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Final

Site Investigation Report
Site 18
Former NM Hazardous Waste
Storage Area
Naval Station Norfolk
Norfolk, Virginia



Prepared for

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

Contract No. N62470-95-D-6007
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Prepared by

CH2MHILL

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Contract Task Order 0131

LANTDIV Clean II Program

Contract No. N62470-95-D-6007

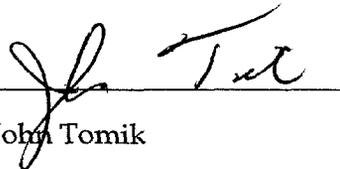
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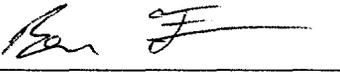
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1 Introduction

This Site Investigation (SI) Report presents the results of a field investigation completed during February, 2002 as well as previous data collected for Site 18 at Naval Station Norfolk (NSN), Norfolk, Virginia. The 2002 field investigation is described in the Site 18 Additional Investigation Work Plan (CH2M HILL, September 2001) submitted to Naval Facilities Engineering Command (NAVFACENGCOM) LANTDIV as part of Navy Contract N62470-95-D-6007, Navy Comprehensive Long-Term Environmental Action Navy (CLEAN), District III, Contract Task Order - 0131. The general background and physical setting of NSN is described in Sections 3 and 4 of the Master Project Plan (CH2M HILL, October 1997).

The location of Site 18 relative to the base is presented in Figure 1-1. The site background and a summary of previous investigations are presented in Section 1 of this report. Section 2 documents field investigation activities including sampling methodology and sample locations. A summary of the field investigation results including a subsurface characterization, description of site hydrogeology, a comparison to screening levels, and data validation results are provided in Section 3. Section 4 provides conclusions and recommendations.

1.1 Site Background

In 1981, the Department of the Navy initiated the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The NACIP Program utilized a three-phase approach to a site study and cleanup. The program encompassed an Initial Assessment Study (IAS) to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations (Environmental Science and Engineering, February 1983). Site 18 was one area of concern identified during this study.

Site 18, the Naval Magazine (NM) storage area, was used 1975–1979 to store drums of hazardous waste, consisting of waste oil, metal plating solutions and sludges, chlorinated organic acids (including trichloroethene and 1,1,1 trichloroethane), and paint stripping solutions. The storage area was an open, unpaved yard east of the metal storage buildings in the NM area. Spillage of waste oil and hazardous wastes occurred in this area. As a result of a July 1979 spill, a pit was excavated and an existing drainage ditch was widened and lengthened to channel the waste oil and contaminated runoff into the unlined pit. Oil and contaminated water were periodically pumped from the pit and transported to a wastewater treatment plant. Soil in the area of the spill was sampled and found to be contaminated primarily with chromium and cadmium. Based upon USEPA EP toxicity testing, the contaminated soil was classified as non-hazardous. A landfill permit was obtained in October 1980 for the one-time disposal of the contaminated soil. Subsequent to disposal, the site was regraded and seeded to establish a vegetative cover.

1.2 Regulatory History

The permit required continuous monitoring of the shallow groundwater and surface water to determine if contaminant transport was occurring (Environmental Science and Engineering, Inc., February 1983). The monitoring program was conducted over a period of 55 months. In October 1985, the State Water Control Board agreed to discontinue the monitoring on the basis that no significant contamination was observed.

In 1995, a RCRA inspection was conducted and concluded that no signs of adverse impacts or threats to human health or the environment were observed; therefore, the site was no longer subject to RCRA inspections. In addition, two surface soil samples were collected during the 1995 Phase I RRR Study (Baker Environmental, Inc., January 1996). On the basis of the Phase I RRR Study, Site 18 was determined as a NFA site.

In the fall of 2000, the NSN Partnering Team decided to re-evaluate Site 18 because the previous NFA determination was based upon a comparison to the industrial soil RBCs. The site was reassessed in comparison with the residential soil RBCs and the Team recommended additional investigation during the summer of 2001.

1.3 Summary of Previous Investigations

1.3.1 Landfill Monitoring

Monthly monitoring of the standing water from the pit and the nearby creek was conducted from February 1980 to April 1982. The analysis of the pit surface water and the creek samples indicated low levels of cadmium, chromium, cyanide, and phenol contamination (Environmental Science and Engineering, Inc., February 1983).

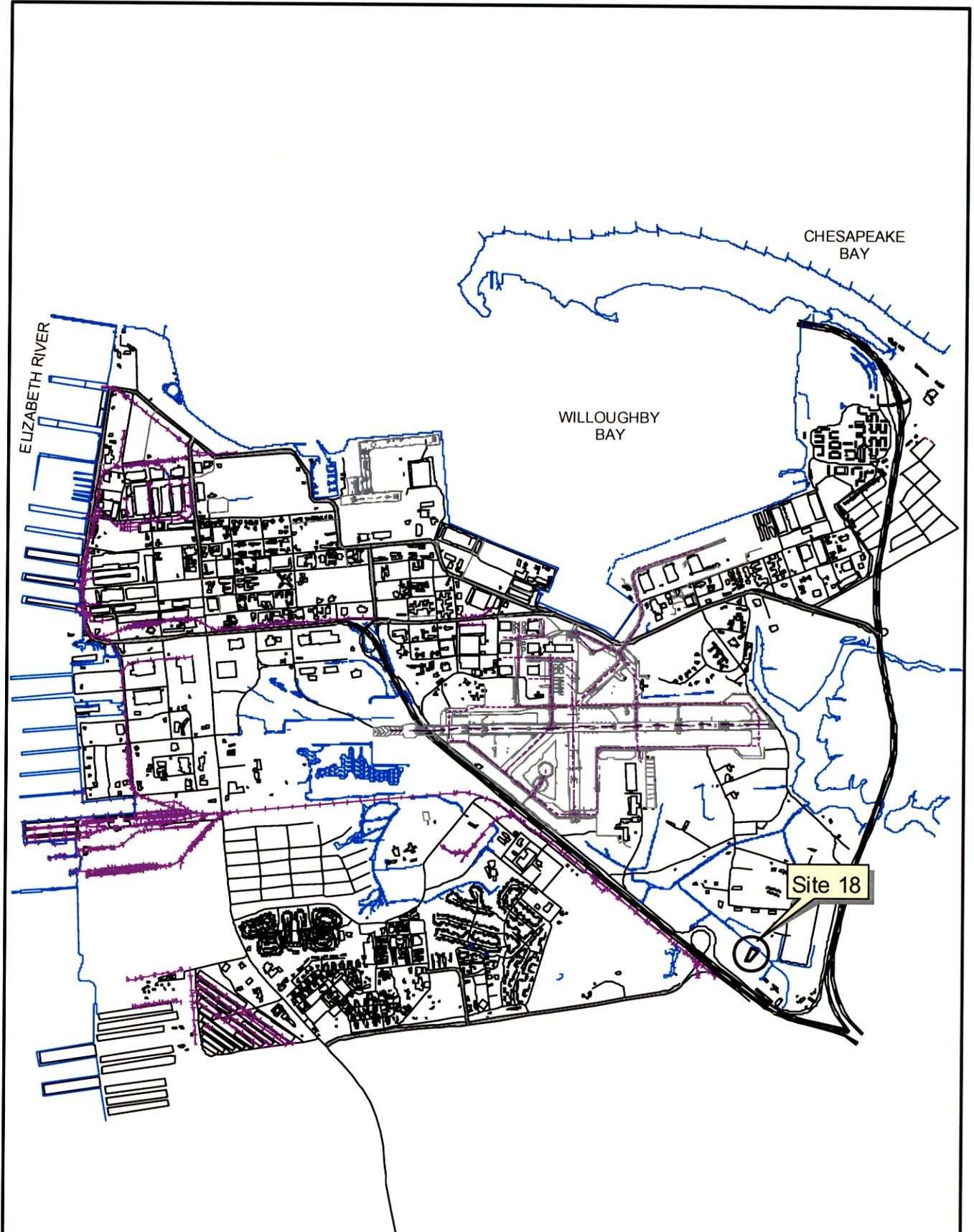
1.3.2 1996 Phase I RRR Study

During the 1996 Phase I Relative Risk Ranking (RRR) Study, two surface soil samples were collected and analyzed for Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs), Metals and Cyanide, and Pesticides/Polychlorinated Biphenyls (PCBs) (Baker Environmental, Inc., January 1996). The soil analytical results show that the concentrations of arsenic and benzo(a)pyrene were in exceedance of the USEPA Residential Soil Risk-Based Concentrations (RBCs). However, the benzo(a)pyrene detect did not exceed the background levels established in the Soil Background Report (CH2M HILL, September 2000). Arsenic was detected in one location at a level that exceeded the background levels. The sampling locations and comparison criteria exceedances are shown on Figure 1-2.

1.3.3 2001 Supplemental Investigation

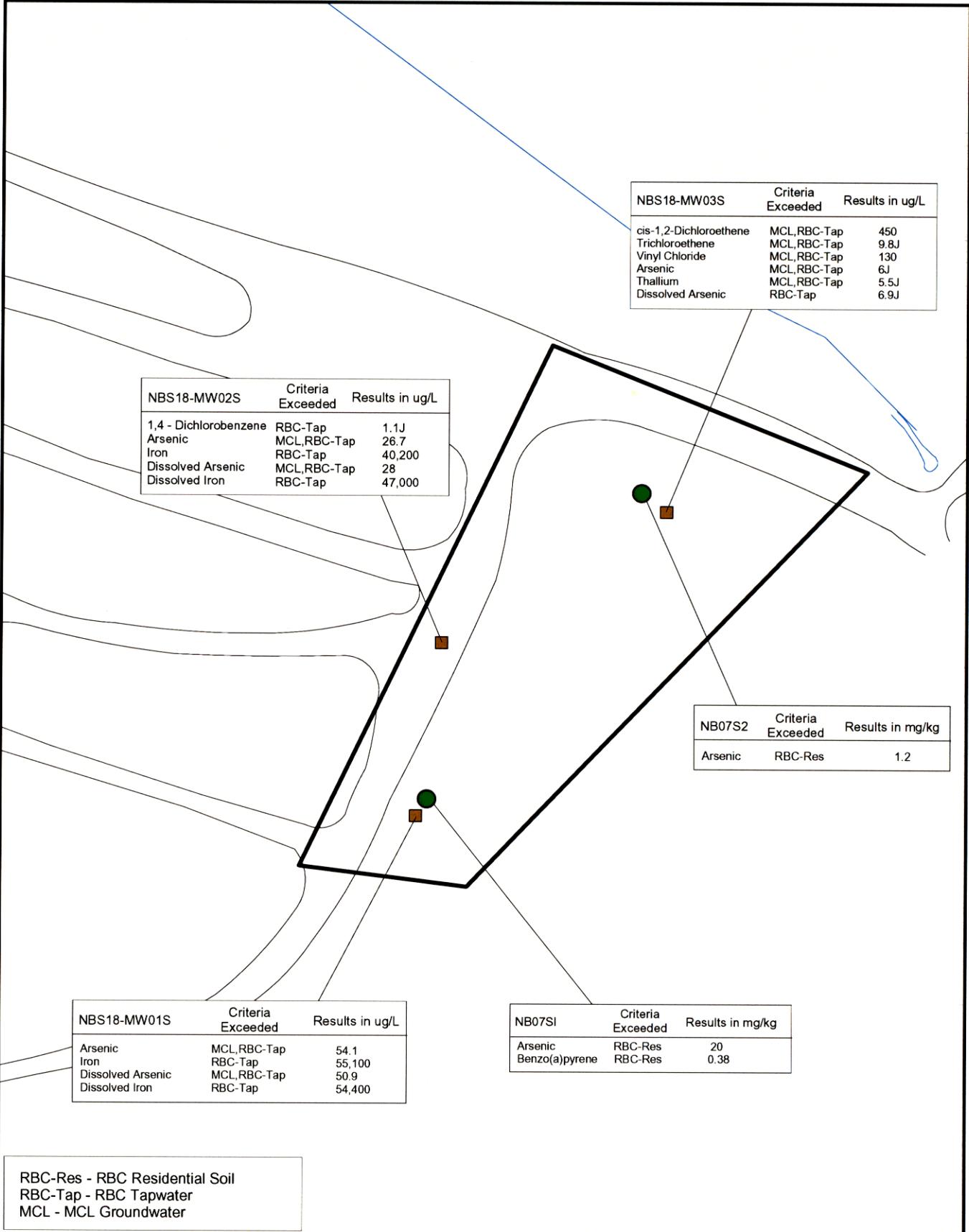
CH2M HILL conducted a Supplemental Investigation at Site 18 in 2001, as documented in the Site Investigation Report for Sites 10, 16, and 18 (CH2M HILL, September 2001). The purpose of this investigation was to evaluate potential impacts of the site on groundwater. Three monitoring wells were installed within the estimated boundary of the site and sampled for VOCs, SVOCs, Total Metals and Cyanide, Dissolved Metals, and Pesticides/PCBs. The results were compared to the USEPA Tapwater RBCs and EPA Region III drinking water Maximum Contaminant Levels (MCLs). The sampling locations and

exceedances are shown on Figure 1-2. The groundwater analytical results from Site 18 showed that there were exceedances of the following volatile organic compounds: cis-1,2-dichloroethene, trichloroethene, vinyl chloride, and 1,4-dichlorobenzene. In addition, there were metals exceedances of arsenic, iron, and thallium.



0 2000 4000 Feet

Figure 1-1
Location Map
Site 18
Naval Station Norfolk



NBS18-MW03S	Criteria Exceeded	Results in ug/L
cis-1,2-Dichloroethene	MCL,RBC-Tap	450
Trichloroethene	MCL,RBC-Tap	9.8J
Vinyl Chloride	MCL,RBC-Tap	130
Arsenic	MCL,RBC-Tap	6J
Thallium	MCL,RBC-Tap	5.5J
Dissolved Arsenic	RBC-Tap	6.9J

NBS18-MW02S	Criteria Exceeded	Results in ug/L
1,4 - Dichlorobenzene	RBC-Tap	1.1J
Arsenic	MCL,RBC-Tap	26.7
Iron	RBC-Tap	40,200
Dissolved Arsenic	MCL,RBC-Tap	28
Dissolved Iron	RBC-Tap	47,000

NB07S2	Criteria Exceeded	Results in mg/kg
Arsenic	RBC-Res	1.2

NBS18-MW01S	Criteria Exceeded	Results in ug/L
Arsenic	MCL,RBC-Tap	54.1
Iron	RBC-Tap	55,100
Dissolved Arsenic	MCL,RBC-Tap	50.9
Dissolved Iron	RBC-Tap	54,400

NB07S1	Criteria Exceeded	Results in mg/kg
Arsenic	RBC-Res	20
Benzo(a)pyrene	RBC-Res	0.38

RBC-Res - RBC Residential Soil
 RBC-Tap - RBC Tapwater
 MCL - MCL Groundwater

LEGEND
 ● 1996 Baker RRR Study, Surface Soil Sample Location
 ■ 2001 CH2MHILL Supplemental Investigation, Groundwater Sample Location



0 50 100 Feet

Figure 1-2
 Site 18 - Former NM Hazardous Waste Storage Area
 Previous Sampling Locations and Exceedances
 Naval Station Norfolk
 Norfolk, Virginia

2 Field Investigation Activities

This section summarizes the field investigation activities including sample locations and sampling methods used to complete the February 2002 investigation for Site 18 as described in the Work Plan (CH2M HILL, September 2001). Refer to the Work Plan for a complete description of specific sampling techniques/protocols and analytical methods.

2.1 Sampling Methodology

The goal of the sampling efforts described in the Work Plan was to further characterize the nature and extent of the groundwater contamination detected in the previous investigations at Site 18.

CH2M HILL coordinated subsurface utility clearances with the Miss Utility group and the Public Works Center (PWC) at NSN prior to the start of subsurface investigation activities at the site. CH2M HILL also procured subcontractors at NSN for the following tasks: (1) hollow stem auger drilling, (2) analytical laboratory work, (3) data validation services, and (4) investigation derived waste (IDW) disposal.

Investigation derived waste (IDW) including purge water, development water, soil cuttings, and equipment decontamination water generated during the drilling and sampling activities was containerized in 55-gallon drums. The 55-gallon drums were properly labeled and stored at a location designated by NSN and subsequently disposed of following state and federal waste disposal guidelines.

Each sampling location was horizontally located using a global positioning system (GPS) following field activities. In addition, the well casing elevations were surveyed at each of the monitoring wells. All survey data were incorporated into the NSN GIS Data Management system.

2.2 Sample Locations

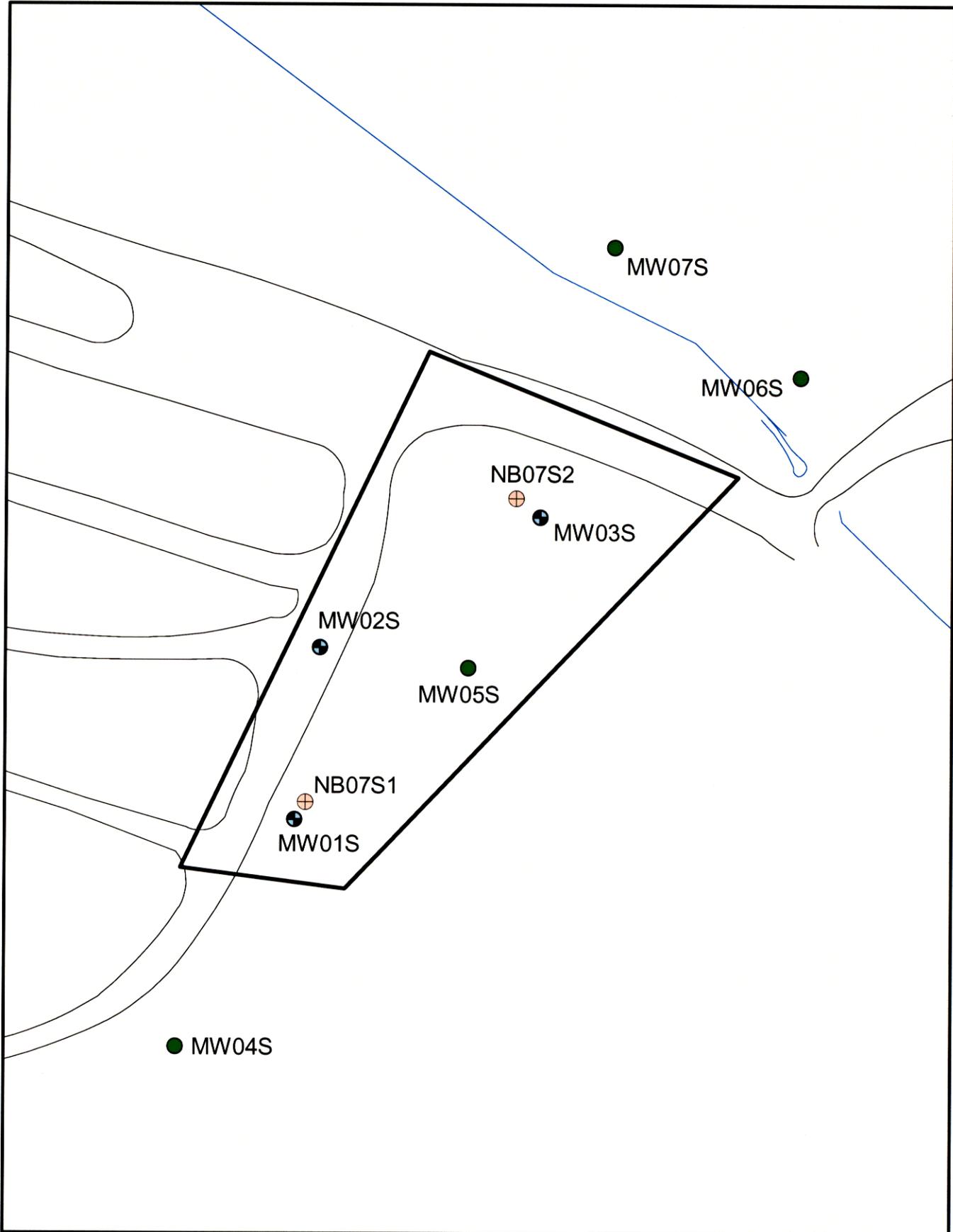
The 2002 investigation at Site 18 involved the installation of four monitoring wells and subsequent collection of groundwater samples. One well (MW04S) was installed upgradient and two wells (MW06S and MW07S) were installed downgradient of the site. An additional well was installed in the interior of the site (MW05S) to further evaluate the upgradient extent of the VOCs previously detected in well MW03S. The monitoring well locations (Figure 2-1) were selected based on a review of the existing analytical data.

The monitoring wells were installed at depths ranging from 12.5 to 15 feet below ground surface (bgs) based upon the depth to first encountered water. The wells were constructed of 2-inch diameter polyvinyl chloride (PVC) well casings with 10-foot well screens, and installed using a hollow stem auger (HSA) drill rig with 4¼-inch-inner-diameter auger stems. The well completion details are provided in Appendix A and the borelogs are

provided in Appendix B. The applicable Standard Operating Procedures (SOPs) for well installation and

collection of groundwater samples are provided in Volume 2 of the Master Project Plan (CH2M HILL, October 1997).

Following well installation and development, groundwater samples were collected from the seven monitoring wells (four new and three pre-existing) and analyzed for TCL VOCs and TAL Metals (total and dissolved).



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- New Monitoring Wells
- ⊕ Pre-existing Monitoring Wells
- ⊕ 1996 Baker RRR Study, Surface Soil Sample
- Roads
- Water Features
- ▭ Site Boundary

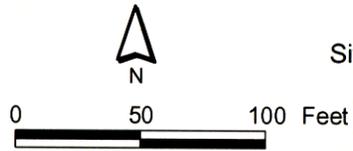


Figure 2-1
Site 18 - Sampling Locations
Naval Station Norfolk
Norfolk, Virginia

3 Summary of Investigation Results

This section summarizes the results of the additional field investigation completed at Site 18 as described in the Work Plan (CH2M HILL, September 2001). Additionally, the summary includes the subsurface characterization, followed by a description of the site hydrogeology, and a comparison of the analytical groundwater data to the screening levels.

3.1 Subsurface Characterization

This section describes the soil conditions encountered at Site 18. The borelogs are provided in Appendix B.

The subsurface soil at Site 18 is generally characterized by fine to medium grained sands with minor amounts of silt. A fill layer consisting of sand with some debris (wood, glass, and coal fragments) was observed at the surface in the central and western portions of the site during the installation of wells MW01S, MW02S, and MW03S. This fill layer ranges from 1 to 3 feet in thickness and is underlain by what appears to be native soil. No significant amounts of fill material were observed at the eastern edge of the site proximal to well MW05S or in the upgradient and downgradient monitoring well locations (MW04S, MW06S, MW07S).

3.2 Hydrogeology

Groundwater at the site occurs at a depth of 5.66 to 2.88 feet bgs. As shown in Figure 3-1, the groundwater flow across the site trends in a northeasterly direction towards the creek located at the northern boundary of the site. In addition, the wells installed downgradient of the site (on the northeast side of the creek) show that groundwater flow in this area is also to the northeast, away from the creek.

3.3 Comparison to Screening Levels

3.3.1 Comparison of the Data to Human Health Risk Criteria

To provide a qualitative assessment of the human health risks, the constituents detected in the groundwater samples from the additional field investigation were compared to MCLs, and USEPA RBCs for tap water. Constituents detected in the 1996 surface soil samples are compared to the USEPA Residential Soil RBCs.

Groundwater

As discussed in Section 2, four monitoring wells were installed; one upgradient of the site (MW04S), two downgradient (MW06S and MW07S), and one upgradient of the area of highest concentrations of VOCs (MW05S). Following installation and development, the new and pre-existing monitoring wells were sampled for VOCs, Total Metals, and Dissolved Metals. The groundwater analytical results are provided in Appendix C, Table C-1. In

addition, the QA/QC results for groundwater analyses are provided in Appendix C, Table C-2.

The groundwater exceedances for the 2002 (Round 02) data are listed in Table 3-1 and presented on Figure 3-2. The 2002 analytical results are summarized below:

- The groundwater analytical results for VOCs indicate that there were MCL and RBC exceedances of cis-1,2-dichloroethene and vinyl chloride as well as a RBC exceedance of trichloroethene at well MW03S. However, no other VOC exceedances were observed in this round of data. In addition, these constituents were not detected in the down-gradient wells, indicating that the extent of the VOCs is limited to the close proximity of MW03S.
- The metals analytical results showed that exceedances of the MCLs and RBCs for the total and dissolved concentrations of arsenic and thallium were observed in the monitoring wells (MW01S, MW02S, MW03S) located within the site interior. The data from interior well MW05S only showed a MCL and RBC exceedance for dissolved thallium, with no detection of total thallium. In addition, interior wells MW01S and MW02S showed iron concentrations (total and dissolved) in exceedance of the RBCs.
- Downgradient well MW06S demonstrated a MCL exceedance for total antimony as well as MCL and RBC exceedances for thallium (total and dissolved). However, there were no exceedances observed in downgradient well MW07S.
- The metals analytical results for the upgradient monitoring well (MW04S) demonstrated MCL and RBC exceedances of dissolved arsenic, antimony, and thallium. The presence of these constituents in the upgradient well indicates that they are not likely to be site related and may be attributable to background conditions.

Surface Soil

The soil screening values and analytical results for the two surface soil samples collected in 1996 are provided in Table 3-2 and shown in Figure 1-2. The soil analytical results show the concentrations of arsenic and benzo(a)pyrene were in exceedance of the RBCs. However, only the arsenic concentration at one location exceeded the soil background levels established for the facility (CH2M HILL, September 2000).

3.3.2 Comparison of the Data to Ecological Risk Criteria

As a further evaluation of the site, the surface soil and both rounds of groundwater data were screened to qualitatively evaluate potential risks to ecological receptors. The ecological screening values used were based on USEPA Region III Biological Technical Assistance Group (BTAG) screening values (USEPA, August 1995) and additional screening values available in the literature.

Groundwater

As shown in Table 3-3, the undiluted groundwater concentrations were compared with surface water screening values. No detected organic chemical exceeded the screening values (two detected organics lacked screening values). However, the concentrations of aluminum, cadmium, iron, lead, manganese, and selenium exceeded screening values in at least one

total or dissolved sample. In addition, the maximum dissolved concentrations of aluminum, lead, and selenium were found in the upgradient well. The one exceedance for cadmium (total sample) was of low magnitude (HQ of 1.17) and cadmium did not exceed the screening criteria in dissolved samples. Iron and manganese exceeded screening values in wells MW01S (both rounds), MW02S (both rounds), and MW03S (round 1 only) for both dissolved and total samples. Manganese also exceeded screening values for both dissolved and total samples in the upgradient well, although the magnitude of these exceedances were lower than for on-site wells.

Surface Soil

The soil screening values and analytical results for the two surface soil samples collected in 1996 are provided in Table 3-4. The metals soil screening values were exceeded for aluminum, chromium, iron, mercury, and vanadium. However, of these metals, only mercury exceeded the background levels established for the facility (CH2M HILL, September 2000).

The results of the organic chemical screening showed that the following PAHs exceeded their individual screening values: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. However, of these compounds, only benzo(b)fluoranthene exceeded the background levels (CH2M HILL, September 2000). In addition, while a number of individual PAHs exceeded in sample NB07S1, the total PAH concentration did not exceed the screening value.

3.3.3 Comparison of the 2001 and 2002 Groundwater Data

This section provides a comparison of the 2001 (Round 01) and 2002 (Round 02) data collected from monitoring wells MW01S, MW02S, and MW03S. The groundwater exceedances for both rounds of data are listed in Table 3-1 and presented on Figure 3-2.

The analytical data indicate that the concentrations of organic compounds in the groundwater were significantly lower in the 2002 data. Specifically, the concentrations of trichloroethene, vinyl chloride, and cis-1,2-dichloroethene at MW03S decreased. Further, the concentration of trichloroethene dropped below the MCL in 2002. In addition, the 1,4-dichlorobenzene level at MW02S exceeded the RBCs in the 2001 data but was not detected in 2002.

The metals analytical data shows the concentrations of arsenic were lower (with the exception of total arsenic at MW03S) in the 2002 data. In addition, the iron and manganese levels remained consistent between the rounds. However, the thallium concentrations tended to increase at wells MW01S and MW02S.

Table 3-1
Groundwater Exceedances of the MCLs, and RBCs
Site 18
Naval Station Norfolk

Station ID	RBC-Tap (1)	MCL-Groundwater (2)	NBS18-MW01S		NBS18-MW02S				NBS18-MW03S		NBS18-MW04S	NBS18-MW05S	NBS18-MW06S	NBS18-MW07S
			NBS18-MW01S-R01	NBS18-MW01S-R02	NBS18-MW02S-P-R01	NBS18-MW02S-R01	NBS18-MW02S-P-R02	NBS18-MW02S-R02	NBS18-MW03S-R01	NBS18-MW03S-R02	NBS18-MW04S-R02	NBS18-MW05S-R02	NBS18-MW06S-R02	NBS18-MW07S-R02
Sample ID			06/08/01	02/26/02	06/08/01	06/08/01	02/26/02	02/26/02	06/08/01	02/26/02	02/26/02	02/26/02	02/27/02	02/27/02
Sample Date														
Chemical Name														
Volatile Organic Compounds (UG/L)														
1,4-Dichlorobenzene	0.47	75	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Trichloroethene	0.026	5	10 U	10 U	10 U	10 U	10 U	10 U	9.8 U	4.9 U	10 U	10 U	10 U	10 U
Vinyl chloride	0.015	2	10 U	10 U	10 U	10 U	10 U	10 U	30	60	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	61	70	10 U	10 U	10 U	10 U	10 U	10 U	450	340	10 U	10 U	10 U	10 U
Total Metals (UG/L)														
Antimony	15	6	2.9 U	4.3 U	2.9 U	2.9 U	4.3 U	4.3 U	2.9 U	4.8 J	4.3 U	4.3 U	4.3 U	4.3 U
Arsenic	0.045	10	2.5 U	3.6 U	2.5 U	2.5 U	3.6 U	3.6 U	2.5 U	2.0 U	2.5 B	1.8 U	1.8 U	2.5 B
Iron	11,000	-	5,500	7,900	5,500	5,500	7,900	7,900	3,750	2,650	574	271 B	141 B	141 B
Thallium	2.6	2	5.5 U	7.9 U	5.5 U	5.5 U	7.9 U	7.9 U	5.5 U	7.9 U				
Dissolved Metals (UG/L)														
Antimony	15	6	2.9 U	4.3 U	3.4 J	2.9 J	4.3 U	4.3 U	2.9 U	4.3 U				
Arsenic	0.045	10	2.5 U	3.6 U	2.5 U	2.5 U	3.6 U	3.6 U	2.5 U	2.1 B	1.8 U	1.8 U	1.8 U	1.8 U
Iron	11,000	-	5,500	7,900	5,500	5,500	7,900	7,900	3,600	357	447	24.5 U	27.6 B	113 B
Thallium	2.6	2	5.5 U	7.9 U	5.5 U	5.5 U	7.9 U	7.9 U	5.5 U	7.9 U				

Notes:

Exceeds one or more criteria.

U - Not Detected. The associated number indicates approximate sample concentration necessary to be detected.

B - Not detected substantially above the level reported in laboratory or field blanks - Possible blank contamination.

J - Analyte Present. Reported value may not be accurate or precise.

L - Analyte Present. Reported value may be biased high. Actual value is expected to be lower.

R - Unreliable result.

NA - Not Analyzed.

Each screening criterion has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.

Table 3-2
Surface Soil Exceedances of Residential Soil RBCs
Site 18
Naval Station Norfolk

Chemical	Soil Residential RBC	Background	NB07S1	NB07S2
Volatiles (ug/kg)				
Acetone	7.8 x 10 ⁶	NA	11 U	74
2-Butanone	NA	NA	11 U	16
Semivolatiles (ug/kg)				
Anthracene	2.3 x 10 ⁷	491	52 J	350 U
Benzo(a)anthracene	870	490	320 J	350 U
Benzo(a)pyrene	87	490	380	350 U
Benzo(b)fluoranthene	870	NA	530	350 U
Benzo(g,h,i)perylene	NA	NA	110 J	350 U
Benzo(k)fluoranthene	8.7 x 10 ³	NA	280 J	350 U
Chrysene	8.7 x 10 ⁴	621	390	350 U
Fluoranthene	3.1 x 10 ⁶	950	640	350 U
Indeno(1,2,3-cd)pyrene	870	401	130 J	350 U
Phenanthrene	NA	660	200 J	350 U
Pyrene	NA	830	400	350 U
Pesticide/PCBs (ug/kg)				
4,4'-DDE	NA	4	67	3.5 U
4,4'-DDT	NA	4	47	3.9
Metals (mg/kg)				
Aluminum	7.8 x 10 ⁴	14,213	2520	2480
Arsenic	0.43	17.1	20.2	1.2
Cadmium	NA	0.2	0.75	0.53 U
Calcium	NA	25,771	37400	530
Chromium	230	23	6.7	2.8
Copper	NA	53	8.6	2.7 U
Iron	4.7 x 10 ⁴	24,680	5400	1980
Lead	NA	125	40.4	6.1
Magnesium	NA	7,970	567	530 U
Manganese	1.6 x 10 ³	157	66.9	15.2
Mercury	NA	0.1	0.56	0.16
Nickel	1.6 x 10 ³	19	5.2	4.2 U
Vanadium	550	68	8.9	5.3 U
Zinc	2.3 x 10 ⁴	97	39.5	7.2

Notes:

Exceeds Screening Criteria

U - Not Detected. The associated number indicates approximate sample concentration necessary to be detected.

J - Analyte Present. Reported value may not be accurate or precise.

NA - Not applicable.

Table 3-3
Groundwater Exceedances of Ecological Screening Criteria
Site 18

Naval Station Norfolk

Station ID Sample ID Sample Date	Screening Value	NBS18-MW01S		NBS18-MW02S				NBS18-MW03S		NBS18-MW04S	NBS18-MW05S	NBS18-MW06S	NBS18-MW07S
		NBS18-MW01S-R01 06/08/01	NBS18-MW01S-R02 02/26/02	NBS18-MW02S-P-R01 06/08/01	NBS18-MW02S-R01 06/08/01	NBS18-MW02S-P-R02 02/26/02	NBS18-MW02S-R02 02/26/02	NBS18-MW03S-R01 06/08/01	NBS18-MW03S-R02 02/26/02	NBS18-MW04S-R02 02/26/02	NBS18-MW05S-R02 02/26/02	NBS18-MW06S-R02 02/27/02	NBS18-MW07S-R02 02/27/02
Inorganics (UG/L)													
Aluminum	87.0	66.9 U	268 B	113 B	112 B	114 B	139 B	132 B	1240	1130	348 B	2100	163 B
Antimony	30.0	2.90 U	4.30 U	2.90 U	2.90 U	4.30 U	4.30 U	2.90 U	4.80 J	4.30 U	4.30 U	8.10 J	4.30 U
Arsenic	150	54.1	36.4	26.7	24.8	16.4	17.4	6.00 J	20.4	2.50 B	1.80 U	1.80 U	2.50 B
Barium	1,000	97.7 J	72.9 J	41.0 J	38.4 J	39.7 J	39.8 J	31.3 J	29.4 J	71.2 J	39.5 J	62.9 J	79.6 J
Cadmium	2.31	0.26 U	0.34 U	0.26 U	0.26 U	0.34 U	0.34 U	0.45 B	2.70 J	0.85 J	0.34 U	0.34 J	0.34 U
Calcium	--	78,000	77,500	46,700	44,100	49,500	50,100	72,000	57,900	45,000	79,400	16,100	5,580
Chromium	11.4	0.65 U	1.30 U	0.72 B	0.65 U	1.30 U	1.30 U	0.65 U	4.30 J	1.30 U	1.30 U	1.90 J	1.30 U
Cobalt	23.0	0.61 B	1.40 J	0.58 U	0.87 B	0.87 U	0.87 U	2.00 B	1.80 J	13.4 J	0.87 U	2.10 J	4.20 J
Copper	8.70	1.20 U	1.20 UL	1.20 U	1.20 U	1.20 UL	1.20 UL	1.20 U	1.30 L	1.20 UL	1.20 UL	1.20 UL	1.20 UL
Cyanide	5.20	10.0 U	NA	1.60 J	10.0 U	NA	NA	1.60 J	NA	NA	NA	NA	NA
Iron	1,000	55,100	55,500	40,200	37,900	45,400	45,500	37,500	2,650	574	271 B	141 B	141 B
Lead	2.87	1.60 UJ	1.50 U	1.60 UJ	1.60 UJ	1.50 U	1.50 U	1.60 UJ	1.50 U	2.50 J	1.50 U	1.50 U	1.50 U
Magnesium	--	7,100	6,790	6,910	6,490	7,680	7,690	12,700	10,600	5,720	4,950 J	2,980 J	3,760 J
Manganese	120	465	428	326	307	315	315	367	114	208	9.10 J	49.7	108
Mercury	0.91	0.10 UL	0.23	0.10 UL	0.10 UL	0.10 U	0.10 U	0.10 UL	0.12 J	0.10 U	0.10 U	0.10 U	0.10 U
Nickel	48.7	1.30 U	2.60 J	2.00 B	1.30 U	1.30 U	1.70 J	4.00 B	2.70 J	14.7 J	1.40 J	2.00 J	2.60 J
Potassium	--	7,130	5,030	5,160	4,840 J	4,620 J	4,620 J	2,140 J	1,740 B	3,910 J	2,100 B	2,110 B	2,430 J
Selenium	5.00	4.50 UL	3.70 U	4.50 UL	4.50 UL	3.70 U	3.70 U	4.50 UL	5.10	3.70 U	5.80	3.70 U	3.70 U
Sodium	--	23,200	19,600	6,590	6,300	5,670	5,870	8,780	8,260	57,700	6,250	4,450 J	4,540 J
Thallium	40.0	5.50 U	9.60 J	5.50 U	5.50 U	7.90 U	10.9	5.50 J	7.90 U	7.90 U	7.90 U	8.30 J	7.90 U
Vanadium	10,000	0.88 U	2.10 J	0.88 U	0.88 U	1.00 U	1.00 U	0.88 U	3.50 J	1.00 U	1.00 U	1.20 J	1.00 U
Dissolved Metals (UG/L)													
Aluminum	87.0	66.9 U	131 B	66.9 U	67.0 B	48.9 B	47.6 B	66.9 U	59.6 B	322	33.6 B	146 B	146 B
Antimony	30.0	2.90 U	4.30 U	3.40 J	2.90 J	4.30 U	4.30 U	2.90 U	4.30 U	6.00 J	4.30 U	4.30 U	4.30 U
Arsenic	150	50.9	33.0	28.0	23.0	17.2	16.0	6.90 J	2.10 B	24.0	1.80 U	1.80 U	1.80 U
Barium	1,000	97.0 J	73.0 J	47.3 J	39.8 J	40.7 J	38.2 J	31.0 J	24.5 J	72.9 J	35.8 J	54.8 J	82.1 J
Cadmium	2.11	0.26 U	0.34 U	0.26 U	0.26 U	0.34 U	0.34 U	0.28 B	1.60 J	0.93 J	0.34 U	0.35 J	0.34 U
Calcium	--	76,800	82,200	54,600	45,900	51,600	48,200	71,900	55,400	44,700	74,400	6,640	8,690
Chromium	11.0	0.65 U	1.30 U	0.65 U	0.65 U	1.30 U	1.30 U	0.65 U	1.30 U	1.70 J	1.30 U	1.30 U	1.30 U
Cobalt	23.0	1.10 B	0.87 U	0.92 B	1.20 B	0.87 U	0.87 U	2.00 U	0.88 J	13.9 J	2.20 J	1.60 J	3.70 J
Iron	1,000	54,400	57,900	47,000	39,200	47,200	44,100	3,800	357	447	24.5 U	27.6 B	113 B
Lead	2.30	1.60 UJ	1.50 U	1.60 UJ	1.60 UJ	1.50 U	1.50 U	1.60 UJ	1.50 U				
Magnesium	--	6,990	7,090	8,020	6,780	7,970	7,480	12,600	10,100	5,830	4,630 J	3,030 J	3,780 J
Manganese	120	351	327	231	215	227	227	267	109	208	7.70 J	52.0	109
Mercury	0.77	0.10 UL	0.15 J	0.10 UL	0.10 UL	0.10 U	0.10 U	0.10 UL	0.10 U				
Nickel	48.6	1.30 U	1.30 J	1.30 U	1.50 B	2.00 J	1.30 U	2.50 B	2.50 J	15.3 J	1.30 U	1.50 J	2.30 J
Potassium	--	7,020	5,360	6,010	5,080	4,790 J	4,490 J	2,120 J	1,490 B	4,020 J	2,150 B	2,210 J	2,610 J
Selenium	4.60	4.50 UL	3.70 U	4.50 UL	4.50 UL	3.70 U	3.70 U	4.50 UL	3.70 U	3.70 U	6.10	3.70 U	3.70 U
Sodium	--	22,900	20,500	7,680	6,290	5,950	5,570	8,570	7,850	58,100	5,910	4,530 J	5,040
Thallium	40.0	5.50 U	10.4	5.50 U	5.50 U	7.90 U	7.90 U	5.50 U	7.90 U	9.30 J	9.90 J	9.90 J	7.90 U
Vanadium	10,000	0.88 U	1.20 J	0.88 U	0.88 U	1.00 U	1.00 U	0.88 U	1.00 U				
Zinc	110	4.10 B	7.80 B	4.00 B	7.60 B	5.00 B	4.50 B	20.7 B	13.2 B	34.0	46.3	8.90 B	11.4 B
Pesticide/Polychlorinated Biphenyls (UG/L)													
No Detections													
Semivolatile Organic Compounds (UG/L)													
Acenaphthene	520	1.00 J	NA	10.0 U	10.0 U	NA	NA	10.0 U	NA	NA	NA	NA	NA
Caprolactam	--	10.0 U	NA	1.00 J	10.0 U	NA	NA	10.0 U	NA	NA	NA	NA	NA
Naphthalene	100	1.00 J	NA	10.0 U	10.0 U	NA	NA	10.0 U	NA	NA	NA	NA	NA
Volatile Organic Compounds (UG/L)													
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	21.0 J	30.0	10.0 U	10.0 U	10.0 U	10.0 U
1,1-Dichloroethane	1,600	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	4.70 J	4.70 J	10.0 U	10.0 U	10.0 U	10.0 U
1,4-Dichlorobenzene	763	10.0 U	10.0 U	10.0 U	1.10 J	10.0 U	10.0 U	33.0 U	20.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Dichlorodifluoromethane (Freon-12)	1,100	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	3.90 J	20.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Trichloroethene	21,900	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	9.80 J	4.90 J	10.0 U	10.0 U	10.0 U	10.0 U
Vinyl chloride	1,160	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	130	68.0	10.0 U	10.0 U	10.0 U	10.0 U
cis-1,2-Dichloroethene	1,160	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	450	340	10.0 U	10.0 U	10.0 U	10.0 U

Table 3-4
Surface Soil Exceedances of Ecological Screening Criteria
Site 18
Naval Station Norfolk

Chemical	Soil Screening Value	Background	NB07S1	NB07S2
Volatiles (ug/kg)				
Acetone	NA	NA	11 U	74
2-Butanone	NA	NA	11 U	16
Semivolatiles (ug/kg)				
Anthracene	100	491	52 J	350 U
Benzo(a)anthracene	100	490	320 J	350 U
Benzo(a)pyrene	100	490	380 J	350 U
Benzo(b)fluoranthene	100	NA	530 J	350 U
Benzo(g,h,i)perylene	100	NA	110 J	350 U
Benzo(k)fluoranthene	100	NA	280 J	350 U
Chrysene	100	621	390 J	350 U
Fluoranthene	100	950	640 J	350 U
Indeno(1,2,3-cd)pyrene	100	401	130 J	350 U
Phenanthrene	100	660	200 J	350 U
Pyrene	100	830	400 J	350 U
PAH, total	4100	NA	3432	1925 U
Pesticide/PCBs (ug/kg)				
4,4'-DDE	100	4	67	3.5 U
4,4'-DDT	100	4	47	3.9
Metals (mg/kg)				
Aluminum	50	14,213	2520	2480
Arsenic	60	17.1	20.2	1.2
Cadmium	4.0	0.2	0.75	0.53 U
Calcium	NA	25,771	37400	530
Chromium	0.4	23	67	2.8
Copper	50	53	8.6	2.7 U
Iron	200	24,680	5400	1980
Lead	50	125	40.4	6.1
Magnesium	NA	7,970	567	530 U
Manganese	500	157	66.9	15.2
Mercury	0.1	0.1	0.56	0.16
Nickel	30	19	5.2	4.2 U
Vanadium	2.0	68	8.8	5.3 U
Zinc	50	97	39.5	7.2

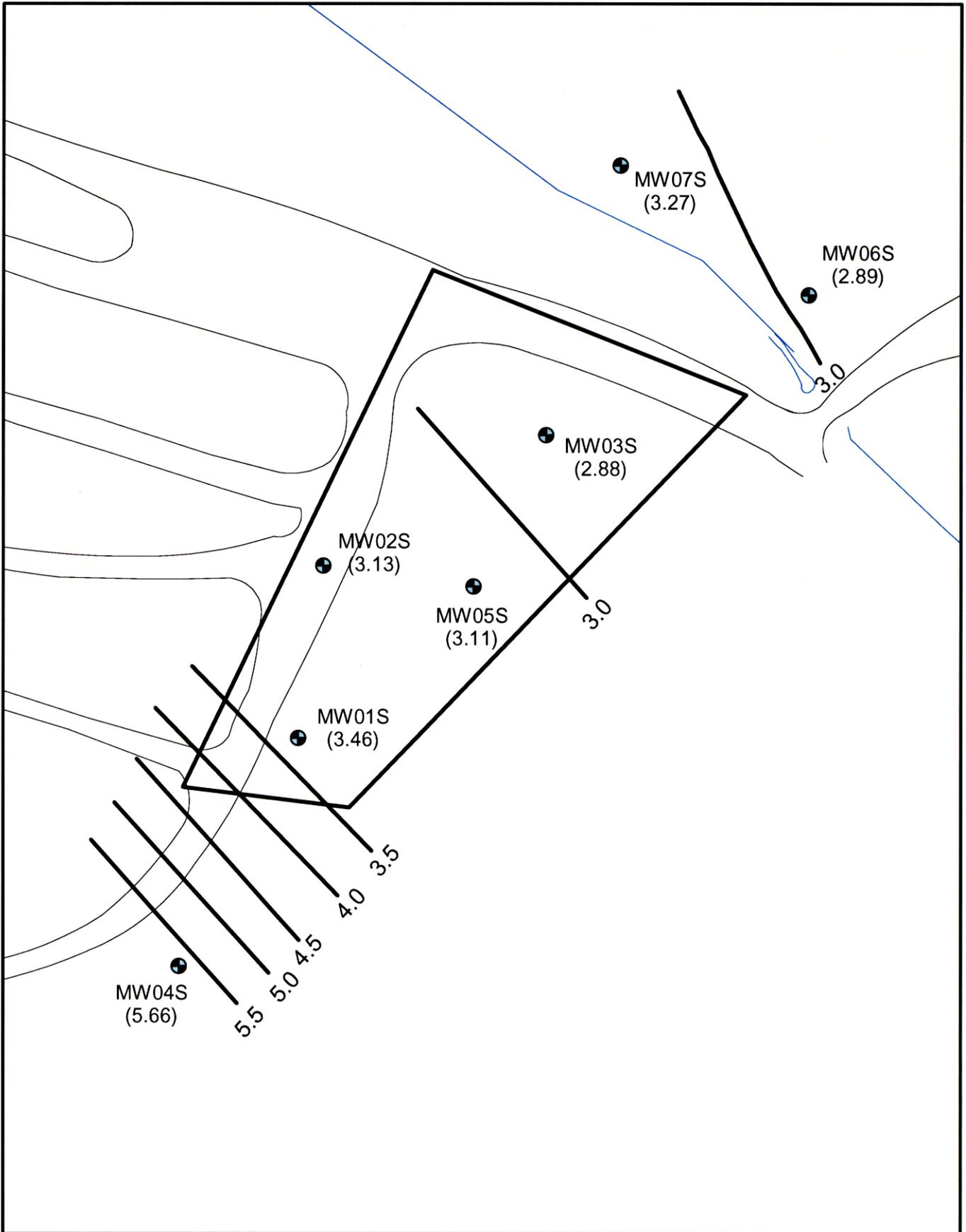
Notes:

Exceeds Screening Value

U - Not Detected. The associated number indicates approximate sample concentration necessary to be detected.

J - Analyte Present. Reported value may not be accurate or precise.

NA - Not applicable.



LEGEND

- Monitoring Well
- ▭ Site Boundary



0 50 100 Feet

Figure 3-1
Site 18 - Ground Water Contour Map
Naval Station Norfolk
Norfolk, Virginia

NBS18-MW03S	Criteria Exceeded	Results in ug/L	
		R01	R02
Trichloroethene	MCL/RBC-Tap	9.8J	4.9J
Vinyl Chloride	MCL/RBC-Tap	130	68
cis-1,2-Dichloroethene	MCL/RBC-Tap	450	340
Total Arsenic	MCL/RBC-Tap	6J	20.4
Total Thallium	MCL/RBC-Tap	5.5J	ND
Dissolved Arsenic	RBC-Tap	6.9J	ND

NBS18-MW07S

NBS18-MW06S	Criteria Exceeded	Results in ug/L	
		R01	R02
Total Antimony	MCL	NA	8.1J
Total Thallium	MCL/RBC-Tap	NA	8.3J
Dissolved Thallium	MCL/RBC-Tap	NA	9.9J

NBS18-MW02S	Criteria Exceeded	Results in ug/L	
		R01	R02
1,4-Dichlorobenzene	RBC-Tap	1.1J	ND
Total Arsenic	MCL/RBC-Tap	26.7	17.4
Total Iron	RBC-Tap	40200	45500
Total Thallium	MCL/RBC-Tap	ND	10.9
Dissolved Arsenic	MCL/RBC-Tap	28	17.2
Dissolved Iron	RBC-Tap	47000	47200

NBS18-MW05S	Criteria Exceeded	Results in ug/L	
		R01	R02
Dissolved Thallium	MCL/RBC-Tap	NA	9.9J

NBS18-MW01S	Criteria Exceeded	Results in ug/L	
		R01	R02
Total Arsenic	MCL/RBC-Tap	54.1	36.4
Total Iron	RBC-Tap	55100	55500
Total Thallium	MCL/RBC-Tap	ND	9.6J
Dissolved Arsenic	MCL/RBC-Tap	50.9	33
Dissolved Iron	RBC-Tap	54400	57900
Dissolved Thallium	MCL/RBC-Tap	ND	10.4

NBS18-MW04S	Criteria Exceeded	Results in ug/L	
		R01	R02
Dissolved Antimony	MCL/RBC-Tap	NA	6J
Dissolved Arsenic	MCL/RBC-Tap	NA	24
Dissolved Thallium	MCL/RBC-Tap	NA	9.3J

LEGEND

-  Monitoring Wells
-  Roads
-  Water Features
-  Site Boundary

R01 = 2001
R02 = 2002



0 50 100 Feet

Figure 3-2
Site 18
Groundwater Sampling Locations and Exceedances
Naval Station Norfolk
Norfolk, Virginia

4 Conclusions and Recommendations

The goal of the 2002 investigation was to further characterize the extent of groundwater contamination detected during previous investigations at Site 18, Naval Station Norfolk.

A comparison of the groundwater analytical results from the 2002 investigation to the MCLs and RBCs was conducted to provide a qualitative assessment of human health risks. The results show that there were exceedances of cis-1,2-dichloroethene, trichloroethene, and vinyl chloride at MW03S. However, no other VOC exceedances were observed during the 2002 event. In addition, these constituents were not detected in the downgradient wells, indicating that the extent of the VOCs is limited to the close proximity of MW03S.

The 2002 metals analytical results for groundwater showed exceedances for the total and dissolved concentrations of arsenic, iron, and thallium in the monitoring wells within the site interior (MW01S, MW02S, MW03S). However, the data from interior well MW05S only showed an exceedance for dissolved thallium. The upgradient monitoring well (MW04S) demonstrated exceedances of the dissolved concentrations of arsenic, antimony, and thallium. The presence of these constituents in the upgradient well indicates that they are not likely to be site related and may be attributable to background conditions. Downgradient well MW06S demonstrated exceedances for total antimony, and thallium (total and dissolved). There were no exceedances in downgradient well MW07S.

A comparison of the surface soil analytical results to the residential soil RBCs showed that there were exceedances of arsenic and benzo(a)pyrene. However, only the arsenic concentration at one location exceeded the soil background levels established for the facility.

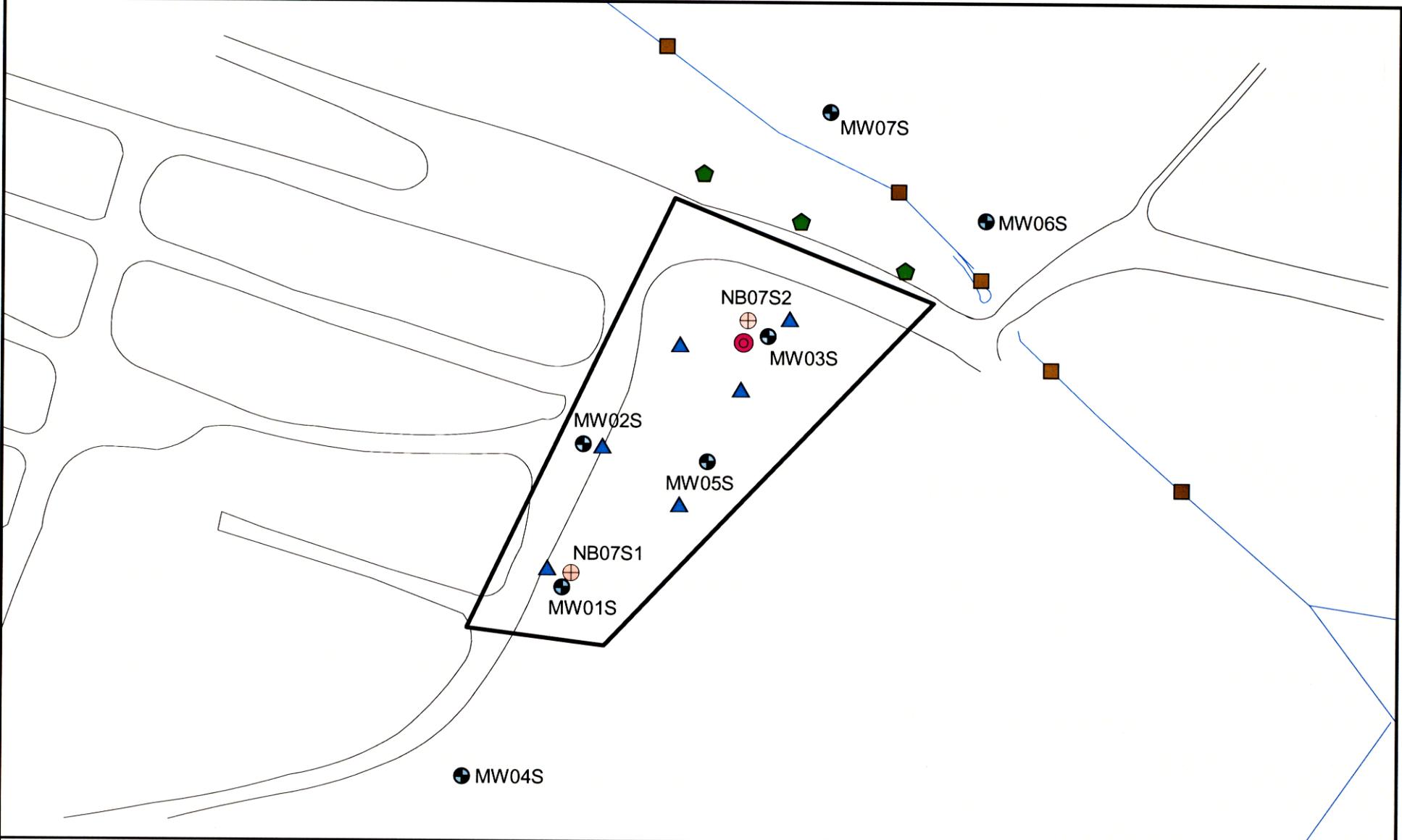
As a further evaluation of the site, the surface soil and both rounds of groundwater data were screened against USEPA Region III BTAG screening values (and additional screening values available in the literature) to qualitatively evaluate potential risks to ecological receptors. Soil screening values were exceeded for aluminum, chromium, iron, mercury, vanadium, and a number of PAHs. However, of these metals, only mercury exceeded the background levels established for the facility. The results of the surface soil organic chemical screening showed that a number of PAHs exceeded their individual screening values, however, only benzo(b)fluoranthene exceeded the background soil levels. In addition, the total concentration of PAHs did not exceed the screening value. The undiluted groundwater concentrations were compared with surface water screening values. No detected organic chemical exceeded screening values. However, aluminum, cadmium, iron, lead, manganese, and selenium exceeded screening values in at least one total or dissolved sample.

A comparison of the 2001 and 2002 analytical data indicates that the concentrations of organic compounds in the groundwater were significantly lower in the 2002 data. Only one well, MW03S, showed concentrations of organic compounds exceeding the screening criteria in the 2002 data. Specifically, the concentrations of trichloroethene, vinyl chloride, and cis-1,2-dichloroethene at MW03S decreased. The metals analytical data show that, overall, the concentrations of arsenic were lower in the 2002 data. In addition, the iron

levels remained consistent between the rounds. However, the thallium concentrations tended to increase at wells MW01S and MW02S.

Due to the levels of VOCs at MW03S as well as the concentrations of metals across the site, it is recommended that an expanded Site Investigation be conducted. In order to generate sufficient data for additional site characterization, it is recommended that additional soil, sediment, groundwater, and surface water sampling be conducted. The proposed sampling locations are shown on Figure 4-1 and include:

- The screening of site soils to delineate the extent of the VOC contamination.
- The collection of five surface water and sediment samples from the creek north of the site to evaluate the potential of the contaminants detected in MW03S to discharge into the creek.
- The collection of six surface and subsurface soil samples within the site interior to evaluate the current site conditions and provide data for use in the risk assessments. In addition, three surface soil samples, collected between the site and the creek, are recommended to evaluate the impact of overland flow into the creek.
- The installation and sampling of a deep and intermediate monitoring well proximal to MW03S. The intermediate well would be installed to the top of the confining unit (between the Columbia and Yorktown aquifers) to evaluate contamination throughout the entire thickness of the shallow aquifer. The deep monitoring well would be installed in the Yorktown aquifer to evaluate the potential transport of contaminants from the shallow to the deep aquifer.
- The collection of nine groundwater samples from the pre-existing and newly installed monitoring wells to evaluate natural attenuation and provide data on the current VOC and metals concentrations.



LEGEND			
<ul style="list-style-type: none"> Existing Monitoring Wells 1996 Baker RRR Study, Surface Soil Sample Proposed Sediment and Surface Water Sample Proposed Surface and Subsurface Soil Sample 	<ul style="list-style-type: none"> Proposed Surface Soil Samples Proposed Deep Monitoring Well Roads Water Features Site Boundary 		

Figure 4-1
 Site 18 - Proposed Sampling Locations
 Naval Station Norfolk
 Norfolk, Virginia

5 References

Baker Environmental, Inc. *Final Relative Risk Ranking System Data Collection Sampling and Analysis Report, Naval Base, Norfolk, Virginia*. January 1996.

CH2M HILL. *Final Master Work Plan, Naval Base Norfolk, Norfolk, Virginia (Two Volumes)*. October 1997

CH2M HILL. *Draft Soil Background Investigation Report, Naval Station Norfolk, Norfolk, Virginia*. September 2000.

CH2M HILL. *Draft Work Plan Additional Investigation Site 18, Naval Station Norfolk, Norfolk, Virginia*. September 2001.

CH2M HILL. *Draft Site Investigation Report Sites 10, 16, and 18, Naval Station Norfolk, Norfolk, Virginia*. September 2001.

Environmental Science and Engineering, Inc. *Initial Assessment Study, Sewells Point Naval Complex, Norfolk, Virginia*. February 1983.

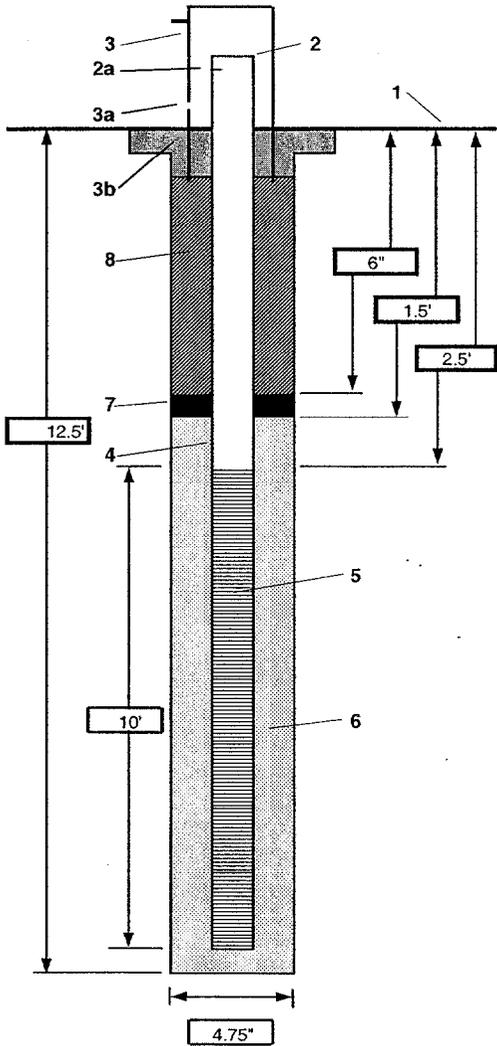
U.S. Environmental Protection Agency (USEPA). *Revised Region III BTAG Screening Levels*. Memorandum from R.S. Davis to Users. 9 August 1995..

Appendix A
Well Construction Details



PROJECT NUMBER CTO 131	WELL NUMBER NBS18-MW07S
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

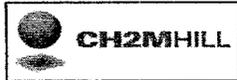
PROJECT : Naval Staion Norfolk LOCATION : Site 18
 DRILLING CONTRACTOR : Parratt Wolf
 DRILLING METHOD AND EQUIPMENT USED : HSA Rig
 WATER LEVELS : START : 02/22/02 END : 02/22/02 LOGGER : D Holloway



1- Ground elevation at well	
2- Top of casing elevation	
a) vent hole?	
3- Wellhead protection cover type	Stick- up casing
a) weep hole?	
b) concrete pad dimensions	2' diameter pad
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	10 Slot PVC
6- Type screen filter	Industrial Quartz
a) Quantity used	5 Bags
7- Type of seal	Enviro Plug bentonite
a) Quantity used	.5 bags
8- Grout	
a) Grout mix used	Pakmix concrete
b) Method of placement	
c) Vol. of well casing grout	
Development method	
Development time	
Estimated purge volume	
Comments	

Appendix B

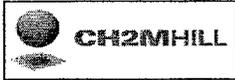
Borelogs



PROJECT NUMBER CTO 131	BORING NUMBER NBS18-MW04S
SHEET 1 OF 1	
SOIL BORING LOG	

PROJECT : Naval Station Norfolk	LOCATION : Site 18: Naval Station Norfolk
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolf
DRILLING METHOD AND EQUIPMENT USED : Hollow-stem Auger Rig	
WATER LEVELS :	START : 02/21/2002 END : 2/21/2002 LOGGER : Ben Francisco

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)			STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION	COMMENTS
	RECOVERY (IN)	#/TYPE				
0-2'	15"	1		0-2'- fine to medium grained SAND with little silt (SW); (10Y4/1)-dark greenish gray; moist; medium dense.	PID= 0ppm Brick fragments observed 1"bgs	
5-7'	15"	2		6'-7'- Same as above (SW). Color change; (5Y7/3)-pale yellow; saturated; loose.	PID=0	
10'-12'	18"	3		10'-11'- same as above (SW). Color change; (10Y6/1); greenish gray, saturated; loose.	PID=0	
15'				Boring terminated at 13.5' bgs. Monitoring well installed at this location		
20'						
25'						
30'						
35'						
40'						



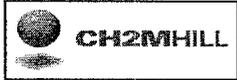
PROJECT NUMBER CTO 131	BORING NUMBER NBS18-MW055
----------------------------------	-------------------------------------

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Naval Station Norfolk	LOCATION : Site 18: Naval Station Norfolk
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolf
DRILLING METHOD AND EQUIPMENT USED : Hollow-stem Auger Rig	
WATER LEVELS :	START : 02/21/2002 END : 2/21/2002 LOGGER : Ben Francisco

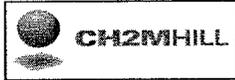
DEPTH BELOW SURFACE (FT)	INTERVAL (FT)			STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION	COMMENTS
	RECOVERY (IN)	#/TYPE				
0-2'	15"	1			0-2'- fine to medium grained SAND with little fines (SW); (2.5Y4/3)-olive brown; moist; medium dense.	PID= 0ppm
2-4'	12"	2			2-4' Same as above; Saturated; medium dense.	PID=0
4-6'	15"	3			4-6' Same as above.	Water Table at 4' bgs PID=0
6-8'	8"	4			6-8'- Same as above.	PID=1.9
8-10'	5"	5			8-10'- Same as above.	PID=1.9
10'-12'	12"	6			10-12'- Same as above.	PID=0
15					Boring terminated at 13.5' bgs. Monitoring well installed at this location	
20						
25						
30						
35						
40						



PROJECT NUMBER CTO 131	BORING NUMBER NBS18-MW06S
SHEET 1 OF 1	
<h2 style="margin: 0;">SOIL BORING LOG</h2>	

PROJECT : Naval Station Norfolk	LOCATION : Site 18: Naval Station Norfolk
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolf
DRILLING METHOD AND EQUIPMENT USED :	Hollow-stem Auger Rig
WATER LEVELS :	START : 02/21/2002 END : 2/21/2002 LOGGER : Ben Francisco

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)			STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION	COMMENTS
	RECOVERY (IN)	#/TYPE				
5	0-2'	15"	1		0-1.5' - firm to medium grained SAND with trace fines (SW) (2.5Y7/6) yellow; moist, medium dense. 1.5-2' - medium grained SAND with trace fines (SP) (10Y6/1)- Greenish gray; moist; medium dense.	PID= 0.8ppm 1" of top soil at surface Water table observed at 3.5' bgs
10	5-7'	22"	2		5-7'- Same as above; saturated Color change to (2.5Y7/4)- pale yellow at 6' bgs	PID=3.1
15	10'-12'	10"	3		10-12' Same as above; Color Change to (2.5Y7/2)- Light gray- saturated; loose.	PID= 0.8ppm
20						
25						
30						
35						
40						



PROJECT NUMBER CTO 131	BORING NUMBER NBS18-MW07S
SHEET 1 OF 1	
<h2 style="margin: 0;">SOIL BORING LOG</h2>	

PROJECT : Naval Station Norfolk	LOCATION : Site 18: Naval Station Norfolk
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolf
DRILLING METHOD AND EQUIPMENT USED : Hollow-stem Auger Rig	
WATER LEVELS :	START : 02/22/2002 END : 2/22/2002 LOGGER : D Holloway

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			
5	0-2'	12"	1		0-2'- Fine to medium grained SAND with little fines (SW) (2.5Y3/3) dark olive brown; Moist; medium density.	PID=1.5 Water table observed at 2.5' bgs
10	5-7'	24"	2		5-6.5'- Sandy SILT, very soft (ML) (2.5Y3/2) very dark grayish brown; very moist. 6.5-7' fine to medium grained SAND. (10Y6/1) greenish gray; very moist; medium density sand.	PID=1.1 high organic content
	10'-12'	18"	3		10-12' Medium to coarse grained SAND; (2.5Y7/2) light gray; saturated; loose.	PID=0
15					End of boring at 12.5' bgs. Monitoring well installed at this location.	
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Appendix C
Groundwater Analytical Data

Table C-1
Groundwater Analytical Results
Site 18
Naval Station Norfolk

Station ID	NBS18-MW01S		NBS18-MW02S				NBS18-MW03S		NBS18-MW04S	NBS18-MW05S	NBS18-MW06S	NBS18-MW07S
	NBS18-MW01S-R01	NBS18-MW01S-R02	NBS18-MW02S-P-R01	NBS18-MW02S-R01	NBS18-MW02S-P-R02	NBS18-MW02S-R02	NBS18-MW03S-R01	NBS18-MW03S-R02	NBS18-MW04S-R02	NBS18-MW05S-R02	NBS18-MW06S-R02	NBS18-MW07S-R02
	06/08/01	02/26/02	06/08/01	06/08/01	02/26/02	02/26/02	06/08/01	02/26/02	02/26/02	02/26/02	02/27/02	02/27/02
Sample ID												
Sample Date												
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,2-Dibromo-3-chloropropane	10 U	10 R	10 U	10 U	10 R	10 R	33 U	20 R	10 R	10 R	10 R	10 R
1,2-Dibromoethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
2-Butanone	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U	33 UJ	20 U	10 U	10 U	10 U	10 U
2-Hexanone	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U	33 UJ	20 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Acetone	2.5 B	1.1 B	2.6 B	3.2 B	10 U	10 U	20 B	20 U	1.8 B	1.6 B	10 U	1.6 B
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Bromoforn	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Bromomethane	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U	33 UJ	20 U	10 U	10 U	10 U	10 U
Carbon disulfide	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Cumene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Cyclohexane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Dichlorodifluoromethane(Freon-12)	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Methyl acetate	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Methylcyclohexane	10 U	1.4 B	10 U	10 U	10 U	10 U	33 U	4.1 B	1.1 B	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Toluene	10 U	1.4 B	10 U	10 U	10 U	1 B	33 U	2.9 B	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Trichlorofluoromethane(Freon-11)	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Xylene, total	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	33 U	20 U	10 U	10 U	10 U	10 U
Semi-volatile Organic Compounds (UG/L)												
1,1-Biphenyl	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,2'-Oxybis(1-chloropropane)	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,4-Dichlorophenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,4-Dimethylphenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,4-Dinitrophenol	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2-Chloronaphthalene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2-Chlorophenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2-Methylnaphthalene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2-Methylphenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
2-Nitroaniline	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
2-Nitrophenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
3-Nitroaniline	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA

Table C-1
Groundwater Analytical Results
Site 18
Naval Station Norfolk

Station ID	NBS18-MW01S		NBS18-MW02S				NBS18-MW03S		NBS18-MW04S	NBS18-MW05S	NBS18-MW06S	NBS18-MW07S
Sample ID	NBS18-MW01S-R01	NBS18-MW01S-R02	NBS18-MW02S-P-R01	NBS18-MW02S-R01	NBS18-MW02S-P-R02	NBS18-MW02S-R02	NBS18-MW03S-R01	NBS18-MW03S-R02	NBS18-MW04S-R02	NBS18-MW05S-R02	NBS18-MW06S-R02	NBS18-MW07S-R02
Sample Date	06/08/01	02/26/02	06/08/01	06/08/01	02/26/02	02/26/02	06/08/01	02/26/02	02/26/02	02/26/02	02/27/02	02/27/02
Chemical Name												
4,6-Dinitro-2-methylphenol	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
4-Chloroaniline	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
4-Methylphenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
4-Nitroaniline	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
4-Nitrophenol	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
Acenaphthene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Acenaphthylene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Acetophenone	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Anthracene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Atrazine	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzaldehyde	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzo(a)anthracene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzo(a)pyrene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Butylbenzylphthalate	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Caprolactam	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Carbazole	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Chrysene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Di-n-butylphthalate	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Di-n-octylphthalate	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Dibenzofuran	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Diethylphthalate	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Dimethyl phthalate	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Fluoranthene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Fluorene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Hexachlorobenzene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Hexachlorobutadiene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Hexachloroethane	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Isophorone	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Naphthalene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Nitrobenzene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Pentachlorophenol	25 U	NA	25 U	25 U	NA	NA	25 U	NA	NA	NA	NA	NA
Phenanthrene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Phenol	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Pyrene	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	1 B	NA	2 B	1 B	NA	NA	10 U	NA	NA	NA	NA	NA
n-Nitroso-di-n-propylamine	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
n-Nitrosodiphenylamine	10 U	NA	10 U	10 U	NA	NA	10 U	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)												
4,4'-DDD	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
4,4'-DDE	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
4,4'-DDT	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Aldrin	0.05 U	NA	0.05 U	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA	NA
Aroclor-1016	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Aroclor-1221	2 U	NA	2 U	2 U	NA	NA	2 U	NA	NA	NA	NA	NA
Aroclor-1232	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Aroclor-1242	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Aroclor-1248	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Aroclor-1254	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Aroclor-1260	1 U	NA	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA
Dieldrin	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Endosulfan I	0.05 U	NA	0.05 U	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA	NA
Endosulfan II	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Endosulfan sulfate	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Endrin	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Endrin aldehyde	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Endrin ketone	0.1 U	NA	0.1 U	0.1 U	NA	NA	0.1 U	NA	NA	NA	NA	NA
Heptachlor	0.05 U	NA	0.05 U	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA	NA

Table C-2
 QA-QC Analytical Results
 Site 18
 Naval Station Norfolk

Station ID Sample ID Sample Date	NSN-QC			
	NBS18-EB022602 02/26/02	NBS18-FB022602 02/26/02	NBS18-TB022602 02/26/02	NBS18-TB022702 02/27/02
Chemical Name				
Volatile Organic Compounds (UG/L)				
1,1,1-Trichloroethane	NA	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	NA	10 U	10 U	10 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	NA	10 U	10 U	10 U
1,1,2-Trichloroethane	NA	10 U	10 U	10 U
1,1-Dichloroethane	NA	10 U	10 U	10 U
1,1-Dichloroethene	NA	10 U	10 U	10 U
1,2,4-Trichlorobenzene	NA	10 U	10 U	10 U
1,2-Dibromo-3-chloropropane	NA	10 R	10 R	10 R
1,2-Dibromoethane	NA	10 U	10 U	10 U
1,2-Dichlorobenzene	NA	10 U	10 U	10 U
1,2-Dichloroethane	NA	10 U	10 U	10 U
1,2-Dichloropropane	NA	10 U	10 U	10 U
1,3-Dichlorobenzene	NA	10 U	10 U	10 U
1,4-Dichlorobenzene	NA	10 U	10 U	10 U
2-Butanone	NA	10 U	10 U	10 U
2-Hexanone	NA	10 U	10 U	10 U
4-Methyl-2-pentanone	NA	10 U	10 U	10 U
Acetone	NA	10 U	10 U	10 U
Benzene	NA	10 U	10 U	10 U
Bromodichloromethane	NA	10 U	10 U	10 U
Bromoform	NA	10 U	10 U	10 U
Bromomethane	NA	10 U	10 U	10 U
Carbon disulfide	NA	10 U	10 U	10 U
Carbon tetrachloride	NA	10 U	10 U	10 U
Chlorobenzene	NA	10 U	10 U	10 U
Chloroethane	NA	10 U	10 U	10 U
Chloroform	NA	10 U	10 U	10 U
Chloromethane	NA	10 U	10 U	10 U
Cumene	NA	10 U	10 U	10 U
Cyclohexane	NA	10 U	10 U	10 U
Dibromochloromethane	NA	10 U	10 U	10 U
Dichlorodifluoromethane(Freon-12)	NA	10 U	10 U	10 U
Ethylbenzene	NA	10 U	10 U	10 U
Methyl acetate	NA	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	NA	10 U	10 U	10 U
Methylcyclohexane	NA	10 U	10 U	10 U
Methylene chloride	NA	10 U	10 U	10 U
Styrene	NA	10 U	10 U	10 U
Tetrachloroethene	NA	10 U	10 U	10 U
Toluene	NA	10 U	10 U	10 U
Trichloroethene	NA	10 U	10 U	10 U
Trichlorofluoromethane(Freon-11)	NA	10 U	10 U	10 U
Vinyl chloride	NA	10 U	10 U	10 U
Xylene, total	NA	10 U	10 U	10 U
cis-1,2-Dichloroethene	NA	10 U	10 U	10 U
cis-1,3-Dichloropropene	NA	10 U	10 U	10 U
trans-1,2-Dichloroethene	NA	10 U	10 U	10 U
trans-1,3-Dichloropropene	NA	10 U	10 U	10 U

Table C-2
 QA-QC Analytical Results
 Site 18
 Naval Station Norfolk

Station ID Sample ID Sample Date	NSN-QC			
	NBS18-EB022602 02/26/02	NBS18-FB022602 02/26/02	NBS18-TB022602 02/26/02	NBS18-TB022702 02/27/02
Chemical Name				
Total Metals (UG/L)				
Aluminum	NA	74.5 J	NA	NA
Antimony	NA	4.3 U	NA	NA
Arsenic	NA	1.8 U	NA	NA
Barium	NA	0.69 J	NA	NA
Beryllium	NA	0.11 U	NA	NA
Cadmium	NA	0.34 U	NA	NA
Calcium	NA	925 J	NA	NA
Chromium	NA	1.3 U	NA	NA
Cobalt	NA	0.87 U	NA	NA
Copper	NA	1.2 U	NA	NA
Iron	NA	24.5 J	NA	NA
Lead	NA	1.5 U	NA	NA
Magnesium	NA	92.5 J	NA	NA
Manganese	NA	0.6 J	NA	NA
Mercury	NA	0.1 U	NA	NA
Nickel	NA	1.3 U	NA	NA
Potassium	NA	272 J	NA	NA
Selenium	NA	3.7 U	NA	NA
Silver	NA	0.97 U	NA	NA
Sodium	NA	328 U	NA	NA
Thallium	NA	7.9 U	NA	NA
Vanadium	NA	1 U	NA	NA
Zinc	NA	2.4 J	NA	NA
Dissolved Metals (UG/L)				
Aluminum	58.3 J	NA	NA	NA
Antimony	4.3 U	NA	NA	NA
Arsenic	1.8 U	NA	NA	NA
Barium	0.65 J	NA	NA	NA
Beryllium	0.11 U	NA	NA	NA
Cadmium	0.34 U	NA	NA	NA
Calcium	387 J	NA	NA	NA
Chromium	1.3 U	NA	NA	NA
Cobalt	0.87 U	NA	NA	NA
Copper	1.2 U	NA	NA	NA
Iron	24.5 U	NA	NA	NA
Lead	1.5 U	NA	NA	NA
Magnesium	93.6 J	NA	NA	NA
Manganese	0.54 J	NA	NA	NA
Mercury	0.1 U	NA	NA	NA
Nickel	1.3 U	NA	NA	NA
Potassium	215 J	NA	NA	NA
Selenium	3.7 U	NA	NA	NA
Silver	0.97 U	NA	NA	NA
Sodium	328 U	NA	NA	NA
Thallium	7.9 U	NA	NA	NA
Vanadium	1 U	NA	NA	NA
Zinc	4.5 J	NA	NA	NA

Notes:

Shaded Cells Represent Detected Compounds

R - Unreliable result

U - Not Detected

J - Analyte Present. Reported value may not be accurate or precise