2) and analyzed for VOCs, SVOCs, and metals. Based on the absence of elevated constituent concentrations from the RRRS results (Appendix A), the Navy, in partnership with the EPA and VDEQ, agreed that NFA was warranted for soil. However, additional groundwater sampling was recommended because of to MCL exceedances of total arsenic, chromium, and lead.

### 3.2.2 Field Activities and Data Evaluation

Two in situ groundwater samples were collected at depths of 8-12 ft below ground surface utilizing DPT, and analyzed for dissolved antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc by CLP OLM05-ICP/MS to confirm the presence or absence of metals indicative of a CERCLA release. The groundwater sampling locations were selected based on RRRS results and are shown on Figure 3-2. Appropriate QA/QC samples were collected (field blank, equipment blank, duplicate sample, and an MS/MSD) in accordance with the Final Work Plan (CH2M HILL, July 2005) (Appendix C).

The laboratory results were validated by an independent, third-party data validation contractor (Appendix D). Analytical results were compared to MCLs and background UTLs (Table 3-2). Of the two groundwater samples, arsenic was detected (25.8 µg/L) above the MCL and background at LW06GW102 (Figure 3-2).

The structures at SWMU 6 no longer exist and painting/storage activities no longer take place in this vicinity. Arsenic in groundwater is not considered to reflect a CERCLA release because arsenic was not detected in soil, the aquifer material is dredge fill, and because there were no detections of other constituents in soil or groundwater that would indicate a release. It is expected that a CERCLA release would result in the detection of more than just arsenic in the groundwater. Therefore, NFA is recommended at SWMU 6.

## 3.3 SWMU 13 - Former Pesticide Shop

SWMU 13 is located north of Gator Boulevard within the Public Works Center (Figure 3-3).

### 3.3.1 Site Description and History

While the RFA described the former pesticide shop as being located in Building 3360-3, near Building 3166 and the intersection of 6th and F Streets (A.T Kearny, 1989), public works personnel note that the shop was actually in Building 3170, in the vicinity of Building 3360-3.

Hand-held sprayers were reportedly rinsed daily after use and between mixtures of different pesticides if they were used on the same day. Empty pesticide containers were triple-rinsed at the site and disposed of with the other general solid waste. Metal containers were triple-rinsed and then punctured or crushed to prevent reuse before disposal. Pesticide application was performed using tank sprayers and hand-held sprayers. The mixed pesticides were usually completely used at the job site. Residue in tank sprayers was either left in the tank until the next job or diluted with rinse water and left in the tank to mix with the next application. The pesticide shop operated from 1973 to 1980, after which the building was razed. The site is now a paved parking lot.

Types of pesticides used in the shop include: Abate (insect), Anticoagulant (rodent), Baygon (insect), Diazinon (insect), Dursban (insect), Mineral Oils (insect), Naled (insect), Other Carbamate (insect), Pyrethrum (insect), and Silica Aerogel (insect). No evidence of release was observed during the 1988 VSI, and no formal closure or follow-up sampling was conducted at the time the building was razed. The Navy, VDEQ, and EPA recommended soil and groundwater sampling at the site.

### 3.3.2 Field Activities and Data Evaluation

Two surface soil, two subsurface soil, and one groundwater sample were collected and analyzed for Target Compound List (TCL) pesticides/polychlorinated biphenyls (PCBs) using CLP OLM04. The locations of the samples were chosen based on the location of Former Building 3170 and site visit conducted by the Partnering Team in June 2005. The sampling locations are shown on [Figure 3-3](#).

Soil samples were collected in disposable acetate sleeves using DPT. The groundwater sample was collected from existing monitoring well LS13-MW18T using a peristaltic pump and low-flow sampling protocol. Appropriate QA/QC samples were collected (field blank, equipment blank, duplicate sample, MS/MSD). Standard water quality parameters (pH, conductivity, turbidity, DO, ORP, and salinity) were measured in the field using a Horiba U-22 water quality meter, and sampling occurred upon stabilization of these parameters. Groundwater quality data, analytical results, and QA/QC results are provided in [Appendix C](#).

The laboratory results were validated by an independent, third-party data validation contractor ([Appendix D](#)). Pesticides were not detected above the screening criteria (EPA Region III Risk-Based Concentrations [RBCs] and background UTLs) in surface soil, and there were no pesticide detections in subsurface soil ([Table 3-3](#)) or groundwater ([Appendix C](#)).

Pesticide mixing and storage activities have been discontinued at the site, and there is no evidence of a CERCLA release based on the SSA analytical results. Therefore, NFA is recommended for SWMU 13.

## 3.4 Site 6 – Special Boat Unit Battery Storage Yard

Site 6 is the Special Boat Unit (SBU) 2 Battery Storage Yard located south of Little Creek Channel ([Figure 3-4](#)).

### 3.4.1 Site Description and History

Site 6, SBU 2 Battery Storage Yard, is also referred to as SWMU 117 in the RFA and renamed “New” SWMU 4 in several subsequent Navy correspondences (A.T. Kearny, 1989). From 1943 until approximately 1993, spent lead-acid batteries containing electrolyte solution, and painting wastes, oily wastes, and scrap metal were temporarily stored on wooden pallets prior to offsite disposal. The pallets were placed on bare soil approximately 100 ft south of Pier 61 outside the southeast corner of Building 103. There were no release controls present in the area. The 1984 IAS and the 1988 VSI noted that oil stains have been observed on the ground in the area. Batteries are now stored inside Building 103.

On October 19, 1995, utility excavations in the vicinity of Site 6 uncovered oil- contaminated soil. The release was reported to VDEQ. Two soil samples and one groundwater sample were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, and metals ([Appendix A](#)). As noted in a December 8, 1995 letter from the Navy to Kerita Kegler, VDEQ Tidewater Regional Office, the results were compared to Toxicity Characteristic Leaching Procedure (TCLP) and EPA Region III RBC limits (NAB Little Creek June 2000). The soil and groundwater samples were found to be non-hazardous, and the Navy and VDEQ considered this site closed. The soil excavated for the utility line was placed back into the excavation.

In October 1995, in support of the RRRS, two surface soil samples and one groundwater sample were collected from the vicinity of Building 103 using DPT and analyzed for SVOCs and total metals ([Figure 3-4](#)). Metals and SVOCs were not detected in soil above the residential risk-based screening criteria or background UTLs that have been established for NAB Little Creek, but lead concentrations in groundwater were above the EPA action level of 15 µg/L. Analytical results from the RRRS are provided in [Appendix A](#). The Navy, VDEQ, and EPA agreed that NFA was warranted for soil, and that groundwater sampling was warranted for the SSA.

### 3.4.2 Field Activities and Data Evaluation

One in situ groundwater sample was collected at Site 6 to confirm the presence or absence of total and dissolved lead using CLP ILM04. The sample was collected using DPT, advancing a stainless steel groundwater sampling tool and low-flow sampling methods. Standard water quality parameters (pH, conductivity, turbidity, DO, ORP, and salinity) were measured in the field using a Horiba U-22 water quality meter prior to sampling. A summary of analytical results, water quality data, and QA/QC samples results (field blank, equipment blank, duplicate sample, and a MS/MSD) is provided in [Appendix C](#).

The laboratory results were validated by an independent, third-party data validation contractor ([Appendix D](#)). Lead concentration in groundwater was 0.74 µg/L, and does not exceed the MCL or background UTL ([Table 3-4](#)). Therefore, NFA is recommended at Site 6.

**Table 3-1**  
**SWMU 5 Groundwater Detections and Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	MCL- Groundwater	Background UTL- Groundwater	LW05-MW01
Sample ID			LW05-MW01-05C
Sample Date			07/18/05
Chemical Name			
<b>Total Metals (UG/L)</b>			
Aluminum	--	713	312
Barium	2,000	130	84 J
Calcium	--	129,000	36,600
Cobalt	--	2.6	5 J
Copper	1,300	ND	<b>32.3</b>
Iron	--	70,800	867
Magnesium	--	45,600	<b>46,600</b>
Manganese	--	1,500	381
Potassium	--	36,800	21,500
Sodium	--	337,000	<b>436,000</b>
Zinc	--	59	35 K
<b>Dissolved Metals (UG/L)</b>			
Antimony	6	49	4.9 J
Barium	2,000	136	84.7 J
Calcium	--	136,000	38,300
Cobalt	--	1.9	<b>5.1 J</b>
Copper	1,300	ND	<b>42.5</b>
Iron	--	29,800	1,080
Magnesium	--	49,000	<b>51,300</b>
Manganese	--	1,510	396
Nickel	--	6	17.7 K
Potassium	--	35,500	23,200
Sodium	--	360,000	<b>484,000</b>
Zinc	--	42	32.4 K

Note:

**Exceeds Background UTL**

J - Reported value is estimated

U - Analyte not detected

K - Analyte detected, reported value is biased high

The screening criteria used for comparison purposes was established in the Final SSA Work Plan (CH2M HILL, July 2005)

-- Screening Criteria not established

**Table 3-2**  
**SWMU 6 Groundwater Detections and Exceedances of Screening Criteria**  
**SWMUs 5,6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	MCL- Groundwater	Background UTL- Groundwater	LW06-GW101	LW06-GW102
Sample ID			LW06-GW101-05C	LW06-GW102-05C
Sample Depth			8-12 ft bgs	8-12 ft bgs
Sample Date			07/12/05	07/12/05
Chemical Name				
Dissolved Metals (UG/L)				
Arsenic	10	4	2.8 J	25.8
Nickel	--	6	1.9 J	3.4 J
Zinc	--	42	4.9 B	13.4

Notes:

Exceeds MCL

J- Reported value is estimated

B- Possible blank contamination

The screening criteria used for comparison purposes was established in the Final SSA Work Plan (CH2M HILL, July 2005)

-- Screening Criteria not established

**Table 3-3**  
**SWMU13 Soil Detections and Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	Background UTL Dredged Fill SS	Background UTL- Dredged Fill SB	RBC-Soil Residential	RBC-Soil Industrial	LW13-SO101		LW13-SO102	
					LW13-SS101-00-05C 1.0-1.5ft bgs 07/12/05	LW13-SB101-01-05C 3.5-5.0ft bgs 07/12/05	LW13-SS102-00-05C 0.8-1.4ft bgs 07/12/05	LW13-SB102-01-05C 5.0-6.0ft bgs 07/12/05
<b>Chemical Name</b>								
<b>Pesticide/Polychlorinated Biphenyls (UG/KG)</b>								
4,4'-DDE	240	240	1,900	8,400	2.1 J	3.9 UJ	3.2 J	3.9 UJ
4,4'-DDT	140	6.2	1,900	8,400	3.8 UJ	3.9 UJ	3.7 J	3.9 UJ
alpha-Chlordane	--	--	1,800	8,200	2 UJ	2 UJ	2.2 J	2 UJ
gamma-Chlordane	--	--	1,800	8,200	2 UJ	2 UJ	1.7 J	2 UJ
<b>Wet Chemistry (MG/KG)</b>								
% Solids	--	--	--	--	86	84	84	84

Notes:

The screening criteria used for comparison purposes was established in the Final SSA Work Plan (CH2M HILL, July 2005)

J- Reported value is estimated

U- Analyte not detected

UJ- Analyte not detected. Quantitation limit may be imprecise

-- Screening Criteria not established

**Table 3-4**  
**Site 6 Groundwater Detections and Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

<b>Station ID</b>			LS06-GW100
<b>Sample ID</b>			LS06-GW100-05C
<b>Sample Date</b>			07/11/05
<b>Chemical Name</b>			
<b>Total Metals (UG/L)</b>			
Lead	15	2.4	0.74 J
<b>Dissolved Metals (UG/L)</b>			
No Detections			

Note:

J- Reported value is estimated

The screening criteria used for comparison purposes was established in the Final SSA Work Plan (CH2M HILL, July 2005)



**LEGEND**

- 1995 RRRS Sampling Locations
- ⊕ 2005 SSA Monitoring Well Location
- SWMU 5 Boundary
- S - Soil
- W - Water

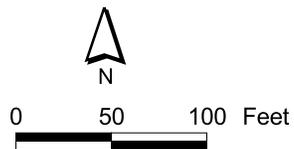


Figure 3-1  
 SWMU 5 Sampling Locations  
 SWMUs 5, 6, 13 and Site 6  
 Site Screening Assessment  
 NAB Little Creek  
 Virginia Beach, Virginia



**LEGEND**

- 1995 RRRS Sampling Locations
- ⊕ 2005 SSA Sampling Locations
- Site Boundary
- S - Soil
- W - Water



Figure 3-2  
 SWMU 6 Sampling Locations  
 SWMUs 5, 6, 13 and Site 6  
 Site Screening Assessment  
 NAB Little Creek  
 Virginia Beach, Virginia

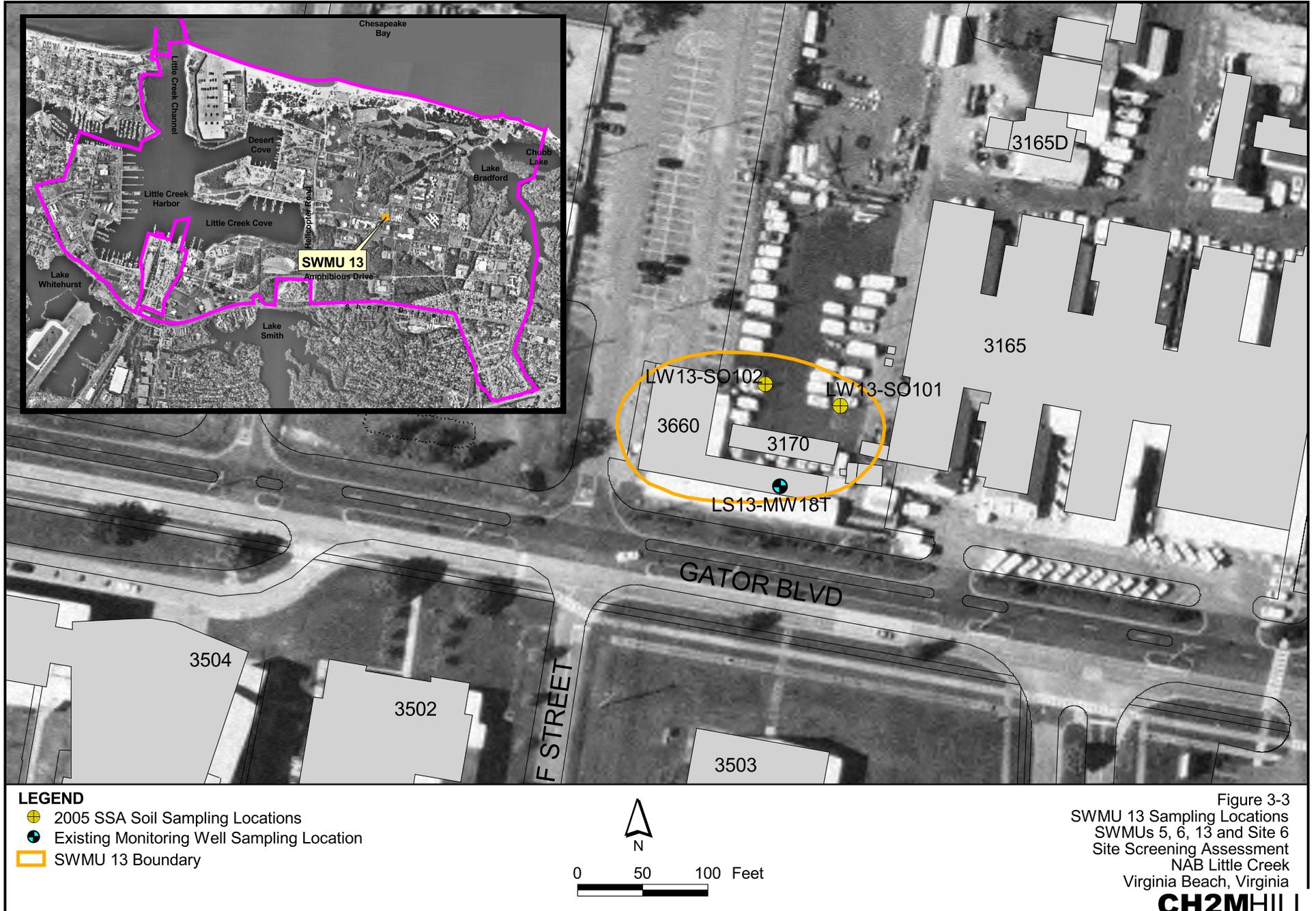
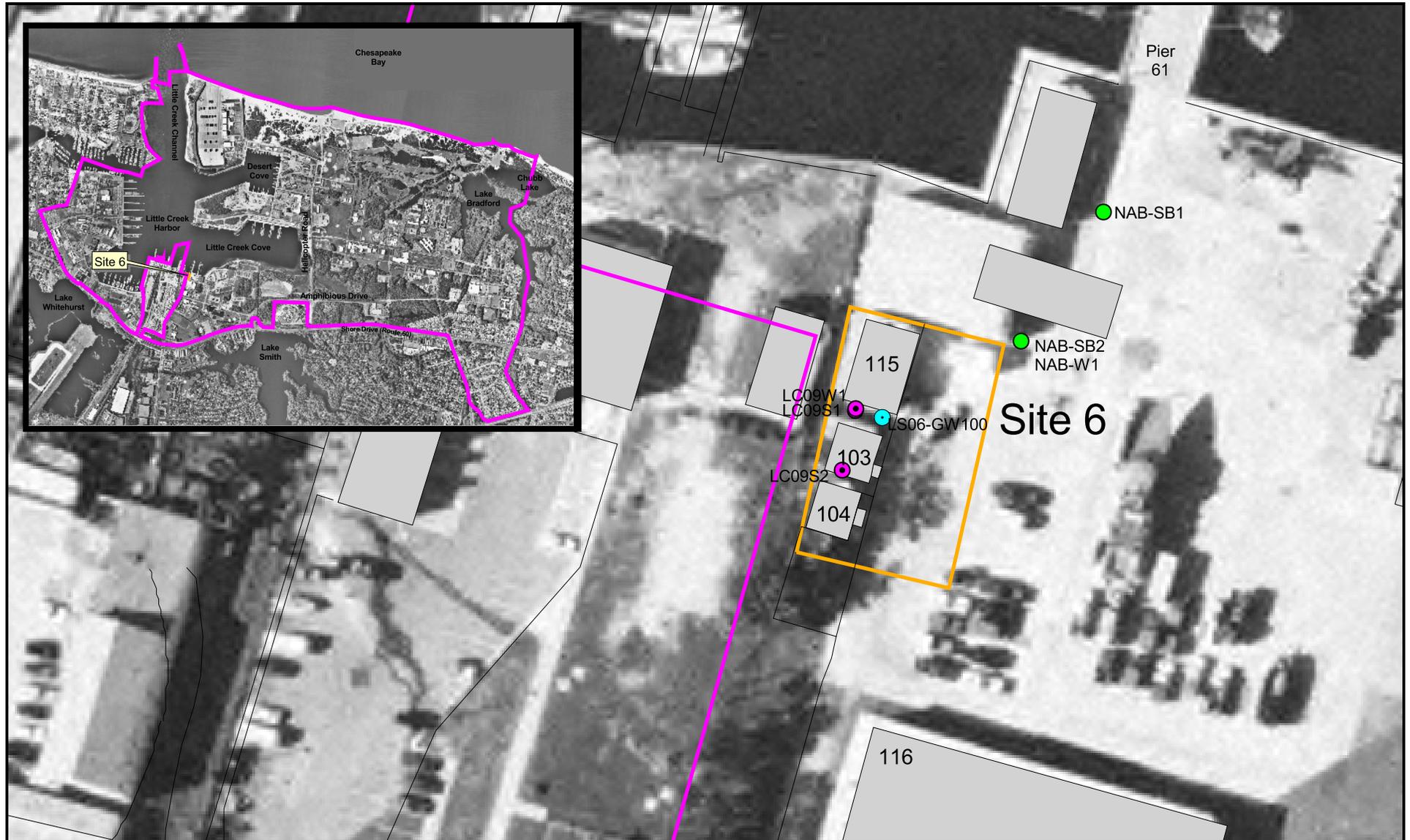


Figure 3-3  
SWMU 13 Sampling Locations  
SWMUs 5, 6, 13 and Site 6  
Site Screening Assessment  
NAB Little Creek  
Virginia Beach, Virginia



**LEGEND**

- 1995 Excavation Sampling Locations
- 1995 RRRS Sampling Locations
- 2005 SSA Sampling Location
- Site Boundary
- Activity Boundary
- SB - Subsurface Soil
- W - Water / Groundwater
- S - Soil

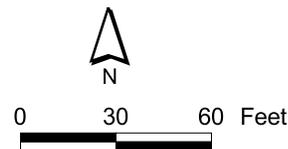


Figure 3-4  
 Site 6 Sampling Locations  
 SWMUs 5, 6, 13 and Site 6  
 Site Screening Assessment  
 NAB Little Creek  
 Virginia Beach, Virginia

#### SECTION 4

## Conclusions and Recommendations

---

Based on the results of the SSA, NFA is recommended for SWMUs 5, 6, and 13 and Site 6. SSA analytical results show no exceedances of the MCLs at SWMU 5, SWMU 13, and Site 6 and only arsenic exceeding the MCL at SWMU 6. Arsenic in groundwater at SWMU 6 is not indicative of a CERCLA release because the aquifer material is dredge fill, there were no detections of arsenic or other constituents in soil or groundwater that would indicate a release, and it is expected that a CERCLA release would result in the detection of more than just arsenic in the groundwater. Therefore, it is recommended that SWMUs 5, 6, and 13 and Site 6 be closed out under CERCLA with unrestricted land use.

# References

---

CH2M HILL, August 2000. *Final Master Project Plans, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.*

CH2M HILL. December 2000. *Final Background Investigation for NAB Little Creek, Virginia Beach, Virginia.*

CH2M HILL. March 2003. *Final Background Investigation Addendum for Summer Groundwater Sampling Event, NAB Little Creek, Virginia Beach, Virginia.*

CH2M HILL, July 2005. *Final Work Plan Site Screening Assessment SWMUs 5, 6, 13 and Site 6, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.*

Kearny, A.T. 1989. *RCRA Facility Assessment.*

NAB Little Creek. June 2000. *SWMU/IR Summary for Naval Amphibious Base, Little Creek.*

Rogers, Golgen, and Halpern (RGH). December 1984. *Initial Assessment Study.*

**Appendix A**  
**Relative Risk Ranking Detections and**  
**Exceedances of Screening Criteria**

---

**Table A-1**  
**1995 RRRS SWMU 5 Soil Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	RBC Residential	RBC Industrial	Background Dredge Fill	LC13-S1	LC13-S2	LC13-S3
<b>Chemical Name</b>						
<b>Volatile Organic Compounds (UG/KG)</b>						
Chloroform	780,000	10,000,000	--	4 J	4 J	4 J
<b>Semivolatile Organic Compounds (UG/KG)</b>						
Naphthalene	1,600,000	20,000,000	ND	ND	8 J	ND
2-Methylnaphthalene	310,000	4,100,000	ND	ND	7 J	ND
Acenaphthylene			ND	ND	160 J	ND
Acenaphthene	4,700,000	6,100,000	ND	ND	32 J	ND
Dibenzofuran	160,000	2,000,000	ND	ND	12 J	ND
Flourene	3,100,000	41,000,000	ND	ND	39 J	ND
Phenanthrene	2,300,000	31,000,000	ND	ND	340 J	ND
Anthracene	23,000,000	310,000,000	ND	ND	310 J	ND
Carbazole	32,000	140,000	ND	ND	210 J	ND
Fluoranthene	3,100,000	41,000,000	ND	ND	770	ND
Pyrene	2,300,000	31,000,000	ND	5 J	920	10 J
Benzo(a)anthracene	870	3,900	ND	ND	540	ND
Chrysene	87,000	390,000	ND	ND	720	ND
Benzo(b)fluoranthene	870	3,900	ND	ND	1800	ND
Benzo(k)fluoranthene	8,700	39,000	ND	ND	950	ND
Benzo(a)pyrene	87	390	ND	8 J	900	17 J
Indeno(1,2,3-cd)pyrene	870	3,900	ND	ND	200 J	10 J
Dibenz(a,h)anthracene	87	390	ND	ND	30 J	ND
Benzo(g,h,i)perylene	2,300,000	31,000,000	ND	ND	40 J	ND
<b>Total Metals (MG/KG)</b>						
Aluminum	78,000	1,000,000	8,500	396	1,800	1,080
Antimony	31	410	ND	1.3 BN	1.4 BN	ND
Barium	5,500	72,000	69	3 BN	12.3 BN	4.1 BN
Beryllium	160	2,000	0.6	ND	0.31 BN	0.24 BN
Calcium	--	--	1,817	126 B	231 B	154 B
Chromium	230	3100	20	1.8 BN	4.5 N	2.5 N
Cobalt	1,600	20,000	5.1	ND	0.46 BN	0.68 BN
Copper	3,100	41,000	ND	1.6 B	5.7 B	1.1 B
Iron	23,000	310,000	15,000	792	3110	1740
Lead	400	400	110	4	14.9	3.1
Magnesium	--	--	1,347	72.4 B	255 B	205 B
Manganese	1,600	20,000	267	6.2	29.2	36.1
Nickel	1,600	20,000	9.5	1.4 BN	4.3 BN	1.8 BN
Potassium	--	--	1,435	60 B	150 B	121 B
Silver	390	5,100	ND	0.72 BN	ND	ND

Notes:

Exceeds Residential RBC and Industrial RBC

-- No criteria established

ND - Compound analyzed but not detected

B - Analyte not detected above associated blank

J - Analyte present, reported value is estimated

N - Spiked sample recovery was not within control limits

**Table A-2**  
**1995 RRRS SWMU 5 Groundwater Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	MCL Groundwater	Background UTL- Groundwater	LC13-W1
<b>Chemical Name</b>			
<b>Volatile Organic Compounds (UG/L)</b>			
Acetone	--	--	55
<b>Semivolatile Organic Compounds (UG/L)</b>			
Diethylphthalate	--	ND	1 J
<b>Total Metals (UG/L)</b>			
Aluminum	--	713	195,000
Antimony	6	ND	6 BN
Arsenic	10	4	112
Barium	2,000	130	366
Beryllium	4	0.5	5 B
Calcium	--	129,000	66,200
Chromium	100	4	226
Cobalt	--	3	50
Copper	1,300	ND	128
Iron	--	29,000	170,000
Lead	15*	2.4	94
Magnesium	--	45,600	21,100
Manganese	--	1,500	526
Mercury	2	0.3	1 BN
Nickel	--	14	115
Potassium	--	36,800	21,400 E
Selenium	50	8	17.1

Notes:

Exceeds both MCL Groundwater and Background UTL

-- No criteria established

ND - Compound analyzed but not detected

B - Analyte not detected above associated blank

J - Analyte present, reported value is estimated

N - Spiked sample recovery was not within control limits

E - (Metals) Estimated concentration due to interference

\* Action Level

**Table A-3**  
**1995 RRRS SWMU 6 Soil Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	RBC Residential	RBC Industrial	Background Dredge Fill	LC14-S1	LC14-S2	LC14-S3	LC14-S4	LC14-S5	LC14-S6
<b>Chemical Name</b>									
<b>Volatile Organic Compounds (UG/KG)</b>									
Acetone	70,000,000	920,000,000	--	8 J	17	26	11	15	29
Chloroform	780,000	10,000,000	--	5 J	ND	ND	ND	3 J	5 JB
<b>Semi-volatile Organic Compounds (UG/KG)</b>									
Pyrene	2,300,000	31,000,000	ND	6 J	ND	ND	ND	ND	ND
<b>Metals ( MG/KG)</b>									
Aluminum	78,000	1,000,000	8,500	10,900	6,920	12,700	6,050	8,080	10,300
Antimony	31	410	ND	1.2 J	1.2 B	0.72 B	1.5 B	0.84 B	0.69 B
Arsenic	--	--	5.6	2.8	2.4	2.7	2 B	1.3 B	2.4
Barium	5,500	72,000	69	29.2 B	37.9 B	38.8 B	29.5 B	23.2 B	29.9 B
Beryllium	160	2,000	0.6	0.3 B	0.42 B	0.49 B	0.46 B	0.31 B	0.3 B
Calcium	--	--	1,817	500	391	633	593	656	542
Chromium	230	3100	20	13.8	6.9	17.3	12.8	13.2	12.1
Cobalt	1,600	20,000	5	2 B	2.5 B	4.5 B	2.5 B	2.3 B	2 B
Copper	3,100	41,000	ND	5.2 B	2.8 B	5.8 B	17.5	5 B	4 B
Iron	23,000	310,000	15,000	9,250	7,900	11,600	11,400	6,170	8,670
Lead	400	400	110	17.5	9.4	15.1	34.6	8.4	6.8
Magnesium	--	--	1,347	788	700	1,130	642	1,010	814
Manganese	1,600	20,000	267	32	41.5	57	80.7	51.6	53
Nickel	1,600	20,000	10	5.9 B	5.8 B	10.1	9.9	6.9 D	5.9 D
Potassium	--	--	1,435	408	216 B	588	309	450	462
Selenium	390	5,100	ND	1.2 B	1 B	1.3	1.5	0.7 B	0.93 B
Sodium	--	--	623	85 B	94.7 B	136 B	86 B	68.6 B	72.6 B
Vanadium	78	1,000	34.3	16.8	12.6	19.3	10.2 B	11.5	14.1
Zinc	23,000	310,000	123	34	17.3	66.4	92.4	45.7	17.4

Notes

- No criteria established
- NC- Analyte was analyzed and detected in background but no criteria is established
- ND - Compound analyzed but not detected
- B - Analyte not detected above associated blank
- J - Analyte present, reported value is estimated
- N - Spiked sample recovery was not within control limits

**Table A-4**  
**1995 RRRS SWMU 6 Groundwater Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	MCL Groundwater	Background UTL-Groundwater	LC14-W1	LC14-W2	LC14-W3	LC14-W4
<b>Chemical Name</b>						
<b>Volatile Organic Compounds (UG/L)</b>						
1,2-Dichloroethene	--	--	ND	ND	3 J	ND
<b>Semivolatile Organic Compounds (UG/L)</b>						
Diethylphthalate	--	ND	0.5 J	0.8 J	0.4 J	0.5 J
Di-n-butylphthalate	--	ND	ND	0.7 J	ND	ND
<b>Total Metals (UG/L)</b>						
Aluminum	--	713	74,000	15,300	796	31,100
Antimony	6	ND	7.6 B	5.9 B	3.2 B	ND
Arsenic	10	4	23.6	44.6	71.4	52.4
Barium	2,000	130	374	57.2 B	14.3 B	99.4 B
Beryllium	4	0.5	3.9 B	1.4 B	ND	1.6 B
Calcium	--	129,000	43,000	6,440	6,300	16,700
Chromium	100	4	113	24.1	3 B	46.3
Cobalt	--	3	23 B	4.7 B	1.8 B	11.2 B
Copper	1,300	ND	115	10.6 B	ND	27.9
Iron	--	70,800	93,800	79,900	126,000	123,000
Lead	15*	2.4	164	18.2	6.3	21
Magnesium	--	45,600	14,300	9,510	7,800	15,800
Manganese	--	1,500	1,790	297	329	772
Mercury	2	0.3	1.2 B	ND	ND	ND
Nickel	--	14	49.8	10.7 B	3.3 B	21.6 B
Potassium	--	36,800	10,600 E	2,150 E	766 BE	4,010 E
Selenium	50	50	7.6	7.1	11.1	11.2
Silver	--	2	ND	ND	ND	54.2 N
Sodium	--	337,000	16,800 E	33,100 E	27,900 E	28,500 E
Vanadium	--	5	123	37 B	5.8 B	58.6
Zinc	--	59	912	46.3	39.8	58.5

Notes:

Exceeds both the MCL and Background UTL

-- No criteria established

ND - Compound analyzed but not detected

B - Analyte not detected above associated blank

J - Analyte present, reported value is estimated

N - Spiked sample recovery was not within control limits

E - (Metals) Estimated concentration due to interference

\* Action Level

**Table A-5**  
**1995 RRRS Site 6 Soil Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	RBC Residential	RBC Industrial	Background Dredge Fill	LC09-S1	LC09-S2
<b>Chemical Name</b>					
<b>Semi-volatile Organic Compounds (UG/KG)</b>					
Phenanthrene	2,300,000	31,000,000	ND	ND	5 J
Anthracene	23,000,000	310,000,000	ND	ND	4 J
Fluoranthene	3,100,000	41,000,000	ND	ND	16 J
Pyrene	2,300,000	31,000,000	ND	8 J	28 J
Benzo(a)anthracene	870	3,900	ND	ND	9 J
Chrysene	87,000	390,000	ND	ND	14 J
Benzo(b)fluoranthene	870	3,900	ND	ND	30 J
Benzo(k)fluoranthene	8,700	39,000	ND	ND	21 J
Benzo(a)pyrene	87	390	ND	13 J	37 J
Benzo(g,h,i)perylene	2,300,000	31,000,000	ND	24 J	ND
<b>Total Metals ( MG/KG)</b>					
Aluminum	78,000	1,000,000	8,500	910	2220
Antimony	31	410	ND	1.2 BN	1.1 BN
Arsenic	--	--	5.6	1.3 B	1.2 B
Barium	5,500	72,000	69	5.4 B	22.1 B
Cadmium	--	--	ND	0.24 B	0.35 B
Calcium	--	--	1,817	343	826
Chromium	230	3100	20	6	6.7
Cobalt	1,600	20,000	5	0.3 B	1.1 B
Copper	3,100	41,000	ND	4.5 B	8
Iron	23,000	310,000	15,000	2360	3790
Lead	400	400	110	42.6	23.7
Magnesium	--	--	1,347	248	562
Manganese	1,600	20,000	267	11	51.9
Nickel	1,600	20,000	10	1.6 B	2.7 B
Potassium	--	--	1,435	335	420
Selenium	390	5,100	ND	ND	0.8 B
Silver	390	5,100	ND	0.22 B	ND
Sodium	--	--	623	31.2 B	30.8 B
Vanadium	78	1,000	34.3	3.7 B	6.2 B
Zinc	23,000	310,000	123	24.8	59.2

Notes:  
-- No criteria established  
ND - Compound analyzed but not detected  
B - Analyte not detected above associated blank  
J - Analyte present, reported value is estimated control limits

**Table A-6**  
**1995 RRRS Site 6 Groundwater Exceedances of Screening Criteria**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Sample ID	MCL Groundwater	Background UTL- Groundwater	LC09-W1
<b>Chemical Name</b>			
<b>Semi-volatile Organic Compounds (UG/KG)</b>			
Phenanthrene	--	ND	ND
Anthracene	--	ND	ND
Fluoranthene	--	ND	ND
Pyrene	--	ND	ND
Benzo(a)anthracene	--	ND	ND
Chrysene	--	ND	ND
Benzo(b)fluoranthene	--	ND	ND
Benzo(k)fluoranthene	--	ND	ND
Benzo(a)pyrene	0.2	ND	ND
Benzo(g,h,i)perylene	--	ND	ND
<b>Total Metals (MG/KG)</b>			
Aluminum	--	713	7820 E
Antimony	6	ND	6.1 B
Arsenic	10	73	ND
Barium	2000	130	61.8 BE
Cadmium	5	2.1	ND
Calcium	--	129,000	18200
Chromium	100	4.1	15.6
Cobalt	--	2.6	3.8 B
Copper	1300	ND	11 B
Iron	--	70,800	8550 E
Lead	15*	2.4	414
Magnesium	--	45,600	2730 E
Manganese	--	1,500	52.8 E
Nickel	--	14	9.5 B
Potassium	--	36,800	4020 E
Selenium	50	8	ND
Silver	--	2	ND
Sodium	--	337,000	12000
Vanadium	--	5	16.1 B
Zinc	--	59	109 E

Notes:

Exceeds MCL and Background UTL

-- No criteria established

ND - Compound analyzed but not detected

B - Analyte not detected above associated blank

J - Analyte present, reported value is estimated control limits

E - (Metals) Estimated concentration due to interference

\* Action Level

**Appendix B**  
**Soil Boring and Well Installation Logs**

---



PROJECT NUMBER <b>187222.FI.SS</b>	BORING NUMBER <b>LS10-MW01</b>	SHEET 1 OF 1
---------------------------------------	-----------------------------------	--------------

## SOIL BORING LOG

PROJECT : NAB Little Creek SWMU 5      DRILLING CONTRACTOR : Parratt Wolff      LOCATION : NAB Little Creek, Virginia Beach,  
 ELEVATION : 9.3'      NORTHING: 3501713.35      EASTING: 12162773.25  
 DRILLING METHOD AND EQUIPMENT USED : 4 1/4" Hollow Stem Auger / DPT  
 WATER LEVELS : 8.7' bgs      START : 0955 7/13/05      END : 1600 7/13/05      LOGGER : C. White

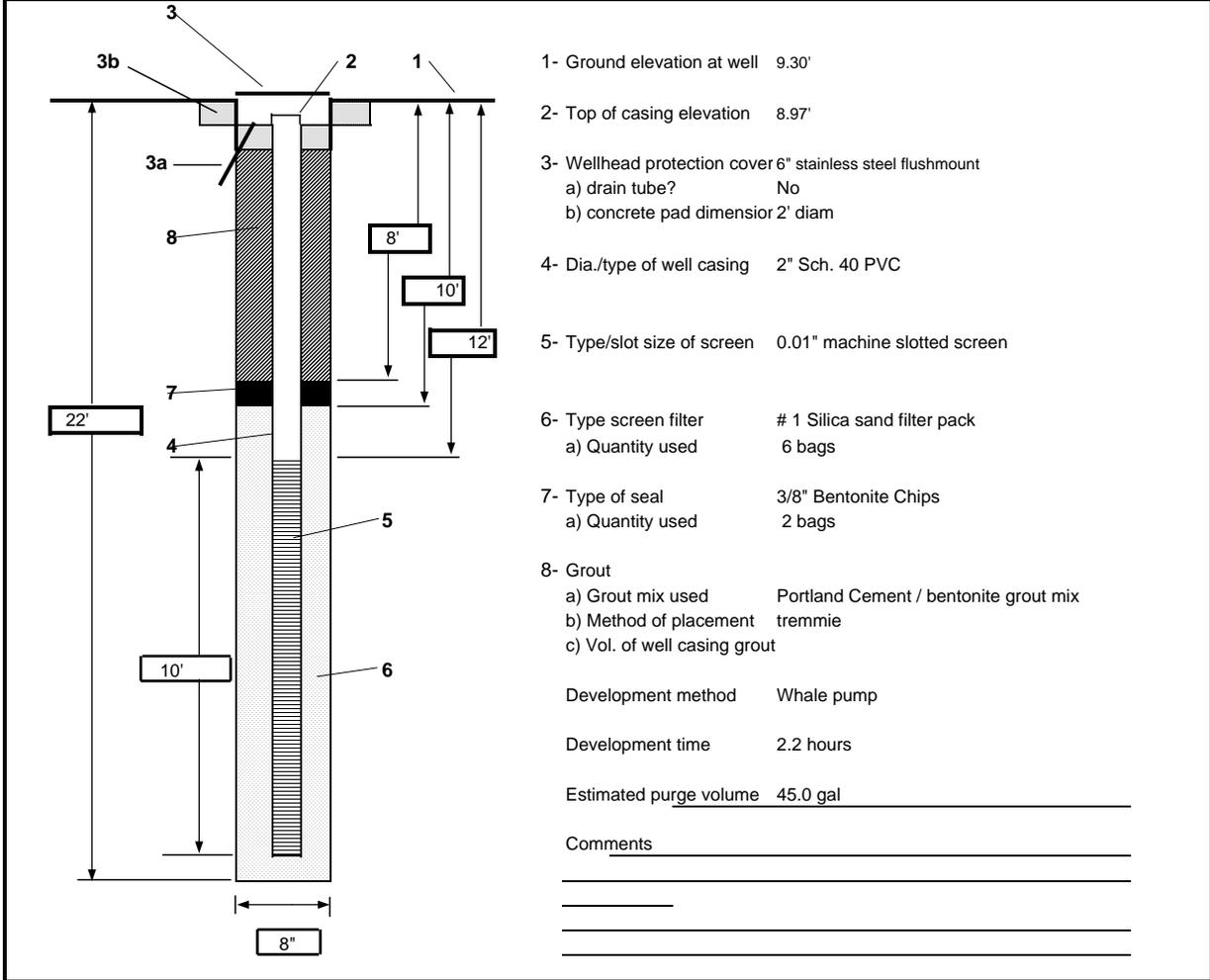
DEPTH BELOW SURFACE (FT)	INTERVAL (FT)		STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
	RECOVERY (IN)	#/TYPE			
	0.0'-4.0'	3.0'	S1	0.0'-0.5' - fill, medium sand with some cobbles, moist, loose 0.5'-4.0' - medium sand, trace silt, SM, 5Y 6/3, moist, loose	
5	4.0'-8.0'	3.0'	S2	5.0'-7.0' - medium sand, trace silt, SM, 5Y 6/3, moist, loose 7.0'-8.0' - silty fine sand, SM, 10YR 4/6, moist, medium dense	
10	8.0'-12.0'	4.0'	S3	8.0'-8.4' - medium sand, SP, 5Y 6/3, moist, loose 8.4'-9.2' - silty fine sand, SM, 10YR 4/6, moist, medium dense 9.2'-10.0' - medium sand, some silt, SM, 10YR 4/6, saturated, loose 10.0'-11.5' - silty fine sand, trace mottling, SM, 10YR 4/6, saturated, medium dense 11.5'-12.0' - medium sand, SP, 5y 6/2, saturated, loose	
15	12.0'-16.0'	3.5'	S4	12.0'-16.0' - medium sand, trace coarse sand, SW, 5Y 6/3, saturated, loose	
	16.0'-20.0'	3.5'	S5	16.0'-20.0' - medium sand, trace coarse and fine sand, SW, 5Y 6/2, saturated, loose	
20	20.0'-24.0'	4.0'	S6	20.0'-23.0' - sandy silt, ML, 2.5Y 5/6, saturated, medium dense 23.0'-24.0' - clay, CH, Gley 5GY 6/1, saturated, very dense	
25				End of boring, well installed at 22.0' bgs	



PROJECT NUMBER <b>187222.FI.SS</b>	WELL NUMBER <b>LS10-MW01</b>	SHEET 1	OF 1
---------------------------------------	---------------------------------	---------	------

## WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek	LOCATION : NAB Little Creek, Virginia Beach, VA
DRILLING CONTRACTOR : Parratt Wolff	NORTHING: 3501713.35 EASTING: 12162773.25
DRILLING METHOD AND EQUIPMENT USED : 4 1/4" Hollow Stem Auger	
WATER LEVELS 8.7' bgs START : 0955 7/13/05 END : 1600 7/13/05 LOGGER : C. White	



Appendix C  
Site Screening Assessment Analytical Results

**Table C-1**  
**SWMU 5 Groundwater Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LW05-MW01	
Sample ID	LW05-MW01-05C	LW05-MW01P-05C
Sample Date	07/18/05	07/18/05
<b>Chemical Name</b>		
<b>Total Metals (UG/L)</b>		
Aluminum	312	202
Antimony	3.54 U	3.54 U
Arsenic	3.2 B	4.9 B
Barium	84 J	80.1 J
Beryllium	0.4 U	0.4 U
Cadmium	2.29 UL	2.29 UL
Calcium	36,600	35,600
Chromium	1.4 B	2.1 B
Cobalt	4.3 U	5 J
Copper	29.6	32.3
Cyanide	10 U	3.8 B
Iron	814	867
Lead	2.07 R	2.07 R
Magnesium	46,000	46,600
Manganese	381	370
Mercury	0.03 B	0.03 B
Nickel	11.6 U	11.6 U
Potassium	21,500	21,400
Selenium	4.08 R	4.08 R
Silver	3.93 U	3.93 U
Sodium	436,000	430,000
Thallium	8 B	10.2 B
Vanadium	5.07 U	5.07 U
Zinc	35 K	31.2 K
<b>Dissolved Metals (UG/L)</b>		
Aluminum	71.5 B	51.1 B
Antimony	4.9 J	3.54 U
Arsenic	4 B	2.9 B
Barium	81.2 J	84.7 J
Beryllium	0.4 U	0.4 U
Cadmium	2.29 UL	2.29 UL
Calcium	37,300	38,300
Chromium	1.6 B	1.7 B
Cobalt	5.1 J	4.3 U
Copper	35.3	42.5
Cyanide	10 U	10 U
Iron	929	1,080
Lead	2.07 R	2.07 R
Magnesium	47,300	51,300
Manganese	392	396
Mercury	0.03 B	0.03 B
Nickel	11.6 U	17.7 K
Potassium	22,500	23,200
Selenium	4.08 R	4.08 R
Silver	4.4 B	5 B
Sodium	418,000	484,000
Thallium	4.26 U	4.26 U
Vanadium	5.07 U	5.07 U
Zinc	31.5 K	32.4 K
<b>Water Quality Parameters</b>		
Dissolved Oxygen (MG/L)	3.12	--
Oxidation Reduction Potential (MV)	42	--
Salinity (%)	0.15	--
PH (pH)	6.5	--
Specific Conductivity (MS/CM)	2.95	--
Temperature (C)	24.15	--

**Table C-1**  
**SWMU 5 Groundwater Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment NAB Little Creek**  
**Virginia Beach, Virginia**

<b>Station ID</b>	LW05-MW01	
<b>Sample ID</b>	LW05-MW01-05C	LW05-MW01P-05C
<b>Sample Date</b>	07/18/05	07/18/05
<b>Chemical Name</b>		
Turbidity (NTU)	691	--

Note:

B - Possible blank contamination

J - Reported value is estimated

K - Reported value may be biased high

U - Analyte not detected

UL - Analyte not detected. Quantitation limit may be higher.

P - Duplicate sample

-- water quality is the same for duplicate sample

**Table C-2**  
**SWMU 6 Groundwater Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

<b>Station ID</b>	LW06-GW101	LW06-GW102	
<b>Sample ID</b>	LW06-GW101-05C	LW06-GW102-05C	LW06-GW102P-05C
<b>Sample Date</b>	07/12/05	07/12/05	07/12/05
<b>Chemical Name</b>			
<b>Dissolved Metals (UG/L)</b>			
Antimony	0.38 B	0.4 B	0.36 B
Arsenic	2.8 J	25.8	25
Cadmium	0.02 U	0.04 B	0.04 B
Chromium	0.88 B	1.4 B	1.3 B
Copper	0.24 B	0.26 B	0.43 B
Lead	0.02 U	0.02 U	0.02 U
Nickel	1.9 J	3.4 J	2.1 J
Zinc	4.9 B	13.4	7.2 J
<b>Water Quality Parameters</b>			
Dissolved Oxygen (MG/L)	7.06	6.28	--
Oxidation Reduction Potential (MV)	91	-29	--
Salinity (%)	0.02	0.03	--
PH (pH)	5.26	5.59	--
Specific Conductivity (MS/CM)	0.551	0.689	--
Temperature (C)	24.65	23.97	--
Turbidity (NTU)	319	370	--

Notes:

- B - Possible blank contamination
- J - Reported value is estimated
- U - Analyte not detected
- P - Duplicate sample
- water quality is the same for duplicate sample

**Table C-3**  
**SWMU 13 Groundwater Analytical Data**  
**SMWUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LS13-MW18T	
Sample ID	LS13-MW18T-05C2	LS13-MW18TP-05C2
Sample Date	07/18/05	07/18/05
<b>Chemical Name</b>		
<b>Pesticide/Polychlorinated Biphenyls (UG/L)</b>		
4,4'-DDD	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U
Aldrin	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U
Endosulfan I	0.05 U	0.05 U
Endosulfan II	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U
Endrin	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U
Endrin ketone	0.1 U	0.1 U
Heptachlor	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U
Methoxychlor	0.5 U	0.5 U
Toxaphene	5 U	5 U
alpha-BHC	0.05 U	0.05 U
alpha-Chlordane	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U
<b>Water Quality Parameters</b>		
Dissolved Oxygen (MG/L)	2.82	--
Oxidation Reduction Potential (MV)	-30	--
Salinity (%)	0.01	--
PH (pH)	5.59	--
Specific Conductivity (MS/CM)	0.365	--
Temperature (C)	21.03	--
Turbidity (NTU)	74.5	--

Note:

U - Analyte not detected

P - Duplicate sample

-- water quality is the same for duplicate sample

**Table C-4**  
**SWMU 13 Soil Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LW13-SO101		LW13-SO102		
Sample ID	LW13-SS101-00-05C	LW13-SB101-01-05C	LW13-SS102-00-05C	LW13-SB102-01-05C	LW13-SB102P-01-05C
Sample Date	07/12/05	07/12/05	07/12/05	07/12/05	07/12/05
Chemical Name					
<b>Pesticide/Polychlorinated Biphenyls (UG/KG)</b>					
4,4'-DDD	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
4,4'-DDE	2.1 J	3.9 UJ	3.2 J	3.9 UJ	3.9 UJ
4,4'-DDT	3.8 UJ	3.9 UJ	3.7 J	3.9 UJ	3.9 UJ
Aldrin	2 UJ				
Dieldrin	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Endosulfan I	2 UJ				
Endosulfan II	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Endosulfan sulfate	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Endrin	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Endrin aldehyde	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Endrin ketone	3.8 UJ	3.9 UJ	3.9 UJ	3.9 UJ	3.9 UJ
Heptachlor	2 UJ				
Heptachlor epoxide	2 UJ				
Methoxychlor	20 UJ				
Toxaphene	200 UJ				
alpha-BHC	2 UJ				
alpha-Chlordane	2 UJ	2 UJ	2.2 J	2 UJ	2 UJ
beta-BHC	2 UJ				
delta-BHC	2 UJ				
gamma-BHC (Lindane)	2 UJ				
gamma-Chlordane	2 UJ	2 UJ	1.7 J	2 UJ	2 UJ
<b>Wet Chemistry (MG/KG)</b>					
% Solids	86	84	84	84	84

Notes:

J - Reported value is estimated

U - Analyte not detected

UJ - Analyte not detected. Quantitation limit may be imprecise

**Table C-4**  
**SWMU 13 Soil Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

<b>Station ID</b>	LW13-SO101		LW13-SO102		
<b>Sample ID</b>	LW13-SS101-00-05C	LW13-SB101-01-05C	LW13-SS102-00-05C	LW13-SB102-01-05C	LW13-SB102P-01-05C
<b>Sample Date</b>	07/12/05	07/12/05	07/12/05	07/12/05	07/12/05
<b>Chemical Name</b>					

P - Duplicate sample

**Table C-5**  
**Site 6 Groundwater Analytical Data**  
**SWMUs 5, 6, 13 and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LS06-GW100	
Sample ID	LS06-GW100-05C	LS06-GW100P-05C
Sample Date	07/11/05	07/11/05
<b>Chemical Name</b>		
<b>Total Metals (UG/L)</b>		
Lead	0.74 J	0.32 J
<b>Dissolved Metals (UG/L)</b>		
Lead	0.02 U	0.02 U
<b>Water Quality Parameters</b>		
Dissolved Oxygen (MG/L)	6.65	--
Oxidation Reduction Potential (MV)	-152	--
Salinity (%)	0.04	--
PH (pH)	6.29	--
Specific Conductivity (MS/CM)	0.872	--
Temperature (C)	23.66	--
Turbidity (NTU)	999	--

Note:

J- Reported value is estimated

U- Analyte not detected

P - Duplicate sample

-- water quality is the same for duplicate sample

**Table C-6**  
**QA/QC Analytical Results**  
**SWMUs 5, 6, 13, and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LC-QC								LC-QC	
	LS06-FB071105	LS06-EB071105	LW06-FB071205	LW13-FB071205	LW13-EB071205	LW13-FB071805	LW13-EB071805	LW05-FB071805	LW05-EB071805	LW05-EB071805A
Sample ID	07/11/05	07/11/05	07/12/05	07/12/05	07/12/05	07/18/05	07/18/05	07/18/05	07/18/05	07/18/05
Sample Date										
Chemical Name										
PEST/PCBs (UG/L)										
4,4'-DDD	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
4,4'-DDE	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
4,4'-DDT	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Aldrin	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
Dieldrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Endosulfan I	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
Endosulfan II	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Endrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Endrin aldehyde	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Endrin ketone	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA
Heptachlor	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
Methoxychlor	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	NA
Toxaphene	NA	NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA
alpha-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
alpha-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
beta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
delta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA
gamma-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA

**Table C-6**  
**QA/QC Analytical Results**  
**SWMUs 5, 6, 13, and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LC-QC							LC-QC		
Sample ID	LS06-FB071105	LS06-EB071105	LW06-FB071205	LW13-FB071205	LW13-EB071205	LW13-FB071805	LW13-EB071805	LW05-FB071805	LW05-EB071805	LW05-EB071805A
Sample Date	07/11/05	07/11/05	07/12/05	07/12/05	07/12/05	07/18/05	07/18/05	07/18/05	07/18/05	07/18/05
Chemical Name										
Total Metals (UG/L)										
Aluminum	NA	28.2 B	36.7 B	NA						
Antimony	NA	3.54 U	3.54 U	NA						
Arsenic	NA	2.81 U	2.81 U	NA						
Barium	NA	0.5 U	0.57 J	NA						
Beryllium	NA	0.4 U	0.4 U	NA						
Cadmium	NA	2.29 UL	2.29 UL	NA						
Calcium	NA	15.9 U	15.9 U	NA						
Chromium	NA	1 U	1 U	NA						
Cobalt	NA	4.3 U	4.3 U	NA						
Copper	NA	3.6 J	3.7 J	NA						
Cyanide	NA	10 U	7.5 J	NA						
Iron	NA	7.73 U	7.73 U	NA						
Lead	0.02 U	0.02 U	NA	NA	NA	NA	NA	2.07 R	2.07 R	NA
Magnesium	NA	33.7 U	33.7 U	NA						
Manganese	NA	0.91 U	0.91 U	NA						
Mercury	NA	0.03 B	0.04 B	NA						
Nickel	NA	11.6 U	11.6 U	NA						
Potassium	NA	621 U	621 U	NA						
Selenium	NA	4.08 R	4.08 R	NA						
Silver	NA	5.5 B	3.93 U	NA						
Sodium	NA	42.8 J	56.4 J	NA						
Thallium	NA	4.26 U	4.26 U	NA						
Vanadium	NA	6 K	5.07 U	NA						
Zinc	NA	1.8 B	1.8 B	NA						

**Table C-6**  
**QA/QC Analytical Results**  
**SWMUs 5, 6, 13, and Site 6 Site Screening Assessment**  
**NAB Little Creek**  
**Virginia Beach, Virginia**

Station ID	LC-QC							LC-QC		
	LS06-FB071105	LS06-EB071105	LW06-FB071205	LW13-FB071205	LW13-EB071205	LW13-FB071805	LW13-EB071805	LW05-FB071805	LW05-EB071805	LW05-EB071805A
Sample ID	07/11/05	07/11/05	07/12/05	07/12/05	07/12/05	07/18/05	07/18/05	07/18/05	07/18/05	07/18/05
Sample Date										
Chemical Name										
Dissolved Metals (UG/L)										
Aluminum	NA	39 B	NA	37.4 B						
Antimony	NA	0.39 B	0.39 B	NA	NA	NA	NA	3.54 U	NA	3.54 U
Arsenic	NA	0.4 U	0.4 U	NA	NA	NA	NA	2.81 U	NA	3.5 B
Barium	NA	0.5 U	NA	0.5 U						
Beryllium	NA	0.4 U	NA	0.4 U						
Cadmium	NA	0.04 B	0.03 B	NA	NA	NA	NA	2.29 UL	NA	2.29 UL
Calcium	NA	15.9 U	NA	15.9 U						
Chromium	NA	0.63 B	0.64 B	NA	NA	NA	NA	1 U	NA	1 U
Cobalt	NA	4.3 U	NA	4.3 U						
Copper	NA	0.2 B	0.15 B	NA	NA	NA	NA	3.1 J	NA	2.52 U
Cyanide	NA	10 U	NA	10 U						
Iron	NA	7.73 U	NA	7.73 U						
Lead	0.02 U	0.02 U	0.02 U	NA	NA	NA	NA	2.07 R	NA	2.07 R
Magnesium	NA	33.7 U	NA	33.7 U						
Manganese	NA	0.91 U	NA	0.91 U						
Mercury	NA	0.03 B	NA	0.03 B						
Nickel	NA	0.33 B	0.3 B	NA	NA	NA	NA	11.6 U	NA	11.6 U
Potassium	NA	1,350 J	NA	753 J						
Selenium	NA	4.08 R	NA	4.08 R						
Silver	NA	3.93 U	NA	3.93 U						
Sodium	NA	32.1 U	NA	44.5 J						
Thallium	NA	4.26 U	NA	7.1 B						
Vanadium	NA	5.07 U	NA	5.07 U						
Zinc	NA	2.1 B	1.4 B	NA	NA	NA	NA	1.42 U	NA	1.6 B

Notes:

PEST/PCBs- Pesticide/Polychlorinated Biphenyls

U- Analyte not detected

J- Reported value is estimated

R- Unreliable result

B- Possible blank contamination

NA- Not analyzed

UL- Analyte not detected. Quantitation limit is probably higher

**Appendix D**  
**Data Validation Report**

---

CH2M HILL  
5700 Cleveland St.  
Suite 101  
Virginia Beach, Virginia 23462

August 19, 2005  
SDG# CTO48, Katahdin Laboratory  
NAB Little Creek

Dear Ms. Arroyo,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG #CTO48-1. The data validation was performed in accordance with the quality control requirements of the USEPA CLP Statements of Work OLM04.3 and ILM05; the Region III Modifications to the National Functional Guidelines for Organic Data Review, 9/94, (as referred by the Region III document Innovative Approaches to Data Validation, 6/95, for Level M3 review); and the Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Data Review, 4/93, as applicable. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

All areas of concern are discussed in the body of the report and a summary of data qualifications is provided. The samples were evaluated based on the following criteria:

- Data Completeness \*
- Technical Holding Times
- GC Performance \*
- Initial/Continuing Calibrations \*
- CRI Standards
- Interference Check Sample \*
- Blanks
- Surrogate Recoveries \*
- Laboratory Control Samples \*
- Matrix Spike Recoveries \*
- Matrix Duplicate RPDs \*
- Post Digestion Spike Recoveries \*
- Serial Dilutions
- Field Duplicates \*
- Identification/Quantitation
- Reporting Limits \*

\*- indicates that no qualifications were required based on this criteria

## SAMPLE MATRIX

Sample ID	Lab ID	Matrix	Pest	Total Metals/CN	Dissolved Metals/CN	Select Metals	TPb	DPb
LS06-FB071105	WV3394-1	water					X	X
LS06-GW100-05C	WV3394-2	water					X	X
LS06-GW100-05CMS	WV3394-2MS	water					X	X
LS06-GW100-05CMD	WV3394-2MD	water					X	X
LS06-GW100P-05C	WV3394-3	water					X	X
LS06-EB071105	WV3394-4	water				X	X	
LW06-GW101-05	WV3422-1	water				X		
LW06-GW101-05MS	WV3422-1MS	water				X		
LW06-GW101-05MD	WV3422-1MD	water				X		
LW06-GW102-05C	WV3422-2	water				X		
LW06-GW102P-05C	WV3422-3	water				X		
LW06-FB071205	WV3422-4	water				X		
LW13-SS101-00-05C	WV3422-5	soil	X					
LW13-SB101-00-05C	WV3422-6	soil	X					
LW13-SB101-00-05CMS	WV3422-6 MS	soil	X					
LW13-SB101-00-05CMSD	WV3422-6 MSD	soil	X					
LW13-SS102-00-05C	WV3422-7	soil	X					
LW13-SB102-00-05C	WV3422-8	soil	X					
LW13-SB102P-00-05C	WV3422-9	soil	X					
LW13-FB071205	WV3422-10	water	X					
LW13-EB071205	WV3422-11	water	X					
LW13-FB071805	WV3534-1	water	X					
LW13-EB071805	WV3534-2	water	X					
LS13-MW18T-05C2	WV3534-3	water	X					
LS13-MW18T-05C2MS	WV3534-3 MS	water	X					
LS13-MW18T-05C2MSD	WV3534-3 MSD	water	X					
LS13-MW18TP-05C2	WV3534-4	water	X					
LW05-MW01-05C	WV3534-5	water		X	X			
LW05-MW01-05CMS	WV3534-5MS	water		X	X			
LW05-MW01-05CMSD	WV3534-5MD	water		X	X			
LW05-EB0718-05	WV3534-6	water		X	X			
LW05-FB0718-05	WV3534-7	water		X	X			
LW05-MW01P-05C	WV3534-8	water		X	X			

The following quality control samples were provided with this sample delivery group (SDG): samples LS06-FB071105, LW06-FB0712-05, LW13-FB071205, LW13-FB071805 and LW05-FB071805 - field blanks; samples LS06-EB071105, LW13-EB071205, LW13-EB071805 and LW05-EB071805 – rinse blanks; sample LS06-GW100P-05, field duplicate of field sample LS06-GW100-05; sample LW06-GW102P-05C, field duplicate of field sample LW06-GW102-05C; sample LW13-SB102P-05C, field duplicate of field sample LW13-SB102-05C; and sample LW05-MW01P-05C, field duplicate of field sample LW05-MW01P-05C.

## **Overall Evaluation of Data/Potential Usability Issues**

Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria.

### **Major Problems**

#### **Metals**

One major issue was noted in the validation of the ICP AES analysis of the samples for metals analytes. One of the associated CRI standards for lead and one for selenium exhibited recoveries less than 50% (47.5% for Pb and 33.6% for Se). Based on Region III validation guidance, the reported non-detect results for Pb and Se in eight samples required rejection, R. All results rejected due to non-compliant CRI recoveries less than 50% should be considered unusable.

### **Minor Problems**

Issues requiring qualification of the analytical data were found in the validation of this SDG. A summary of these issues for each fraction is presented in the following paragraphs. All results qualified as estimated J/UJ or biased high, K or biased low, L/UL, should be considered usable but estimated.

#### **Pesticides**

The soil samples were extracted 2 days outside the Region III extraction holding time of 7 days. All reported positive and non-detect results were qualified as estimated, J/UJ, in the soil samples.

One sample exhibited a positive result for alpha-chlordane that was flagged P due to high (>25%) column quantitation %Ds. This result was qualified as estimated J.

## **Metals**

Several CRI standards exhibited recoveries above or below the Region III QC limit of 90% to 110%. Qualifications were added to the samples. Specific information is provided below.

Blank contamination was noted in the laboratory and field QC blanks associated with the samples in this batch. Qualifications were added to the data. Specific information is provided below.

The serial dilution analysis associated with the ICP MS analysis for select metals exhibited a %D > 10% for the analyte nickel. Qualifications were added to the data. Specific information is provided below.

## **Specific Evaluation of Data**

### **Data Completeness**

The SDG was received complete and intact. Resubmissions were not required.

### **Technical Holding Times**

According to chain of custody records, sampling was performed on 7/11/05, 7/12/05 and 7/18/05 and samples were received at the laboratory 7/12/05, 7/13/05 and 7/19/05. All sample preparation and analysis was performed within Region III holding time requirements with one exception noted below.

### **Pesticides**

The soil samples were extracted 2 days outside the Region III extraction holding time of 7 days from sampling. All reported positive and non-detect results were qualified estimated, J/UJ in samples LW13-SS101-00-05C and LW13-SB101-00-05C, with a qualifier code of HT. All results qualified as estimated due to holding time non-compliance should be considered usable but estimated.

### **CRI Standards**

#### **Metals**

Several CRI standards exhibited non-compliant recoveries above or below the Region III QC limit of 90% - 110%. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Analyte	%R	Samples	Q Flag	Qual code
CRI FVG16A, 7/17/05, 0201	antimony	114.5%	all select metals by ICP MS	K+ up to 2X CRDL	OT
CRI BVG22A, 7/22/05, 1410, 1632, 1743	cadmium	74.6%, 62.4%	all metals by ICP AES	UL-	OT
	nickel	113.9%	LW05-MW01P-05C diss.	K+ up to 2X CRDL	OT
	vanadium	111.6%, 112.7%	LW05-FB071805 total		OT
	zinc	110.6%	all metals by ICP AES		OT
CRI AVG26A, 7/26/05, 2018, 2307	selenium	33.6%	all metals by ICP AES	R-	OT
	thallium	156.3%	LW05-MW01-05C, LW05- MW01O-05C, LW05-EB071805	K+ up to 2X CRDL	OT
CRI AVG28A, 7/28/05, 2042	lead	47.5%	all metals by ICP AES	R-	OT

## Blanks

### Metals/CN

Associated blanks exhibited contamination as noted in the following table. Sample results are qualified as indicated.

### **Blank Contamination and Qualification Summaries**

Blank ID	Analyte	Concentration	Action Level	Q Flag
CCB FVG16A, 7/16/05, 2302	antimony	0.08 ug/L	0.40 ug/L	B
CCB BVG22A, 7/22/05, 1656	aluminum	32.63 ug/L	163.2 ug/L	B
	silver	4.1 ug/L	20.5 ug/L	B
CCB AVG26A, 7/26/05, 2335	chromium	1.2 ug/L	6 ug/L	B
CCB AVG28A, 7/28/05, 1821	arsenic	4.7 ug/L	23.5 ug/L	B
CCB HVG28C, 7/28/05, 1618	mercury	0.02 ug/L	0.10 ug/L	B
Prep Blank – ICP MS	antimony	0.484 ug/L	2.42 ug/L	B
	cadmium	0.016 ug/L	0.08 ug/L	B
	chromium	0.67 ug/L	3.33 ug/L	B
	copper	0.049 ug/L	0.245 ug/L	B
	nickel	0.290 ug/L	1.45 ug/L	B
	zinc	1.376 ug/L	6.88 ug/L	B
Prep Blank – ICP AES	thallium	5.92 ug/L	29.6 ug/L	B
	zinc	1.59 ug/L	7.95 ug/L	B
Prep Blank – Hg	mercury	0.020 ug/L	0.10 ug/L	B
LW06-FB071205 – ICP MS	antimony	0.39 ug/L	1.95 ug/L	B
	cadmium	0.03 ug/L	0.15 ug/L	B
	chromium	0.64 ug/L	3.2 ug/L	B
	copper	0.15 ug/L	0.75 ug/L	B
	zinc	1.4 ug/L	7 ug/L	B
LW05-EB071805 (total)	mercury	0.04 ug/L	0.2 ug/L	B
LW05-EB071805 (dissolved)	arsenic	3.5 ug/L	17.5 ug/L	B
LW05-FB071805 (dissolved)	aluminum	39 ug/L	195 ug/L	B
	mercury	0.03 ug/L	0.15 ug/L	B

Associated samples and required qualifications are noted in the following table.

Sample ID	analyte	Q Flag	Qualifier Code
All samples select metals by ICPMS	antimony	B	BL
LW05-EB071805 TOT, LW05-FB071805 TOT, LW05-MW01-05C DISS, LW05-EB071805A DISS, LW05-FB071805 DISS, LW05-MW01P-05C DISS	aluminum	B	BL
LW05-EB071805 TOT, LW05-FB071805 TOT, LW05-EB071805A DISS	zinc	B	BL
LW05-MW01-05C DISS, LW05-FB071805 TOT, LW05-MW01P-05C DISS	silver	B	BL
All samples metals by ICPAES	chromium	B	BL
	arsenic		
All samples by CVAA for Hg	mercury	B	BL
LS06-EB071105, LW06-GW101-05C, LW06-FB071205	copper	B	BL
LS06-EB071105, LW06-FB071205	nickel	B	BL
LS06-EB071105, LW06-GW01-05C, LW06-FB071205	zinc	B	BL
LW05-MW01-05C TOT, LW05-MW01P-05C TOT, LW05-EB071805A DISS	thallium	B	BL
LW05-MW01P-05C TOT	cyanide	B	BL
All samples select metals by ICPMS	cadmium	B	BL
	chromium		
	copper		

## Serial Dilution

### Metals

The serial dilution analysis associated with the select metals samples analyzed by ICP MS exhibited a non-compliant %D >10% (11.5%) for the analyte nickel. A summary of this non-compliance and affected samples are noted in the following table. Sample results are qualified as indicated.

SD	Analytes	Samples	%D	Q Flag	Qual Code
LW06-GW101-05C	nickel	all select metals by ICP MS	11.5%	J/UJ	SD

## Compound Identification/Quantitation

### Pesticides

One sample, LW13-SS102-00-05C, exhibited a positive result for alpha-chlordane with a column quantitation %D greater than 25%. This P flagged result was qualified as estimated, J, with a qualifier code of 2C.

All results that were reported at concentrations between the MDL and the CRQL are qualified as estimated, J, with a qualifier code of BRL.

Metals/CN

All results that were reported at concentrations between the IDL and the CRDL are qualified as estimated, J, with a qualifier code of BRL

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland  
Vice-President

## Summary of Data Qualifications

### PEST

Sample ID	Compound	Results	Q-Flag	Qualifier code
LW13-SS101-00-05C and LW13-SB101-00-05C	all compounds	+/-	J/UJ	HT
LW13-SS102-00-05C	alpha-chlordane	+P	J	2C
all samples	all J flagged compounds	+J	J	BRL

### Metals/CN

Sample ID	Analyte/Compound	Results	Q Flag	Qual code
all select metals by ICP MS	antimony	+	K+ up to 2X CRDL	OT
all metals by ICP AES	cadmium	-	UL	OT
LW05-MW01P-05C diss.	nickel	+	K+ up to 2X CRDL	OT
LW05-FB071805 total	vanadium			
all metals by ICP AES	zinc			
all metals by ICP AES	selenium	-	R	OT
LW05-MW01-05C, LW05-MW01O-05C, LW05-EB071805	thallium	+	K+ up to 2X CRDL	OT
all metals by ICP AES	lead	-	R	OT
All samples select metals by ICPMS	antimony	+	B	BL
LW05-EB071805 TOT, LW05-FB071805 TOT, LW05-MW01-05C DISS, LW05-EB071805A DISS, LW05-FB071805 DISS, LW05-MW01P-05C DISS	aluminum	+	B	BL
LW05-EB071805 TOT, LW05-FB071805 TOT, LW05-EB071805A DISS	zinc	+	B	BL
LW05-MW01-05C DISS, LW05-FB071805 TOT, LW05-MW01P-05C DISS	silver	+	B	BL
All samples metals by ICPAES	chromium	+	B	BL
	arsenic			
All samples by CVAA for Hg	mercury	+	B	BL
LS06-EB071105, LW06-GW101-05C, LW06-FB071205	copper	+	B	BL
LS06-EB071105, LW06-FB071205	nickel	+	B	BL
LS06-EB071105, LW06-GW01-05C, LW06-FB071205	zinc	+	B	BL
LW05-MW01-05C TOT, LW05-MW01P-05C TOT, LW05-EB071805A DISS	thallium	+	B	BL
LW05-MW01P-05C TOT	cyanide	+	B	BL
All samples select metals by ICPMS	cadmium	+	B	BL
	chromium			
	copper			
All select metals by ICP MS	nickel	+	J/UJ	SD
All Samples	all analytes	+B	J	BRL

## Glossary of Qualification Flags and Abbreviations

### Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high
Q	estimated dioxin/furan concentration
I	interferences present which may cause the results to be biased high

### Method Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
B	The sample result for the blank contaminant is less than or greater than the sample RL and is less than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is qualified as B at the compound value reported.

### General Abbreviations

IDL	Instrument Detection Limit
MDL	Method Detection Limit
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
+	positive result
-	non-detect result

## QUALIFIER CODE REFERENCE

<b>Qualifier</b>	<b>Description</b>
TN	Tune
BSL	Blank Spike/LCS - Low Recovery
BSH	Blank Spike/LCS - High Recovery
BD	Blank Spike/Blank Spike Duplicate (LCS/LCSD) Precision
BRL	Below Reporting Limit
EMPC	Estimated Possible Maximum Concentration
ISL	Internal Standard - Low Recovery
ISH	Internal Standard - High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate - Low Recovery
MSH	Matrix Spike and/or Matrix Spike Duplicate - High Recovery
MI	Matrix interference obscuring the raw data
MDP	Matrix Spike/Matrix Spike Duplicate Precision
2S	Second Source - Bad reproducibility between tandem detectors
SSL	Spiked Surrogate - Low Recovery
SSH	Spiked Surrogate - High Recovery
SD	Serial Dilution Reproducibility
ICL	Initial Calibration - Low Relative Response Factors (RRF)
ICH	Initial Calibration - High Relative Response Factors (RRF)
ICB	Initial Calibration - Bad Linearity or Curve Function
CCL	Continuing Calibration - Low Recovery or %Difference
CCH	Continuing Calibration - High Recovery or %Difference
LD	Lab Duplicate Reproducibility
HT	Holding Time
PD	Pesticide Degradation
2C	Second Column - Poor Dual Column Reproducibility
LR	Concentration Exceeds Linear Range
BL	Blank Contamination- MBL, EBL, FBL, TBL
RE	Redundant Result - due to Re-analysis or Re-extraction
DL	Redundant Result - due to Dilution
FD	Field Duplicate
OT	Other - explained in data validation report