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FINAL SITE INSPECTION REPORT
PHASE II
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER

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EXECUTIVE SUMMARY

PROJECT TITLE: CONTRACT N62467-89-D-0318, COST PLUS AWARD FEE CONTRACT FOR COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION, NAVY (CLEAN) DISTRICT II; SITE INSPECTION INDIAN HEAD DIVISION, NAVAL SURFACE WARFARE CENTER, (IHDIVNAVSURFWARCEN) INDIAN HEAD, MARYLAND.

This document is the Final Report of Phase II of the Site Inspection (SI) completed at IHDIVNAVSURFWARCEN Indian Head, Maryland, as part of the Installation Restoration (IR) program. The purpose of the SI was to determine if contamination is present in selected media at 14 IR sites and to conduct baseline sampling of 11 production wells. Thirteen of the IR sites and three production wells were indicated with notable concentrations of possible contaminants. Further investigation is needed in each case.

OVERALL FINDINGS

Sediments: BNAs, UDMH, HBNQ, and PNC were detected in sediment samples from Mattawoman Creek at Sites 39 and 41. Additional investigation is recommended to assess the nature and extent of sediment contamination.

Groundwater: Trichloroethylene, heptachlor epoxide, and endosulfan II were detected in groundwater samples from Site 41, and trichloroethylene was detected in groundwater samples from Site 44. Elevated concentrations of metals were detected in samples from production wells PW3A and PW09, and a low concentration of tetrachloroethylene was detected in production well PW07. Quarterly groundwater sampling to monitor contaminant concentrationss is recommended for Sites 41 and 44 and production well PW07.

Soil Contamination: Soil contamination was indicated at Sites 41, 43 through 48, and 50. The range of contaminants includes VOCs, BNAs, metals, and TPH. Additional data are required at each site to assess the nature and extent of contamination.

Building Contamination: Mercury contamination was indicated in the building materials at Sites 54 and 55. Additional study was recommended at both sites to provide data to assess an appropriate removal method.

1.0 INTRODUCTION

The following report discusses field activities and data collected during Phase II of the Site Inspection (SI) at the Indian Head Division Naval Surface Warfare Center (IHDIVNAVSURFWARCEN), Indian Head, Maryland. Phase II of the SI involved the study of 14 sites at the IHDIVNAVSURFWARCEN facility. This report is submitted to the Chesapeake Division Engineering Command Facility (CHESDIV) in accordance with the provisions of Southern Division Navy Contract N62467-89-D-0318. For this report the term "facility" refers to IHDIVNAVSURFWARCEN.

1.1 Facility Description

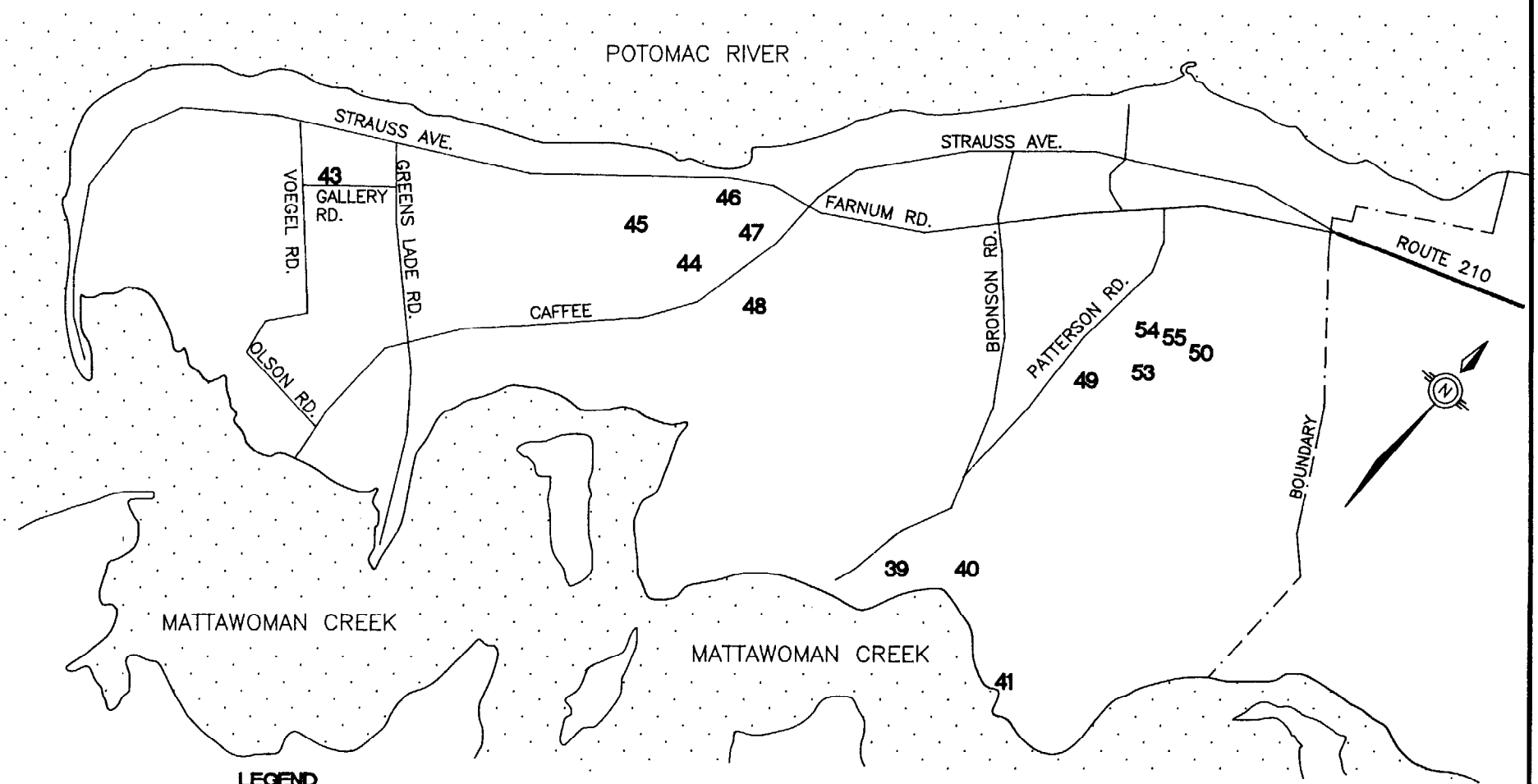
The facility is in northwestern Charles County, Maryland, on the Indian Head Peninsula. It is isolated by the Potomac River to the northwest, west, and south, Mattawoman Creek to the south and east, and the town of Indian Head to the northeast (Figure 1-1). The facility produces ordnance propellants and explosives.

1.2 Overall Project Objective

The objective of this project was to determine if contamination is present at any of the subject sites as a result of former operations and/or releases. This was accomplished by completing an SI specific to each site. Section 5 outlines the specific objective of each site study and reports the field activities and study results. Analytical data are presented in Appendix C.

1.3 Previous Studies

An Initial Assessment Study (IAS) was completed at the facility in 1983 under the former Navy Assessment and Control of Installation Pollutants (NACIP) Program. The IAS is equivalent to the Preliminary Assessment (PA) portion of the Navy Installation Restoration (IR) Program. The focus of the IAS was to assess facility areas for the potential of past releases and to



LEGEND

39–ORGANICS PLANT
40–PALLADIUM IN SEDIMENTS
41–SCRAP YARD
43–TOLUENE DISPOSAL SITE
44–SOAK OUT AREA
45–ABANDONED DRUMS
46–CADMIUM SAND BLAST GRIT
47–MERCURIC NITRATE DISPOSAL
48–DUMP SITE
49–CHEMICAL DISPOSAL PIT
50–BUILDING 103
53–GENERAL LABORATORY AREA
54–BUILDING 101
55–BUILDING 102

* PRODUCTION WELLS LOCATED THROUGHOUT THE FACILITY

NOT TO SCALE

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FIGURE 1–1
FACILITY MAP AND
SITE LOCATIONS

DATE: 02/24/94 | DWG NAME: INDH031

determine if additional study was necessary. The IAS was followed by a Confirmation Study, in 1985, which is equivalent to an SI. A supplemental PA was completed in 1991 under the current Navy IR Program. The PA report contained information pertaining to the suspected source of possible contaminants at each site. Further study was recommended based on findings in the supplemental PA.

1.4 Sites

Fourteen sites plus baseline sampling of 11 facility production wells were scheduled for study under Phase II of the IHDIVNAVSURFWARCEN SI. The sites are listed below and the location of each is indicated on Figure 1-1.

Sites Under Study
Phase II SI

Site Number	Name/Description
39	Organics Plants — Silver contamination in sediments (Mattawoman Creek)
40	Palladium Catalyst in Sediment (Mattawoman Creek)
41	Scrap Yard
43	Toluene Disposal Site
44	Soak Out Area
45	Abandoned Drums
46	Cadmium Sandblast Grit Area
47	Mercuric Nitrate Disposal Area
48	Dump Site — Nitroglycerine Plant Disposal Area
49	Chemical Disposal Pit
50	Building 103 Crawl Space
53	General Laboratory Area
54	Building 101 — Mercury Contamination
55	Building 102 — Mercury Contamination
PW	Production Wells

2.0 GEOLOGY AND HYDROLOGY

2.1 Regional Geology and Physiography

The Indian Head Peninsula is in the Atlantic Coastal Plain physiographic province. The peninsula is on the western edge of an eastward-thickening wedge of interbedded fluvial and marine deposits. This wedge conforms to the underlying crystalline basement rock of the Piedmont Province. These deposits range in age from Cretaceous to Quaternary and in thickness from 650 to 900 feet (Vroblesky, 1991). On the Indian Head Peninsula, this wedge includes the Upper Lowland Deposits and the subordinate Potomac Group (Harsh, 1990). The United States Geological Survey (USGS) geologic map for Charles County (McCartan, 1989) is included as Plate 1. A geologic cross-section and a geologic column are included with the map.

The Lowland Deposits are a Quaternary sequence of fluvial and estuarine deposits ranging from 0 to 150 feet in thickness composed of medium- to coarse-grained sands and gravels grading upward to silt and clay. Isolated cobbles and boulders may be found at the base of the fluvial deposits (Vroblesky, 1991). These sediments are cut-and-fill deposits from paleochannels of the early Potomac River system that unconformably overlie Tertiary and Cretaceous formations in the Indian Head area.

Tertiary deposits at Indian Head are restricted to the marine Aquia Formation. This formation comprises micaceous, glauconitic, fine- to coarse-grained quartz sand with a few beds of olive-gray silty clay and very fine silty sand. In places on the upland, a thin layer of the Aquia Formation unconformably overlies the eroded surface of the Cretaceous Patapsco Formation of the Potomac Group (Hiortdahl, 1990).

The Cretaceous Potomac Group consists of the Patapsco, Arundel, and Patuxent Formations and ranges from 650 to 750 feet in thickness (Vroblesky, 1991; Harsh, 1990). The Potomac Group is characterized by crossbedding, channel fills, and lateral pinching and thickening of beds (Hiortdahl, 1990). These formations are composed of interbedded gravels, argillaceous sands,

and multicolored silts and clays (U.S. Department of the Navy, P-059, 1990). A marker unit on top of the Upper Patapsco Formation consists of an iron-cemented, reddish, medium-grained sand. The Upper Patapsco confining unit was the only member of the Potomac Group encountered during the study.

2.2 Regional Hydrology

There are numerous localized aquifer systems in the Lowland Deposits (Hiortdahl, 1990). These aquifers are not used as a potable water source by the facility or on the Indian Head Peninsula. The main aquifer system used as a potable water source for this region is a series of water-bearing units and confining units of the Potomac Group, topped by the Upper Patapsco confining unit. A study was completed on the changes of water quality in Charles County, Maryland, by the USGS (Hiortdahl, 1990) and is presented in Appendix A, Section A.1.

2.3 Facility Geology and Hydrology

Local topography includes an upland area in the northern portion of the facility, extending northeast beyond the main gate. This upland area slopes to the north and northwest terminating as bluffs along the shore of the Potomac River. It gently slopes to the southeast toward the southern boundary of the facility, where low-lying swampy areas are present along Mattawoman Creek. Along the eastern part of the facility, the eroded edge of the upland forms several steep slopes along Mattawoman Creek.

2.3.1 Geology

The surficial geology comprises Cretaceous fluviodeltic, Tertiary marine, and Quaternary fluvial deposits, which include the Cretaceous Upper Patapsco Formation, the Tertiary Aquia Formation, and the Quaternary deposits of the Potomac River System.

The upland is an erosional remnant of the Upper Patapsco Formation capped by a thin layer of Tertiary Aquia Formation. The Quaternary sediments make up the majority of the surficial exposures and are generally thickest in the lower relief areas.

The USGS reports that the early Potomac River cut paleochannels across the Indian Head Peninsula during the Quaternary (Hiortdahl, 1990). A paleochannel is evident where Quaternary deposits form a belt along the northeast end and the southeastern part of the facility. The southern section of the paleochannel extends across the entire southern region of the facility. Portions of these units subsequently have been eroded by the current Potomac River and Mattawoman Creek systems.

2.3.2 Hydrology

The shallow, water-bearing zones (water table aquifer) of the facility are controlled by the shallow soil deposits. In general, the water table appears to be between 7 and 10 feet below the ground surface within the Quaternary sediment belt. Lithologies of the water-bearing zones were usually restricted to silty and sandy clay zones.

No shallow, water-bearing zones were encountered in the upland area at the General Laboratory Area, Site 53. A thin layer of the Tertiary deposits overlie the Upper Patapsco confining unit along the upland. Soils in this area were very stiff, with lithologies ranging from silt to silty clays. A marker bed on top of the Upper Patapsco Formation, an iron-cemented reddish sand unit, was encountered in three borings in the upland area at depths ranging from 30 to 40 feet. Interception of this unit indicated the Upper Patapsco confining unit and that the Patapsco aquifer would be the upper-most aquifer. The Patapsco aquifer is estimated to be more than 100 feet below ground surface in the upland area. Logs for all borings completed during the SI are included in Appendix A, Section A.2.

Data collected during Phase I and Phase II of the SI generally indicate that the inorganic quality of the water table aquifer is poor. Analytical results of groundwater samples indicate elevated concentrations of total dissolved solids (TDS) in the water table aquifer suggesting that water from the surficial zones is not suitable as a potable water source. This unit is not used by the facility as a potable source. The water table aquifer is not used as a potable water source on the peninsula (Hiortdahl, 1993).

Although no qualified pumping tests were conducted, observations noted during well development indicated that recharge rates were slightly higher than well development pumping rates. Well development pumping rates were not fully quantified; however, estimates range from 1.0 to 2.6 gallons per minute (gpm).

Potable water wells (production wells) at the facility are screened in one or more sand zones in either the Patapsco or Patuxent Formations (Hiortdahl, 1993). These production wells serve a population of 3,350 on the facility. That includes 2,000 employees, 1,000 contracted employees, 100 Strauss Avenue residents, and 200 Bachelor Enlisted Quarters residents. Current information indicates these wells do not supply reserves or residences beyond facility boundaries. This information was obtained from "*Response to Hazard Ranking Score Deficiency Checklist, for Indian Head Division, Naval Surface Warfare Center, Indian Head*," D. 20640-5035, EPA ID #MD 4170024109.

3.0 SAMPLING PROCEDURES

Sampling methods are discussed in detail in this section. Any significant deviation from the procedures described herein are detailed in the site study discussions, Section 5.

3.1 Soil Sample Procedures

All soil borings were completed as described in this section unless site conditions warranted a modification. The soil boring procedures described below include borings completed as shallow monitoring wells. All soil boring logs and monitoring well diagrams are included in Appendix A, Section A.2.

3.1.1 Soil Boring and Sampling

- Borings were completed to the target depth or to groundwater using standard 4.25-inch internal diameter (ID) hollow-stem augers. Standard penetration tests and split-spoon soil samples were collected at 5-foot intervals to depth, or as directed by the site geologist.

- The soil sampler was a standard 24-inch long, 2-inch outside diameter (OD) split-spoon. The augers were advanced to the top of the desired sampling depth. The split-spoon sampler was attached to the end of drilling rods, inserted into the annulus of the auger, and lowered to the sampling depth. The sampler was driven 24 inches, in advance of the auger bit, with a 140-pound hammer dropped 30 inches, in accordance with Naval Energy and Environmental Support Activity (NEESA) 20.2-031A.

- After the split-spoon sampler was retrieved, and opened, and a portion of the soil sample was collected for analysis of the volatile constituents (when applicable). The soil was placed in the appropriate container and labeled. The filled sample container was placed in a cooler on ice at approximately 4 degrees Celsius (°C).

- The remaining portion of the soil sample was split, with one part prepared for laboratory analysis and the other part prepared for headspace analysis in the field. Headspace analysis was completed only on samples scheduled for volatile organic compound (VOC) analysis in the laboratory.

- The headspace screening process involved placing a sub-sample in a resealable plastic bag and allowing the sample to reach ambient temperature. Headspace was measured by inserting the probe into the bag and measuring the total organic vapor in the headspace of the sample container. All headspace data were recorded on the appropriate boring logs. When sample quantity was insufficient for applying headspace techniques, direct measurements were completed immediately after the split-spoon was opened. Sample head space was measured for VOCs by a photo-ionization detector (PID) (MicroTip) with a 10.2 electron volt (eV) lamp.

- The soil sample then was classified by an experienced geologist. Following classification, the sample was placed in a stainless steel bowl and mixed to form a homogenized sample. The soil then was placed in the appropriate container, labeled, and placed in a cooler on ice.

- Soil samples with the highest indicated concentrations of organic vapors were submitted to PACE, Inc., of Minneapolis, Minnesota, (NEESA-approved) under strict chain-of-custody for analysis. If no organic vapors were detected, the project geologist selected the laboratory sample based on sample conditions and/or visual observations.

- All borings were abandoned by pressure grouting to the surface to prevent surface runoff from entering the boring.

- All drilling equipment was decontaminated between borings to prevent cross contamination. Decontamination consisted of a high-pressure hot water wash followed by a potable water rinse. Decontamination was completed before and after each boring was drilled for this project. Split-spoon samplers were decontaminated before and after each use by an Alconox wash followed by a potable water rinse.

3.1.2 Hand Auger Boring and Sampling

Shallow soil samples were collected using a stainless steel hand auger. Soil samples were collected at 1-foot intervals. The sample intervals were generally from 0 to 1 foot, 1 to 2 feet, and 2 to 3 feet. The total depth of boring completion was determined by the scope and conditions at each site. The hand auger was turned to the desired sampling depth. The sample was retrieved from the boring and placed into a pre-cleaned stainless steel bowl. The appropriate container was filled immediately for the volatile fraction analysis. The remaining soil was mixed to homogenize the sample. The sample was then placed into the appropriate, pre-cleaned sample container. A label was placed on each sample container, which was given a unique identification number. Each sample was placed in a cooler on ice.

3.1.3 Surface Soil Sampling

Surface soil samples were collected with a disposable scoop and placed in a stainless steel bowl. First, the volatile fraction was placed in the appropriate container, then the remaining portion was mixed and homogenized and the appropriate container filled. Each container was labeled and placed in a cooler on ice.

3.2 Monitoring Well

All shallow groundwater monitoring wells were constructed to comply with the State of Maryland Well Construction Regulations, Code of Maryland Administrative Responsibilities (COMAR) 26.04.04 and all applicable United States Environmental Protection Agency (USEPA)

criteria. Figure 3-1 is a typical well configuration. Well drilling and installations were logged and supervised by the site geologist.

3.2.1 Monitoring Well Installation Procedures

- Shallow monitoring wells were initiated with 4.25-inch ID augers. Standard penetration tests and split-spoon samples were performed at 5-foot intervals, or as directed by the site geologist throughout the drilling process. Soil samples were collected by the procedures outlined in Section 3.1.1.

- After the drilling was advanced to the target depth, the well boring was overdrilled with 8.25-inch ID hollow-stem augers to the desired target depth.

- Next the well screen and riser were installed through the augers. Well pipe was 4-inch diameter, schedule 40 polyvinyl chloride (PVC) with a 10-foot, 0.010 slot screen section. The well screen was installed to an estimated 7 feet below the water table with approximately 2.5 feet above grade stickup.

- The annular space was packed with a primary filter pack of No. 2 silica sand Unified Soil Classification System (USCS) to prevent clogging of the slots. The sand was placed in the annulus of the borehole to a depth of approximately 3 feet above the slotted screen. A secondary filter pack of finer sand approximately 2 feet thick was placed above the primary filter pack. The secondary filter pack retards infiltration of grout and bentonite into the primary filter pack.

- A bentonite seal approximately 2 feet thick was installed above the secondary filter pack and charged with deionized water. The bentonite was allowed to hydrate per manufacturer's recommendation (at least four hours) to allow complete swelling of the

STATE OF MARYLAND
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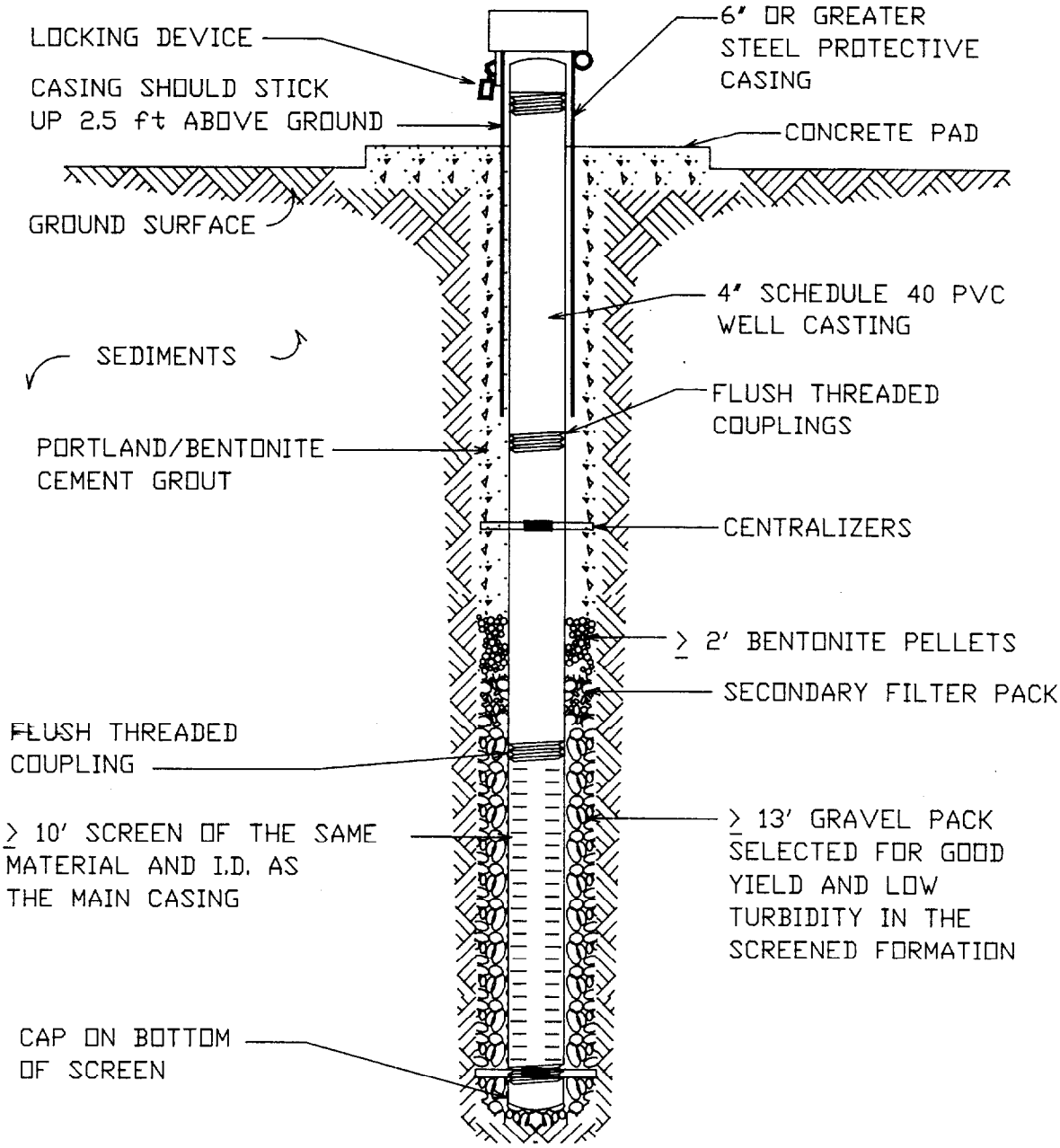
TYPICAL ILLUSTRATION OF MINIMUM SPECIFICATIONS FOR MONITORING WELL CONSTRUCTION



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INDIAN, MD

FIGURE 3-1
MONITORING WELL DESIGN

DWG DATE: 05/07/93 | DWG NAME: 03WELSCH

seal. The remaining annulus of the borehole then was filled with a Type I Portland cement with a 5 percent bentonite slurry to the surface.

- An outwardly sloping concrete platform, 3 feet by 3 feet by 0.5 feet, was constructed at the ground surface around each well casing. A security casing with a locking cap was installed around the well casing to preserve the integrity of the well.

- A permanent measuring point was established at the top of each "true" well casing. This point was marked and surveyed to establish the elevation relative to a permanent USGS North America Datum (NAD) 1983 benchmark to the nearest 0.01 foot.

3.2.2 Monitoring Well Development

When well construction was complete, each well was fully developed by pumping to ensure proper functioning. Pumping was completed using a centrifugal pump by inserting a PVC flex hose into the well with a check valve connected to the submersed end.

3.3 Monitoring Well Sampling Procedures

Monitoring well sampling included reading static water levels, calculating the well casing volume of water, purging the well casing of stagnated water, retrieving the sample, and placing it into properly labeled sample containers. These procedures are described below.

3.3.1 Static Water Level Measurement

Static water levels were measured in all monitoring wells before purging.

Measurement procedures:

- The water level meter was decontaminated by deionized water and tested before use.

- The probe was lowered into the annulus of the monitoring well until the buzzer indicated the probe had intersected the groundwater surface.

- The depth-to-water was measured to the nearest 0.01 foot relative to the permanent mark established at the wellhead and the measurement, date, and time were recorded in the dedicated bound field notebook.

3.3.2 Monitoring Well Purging

Each well was properly purged of stagnant water immediately before sampling. The purging process ensures that the well is functioning properly and representative groundwater samples are obtained. During well purging, pH, temperature, specific conductivity, and turbidity were measured.

Well Purging Procedures:

- At least three casing volumes were purged from each well. The water volume in the well casing was calculated before purging by subtracting the depth to water from the total length of the casing and multiplying by the appropriate factor (0.661 gallons per foot for a standard 4-inch PVC well casing).

- Well purging was completed with a Teflon-coated, single check valve bailer that was manually lowered into the well, filled with water, and retrieved.

- No wells bailed to dryness during the well-purging process.

3.3.3 Groundwater Sample Collection

All groundwater samples were collected using a dedicated Teflon-coated, single check valve bailer, and nylon bailing rope. Samples were collected in accordance with NEESA 20.2-031A, Chapter 7 Ground-Water Sampling and Southern Division *Specifications for Groundwater Monitoring Well Installation and Sampling*.

Groundwater Sampling Procedures:

- A sheet of clean visquine was placed on the concrete platform and around the security casing to prevent the bailer and bailer rope touching the pad surface.

- The bailer was lowered slowly into the water column to minimize water column disturbance and loss of volatile parameters.

- Once the bailer filled, it was retrieved and samples were immediately collected in the appropriate sample containers with the volatile fraction being collected first.

- In the field and during transport to the laboratory, all samples were retained in a field cooler with ice packs.

3.3.4 Groundwater Sampling Equipment Decontamination

All equipment used in measuring and sampling groundwater monitoring wells was decontaminated in accordance with the work plan. Decontamination consisted of a deionized water rinse, followed by an isopropanol rinse, and a final deionized water rinse before initial use and between samples to minimize the potential for cross-contamination between sampling locations. Disposable gloves were worn during all measurement and sampling activities. A new pair of disposable gloves was donned for each water sample and/or measurement.

3.4 Wipe Samples

Wipe samples were collected at Sites 54 and 55 to determine the presence of mercury. Deionized water was used as the solvent to collect these samples. Each wipe sample was collected as outlined below.

Wipe Sample Procedures:

- A 10 cm by 10 cm sample site was marked.
- Filter paper was soaked with deionized water as the solvent for mercury.
- The marked area was wiped twice, from left to right and then from top to bottom.
- The filter paper was placed into a sample vial.
- The sample was properly labeled and placed in a cooler on ice.

3.5 Media Samples (Bulk Building Materials)

Building materials sampled as media samples were treated as suspect asbestos-containing materials, except for concrete samples. The material to be sampled first was wet with soapy water, then the sample was collected by cutting, breaking, or coring the material, as required. Care was taken not to release excessive fibers during this process. The sample then was placed in the appropriate container, which was labeled and placed in a cooler on ice.

3.6 Concrete Samples

Concrete samples were collected at Sites 54 and 55 by selecting a sample location and drilling approximately five to seven holes approximately 0.5-inch into the concrete with a hammer drill and a masonry bit. The powdered concrete was scooped up and placed into a sample container, labeled and placed into a cooler on ice. The drill bit was wiped clean with a damp paper towel and then rinsed with deionized water.

3.7 Top Sediment Samples

Top sediment samples were collected from Mattawoman Creek at Sites 39, 40, and 41 with a petite ponar sampler dropped from a row boat. The ponar sampler was dropped into the stream, then the latch was released, closing the sampler in the sediments. The ponar was retrieved and the sediment sample was placed in a stainless steel bowl. The volatile fraction was collected first, then the remainder sample was homogenized, and the appropriate containers were filled. Each container was properly labeled and placed in a cooler on ice.

3.8 Manhole Sediment Samples

Sediment samples were collected from manholes at Site 53 with a plastic dipper connected to an aluminum extension rod. The dipper was lowered into the manhole and dragged along the bottom where sediments were visible or likely to be deposited. The dipper was then retrieved and the sediment was placed in a stainless steel bowl. The sample was homogenized and placed in the proper containers. Each container was properly labeled and placed in a cooler on ice. The dipper and bowl were decontaminated between samples with a potable water wash, an alcohol rinse, and a final deionized water rinse.

3.9 Soil-Gas Sampling Procedures

Soil gas sample procedures are described in Appendix B. Although soil gas results are reported in micrograms per liter (μg/L) which is equivalent to "parts per billion (volume/volume)" in water analysis, they are not equivalent in gas analysis. This is due to the differences in the mass of equal volumes of water and gas matrices.

3.10 Analytical Procedures

Analytical procedures selected for this SI vary from site to site. Specific analytical parameters are indicated in Section 5 under the description of each site study. For more information regarding detection limits, holding times, etc., please refer to the Quality Assurance Plan (QAP), Section B of the work plan.

3.10.1 Field Analytical Procedures

Temperature (USEPA 170.1), pH (USEPA 150.1), specific conductance (USEPA 120.1), and turbidity were measured during the purging process. These field measurements were completed by filling the instrument sample chamber with water from the particular well being purged. After at least one minute and instrument stabilization, the pH, temperature, and specific conductance were measured and entered in the field logbook along with the date and time. Site-specific data are discussed in the Study Reports in Section 5.

3.10.2 Field and Laboratory Quality Control Checks

Internal laboratory control checks were conducted in the laboratory by laboratory personnel. E/A&H conducted internal quality control checks of sampling procedures and laboratory analyses, including preparation and submittal of: sampler rinsate blanks, trip blanks, field blanks, and field duplicates for analysis and an evaluation of the laboratory analytical package.

The types and frequency of blanks and other control check samples are dictated by NEESA Level C Quality Control (QC) criteria selected for this project by the NEESA Contract Representative (NCR). The required control check sample frequencies are outlined in NEESA 20.2-047B. Level C QC measures for sampling and analysis are discussed below.

3.10.3 Field Data Quality

Field data collection and sampling were conducted and/or observed by the E/A&H project geologist to ensure proper procedures were followed. Records of field activities will be maintained at the E/A&H office in Memphis, Tennessee. Such records include any obstacles encountered during the field work and all variations required due to field conditions. This information also is provided in Section 5.

All field samples were collected per the procedures outlined above. Precision was assessed by evaluating the results of duplicate samples, and accuracy was assessed by evaluating the analyses of field blanks, trip blanks, and laboratory matrix and surrogate spikes. The collection frequencies for QC sample collection is outlined in the QAP, Section B of the work plan. The rationale of the QC samples is discussed below.

Duplicate Samples — A duplicate is an identical sample collected from the same location (i.e., well) at the same time under identical conditions. Duplicate samples are analyzed along with the original sample to obtain sample procedure precision and inherent sample source variability. Duplicate samples were collected from 10 percent of all soil boring samples, and one per site.

Field Blank — A field blank consists of the source water used in decontamination and pressure washing. The sample container is filled with the source water in the field and is prepared, preserved, and stored in the same manner as the other field samples. The field blanks are analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample containers or other exogenous sources. One field blank per sampling event was prepared.

Rinsate Sample — Rinsate blanks are collected by retaining rinsate from sampling equipment. The equipment is rinsed with deionized water after full decontamination procedures have been performed. Rinsate samples are collected in the same type of sample containers as the field samples. Rinsate samples were collected and analyzed in accordance with the work plan.

Trip Blank — A trip blank is a sample container prepared by the laboratory and filled with organic-free water that is transported unopened with the sample bottles to and from the site. It is opened in the laboratory and analyzed along with the field samples for water matrix volatile organic parameters only. Trip blanks were submitted to the laboratory in all sample shipping containers holding field samples for volatile analyses at a frequency of one per sample shipping cooler.

Sample Identification

Each sample container was labeled with the time and date of collection, the sample number, and the specific analytical request for that sample and container. Samples were identified with a unique alpha-numeric series comprising six to eight digits. The first and second digits identify the study site as indicated previously in Section 1.4. The third digit identifies the sample matrix and the fourth digit indicates the sampling method or sample source. The identifiers for the third and fourth digits are listed below. The sample location is identified by the fifth and sixth digits. The last two digits were reserved to identify the depth interval for soil borings and hand

auger samples. The corresponding sample numbers and depth intervals also are provided in the list below.

Sample Identifiers for Indian Head Site Inspection					
Matrix Identifiers		**Method Identifiers**		**Sample Intervals/Feet**	
S	= Soil	**B**	= Soil Boring	**01**	= 0-1
D	= Sediment	**A**	= Hand Auger	**02**	= 5-7
G	= Groundwater	**P**	= Petite Ponar	**03**	= 10-12
W	= Wipe	**M**	= Manhole	**04**	= 15-17
B	= Bulk Materials	**S**	= Surface Soil/Sediment	**05**	= 20-22
C	= Concrete			**06**	= 25-27
SW	= Surface Water	**W**	= Monitoring Well	**07**	= 30-32
				08	= 35-37

QC samples were identified in a similar fashion. The first two digits identify the corresponding site, the third and fourth digits indicate the type of QC sample, and the last four digits indicated the month and day of collection. QC identifiers are as follows: FB — field blank and RB — rinsate blank. Field duplicate samples were identified by a D at the last digit position of the sample identification.

4.0 DATA VALIDATION AND REDUCTION

Phase II of the SI was conducted in accordance with NEESA guidelines and applicable USEPA guidelines. The analytical work was conducted by PACE, Inc., in accordance with the laboratory's NEESA-approved QAP. The guidelines for the analytical work performed are outlined in the *USEPA Contract Laboratory Program, Statement of Work for Organics Analyses* (USEPA CLP 3/90), *USEPA Contract Laboratory Program, Statement of Work for Inorganics Analyses* (USEPA CLP SOW 3/91) and with NEESA's Level C QC guidelines as stated in the *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation and Restoration Program* (NEESA 20.2-047B).

Other analytical parameters included Total Petroleum Hydrocarbons (TPH) by USEPA Method 418.1 and mercury by USEPA Method 7470. Because the site was an explosives-manufacturing facility, selected samples were analyzed for acetal/formal, plastisol nitrocellulose, nitrate esters, unsymmetrical dimethylhydrazine, and high bulk nitroguanidine by United States Army Toxic and Hazardous Material Agency (USATHAMA) methods. The following sections discuss the quality of the analytical results. The validated analytical results and an explanation of data qualifiers are presented in Appendix C.

Summary — Review of the data has determined that the analytical work conducted as part of this Phase II SI in accordance with applicable NEESA and USEPA guidelines. Though some minor problems were discovered during the data review and validation process, the impact on data quality was considered minimal. Data quality objectives were found to be in accordance with NEESA Level C requirements. The overall quality of analytical work for Phase II of the SI has been considered satisfactory and all data are acceptable and usable, with appropriate qualifiers.

4.1 Organics Analyses

4.1.1 Sample Handling and Preservation

Sample Condition — All samples were received by the laboratory in good condition with the proper custody documents and the seals intact. In sample delivery group (SDG) 24371, samples 43RB0820, 43FB0820, 44FB0821, 44RB0821, 39FB0825, 47FB0822, and 47RB0822 were received with elevated pH values. Because these samples are source/distilled water QC samples, the insufficient preservation was not considered to have affected field sample data quality.

Holding Times — The contractual holding times from the Validated Time of Sample Receipt (VTSR) until the time of sample extraction and/or analysis were found to be in compliance with the contract requirements.

4.1.2 Instrument Performance

Gas Chromatograph/Mass Spectrometry (GC/MS) Tuning — The purpose is to ensure mass resolution, identification and, to some extent, instrument sensitivity. In reviewing the data presented, all bromofluorobenzene (BFB) and decafluorotriphenylphosphine (DFTPP) ion abundance criteria and mass calibration requirements were found to be within compliance as established by CLP.

Criteria for the GC by electron capture detector (ECD), in the pesticides/PCBs analysis, were also established to ensure adequate chromatographic resolution and instrument sensitivity by the system. In reviewing the data presented, the GC by ECD calibration requirements also have been determined to be within compliance as established by CLP.

Calibration — QC criteria for instrument calibration were established to ensure acceptable qualitative and quantitative data were produced. The purpose of the initial calibration is to ensure the instrument's capabilities before the analysis run and the continuing calibration is done to ensure the instrument's capabilities throughout each analysis run.

Calibrations performed under the CLP program are required to meet certain criteria. The criteria for the volatile, semivolatile, and pesticide/PCBs parameters are outlined below:

- Both initial and continuing standards of target compounds and surrogates are analyzed at concentrations and frequencies specified in the CLP SOW.

- Calibration criteria require that standard Relative Response Factors (RRFs) for all target compounds and surrogates be greater than or equal to 0.05. Percent Relative Standard Deviation (%RSD) of the RRF values must be less than or equal to 30.0 percent for all compounds in the initial calibration and greater than or equal to 25.0 percent in the continuing calibration.

RRF values and %RSD calculations are:

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

where: A = area of the characteristic ion measured
C = concentration
is = internal standard
x = analyte of interest

$$\%RSD = \frac{\sigma}{x_{avg}} \times 100\%$$

where: σ = standard deviation of corresponding RRFs
x_{avg} = mean of corresponding RRFs

In reviewing the analytical data, certain volatile and semivolatile compounds were found to have %RSD and/or percent difference (%D) outside of QC limits. As a result, affected sample constituents with detections greater than the contract required detection limits (CRDL) were qualified as estimated. The "J" flag indicates the concentration to be an estimated value.

Calibrations for the High Performance Liquid Chromatography (HPLC) method, used in determining explosives, were performed in accordance with USATHAMA requirements. In brief, duplicate injections of calibration standards were analyzed for each compound of interest. Daily calibration includes multiple runs of standards at the beginning, midpoint, and after the last sample analysis. In reviewing the calibration data, all results were determined to be satisfactory.

4.1.3 Accuracy

Accuracy is the degree to which a given result agrees with the true value. To check the accuracy in a volatile or semivolatile analysis, the CLP SOW requires adding known amounts of "surrogate" compounds (compounds that are not likely to be found in the actual samples) and internal standards. If upon analysis of the sample, the percent recovered for the surrogate compounds and/or internal standards are accurate (i.e., close to the known concentrations) as defined within the limits set by CLP, then the reported target compound concentrations are assumed to be accurate.

The accuracy of the overall measurement system also indicates any bias present in the environmental laboratory and in the field sampling/analysis plan. Possible sources of error may be from the sampling process, field, and/or laboratory contamination, preservation, handling, and/or from the sample matrix itself. To determine laboratory inaccuracies or contamination, method blanks are prepared and analyzed along with the field samples. Methods used to determine field inaccuracies include trip blanks, field blanks, and equipment rinsate blanks.

Surrogate Recoveries and Internal Standards — The laboratory's analytical performance on each sample is established by evaluating the surrogate data. The purpose of the internal standards is also to ensure the instrument's sensitivity and the response stabilities during each analytical run. All samples are spiked with the surrogate compounds and standards before sample preparation.

The evaluation of these surrogate compounds and standard recoveries is not necessarily straightforward. One frequent occurrence is an effect from the samples themselves, due to factors such as matrix interferences or high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique sample problems, the evaluation and review of the data based on specific sample results is frequently subjective and demands analytical experience and professional judgment.

No qualifications with respect to surrogate recoveries are placed on sample data unless more than one surrogate is out of specifications in the volatile analysis, or at least two surrogates are out of specifications in the base/neutral fraction or acid fraction in the semivolatile analysis. Exceptions are made for any surrogate with a recovery of less than 10 percent.

No qualification of sample data is warranted based on pesticide surrogate recoveries. As specified in the CLP SOW, no corrective action is required by the laboratory in the case of surrogate recoveries outside of advisory QC limits. Pesticide surrogate recovery data are reviewed in conjunction with other QC data to determine necessary qualification of sample data.

All surrogate recoveries and internal standards recoveries were within QC criteria for this project except for those outlined below (by SDG number):

24371 — In the semivolatile fraction, sample 39RB0825 displayed low recoveries of four internal standards. Low recoveries were detected for two internal standards in sample

47RB0822. Upon re-analysis, both samples resulted in only one internal standard outside of QC limits. All affected compounds in samples 39RB0825 and 47RB0822 were qualified as estimated (i.e., "J" flagged).

In the pesticide/PCB fraction, samples 39RB0825 and 39FB0825 both had surrogate recoveries slightly below advisory QC limits. No qualification of sample data is warranted based on the pesticide surrogate recoveries.

The affected samples within this SDG are QC samples. Field sample data quality is not considered to be affected by the surrogate and internal standard recoveries of the above mentioned QC samples.

24798 — In the volatile fraction, samples 41DP05DL, 41DP07, 41DP08, 41DP08DL, and 41DP09 all contained a high recovery of one surrogate. Samples 41DP07 and 41DP09 were re-analyzed with similar results. No corrective action was required in the case of the one surrogate.

Samples 41DP07, 41DP08DL, 41DP09, and 41SB0201 all displayed low volatile internal standard recoveries. Sample 41SB0201 was re-analyzed with acceptable results. No re-analysis of sample 41DP08DL was required due to the acceptable recoveries in the analysis of sample 41DP08. Samples 41DP07 and 41DP09 were re-analyzed with insufficient improvement. Results for volatile organics in samples 41DP07 and 41DP09 were qualified as estimated, (i.e., "J" flagged). Non-detected volatile target compounds also were qualified as estimated (flagged "UJ").

In the semivolatile fraction, samples 41DP03, 41DP04, 41DP06, and 41DP09 all had one internal standard below QC limits. The samples were all re-analyzed with similar results.

Again, all affected positive sample results were flagged "J." Non-detected compounds were flagged "UJ."

Sample 41SB0201 had four semivolatile internal standard recoveries outside QC limits. A subsequent dilution of the sample showed no internal standard recoveries outside QC criteria. No qualification of this sample was necessary.

Sample 41DP0203 had no semivolatile internal standard recoveries within QC criteria. The sample was re-analyzed, resulting in only one standard recovery below QC limits. Sample 41DP0203 had positive results "J" flagged. Non-detected results were "UJ" flagged.

In the pesticide/PCB fraction, sample 41DP06 displayed all surrogate recoveries below advisory QC limits. Sample 41SB0201DL had one surrogate with recovery above advisory QC limits. As specified in the CLP SOW, no qualification of sample data is warranted based on the pesticide surrogate recoveries outside advisory QC limits.

24431 — In the volatile fraction, samples 47SA08, 39DP04, and 39DP06 contained a high recovery of one surrogate. The re-analysis of sample 47SA08 yielded similar results. No qualification was considered necessary in the case of the one surrogate. Samples 39DP04 and 39DP06 were re-analyzed with acceptable surrogate recoveries but with low internal standard recoveries. Positive results in samples 39DP04 and 39DP06 were qualified as estimated (i.e., "J" flagged). Non-detected compounds were flagged "UJ."

Sample 39DP03 had high recoveries for three volatile surrogate compounds. The re-analysis of this sample yielded acceptable results. No further corrective action is necessary.

24171 — In the volatile fraction, sample 50SS09 displayed low recoveries of two internal standards. The sample was re-analyzed, resulting in one standard just below QC limits.

Positive results were qualified as estimated (i.e., "J" flagged). Non-detected compounds were flagged "UJ."

In the semivolatile fraction, sample 55SS05DL had two internal standard recoveries below QC limits. The results of the original analysis of sample 55SS05 were acceptable; therefore, no corrective action was required for the dilution.

24822 — In the volatile fraction, two internal standard recoveries were outside of QC limits for sample 41SB0301. The sample was re-analyzed, resulting in all internal standard recoveries and two surrogate recoveries outside QC limits. All positive results for affected compounds were qualified as estimated (i.e., flagged "J"). Non-detected compound results were flagged "UJ."

In the pesticide/PCB fraction, samples 41SB0301 and 41SB0304 each displayed two surrogate recoveries outside advisory QC limits. Sample 42SB0301DL displayed three pesticide surrogate recoveries outside advisory QC limits. Samples 41SB0402 and 41SB073D each displayed one pesticide surrogate recovery below advisory QC limits. As specified in the CLP SOW, no qualification of sample data is warranted based on the pesticide surrogate recoveries outside advisory QC limits.

25654 — In the semivolatile fraction, samples 41RB0901, 41FB0901, 44FB0908, 44RB0908, and 44RB0909 all have recoveries below 10 percent for surrogate Phenol-d5. All positive results for affected semivolatile target compounds were flagged "J." CLP data validation guidelines state when a surrogate recovery is below 10 percent, non-detected target compounds may be qualified as unusable (i.e., flagged "R") at the discretion of the data reviewer. Because these are QC samples and field sample data were not affected by the outliers, non-detected compounds were qualified "UJ." All semivolatile surrogate and internal standard recoveries for the other samples in this SDG were within QC limits.

In the pesticide/PCB fraction, one sample, 41FB0901, displayed one surrogate below advisory QC limits. No sample data qualification is required based on the pesticide surrogate recoveries outside advisory QC limits.

25665 — In the semivolatile fraction, sample 49DS01 exhibited one high surrogate recovery and two internal standards outside QC limits. The sample was re-analyzed with similar results. Positive results for sample 49DS01 were qualified as estimated (i.e., "J" flagged). Qualification was not necessary for non-detected affected target compound results.

26647 — In the semivolatile fraction, samples IW12 and IW18 each exhibited one surrogate recovery just below QC requirements. No qualification is necessary for the case of one surrogate outside QC limits.

Sample IW09 had one semivolatile internal standard below QC limits. The sample was re-analyzed with similar results. Positive results for sample IW09 were qualified as estimated (i.e., "J" flagged). Non-detected compounds were flagged "UJ."

In the pesticide/PCB fraction, samples IW07, IW09, IW15, and IW18 each had surrogate recoveries below advisory QC limits. No data qualification is necessary based on the pesticide surrogate recoveries outside advisory QC limits.

27399 — Sample 41GW01D had one high surrogate recovery in the volatile fraction. No corrective action was necessary in the case of the one surrogate.

In the semivolatile fraction, sample 44GW03 had two surrogates and one internal standard above QC limits. The sample was re-analyzed, resulting in one surrogate and one internal standard outside QC limits. No qualification was necessary as there were no positive semivolatile target compounds were detected in this sample.

In the pesticide/PCB fraction, samples 41FB0918, 41GW02, and 41RB0918 each had two surrogate recoveries below advisory QC limits. No data qualification is necessary based on the pesticide surrogate recoveries outside of advisory QC limits.

Blanks — Assessments of laboratory or field blank analysis results determine the existence and the magnitude of any contamination resulting from the laboratory or field. If problems are found in any of the blanks, all associated data are evaluated to determine whether there is an inherent variability in the data, or if the problem is an isolated occurrence and does not affect the data. In some cases these contaminants are solvents considered to be common laboratory artifacts, for example, methylene chloride, acetone, and 2-butanone for volatile methods. Phthalate ester compounds are considered to be common laboratory artifacts in the semivolatiles methods.

Action regarding the blank results depends on the circumstances and origin of the blank. In accordance with CLP, laboratory and field blanks are evaluated using the 10- and five-times rules. The associated sample results are reported only if the concentrations of detected compounds exceed 10 times the highest amount detected in the blank for known laboratory artifacts or five-times the amount detected in the blank for other target compounds. The 10- and five-times criteria allow target compounds in the sample to be qualified and/or elevate their quantitation limits.

In reviewing the sample results, concentrations of laboratory artifacts were detected above the calculated quantitation limits in some samples. The project QA manager determined these compounds should be considered laboratory artifacts only and that no conclusions or recommendations be based on these compounds.

Field Blank — These blanks are sample containers filled with the source water used in decontamination and pressure washing. The field blanks are from the same environment and condition in which the other field samples were collected. The field blanks were prepared,

preserved, and stored in the same manner as the field samples and analyzed along with those samples for the same constituents of interest. Field blanks are collected to check for contamination imparted to the samples by the sample containers or other exogenous sources.

Each field blank organic contamination has been detailed in Table D-1 of Appendix D. The results from each field blank were used to review and qualify contaminants detected in the associated field samples.

Rinsate Blank — The equipment rinsate blanks were prepared by retaining rinsate from completely decontaminated sampling equipment. The rinsate blanks were analyzed along with the field samples and for the same constituents of interest. The rinsate blank organic contamination has been detailed in Table D-2 of Appendix D. The results from each rinsate blank were used to review and validate contaminants detected in the associated field samples.

Trip Blank — Trip blanks are used in the volatile constituent measurements only. A trip blank consists of a volatile organics analysis (VOA) sample container filled by the laboratory with organic-free water that travels unopened with the sterile sample bottles to the field. The blank is shipped back to the laboratory with the collected field samples and then analyzed. The trip blank is opened only in the laboratory and analyzed along with the field samples for the same volatile constituents. The trip blank contamination has been detailed in Table D-3 of Appendix D. The results from the trip blanks are used to review and validate volatile contaminants detected in the field samples.

4.1.4 Precision

For each analytical method used to analyze environmental samples, there are variations in the reported results that may be due to the random differences in the handling and analysis of that matrix. These variations are referred to as the *precision* or the reproducibility of results. To demonstrate precision, the CLP SOW specifies the addition of known quantities of several

compounds to two aliquots of each sample matrix type. The "spiked" aliquots are referred to as the matrix spike and the matrix spike duplicate (MS/MSD). These samples are then analyzed using the same preparation and the same analytical methods as used for all the samples of the same matrix type. These samples can detect matrix effects in which other sample components interfere with the analysis of the contaminants of concern (CCOC).

(MS/MSD) — Information acquired from the MS/MSD determine the long-term accuracy and precision of the analytical methods and the effects of the sample matrix. The analytical MS/MSD were performed on the samples at a frequency of one per 20 samples of a similar matrix, in accordance with the USEPA CLP SOW (3/90). The USEPA CLP SOW also sets the criteria for acceptable control limits on the laboratory's MS/MSD recoveries and RPDs. The organic MS/MSD samples are discussed below:

24371 — Sample 39RB0825 was selected as the MS/MSD sample for the high bulk nitroguanidine (HBNQ) analysis. All recoveries (%R) and RPDs were within QC limits.

24194 — In the nitrate ester analysis, sample 54C001 was selected as the MS/MSD sample. 1,3,5-tinitrobenzene, tetryl, and 2,4,6-trinitrotoluene showed no recovery in the MS and MSD. The sample was re-extracted and re-analyzed with similar results. A mid-level control spike was analyzed and recoveries obtained were within 95 percent to 112 percent. Nitrate ester analytical results for all of the samples in this SDG were negative for these three compounds (1,3,5-trinitrobenzene, tetryl, and 2,4,6-tinitrotoluene). Results of the MS/MSD analysis indicate matrix interference, due to the concrete matrix of the sample. Upon review of the data, the project QA manager determined the results may be false negatives, and sample results were qualified as estimated (i.e., flagged "UJ").

24798 — Samples 41DP01D and 41DP10 were used as MS/MSD samples for this SDG. All results were within QC limits.

24431 — Sample 47SA02D and 47SA06 were selected as the MS/MSD samples for this SDG. All %Rs and RPDs were within QC limits in the volatile and HBNQ analyses. In the semivolatile fraction, all recoveries were within QC limits; however, all RPDs were above QC limits. The laboratory believes part of the matrix spike (MS) sample could have been lost during sample preparation, leading to inconsistent results. Internal standard recoveries were determined to be satisfactory between the MS and MSD sample recoveries.

24171 — Samples 50SS01D and 47SA01 were chosen as the MS/MSD samples for this SDG. All recoveries and RPDs were within QC criteria for the volatile and semivolatile fractions. In the TPH fraction, sample 44SA02 was chosen for the MS/MSD analysis. All spike recoveries and RPDs were found to be satisfactory. In the nitrate ester analysis, the recoveries of six compounds were below QC limits. All RPDs were less than 7 percent, indicating possible matrix interference.

24822 — Sample 41SB072D was selected for the MS/MSD samples for this SDG. All recoveries and RPDs were acceptable in the volatile, pesticide/PCB, and TPH fractions. In the semivolatile fraction, all recoveries were within limits, but the RPD for 1,2,4-trichlorobenzene was just above the QC limit for that compound.

25654 — Sample 41FB0901 was the MS/MSD sample in the TPH analysis. The percent recovery was above QC limits. However, because no TPH was detected in the associated samples, no qualification of the results was necessary.

25665 — Sample 41SB062D was selected as the MS/MSD sample for this SDG. All recoveries and RPDs were within acceptable limits in the volatile, semivolatile, pesticide/PCB, and TPH fractions.

Sample 49DS01 was the only sample from this SDG analyzed for nitrate esters. In the nitrate ester MS/MSD analysis, the RPD for HMX was 98 percent, due to a high recovery in the MSD. Upon review of the data, the QA manager determined that the MSD results are erroneous and, therefore, should not be considered in the data review process. Analytical results for this sample are not believed to be affected.

26667 — Sample 53SB093D was used for the nitrate ester MS/MSD in this SDG. All results were satisfactory.

26643 — Sample 48SA0301 was chosen for the MS/MSD analysis in the volatile fraction. All results were within QC specifications. Sample 48SA0302 was used for the MS/MSD sample in the semivolatile fraction. There were five recoveries above the QC limits in the MS, and two recoveries above limits in the MSD. All RPDs were within limits. Sample 53SB043D was selected for the nitrate ester MS/MSD sample. All results were acceptable.

27399 — Samples 41GW01D and IW06 were chosen for the volatile, semivolatile, and pesticide/PCB MS/MSD analyses. All results were acceptable in the volatile and pesticide/PCB fractions. Sample 41GW01DMS, 41GW01DMSD, and IW06MSD each had one recovery just above QC limits in the semivolatile fraction. All RPDs were satisfactory.

26262 — Sample 44SB054D was chosen for the MS/MSD sample in the volatile, semivolatile, TPH, and nitrate ester fractions. All MS/MSD results were within QC limits. Sample 41SB0802 was chosen as the MS/MSD for the pesticide/PCB analysis. All results were acceptable.

MS/MSD data are used to assist in the review and qualification process. As presented in the *CLP National Functional Guidelines for Evaluating Organic Analysis*, no action is taken on MS/MSD data <u>alone</u> to qualify an entire case. Using informed professional judgment, the data

reviewer uses the MS/MSD results in conjunction with other QC criteria to determine the need for data qualification.

Field Duplicates — The duplicate samples assist in giving an indication of overall precision. A greater variance should be expected for the soil sample duplicates compared to water sample duplicates due to the matrix differences. Sample duplicates are analyzed at a frequency of one per 10 soil boring samples, and one per site for groundwater samples, in accordance with NEESA Level C guidelines.

Proposed Guidance on the Usage of Tentatively Identified Compounds (TICs)

Analyzing an environmental sample by GC/MS produces a spectrum of chromatographic peaks of the compounds present, reflecting the type and arrangement of atoms within molecules of the sample. Analogous to fingerprints, which may identify an individual person when matched with other fingerprints on file, a spectrum may identify a compound when compared to spectrums on file.

Chromatographic peaks that are not identified as a target compound, surrogate, or internal standard are labeled TICs, sometimes called "library search compounds." TICs are qualitatively determined with the aid of the mass spectral library and assessed by a qualified chemist. The library is continually updated by the National Institute of Standards and Technology (NIST), which currently contains approximately 52,000 compounds. Identification is made by choosing the best available matches from the library. Although this method is useful in providing a "tentative" identification, it does not necessarily provide a correct identification. Searching algorithms are designed to recognize matches, and most present the three best matches.

Under the USEPA CLP, samples analyzed by GC/MS for volatiles must undergo a library search and report possible identification of the 10 largest peaks with peak area of greater than 40 percent of the nearest internal standard peak. The semivolatile analysis requires a library search

and possible identification of the 20 largest peaks with a peak area greater than 50 percent of the nearest internal standard peak. However, peaks properly identified under one fraction may not be reported as tentatively identified in any other fraction. For example, a late eluting volatile target compound cannot be reported as a semivolatile TIC.

The CLP documents offer guidance on action regarding TICs as outlined below:

- All TIC results are to be qualified as tentatively identified (i.e., "N" flag) with estimated concentrations (i.e., "J" flag).

- TIC results comparable to results in an associated blank are not to be reported. Note: dilutions and sample quantity must be taken into account when comparing analytical results.

- TIC results detected in the sample and not in an associated blank, but suspected to be a laboratory artifact, may be qualified as unusable (i.e. R flag).

- For reporting purposes, all isomers may be listed as a total value.

Generally, TICs should be used strictly as a *potential* site contaminant and may be investigated further by writing a Special Analytical Services Statement of Work to confirm TICs or identify unknown TICs.

4.2 Inorganics Analyses

The analytical methods were performed and reported in accordance with the USEPA CLP, SOW 3/91 and applicable NEESA Level C guidelines for the inorganics analyses. All data are flagged using CLP qualifiers. An explanation of the qualifiers is included with the data in Appendix C.

4.2.1 Sample Handling and Preservation

Sample Condition — All samples were received by the laboratory in good condition with the proper custody documents and the seals intact.

Holding Times — Based on the VTSR to the date of sample digestion/preparation, sample holding times were found to be within QC requirements for all the SDGs.

Laboratory Control Sample Analysis (LCSA) — The LCSA monitors efficiency of the overall performances of all steps in the analysis, including the digestion procedures. Laboratory control samples (LCSs) consist of American Society of Testing and Materials (ASTM) Type II water to which known amounts of specific analytes have been added. LCS analyses and results were found to be within compliance of QC control limits for all SDGs.

4.2.2 Instrument Performance

Calibration — The purpose of the initial and continuing calibration verification is to ensure the instrument is capable of acceptable and quantitative performance at the beginning of analysis and throughout each analytical run. Initial and continuing calibration verifications were performed for the inorganics analyses within QC criteria for all SDGs.

Interference Check Sample Analyses (ICSA) — The inductively coupled plasma (ICP) ICSA is performed to check the laboratory's instrument and the background correction factors. Compliance requirements were found to be satisfactory for the ICSA in all SDGs.

4.2.3 Accuracy

Blanks — The purpose of the blank results are to determine the existence and magnitude of any contamination problems. The criteria for evaluating blanks applies to any blank associated with the samples. If problems are found in any of the blanks, all associated data are evaluated to

determine whether there is an inherent variability in the data, or if the problem is an isolated occurrence and does not affect the data.

Action regarding the blank results depends on the circumstances and origin of the blank. In accordance with CLP, laboratory and field blanks are evaluated with the five-times criteria. The associated sample results are reported only if the concentrations of detected inorganics exceed five-times the highest amount detected in the blank. The five-times criteria allows target inorganics in the sample to be qualified and/or quantitation limits to be elevated.

In reviewing the data provided, compliance requirements were found to be satisfactory. Inorganic field blank contamination has been detailed in Table D-4 of Appendix D. Inorganic rinsate blank contamination has been detailed in Table D-5 of Appendix D.

Method of Standard Additions (MSA) — The MSA is applied to quantitate sample results in graphite furnace atomic absorption (GFAA) analyses when spike recovery is outside of QC acceptance limits. MSA consists of analyzing samples spiked at approximately 50 percent, 100 percent, and 150 percent of sample analyte concentration. Data from each MSA analysis are reported. QC criteria for MSA require the correlation coefficient (r) must be greater than or equal to 0.995. All samples not meeting this criteria are qualified as estimated. All MSA analyses were found to meet required specifications, except for:

26262 — Samples 48SB0102, 53SB0102, 48SA0102 each displayed a correlation coefficient below 0.995 for arsenic. Samples 49SB0104, 49SB0106, and 53SB0102 did not meet correlation coefficient criteria for lead. Positive results for these samples were qualified as estimated (i.e., flagged "J"). Negative results were flagged "UJ."

24822 — Sample 41SB0404 did not meet correlation coefficient criteria for lead. Results for lead were flagged "J" for this sample.

25665 — Sample 41SB0502 did not meet correlation coefficient criteria for arsenic. Sample 41SB0503 did not meet correlation coefficient criteria for lead. Results for these analytes were flagged "J" for positive detections; negative results for these analytes were flagged "UJ."

24798 — Sample 41DP01D did not meet correlation coefficient criteria for arsenic. Positive results for arsenic were flagged "J."

4.2.4 Precision

Spike/Duplicate — The purpose of duplicate samples is to determine the precision of analytical methods for each parameter. The spiked samples are designed to provide information about the effects of the sample matrix on the digestion and measurement methodology. The inorganic spike/duplicate sample results are outlined below:

24371 — Samples 47FB0822, 50RB0819, 46RB0826, and 39RB0829 were chosen for the spike/duplicate analysis. All percent recoveries (%R) and percent differences (%D) were within QC limits.

24194 — Sample 55CO01D was used as the spike/duplicate sample in the mercury analysis. All %R and %D were within contract criteria for this SDG.

24798 — Sample 41DP01D was analyzed as the spike/duplicate. Antimony, arsenic, lead, manganese, selenium, and thallium had low spike recoveries. All positive detections of these inorganics were flagged "J" and non-detections were flagged "UJ." In the duplicate analysis, manganese was outside of QC limits and was flagged "J" for positive detections and "UJ" for non-detections.

24431 — Manganese, silver, and zinc recoveries were outside QC parameters in the spike/duplicate analysis of sample 39DP01D. All positive detections of these inorganics were flagged with a "J."

24171 — Sample 50SS01D was used for the spike/duplicate analysis. Antimony, arsenic, mercury, silver, and zinc were all outside QC limits in the spike analysis. All positive detections of these inorganics were flagged "J" and non-detections were flagged "UJ." Aluminum, iron, lead, and zinc were outside the QC limits in the duplicate analysis. All positive detections of these inorganics were flagged "J."

24822 — Sample 41SB072D was used as the spike/duplicate sample for this SDG. Antimony, arsenic, and lead recoveries all were below QC limits. All sample results for these inorganics were flagged with a "J." All duplicate analysis results were within QC limits.

25654 — Sample 41RB0902 was utilized for the spike/duplicate analysis. Lead recovery in the spike sample was 12.6 percent. All positive detections of lead were flagged "J." Non-detections of lead were flagged "UJ." Because this sample was a water QC sample, sample data quality was not adversely affected by the low spike recovery. Thallium and zinc recoveries were above QC limits, and all positive detections of these metals were flagged "J." Duplicate analysis results were within QC limits.

25665 — Sample 41SB062D was used for the spike/duplicate analysis. Antimony, arsenic, lead, and selenium all had recoveries outside QC limits. Results for these inorganics were flagged with a "J." All duplicate analysis results were within QC limits.

24188 — Sample 55BO1D was selected for the mercury spike/duplicate analysis. Spike recovery was just above QC limits. Duplicate results were within QC criteria.

24791 — Sample 40PD01D was used in the palladium spike/duplicate analysis, and all results were within QC criteria.

26667 — Sample 53SB093D was used for the mercury spike/duplicate analysis. All results were within QC criteria.

24182 — Because this SDG consisted of wipe samples for mercury, no spike/duplicate samples were analyzed.

26643 — No spike/duplicate analysis was conducted for cyanide in this SDG. Samples 48SA0301 and 53SB043D were used for the inorganic spike analysis. Antimony, arsenic, lead, and selenium all had recoveries outside QC limits. Results for these inorganics were flagged "J" in all affected samples. Samples 48SA0203 and 53SB043D were used for the duplicate analyses. All results were within QC criteria.

26647 — No spike/duplicate analysis was conducted for cyanide in this SDG. Sample 48RB0912 was chosen for the spike analysis, and sample 48FB0912 was chosen for the duplicate analysis. All results were within QC limits.

27399 — Samples 41GW01D and IW06 were selected for the spike/duplicate analyses. Iron, lead, and selenium had spike recoveries outside QC limits. In the duplicate analysis of sample IW06, lead was outside QC limits. Results for these metals were flagged "J" in all affected samples.

26262 — Sample 41SB0803 was selected for the spike/duplicate analysis. Antimony and selenium were outside the spike QC limits. Aluminum, iron, and manganese were outside of QC limits in the duplicate analysis. Results for these metals were flagged with a "J" in all samples.

Data associated with the plastisol nitrocellulose (PNC) analyses produced by the *USATHAMA Method for the Determination of Nitrocellulose (NC) in Soil* should be considered estimated. This is recommended because the analytical method designed to determine NC by the nitrate/nitrite count in the sample was applied unsuitably. It is inaccurate to presume the resulting nitrate/nitrite solely from NC in an environmental sample due to the potential of other sources from an uncontrolled environment. In addition, the method includes a pre-rinsing step with methanol, which is believed to potentially remove NC from the sample. NC is known to be soluble in methanol, further validating the data as estimated. The project QA manager believes the intended use of the method may have been for QC purposes within a controlled environment (e.g., manufacturing facility).

5.0 SITE STUDY REPORTS

This section comprises individual reports of each site study conducted during the SI. Each report briefly describes the site layout, processes, release history, field activities, and study results followed by recommendation for further action. Figure 5-1 is a facility map indicating the location of each site studied.

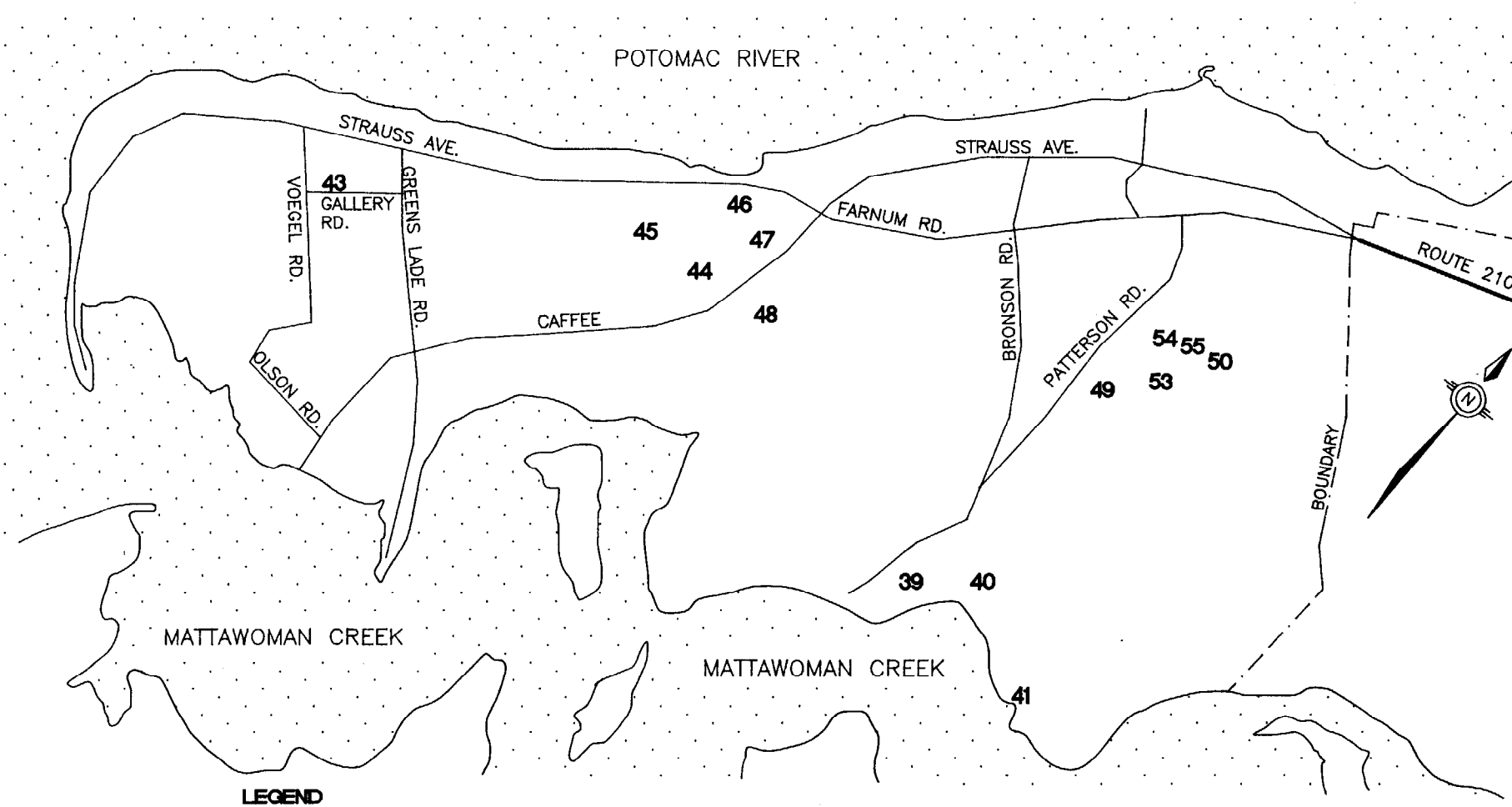
Field sampling techniques used in completing this SI ranged from shallow soil and groundwater samples to wipe samples. Sampling techniques detailed in Section 3 were employed unless site conditions warranted otherwise. Any variation was properly noted by the project geologist in the dedicated field logbook and is noted in the study reports. Soil boring logs were completed for each augured boring and monitoring well and are presented in Appendix A, Section A.2.

Field work began August 19, 1992, and ended September 23, 1992. Soil-gas surveys were conducted August 20 and 21, 1992, by Target Environmental Services, Inc. (Target). Drilling operations were conducted from August 31 through September 15, 1992, by Hardin Huber, Inc.

Soil-gas analysis was completed in the Columbia, Maryland, laboratory of Target by gas chromatograph/flame ionization detections (GC/FID) and GC/electron capture device (GC/ECD). The GC/FID target list includes benzene, toluene, ethlybenzene, xylene (total), and total volatile organic vapors. The target list for GC/ECD is provided in Table 5-1.

Table 5-1
GC/ECD Target Compound List

1,1-dichloroethene	1,1-dichloroethane
cis-1,2-dichloroethene	1,1,1-trichloroethane
trans-1,2-dichloroethene	1,1,2-trichloroethane
trichloroethene	Tetrachloroethene
Methylene Chloride	Chloroform
Carbon Tetrachloride	



LEGEND

39–ORGANICS PLANT
40–PALLADIUM IN SEDIMENTS
41–SCRAP YARD
43–TOLUENE DISPOSAL SITE
44–SOAK OUT AREA
45–ABANDONED DRUMS
46–CADMIUM SAND BLAST GRIT
47–MERCURIC NITRATE DISPOSAL
48–DUMP SITE
49–CHEMICAL DISPOSAL PIT
50–BUILDING 103
53–GENERAL LABORATORY AREA
54–BUILDING 101
55–BUILDING 102

* PRODUCTION WELLS LOCATED THROUGHOUT THE FACILITY

NOT TO SCALE

SITE INSPECTION
INDIAN HEAD DIVISION,
NAVAL SURFACE
WARFARE CENTER

FIGURE 5–1
FACILITY MAP AND
SITE LOCATIONS

DATE: 02/24/94 | DWG NAME: INDH035

A wide range of analytical parameters and methods were employed to complete this SI. For purposes of clarity, analytical parameter groups are listed below. The number and type of samples proposed for each site are outlined with each study report. All analytical work was completed in accordance with CLP and NEESA guidelines.

Analytical Groups Required for This SI

TCL	=	Target Compound List
TAL	=	Target Analyte List (metals)
VOC	=	Volatile Organic Compounds
BNA	=	Base-Neutrals/Acid Extractables (Semivolatile Organic Compounds [SVOC])
PEST	=	Pesticides/PCBs
TPH	=	Total Petroleum Hydrocarbons
PNC	=	Plastisol Nitrocellulose
UDMH	=	Unsymmetrical Dimethylhydrazine
HBNQ	=	High Bulk Nitroguanidine
NE	=	Nitrate Esters (Explosive Derivatives)

Tables 5-2 through 5-5 present assessment data used to prepare this report. These data are regulatory and risk-based criteria references that are instrumental in assessing possible environmental impacts. The tables are grouped as VOCs, BNAs, PESTs, and metals. Table 5-5 includes the range of background metal concentrations for Maryland and U.S. soils, which will be referred for soil metal background concentrations. All analytical data were compared to the reference values presented in these tables; therefore, this information will be frequently referred to throughout Sections 5 and 6.

Analytical data presented are the overall range and the average concentrations detected. These data are discussed in the text and presented in analytical parameter groups as listed above. The compounds and analytes presented in these data tables are ordered by chemical signature as they

are detected by the analytical equipment. All analytical data are presented in Appendix C. Section C.1 includes tabulated data for all detected compound entitled "Hits Only." Section C.2 contains the calculated range and average concentration of all compounds detected and Section C.3 includes all reported analytical results. The "Hits Only" data represent all positively detected parameters and analytes with the appropriate data qualifiers.

Table 5-2
Volatile Compounds

Compound	Assessment Criteria**		Use(s) and/or Sources*
	Soil mg/kg	Groundwater µg/L	
Acetone	8,000	ND	Paint, Varnish, Lacquer, Sealant, Adhesive, Solvent
Benzene	24	ND	Gasoline, Pesticides, Plastics, Paint, Aviation Fuel, Explosives, Dye, PCBs
2-Butanone (methylethylketone)	4,000	ND	Solvent, Paint Stripper, Adhesive, Cleaning Fluids, Printing
Carbon Disulfide	8,000	ND	Flotation chemicals, Disinfectants, Solvents, Herbicides
Carbon Tetrachloride	5	ND	Degreaser, Dry-cleaning, Solvent, Refrigerant, Propellant
Chloroform	100	ND	Solvent, Refrigerant, Propellant, Sweetener, Insecticide, Anesthetics
Chloromethane	40[b]	ND	Silicone, Refrigerants, Propellant, Solvents, Herbicides
1,2-Dichloroethene (total)	8	70[c]	Refrigerant, Solvent, Dye, Perfume
Ethylbenzene	8,000	ND	Solvent, Asphalt, Styrene
2-Hexanone	—	—	Solvent, Alcohol Denaturant
Tetrachloroethene (tetrachloroethylene/ perchloroethylene)	10	5[c]	Dry cleaning, Degreaser, Solvents, Inks
Toluene	20,000	ND	Solvent, Gasoline, Dyes, Perfumes, Asphalt, Detergent
1,1,1-Trichloroethane	7,000	200[c]	Degreaser, solvent
Trichloroethene (trichloroethylene)	60	5[c]	Dry cleaning, Degreaser, Solvents
Xylene (total)	200,000	ND	Solvent, Gasoline, Dye, Insecticides, Lacquers, Asphalt

Notes:

** Unless otherwise noted, Action Levels from Proposed 40 CFR Part 264, Subpart S. (FR55, No. 145, July 27, 1990).

* Verschueren, Karel, *ed. Handbook of Environmental Data on Organic Chemicals,* second edition. New York: Van Nostrand Reinhold Company, Inc. 1983.

[b] Indicates approximate action level based on standard risk assessment formulae (rough estimate).

[c] These are MCLs as established by the USEPA Office of Water.

— No information available.

ND Compound not detected in the medium.

Table 5-3
Semivolatile Compounds

Compound	Assessment Criteria*		Use(s) and/or Sources*
	Soil (mg/kg)	Groundwater (µg/L)	
Acenaphthene	—	ND	Wood preservative, Petroleum Refining, Dye, Insecticide, Fungicide, Coal Tar
Acenaphthylene	—	ND	Plastic, Dye, Perfume, Synthetic rubber, Silvering Mirrors
Anthracene	5000[b]	ND	Dyes
Benzo(a)anthracene	0.06[b]	ND	Motor Oil, Gasoline, Bitumen
Benzo(b)fluoranthene	0.48[b]	ND	Wood Preservative, Gasoline
Benzo(k)fluoranthene	—	ND	Wood Preservative, Gasoline
Benzo(a)pyrene	0.07[b]	ND	Coal Tar, Petroleum Refining, Wood Preservative, Gasoline
Benzo(g,h,i)perylene	3.0[b]	ND	Motor Oil, Gasoline
bis(2-ethylhexyl)phthalate	50	ND	Plasticizer
Carbazole	24[b]	ND	Coal tar
Chrysene	15[b]	ND	Motor Oil, Gasoline, Coal Tar
Dibenz(a,h)anthracene	0.06[b]	ND	Wood Preservative, Coal Tar, Gasoline
Dibenzofuran	—	ND	Coal Tar
Diethylphthalate	60,000	ND	Plastics, Explosives (Propellant), Dyes, Insecticides, Repellant
2,4-Dimethylphenol (2,4 Xylenol)	17,000[b]	ND	Antioxidants, Pharmaceutical, Plastics, Resins, Dyes, Insecticides, Fungicides
2,4-Dinitrotoluene	—	—	—
2,6-Dinitrotoluene	1.0	ND	TNT, Polymers, Foams, Coatings, Dyes
Di-n-butylphthalate	8,000	ND	Plastics, Cosmetics, Explosives, Explosive (propellant), Lubricant, Insecticide, Ink
Dodecanoic acid (lauric acid) (TIC)	0.14+	—	Fatty acid, Vegetable Fats, Coconut Oil
Fluoranthene	—	ND	Wood Preservative, Gasoline
Fluorene	—	ND	Wood Preservative
Hexanedioic acid (adipic acid) (TIC)	—	—	—

Table 5-3
Semivolatile Compounds

Compound	Assessment Criteria*		Use(s) and/or Sources*
	Soil (mg/kg)	Groundwater (µg/L)	
Indeno(1,2,3-cd)pyrene	0.29[b]	ND	Motor Oil, Gasoline
2-Methylnaphthalene	840[b]	ND	Insecticides, Petroleum Refining, Asphalt
Naphthalene	840[b]	ND	Wood Preservative, Gasoline
N-Nitrosodiphenylamine(1)	100	ND	Pesticides, Vulcanization of Rubber
Pentachlorophenol	2,000	ND	Pesticides, Wood Preservative
Phenanthrene	—	ND	Wood Pres., Dye stuff, Explosives, Biochem Research
Pyrene	0.8[b]	ND	Wood Preservative
1,2,4-Trichlorobenzene	2,000	9[c]	Solvent, Dyes, Lubricants, Dielectric Fluid, Synthetic Transformer Oil, Insecticides

Notes:

* Unless otherwise noted, all Action Levels are from Proposed 40 CFR Part 264, Subpart S. (FR55, No.145, July 27, 1990).

[a] Verschueren, Karel, *ed. Handbook of Environmental Data on Organic Chemicals,* second edition. New York: Van Nostrand Reinhold Company, Inc. 1983.

[b] Indicates approximate action level based on standard risk assessment formula (rough estimate).

[c] These are MCLs as established by the USEPA Office of Water.

— No information available.

ND Compound not detected in the medium.

Table 5-4
Pesticide and PCB Compounds

Compound	Assessment Criteria*		Use(s) and/or Sources[a]
	Soil (mg/kg)	Groundwater (μg/L)	
α-Chlordane[b]	0.5	2.0	Insecticide
γ-Chlordane	0.5	2.0[c]	Insecticide
4,4'-DDD	3.0	ND	Insecticide
4,4'-DDE	2.0	ND	DDT Impurity, Military Product
4,4'-DDT	2.0	ND	Insecticide
Endosulfan I	4.0	2.0	Insecticide
Endosulfan II	4.0	2.0	Insecticide
Endrin	20	2.0[c]	Insecticide
Heptachlor epoxide	0.08	0.2[c]	Insecticide
PCB-1260[d]	10	—	Dielectric Fluid, Lubricants, Pesticides, Plastics, Paints, Sealants

Notes:

* Unless otherwise noted, all Action Levels are from Proposed 40 CFR Part 264, Subpart S.

[a] Verschueren, Karel, *ed. Handbook of Environmental Data on Organic Chemicals*, second edition. New York: Van Nostrand Reinhold Company, Inc. 1983.

[b] Values for α - chlordane and γ - chlordane represent total chlordane concentrations.

[c] These are MCLs as established by the USEPA Office of Water.

[d] 40 CFR 761.125(c)(4)(v).

ND Compound not detected in the medium.

— No information available.

Table 5-5
Metals in Soils
mg/kg

Analytes	Average	Range	Proposed Action Levels[a]	Preliminary Remedial Goals[b]
Al	57000[c]	7000-100K[c]	—	—
Sb	<1.0	<1.0-2.0	30	108
As	3.8	1-7.1	80	81
Ba	393	150-700	4000 (ionic)	18900
Be	1.0	ND-3.0	20	0.0149
Cd	0.25-0.34[c]	<0.1-0.83	40	162
Ca	6300[c]	100-260K[c]	—	—
Cr	48	15-100	400 (vi)	$2.7X10^5$ (III)
Co	6.9	ND-20	—	—
Cu	20.0-27.6[d]	2.2-109.1	—	$3.5X10^5$
Fe	25000[c]	100-100K[c]	—	—
Pb	-22	10-50	—	(378 est) 200*
Mg	4600[c]	50-50K[c]	—	—
Mn	640[c]	<2-7000[c]	—	$2.7X10^4$
Hg	0.070	0.04-0.14	20 (inorganic)	81
Ni	12.0-16.7	ND-43.5	200	5400
K	12000[c]	50-37000[c]	—	—
Se	0.27	<0.1-0.5	—	1350
Ag	—	ND-5.0[d]	20	1350
Na	7800[c]	<500-50K[c]	—	—
Tl	ND	ND	—	—
V	63	20-150	—	1890
Zn	36.8-68.3	5.6-198	—	$5.4X10^4$
CN	—	—	200	—

[a] Action Level-Proposed Rules, 40 CFR, 261 Subpart S (FR 55, No. 145, July 27, 1990).
[b] RAGS. Vol. 1, Part B.
[c] Eastern U.S., (Dragun, 1988).
[d] Conterminous U.S., (Dragun, 1988).
CN = Cyanide.
ND = None Detected.
— No Reference value.
* Not bioavailable below indicated value.

5.1 Site 39 — Organics Plant-Silver Contamination in Sediments

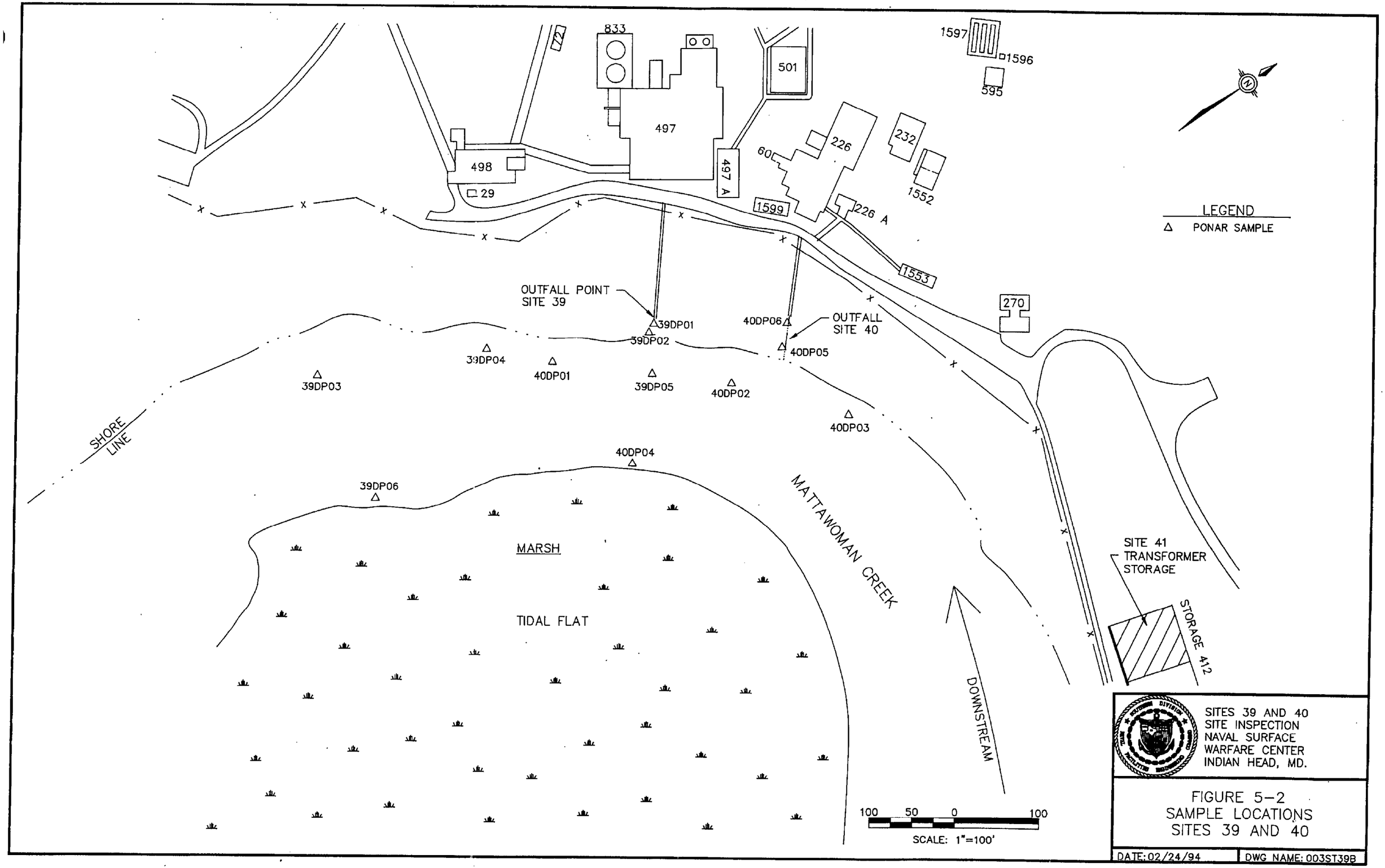
Site 39, the organics plant, (Building 497, Figure 5-2), is in the southeast portion of the facility, on a steep slope adjacent to Mattawoman Creek. This site was subject to an SI based on reported accidental releases of elemental silver and other compounds to Mattawoman Creek.

Operations from 1961 to 1965 included formulating bis-2,2 dinitropropanol acetal/formal (acetal/formal), a propellent binder. Silver nitrate was used as a catalyst in producing acetal/formal. During one stage of the process, silver was in the elemental form.

A discharge pipe extends from Building 497 to an outfall at Mattawoman Creek. Reportedly, several accidental releases occurred via the outfall resulting from an improperly closed valve. Compounds suspected of having been released include: acetal/formal, silver, dinitropropanol, ethylene dichloride, methylene chloride, and formaldehyde. Also, as was indicated in the PA, site personnel reported that acetal/formal and silver were visible at times on the surface of Mattawoman Creek near this outfall.

5.1.1 Study Description

The study objective was to determine if sediments at the outfall and in Mattawoman Creek were contaminated from the reported releases. This involved collecting four top sediment samples from Mattawoman Creek and two surface sediment samples at the outfall. Samples were collected by surface soil and petite ponar sampling techniques (Section 3). The sampling and analysis approach is outlined below.


833
72
501
1597
1596
595
497
498
29
497 A
60
226
232
1552
1599
226 A
1553
270
LEGEND
PONAR SAMPLE
OUTFALL POINT
SITE 39
39DP01
39DP02
40DP06
OUTFALL
SITE 40
40DP05
39DP04
40DP01
39DP03
39DP05
40DP02
40DP03
SHORE
LINE
40DP04
39DP06
MARSH
TIDAL FLAT
MATTAWOMAN CREEK
DOWNSTREAM
SITE 41
TRANSFORMER
STORAGE
STORAGE 412
100 50 0 100
SCALE: 1"=100'
SITES 39 AND 40
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.
FIGURE 5-2
SAMPLE LOCATIONS
SITES 39 AND 40
DATE: 02/24/94
DWG NAME: 003ST39B

Site 39 - Sampling and Analysis Approach				
Sample Media:	Surface sediments (at outfall) Sediments (Mattawoman Creek)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Surface sediments	2	1	2
	Sediment samples	4	1	4
Analytical Requirements:	**Media**	**Analyses**		
	Surface sediments	TAL, VOC, BNA, Acetal/formal, PNC, UDMH, HBNQ		
	Sediment	TAL, VOC, BNA, Acetal/formal, PNC, UDMH, HBNQ		

One surface sediment sample was collected at the outfall discharge point and the second at the effluent point of entry to the creek. Three top sediment samples were collected downstream of the outfall point and the fourth was collected upstream. Sediment samples were collected from apparent low energy zones of the stream and all creek sample points were spaced, approximately 200 feet apart, along the main channel of the creek. Figure 5-2 indicates the location of each sample point.

5.1.2 Study Findings — Site 39

Observations

Soil texture along the outfall discharge ditch and along the shoreline consisted of coarse-grained sand to fine gravel. There was no indication of staining in the sediments or signs of stressed vegetation along the outfall discharge channel to the creek.

Creek sediments in low energy areas generally consisted of silty clays with a moderate amount of organic material. Mattawoman Creek is influenced by daily tides; the water level in early afternoon was observed to be more than 2 feet higher relative to the early morning level.

Analytical Results — Site 39

Analytical data are presented in Appendix C where Section C.1 includes "Hits Only" data.

VOCs: Acetone, chloromethane, and carbon disulfide were detected by laboratory analysis. Acetone was detected in only one sample, 39DP06RE at 780 μg/kg. This sample was the re-analysis of 39DP06 and acetone was not detected during the original analysis, but was detected in the laboratory blank. The reported concentration for acetone is valid, but is qualified as an estimate. Chloromethane was detected in two samples. It was detected in sample 39DP04 at 13.0 μg/kg; however, when this sample was re-analyzed (39DP04RE), the reported concentration changed to 18.0 μg/kg. Both reported concentrations are estimated values and below the method detection limit. Carbon disulfide was detected in two samples: 39DP03 at 5.0 μg/kg and 39DP06RE at 8.0 μg/kg. Again both values are below method detection limits and are estimated.

BNAs: Thirteen BNA compounds were detected in samples from Site 39. The range and average concentrations detected are indicated in Table 5-6. All concentrations were reported as estimated values. Individual analytes may be representative of compounds commonly found in petroleum products and/or waste oils.

Table 5-6
Site 39 - BNAs
Sediments

μg/kg

Parameter	Average	Minimum	Maximum	Frequency
Anthracene	45.50	27.00	64.00	2/7
Pyrene	117.17	77.00	190.00	6/7
Benzo(g,h,i)perylene	43.33	28.00	62.00	3/7
Indeno(1,2,3-cd)pyrene	34.33	21.00	49.00	3/7
Benzo(b)fluoranthene	41.00	24.00	54.00	3/7
Fluoranthene	87.40	65.00	110.00	5/7
Benzo(k)fluoranthene	53.33	36.00	76.00	3/7
Acenaphthylene	33.00	33.00	33.00	1/7
Chrysene	70.00	49.00	98.00	4/7
Benzo(a)pyrene	63.33	36.00	95.00	3/7
Benzo(a)anthracene	62.00	39.00	82.00	3/7
Phenanthrene	44.67	30.00	55.00	3/7
N-Nitrosodiphenylamine (1)	230.00	230.00	230.00	1/7

TALs: Twenty analytes were detected under TAL procedures (Table 5-7). Twelve TAL analytes were detected in all six sediment samples (plus the field duplicate sample). Four of the 12 analytes were reported at concentrations above the average background levels in soils (Table 5-7). These were lead, cobalt, mercury, and silver. Arsenic was detected in every sample except 39DP04. The maximum of the detected range is slightly above the average range of background levels for soils.

Table 5-7
Site 39 - TALs
Sediments

mg/kg

Parameter	Average	Minimum	Maximum	Frequency
Aluminum	4594.14	352.00	12600.00	7/7
Iron	13664.29	2320.00	29800.00	7/7
Lead	41.23	10.80	89.60	7/7
Magnesium	1279.73	25.20	3260.00	7/7
Manganese	447.57	52.30	1050.00	7/7
Mercury	5.85	2.20	9.50	2/7
Nickel	33.20	17.70	59.80	4/7
Potassium	955.00	857.00	1040.00	3/7
Silver	16.17	1.40	42.70	4/7
Sodium	116.76	29.50	253.00	7/7
Arsenic	4.09	0.87	7.70	6/7
Barium	56.60	3.70	138.00	7/7
Beryllium	0.57	0.20	1.20	5/7
Cadmium	1.00	1.00	1.00	1/7
Chromium	13.69	2.80	27.50	7/7
Cobalt	14.01	5.20	22.90	7/7
Copper	20.20	5.40	35.90	6/7
Vanadium	15.20	2.90	36.60	7/7
Zinc	108.91	27.30	191.00	7/7
Calcium	1717.43	191.00	4200.00	7/7

Explosive Derivatives: PNC, UDMH, and HBNQ were detected in sediment samples. Table 5-8 summarizes the reported concentrations of each compound. PNC was detected in all six sediment samples (plus the field duplicate sample). The reported concentrations of PNC ranged from 9.9 to 365.0 mg/kg with an average of 126 mg/kg. However, as outlined in Section 4, PNC results may be subject to an inherent flaw in the analytical procedure, and should be qualified as estimated values only.

UDMH was detected in three sediment samples: 39DP03, 39DP04 and 39DP06. UDMH concentrations ranged from 57.5 to 85.5 mg/kg with an average of 68.3 mg/kg. HBNQ was detected in three sediment samples ranging from 1.88 to 429 mg/kg and averaging 202.9 mg/kg.

Table 5-8
Site 39 Sediments
Explosive Derivatives
mg/kg

Sample Location	PNC	UDMH	HBNQ
39DP01	17.3	BDL	429.00
39DP01D	10.2	BDL	178.00
39DP02	9.9	BDL	1.88
39DP03	365.0	61.8	BDL
39DP04	209.0	57.5	BDL
39DP05	41.6	BDL	BDL
39DP06	227.0	85.5	BDL
Average	125.71	68.3	202.96

5.1.3 Discussion — Site 39

Creekbed sediment may have been contaminated as a result of releases from the Organics Plant. Data indicate low levels of VOCs, several BNA compounds and explosive compounds in the creek sediment adjacent to Site 39. It is not clear if the only source of these compounds was the outfall from the Organics Plant. Processes in areas upstream of Site 39 may have contributed to the presence of the compounds detected, as UDMH was produced at the hydrogenation facility (Site 40) directly upstream of Site 39.

5.1.4 Recommendations — Site 39

Further investigation should be completed at this site to determine the nature and extent of contamination. This investigation should determine if multiple sources may be involved, including any influences by permitted discharges, the migration rates and mechanisms of contaminants involved, and the identification of potential receptors and subsequent implementation of an Ecological Risk Assessment, if necessary. This objective will require collecting a series of sediment samples from Mattawoman Creek, along the shore and possibly

along the bank slope, downgradient of the Organics Plant. Background samples should be collected upstream to establish baseline levels for evaluating risk and possible remedial alternatives. Additional special analytical services and methods should be explored for a quantitative analysis of PNC. E/A&H recommends combining the sediment studies of Sites 39, 40, and 41. This is discussed in more detail in Section 7.0.

5.2 Site 40 — Palladium Catalyst in Sediments

Site 40 is the area downgradient of the former hydrogenation facility, Buildings 232, 1552, and 1559. This site is adjacent to and upstream of Site 39 (Figure 5-2).

Site processes included formulating UDMH, a production process that hydrogenated dimethylnitrosamine using a palladium catalyst on carbon black. UDMH was produced at the hydrogenation facility from 1974 to 1975.

One release to Mattawoman Creek reportedly resulted from a faulty valve. The estimated volume of this release was 2000 gallons. Personnel interviews completed during the PA indicated that a plume of palladium on carbon black was visible on Mattawoman Creek in association with this spill.

Spills also were reported during the startup of production; however, the nature and quantities of these releases are unknown. Any uncontained spills would likely migrate down-slope toward Mattawoman Creek and/or discharge through the hydrogenation outfall. Difficulty with the corrosive nature of the compounds was believed to cause numerous releases.

5.2.1 Study Description — Site 40

The study objective was to determine if palladium contamination was present in the sediments at and downstream of the outfall discharge point to Mattawoman Creek. Achieving this objective involved collecting four top sediment samples and two surface sediment samples.

Samples were collected by surface soil and petite ponar sampling techniques (Section 3). The sampling and analysis approach is outlined below.

Site 40 - Sampling and Analysis Approach				
Sample Media:	Surface sediments (at outfall) Sediments (Mattawoman Creek)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Surface sediments	2	1	2
	Sediment samples	4	1	4
Analytical Requirements:	**Media**	**Analyses**		
	Surface sediments	Palladium		
	Sediment	Palladium		

Site 40 was not recommended for further investigation in the PA report; however, the Navy requested that a study of this site be completed under the IR program. Furthermore, UDMH was targeted in the analysis of sediment samples from Site 39, which overlapped the downgradient portion of Site 40. UDMH was detected in three downgradient sediment samples from Site 39. Figure 5-2 indicates the relationship of Site 39 and 40.

One surface sediment sample was collected at the outfall discharge point and the second at the effluent point of entry to the creek. Three top sediment samples were collected downstream of the outfall point and the fourth was collected upstream. Sediment samples were collected from apparent low energy zones of the stream and all creek sample points were spaced approximately 200 feet apart, along the main channel of the creek. Figure 5-2 indicates the location of each sample point.

The matrix and sample method identifiers for samples collected at Site 40 were inadvertently transposed (PD instead of DP, Section 3.10.3). This did not compromise the data but may cause confusion during data review.

5.2.2 Study Findings — Site 40

Observations

Soil textures at the outfall point and along the shoreline consisted of medium- and coarse-grained sand to fine gravel. There was no indication of staining in the sediment or signs of stressed vegetation along the outfall channel to the creek. Creek sediment textures collected in the low energy areas were generally silty clays with a moderate amount of organics, suggesting deposition of sediment in this area of Mattawoman Creek is strongly influenced by daily tidal fluctuations.

Analytical Results — Site 40

Six sediment samples were collected and submitted for laboratory analysis for palladium. Analytical data are presented in Appendix C where Section C.1 includes "Hits Only" data.

5.2.3 Discussion — Site 40

Based on the limited study, it does not appear that the sediments of Mattawoman Creek have been contaminated by palladium contained in releases from Site 40. There was, however, an indication of contamination at Site 39 directly downstream of Site 40. Sample points of each site overlapped. Releases at Site 40 may have contributed to the apparent contamination at Site 39. UDMH was produced at Site 40 and was detected in sediment samples collected downstream at Site 39.

5.2.4 Recommendations — Site 40

Further study at Site 40 is not recommended at this time; however, additional study at Site 39 should overlap the discharge point at Site 40 to better define the extent of contamination and the relationships between the two sites. However, Site 40 should be included in the combined sediment study of Sites 39, 40, and 41. This is discussed in Section 7.0.

5.3 Site 41 — Scrap Yard

The scrap yard is in the southeastern section of the facility along the shore of Mattawoman Creek, upstream of Sites 39 and 40 (Figure 5-3). The topography is flat except for a steep hill along the northern boundary. Surface runoff is southwest toward the Mattawoman Creek, which is less than 100 feet away from the southern boundary of the site.

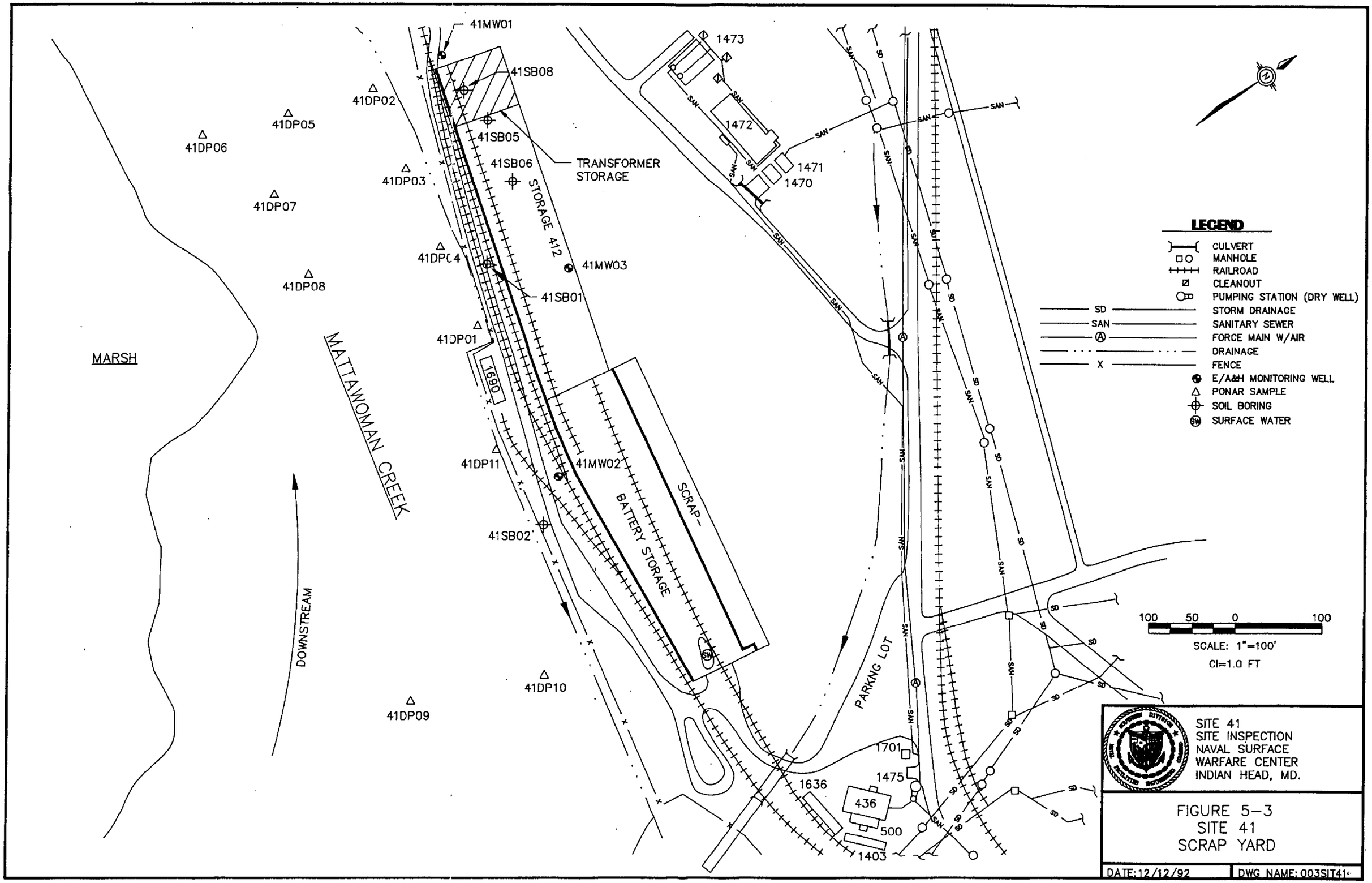
The scrap yard is secured by a fence, a locked gate and a 3-foot concrete wall extending the length of the southern boundary. A dirt road stretches along the southern boundary separating the scrap yard and Mattawoman Creek. Several abandoned railway spurs transect the area.

The scrap yard is used to store metal materials and scraps, including empty storage drums, electrical transformers, spent batteries, and old office furniture. The scrap materials eventually are sold to a recycler and/or reused. The northwest end of the scrap yard was once a coal storage area, according to base maps and visual evidence of coal dust and chips on the surface in this area.

From the 1960s to 1988, electrical transformers were stored at the northwest end of the scrap yard before offsite disposal. Seventeen transformers were identified as either PCB-contaminated or as PCB-containing after an inspection conducted in 1981 (NEESA, 1983). These transformers were believed to have leaked, potentially contaminating this area. In addition, lead batteries also have been stored in the scrap yard and may have released lead to the surface soils.

5.3.1 Study Description

The objective of this study was to determine if PCBs, solvents, or lead had contaminated the shallow soil zone, shallow groundwater, and/or creek sediments. This objective was accomplished by installing a series of shallow soil borings, soil-gas borings, and monitoring wells and collecting top sediment samples from Mattawoman Creek. In addition, one water


41MW01
41SB08
41DP02
41DP05
41DP06
41SB05
41SB06
TRANSFORMER STORAGE
41DP03
41DP07
STORAGE 412
41DP04
41MW03
41DP08
41SB01
41DP01
MARSH
MATTAWOMAN CREEK
1690
41DP11
41MW02
SCRAP-
BATTERY STORAGE
41SB02
DOWNSTREAM
41DP10
41DP09
1473
1472
1471
1470
PARKING LOT
1701
1475
1636
436
500
1403
SAN
SD
LEGEND
CULVERT
MANHOLE
RAILROAD
CLEANOUT
PUMPING STATION (DRY WELL)
STORM DRAINAGE
SANITARY SEWER
FORCE MAIN W/AIR
DRAINAGE
FENCE
E/A&H MONITORING WELL
PONAR SAMPLE
SOIL BORING
SURFACE WATER
100 50 0 100
SCALE: 1"=100'
CI=1.0 FT
SITE 41
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.
FIGURE 5-3
SITE 41
SCRAP YARD
DATE:12/12/92
DWG NAME: 003SIT41

sample was collected from a puddle of water located near the entrance to the scrap yard. The sampling and analysis approach is outlined below.

Site 41 - Sampling and Analysis Approach				
Sample Media:	Shallow soil profile (0-20 feet, at 5-foot sample intervals) Shallow aquifer (water table aquifer) Soil-gas (vadose Zone) Sediments (Mattawoman Creek) Water puddle			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Shallow soil borings[a]	8	3	24
	Monitoring wells - September., 1992	3	1	3
	Monitoring wells - April., 1993	3	1	3
	Soil-gas borings	8	1	8
	Sediment samples (Mattawoman Creek)	11	1	11
	Grab-Water puddle	1	1	1
Analytical Requirements:	**Media**	**Analyses**		
	Soil	TCL, TAL, TPH		
	Groundwater	TCL, TAL, TPH		
	Soil-gas	GC/FID Volatile Organic Compounds		
	Sediment	TCL, TAL, TPH		
	Water puddle	TCL, TAL		
	[a] Includes soil boring samples collected during the completion of soil borings and monitoring well borings.			

Five sampling methods were used at Site 41 for collecting data on sediment, soil-gas, shallow soil, shallow groundwater, and a localized water puddle. Soil-gas sampling techniques and sample locations are described in the report prepared by Target (Appendix B).

Sediment Samples: Sediment sample locations were estimated at 100-foot intervals. Two traverses were completed parallel to the main stream channel. The selection of sample points

was biased by choosing areas of low stream energy. These areas are local points of sedimentation and would likely collect contaminated sediments.

Soil-gas Survey: Target was subcontracted to complete a limited soil-gas survey in the areas of the transformers and the lead batteries. Six shallow soil-gas borings were installed in and around the transformer storage area. Two borings were completed outside the storage area beyond the south concrete wall, between the dirt road and the wall. The remaining four borings were completed in the transformer storage area. Two soil-gas borings were completed near the discarded batteries. One boring was completed approximately 10 feet south of the batteries. The second boring was completed approximately 15 feet west of the batteries. A concrete slab covering this area prevented sampling closer to the batteries.

Soil Borings: Eight soil borings were completed during this study. Boring locations are indicated on Figure 5-3. Soil boring placement was based on the interpretation of surface features as a potential indicator of subsurface and overland flow gradients. Borings 41SB03, 41SB04, and 41SB07 were placed to achieve adequate positioning of groundwater monitoring wells.

Four soil borings, 41SB01 through 41SB04, were completed between the south concrete wall of the scrap yard and Mattawoman Creek. Three borings — 41SB05, 41SB06 and 41SB08 — were completed in and around the transformer storage area. Boring 41SB07 was placed along the northcentral section of the study area.

Monitoring Wells: Three monitoring wells were installed at the following three soil boring locations: 41SB03 (41MW01), 41SB04 (41MW02), and 41SB07 (441MW03). Each monitoring well was sampled during this study. Each monitoring well was sampled a second time in April 1993. The April 1993 results are summarized here and a copy of the monitoring report is included as Section A.3 of Appendix A.

Water Puddle: A large water puddle was noted near the entrance of the scrap yard during a pre-field work walk-over August 18, 1992. The puddle was observed to have a green fluorescent color. Upon closer visual observation, the source was determined to be a fluorescent dye pack in an old aircraft seat near the water puddle. One water sample was collected from the water puddle, although sampling was not outlined in the work plan.

5.3.2 Study Findings — Site 41

Observations

Mattawoman Creek is several hundred feet wide in this area. The main creek channel is directly adjacent to the scrap yard and is estimated to be 100 to 150 feet wide. Creek sedimentation is influenced by tidal fluctuations in the Chesapeake Bay. This influence includes depositing fine-grained, low energy materials on the tidal flats in contrast to the more coarsely grained, high energy materials of the main stream channel.

Tidal flats comprise fine-grained sediments (silts and clays) and are moderately vegetated. The main creek channel cuts along the edge of the tidal flats with sediment textures ranging from coarse-grained sands to large pebbles. Grain sizes along the shore line range from medium-grained sands to pebbles.

Lithologies of the shallow soil profile ranged from medium-grained sand to very stiff green clays. Completed boring logs are included in Appendix A, Section A.2. The zone from the land surface to approximately 11 to 12 feet bls generally consists of poor to moderately sorted fine- to medium-grained silty sand with some clays. At approximately 11 to 12 feet, the lithology changed to a stiff-to-very-stiff brown or green clay. The brown clay was observed near Mattawoman Creek and the green clay was observed closer to the hill, north of the scrap yard. The green clay was noted to be very hard and is believed to be an erosional surface on top of the Upper Patapsco confining unit, based on the general description of the formation and

personal communication with the U.S.G.S. (Hiortdahl, USGS, Personal Communication, September 2, 1992).

The land surface at the transformer storage area appeared dark or stained. Closer examination revealed that coal dust and small gravel-sized coal chips appeared to be the main factor in causing the dark surface appearance. As previously stated, this portion of the scrap yard was once used to store coal. Shallow soil borings installed in this area revealed coal chips and dust to a depth of 5 feet bls.

The saturated zone was observed between 5 and 11 feet bls and was restricted to the siltier lithologies. The depth of the saturated zone was noted to closely correlate to water levels in the creek. Well recovery was slow with an average yield estimated between 1.0 to 2.6 gpm based on well development pumping data. None of the three wells pumped dry during the development process; however, flow rates were closely monitored and appropriately adjusted to prevent exceeding the recharge capacity.

Four water quality parameters were measured during well purging, just before sampling. These measurements include pH, temperature (°C), specific conductivity (δ, siemens) and when practical turbidity (NTU). These data were tabulated and graphed to examine trends. The graphs and data are presented in Figure 5-4A and 5-4B. Data suggest groundwater conditions were stable at each well during sampling.

Groundwater elevation data from September 1992 are presented in Figure 5-5A along with a potentiometric surface map. The preliminary data indicate a potentiometric surface with an apparent flow direction to the southeast. The groundwater gradient parallel to the apparent flow direction is estimated at 1.76×10^{-2} ft/ft (feet per foot). Groundwater flow is likely influenced by fluctuations in the creek levels and associated tidal changes.

11 x 17

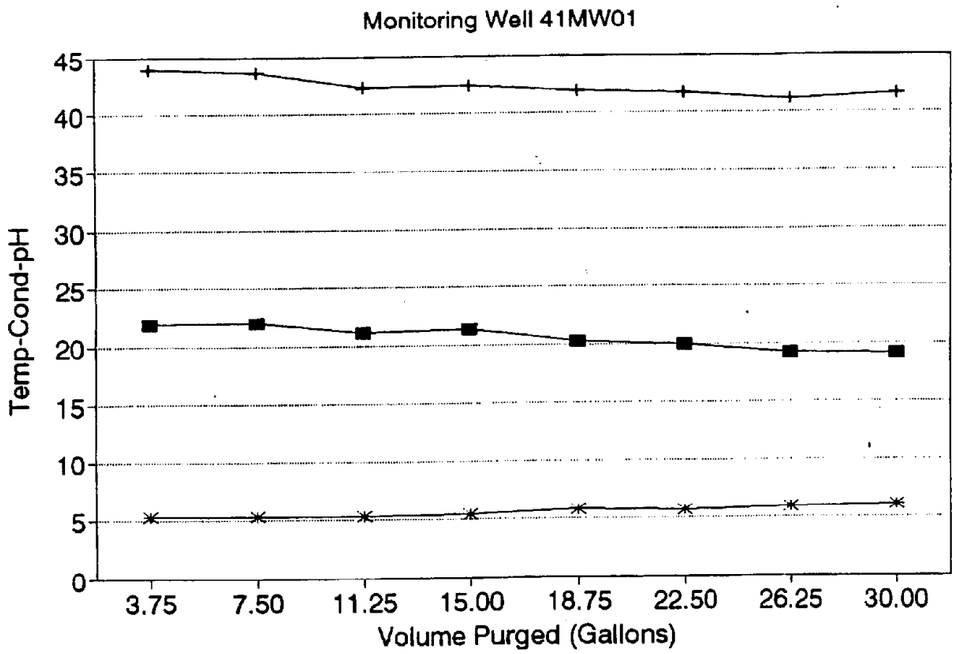
Name: 0 0 0 1 1 0 3 Z

Fig No. 5-4a

0001I04Z 5-4B
0001I05Z 5-5

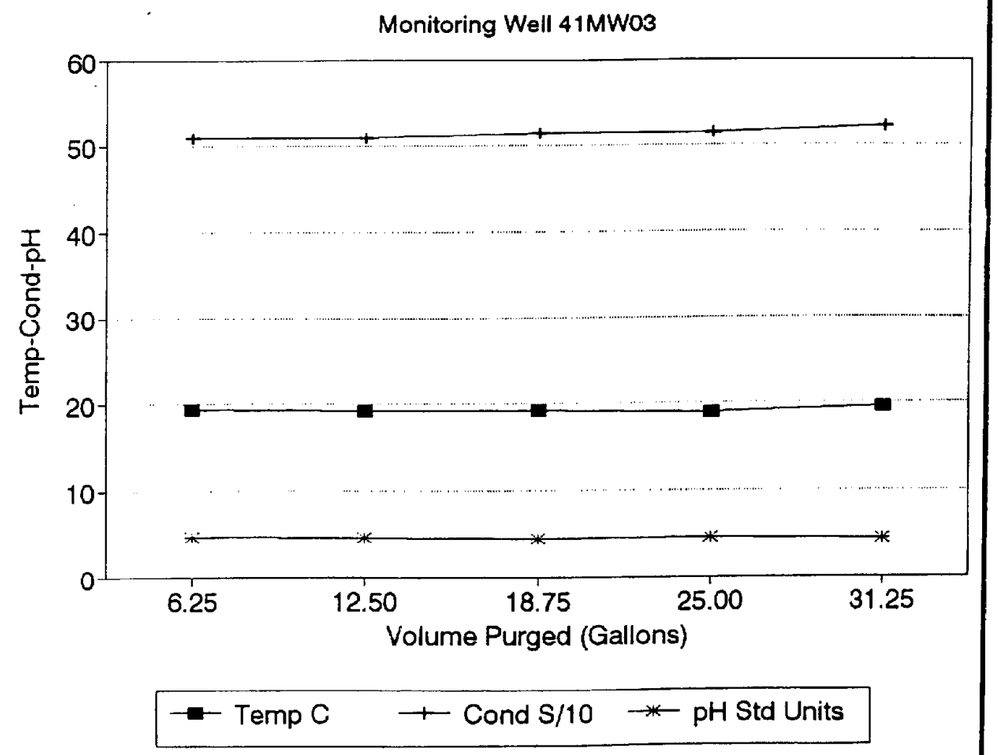
Monitoring Well Data 41MW01

TIME	TEMP (C)	COND (S)	pH	GAL REM	TURB
1530	21.90	439	5.27	3.75	8.23
1537	22.00	436	5.28	7.50	12.06
1543	21.10	423	5.26	11.25	17.15
1550	21.30	424	5.35	15.00	50.30
1600	20.30	419	5.72	18.75	56.20
1610	20.00	417	5.65	22.50	133.50
1618	19.20	412	5.85	26.25	-
1625	19.10	416	6.02	30.00	-



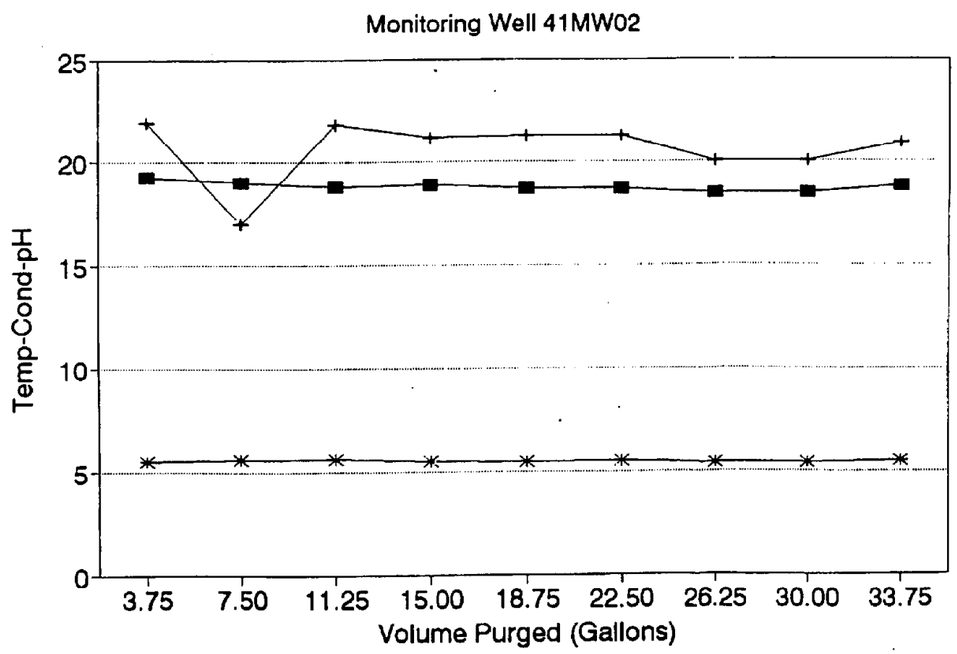
Monitoring Well Data 41MW03

TIME	TEMP (C)	COND (S)	pH	GAL REM	TURB
1618	19.30	510	4.58	6.25	-
1624	19.20	509	4.55	12.50	-
1630	19.20	514	4.41	18.75	-
1636	18.90	515	4.46	25.00	-
1643	19.40	522	4.40	31.25	-



Monitoring Well Data 41MW02

TIME	TEMP (C)	COND (S)	pH	GAL REM	TURB
1150	19.30	219	5.51	3.75	142.50
1203	19.00	170	5.61	7.50	88.80
1215	18.80	218	5.62	11.25	186.20
1219	18.90	212	5.50	15.00	-
1231	18.70	213	5.47	18.75	-
1240	18.70	213	5.50	22.50	148.40
1248	18.50	200	5.38	26.25	95.10
1257	18.50	200	5.42	30.00	72.70
1304	18.80	209	5.49	33.75	62.40

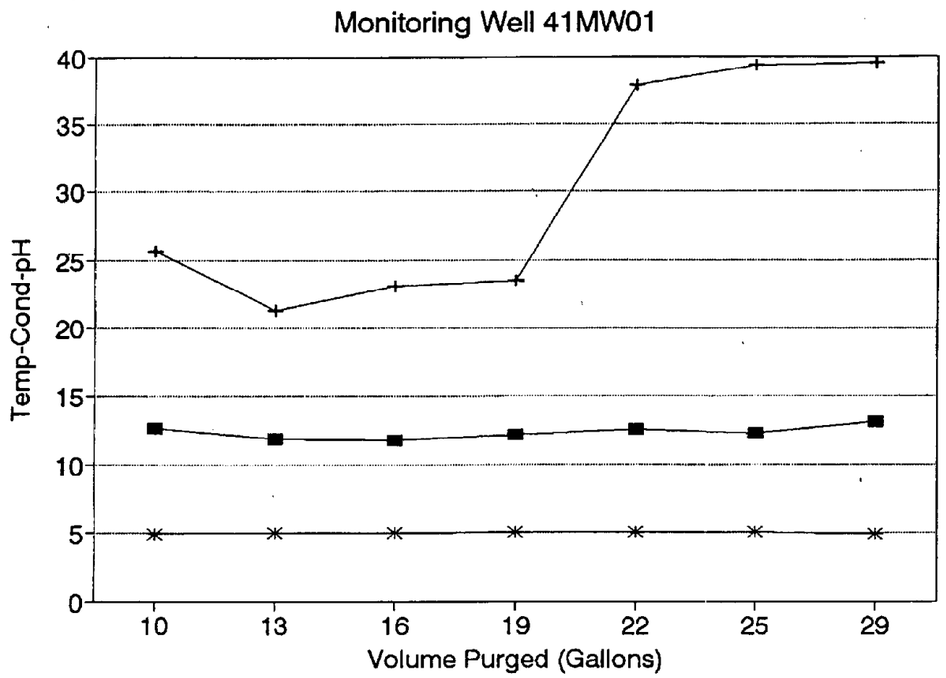


SITE 41
SITE INVESTIGATION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

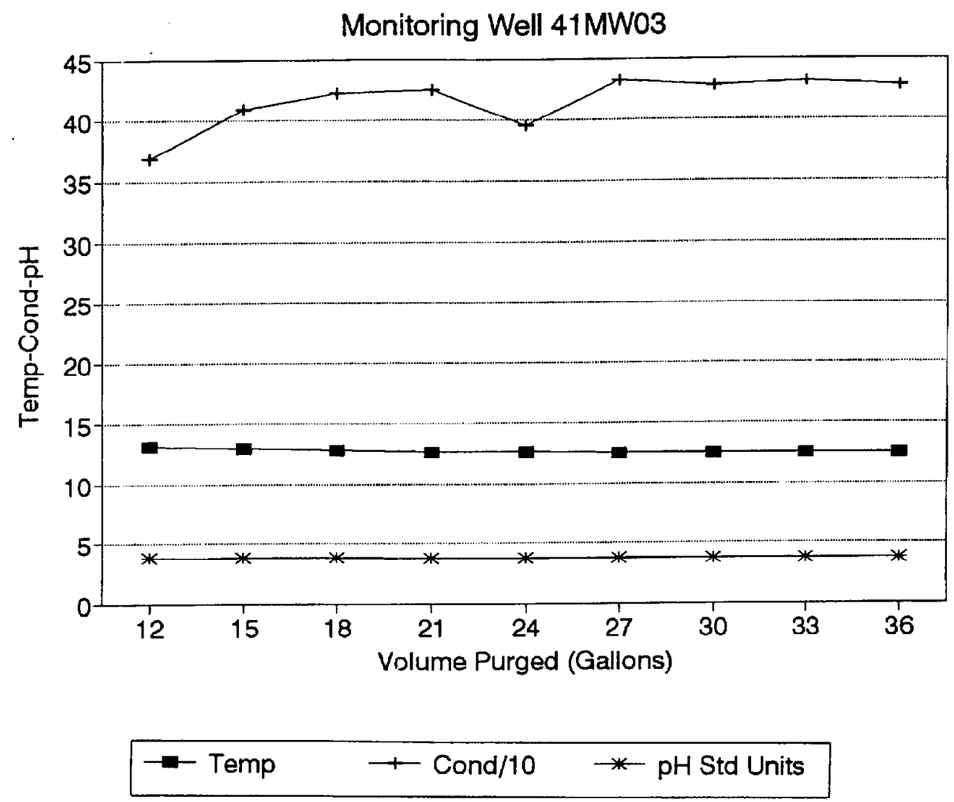
FIGURE 5-4A
SITE 41
WATER QUALITY DATA
September 1992

DWG DATE:03/01/94 | DWG NAME:CLN17X11

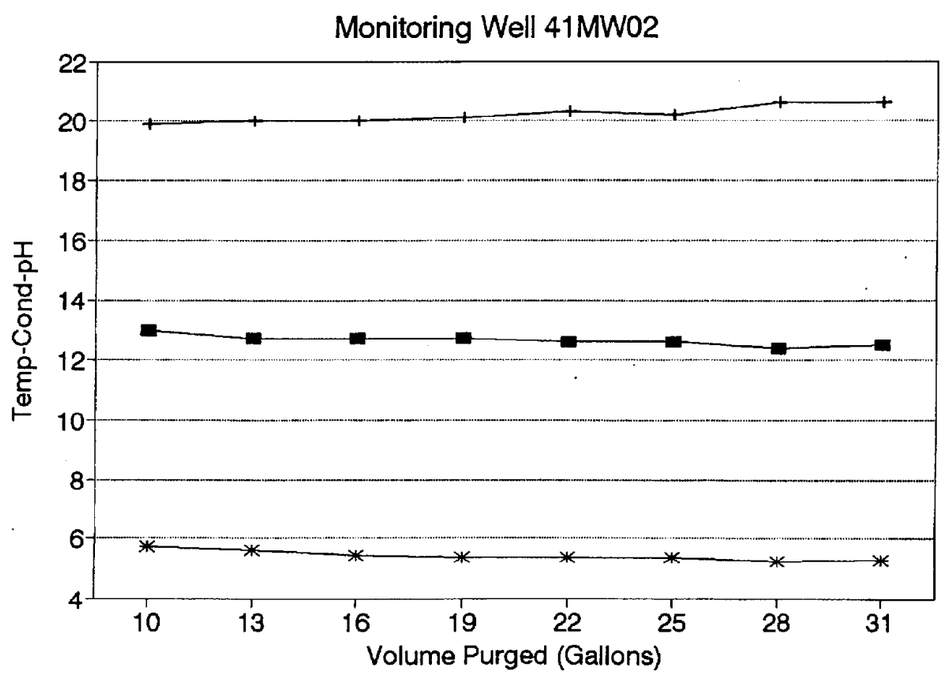
MONITORING WELL DATA 41MW01				
Time	Temp	Cond	pH	GAL REM
935	12.7	257	4.97	10
941	11.9	213	5.00	13
948	11.8	231	4.98	16
955	12.2	235	5.05	19
1008	12.6	378	5.12	22
1017	12.3	393	5.12	25
1032	13.1	395	4.94	29



MONITORING WELL DATA 41MW03				
Time	Temp	Cond	pH	GAL REM
1222	13.1	369	3.90	12
1225	12.9	409	3.83	15
1228	12.7	422	3.82	18
1231	12.6	425	3.80	21
1234	12.6	395	3.79	24
1237	12.5	432	3.80	27
1241	12.5	427	3.79	30
1244	12.5	431	3.79	33
1248	12.5	427	3.77	36



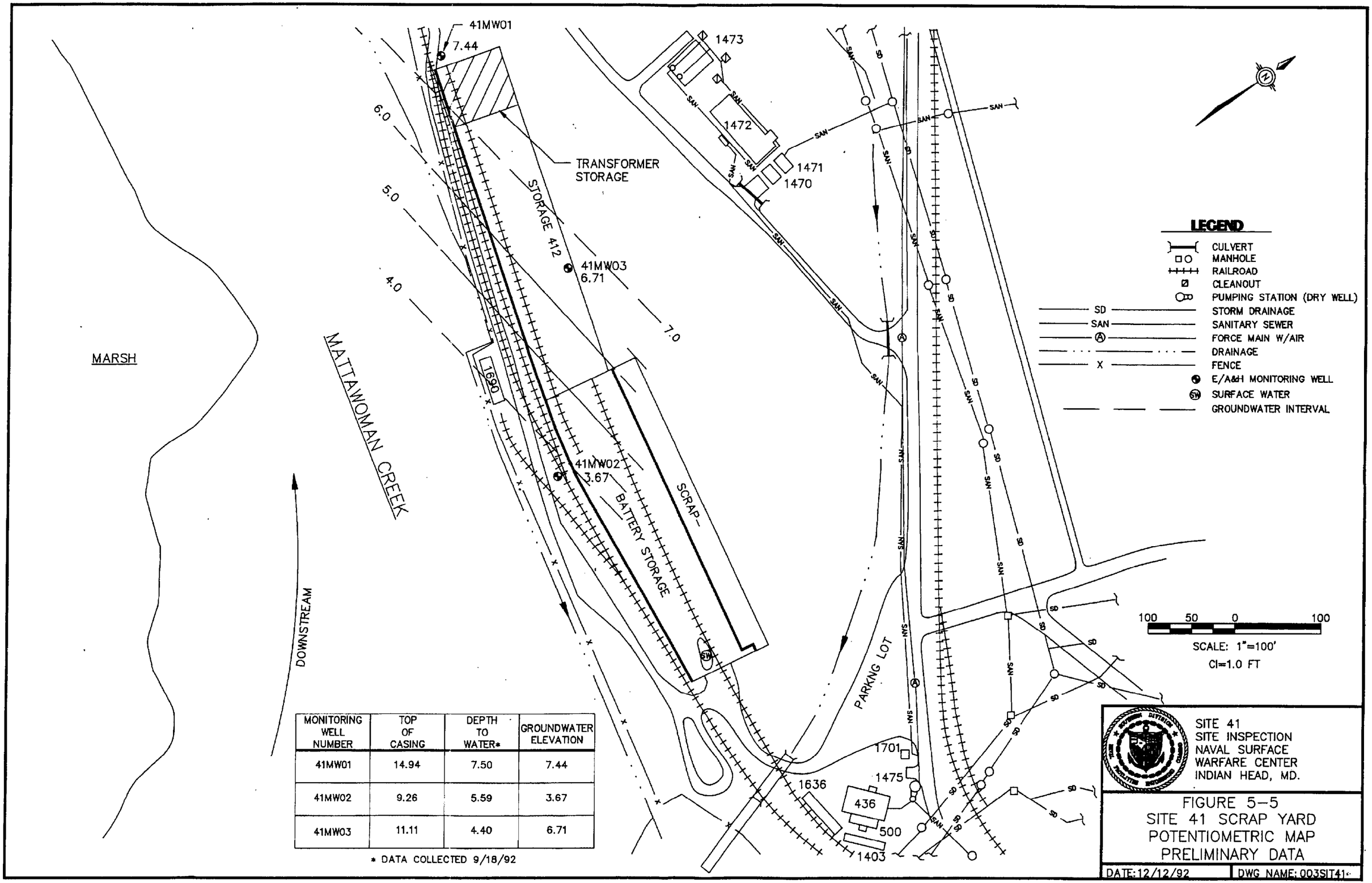
MONITORING WELL DATA 41MW02				
Time	Temp	Cond	pH	GAL REM
1125	13.0	199	5.71	10
1130	12.7	200	5.63	13
1135	12.7	200	5.45	16
1140	12.7	201	5.36	19
1145	12.6	203	5.36	22
1150	12.6	202	5.35	25
1153	12.4	206	5.22	28
1156	12.5	206	5.25	31



SITE 41
SITE INVESTIGATION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-4B
SITE 41
WATER QUALITY DATA
April 1993

DWG DATE:03/01/94 | DWG NAME:CLN17X11



MONITORING WELL NUMBER	TOP OF CASING	DEPTH TO WATER*	GROUNDWATER ELEVATION
41MW01	14.94	7.50	7.44
41MW02	9.26	5.59	3.67
41MW03	11.11	4.40	6.71

* DATA COLLECTED 9/18/92

Analytical Results — Site 41

Analytical data are presented in Appendix C where Section C.1 includes "Hits Only" data. Sediments — VOCs: Four VOCs — acetone, carbon disulfide, chloromethane, and 2-butanone — were detected by laboratory analysis of sediment samples. Table 5-9 summarizes the analytical results. Reported concentrations of chloromethane and carbon disulfide were below method detection limits. Both acetone and 2-butanone were detected in laboratory blanks and qualified as an estimated value.

Table 5-9
Site 41 - VOCs
Sediments

ug/kg

Parameter	Average	Minimum	Maximum	Frequency
Acetone	1517.78	220.00	5800.00	9/15
Chloromethane	16.50	16.00	17.00	2/15
Carbon Disulfide	3.67	2.00	6.00	3/15
2-Butanone	150.67	71.00	390.00	6/15

Sediments — BNAs: Ten BNA compounds that are common components of used motor oils and gasoline were detected in sediment samples: 41DP01 (41DP01D), 41DP02, 41DP04, 41DP05, and 41DP06. All reported concentrations were qualified as estimated values. Table 5-10 summarizes the analytical data.

Three BNA TICs were reported along with several unidentified TIC hydrocarbon compounds and one occurrence of an unknown alkane. Three other TICs that are fatty acids were detected in many of the sediment samples; however, these compounds are not considered environmentally significant. The unknown hydrocarbons may be related to other BNA compounds detected during laboratory analysis.

Table 5-10
Site 41 - BNAs
Sediment

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
bis(2-Ethylhexyl)phthalate	100.00	100.00	100.00	1/15
Pyrene	321.67	150.00	530.00	6/15
Benzo(b)fluoranthene	197.50	120.00	320.00	4/15
Fluoranthene	366.67	160.00	590.00	6/15
Benzo(k)fluoranthene	170.00	170.00	170.00	2/15
Chrysene	173.83	93.00	250.00	6/15
Benzo(a)pyrene	129.67	79.00	170.00	3/15
Benzo(a)anthracene	165.60	78.00	240.00	5/15
Phenanthrene	140.00	130.00	160.00	3/15
N-Nitrosodiphenylamine (1)	325.00	120.00	620.00	4/15

[a] Data include 1 field duplicate and 3 reanalyses.

Sediments — PEST: Low levels of five pesticide compounds were detected in several of the sediment samples. Compounds detected included DDT, DDD, DDE, endrin and γ-chlordane. Table 5-11 summarizes of the analytical data.

Table 5-11
Site 41 - Pesticides
Sediment

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
4,4'-DDT	5.90	3.00	11.00	7/11
g-Chlordane	1.33	1.10	1.50	3/11
Endrin	2.65	2.60	2.70	2/11
4,4'-DDD	4.60	3.10	7.80	4/11
4,4'-DDE	3.05	2.40	4.10	4/11

[a] Includes data from duplicate sample 41DP01D.

Sediments — TAL: Eight metal analytes were detected in sediment samples above soil background levels. Table 5-12 summarizes the analytical data. Mercury was detected in six samples: 41DP04, 41DP05, 41DP06, 41DP07, 41DP09, and 41DP10. Selenium was detected only in sample 41DP01. Cadmium was detected in samples 41DP01D and 41DP09.

Table 5-12
Site 41 – TALs
Sediment

mg/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Lead	43.59	27.20	105.00	11/11
Mercury	0.49	0.36	0.78	6/11
Silver	5.55	3.80	8.70	11/11
Arsenic	5.32	3.20	8.80	11/11
Cadmium	3.10	2.40	3.80	2/11
Cobalt	22.67	16.50	30.40	11/11
Zinc	181.18	127.00	253.00	11/11
Selenium	1.70	1.70	1.70	1/11

[a] Includes duplicate sample date 41DP01D.

TPH was detected in all sediment samples except 41DP01 and 41DP09. Detected levels of TPH ranged from 39.0 to 215 mg/kg and the average concentration was 84.66 mg/kg.

Soil-gas Survey: Total GC/FID volatiles were detected at 2.3 μg/L in soil-gas sample 41-7. This sample was collected adjacent to the battery storage area. No other selected target compounds were detected in soil-gas samples. All soil-gas sample locations are indicated in the report by Target, Appendix B.

Soil — VOCs: Seven VOCs were detected in soil boring samples. Table 5-13 summarizes the analytical data. Table 5-14 indicates the distribution of VOCs in soils.

Table 5-13
Site 41 - VOAs
Soil Boring Samples

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Ethylbenzene	2.00	2.00	2.00	1/32
Toluene	20.50	9.00	32.00	2/32
Xylene (total)	10.00	10.00	10.00	1/32
2-Hexanone	15.00	15.00	15.00	1/32
Acetone	576.67	110.00	1200.00	6/32
Benzene	2.00	2.00	2.00	1/32
Carbon Disulfide	4.00	2.00	6.00	8/32

[a] Includes 4 field duplicate samples and 5 dilutions/re-analyses.

Table 5-14
Site 41
VOCs Distribution in Soil

VOCs	Boring #	Samples/Boring
Ethylbenzene	41SB03	1
Toluene	41SB03	1
Xylene (total)	41SB03	1
2-Hexanone	41SB02	1
Acetone	41SB01	3
	41SB02	4
Benzene	41SB03	1
Carbon Disulfide	41SB01	1
	41SB02	1
	41SB03	2
	41SB04	3
	41SB07	1

Soil — BNAs: Seventeen BNA compounds were detected in soil samples. Distribution of these compounds was limited to soil samples 41SB0201, 41SB0301, and 41SB0402. Table 5-15 indicates the range and average concentrations of each compound.

Samples 41SB0201 and 41SB0301 were collected from 0 to 2 feet bls, adjacent to a moderately traveled dirt road. Compounds detected in sample 41SB0301 are the main components of gasoline. Boring 41SB02 was placed in an area apparently backfilled with soil and wood.

Compounds detected in 41SB0201 are common constituents of wood preservatives, petroleum products — and one explosive — related compound phenanthrene.

Table 5-15
Site 41 - BNAs
Soil Boring Samples

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Anthracene	125.00	90.00	160.00	2/29
Pyrene	810.00	520.00	1100.00	2/29
Dibenzofuran	47.50	42.00	53.00	2/29
Indeno(1,2,3-cd)pyrene	120.00	120.00	120.00	2/29
Benzo(b)fluoranthene	416.67	160.00	560.00	3/29
Fluoranthene	970.00	640.00	1300.00	2/29
Benzo(k)fluoranthene	515.00	420.00	610.00	2/29
Acenaphthylene	91.00	82.00	100.00	2/29
Chrysene	860.00	520.00	1200.00	2/29
Benzo(a)pyrene	173.33	100.00	230.00	3/29
Benzo(a)anthracene	515.00	320.00	710.00	2/29
Diethylphthalate	10300.00	8600.00	12000.00	2/29
Di-n-butylphthalate	3350.00	3300.00	3400.00	2/29
Phenanthrene	496.67	140.00	1000.00	3/29
Carbazole	172.67	48.00	250.00	3/29
Naphthalene	74.00	56.00	92.00	2/29
2-Methylnaphthalene	40.00	38.00	42.00	2/29

[a] Data include 4 duplicate samples and 2 dilutions/re-analyses.

Soil — PEST: Low levels of seven pesticides were detected in samples from soil borings 41SB02, 41SB03, 41SB04, and 41SB05. The range and average concentration of each compound are indicated in Table 5-16 and Table 5-17 indicates the distribution of pesticides compounds in soils.

Table 5-16
Site 41 - Pesticides
Soil Boring Samples

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Heptachlor epoxide	5.00	2.90	6.60	3/29
Endosulfan II	1.50	1.50	1.50	1/29
4,4'-DDT	368.35	5.90	980.00	4/29
g-Chlordane	1.40	1.40	1.40	1/29
Endrin	51.75	15.00	91.00	4/29
4,4'-DDD	43.62	0.86	77.00	3/29
4,4'-DDE	165.00	160.00	170.00	2/29

[a] Data include 4 duplicates and 2 dilutions.

Table 5-17
Site 41
Pesticide Distribution

Pesticide Compound	Boring #	Samples/Boring
Heptachlor epoxide	41SB03	2
	41SB05	1
Endosulfan II	41SB05	1
4,4-DDT	41SB02	3
	41SB04	1
γ-chlodane	41SB02	1
Endrin	41SB02	1
	41SB03	2
	41SB04	1
4,4-DDD	41SB02	2
	41SB05	1
4,4-DDE	41SB02	2

Soil — TALs: Eight metals were detected at concentrations greater than the average background range. Table 5-18 summarizes the analytical data for analytes reported above background and Table 5-19 indicates the distribution of each analyte.

Table 5-18
Site 41 - TALs
Soil Boring Samples

mg/kg

Parameter	Average	Minimum	Maximum	Frequency
Mercury	0.23	0.18	0.28	2/27
Nickel	18.95	4.10	53.10	11/27
Silver	3.42	1.20	10.10	9/27
Arsenic	47.66	1.30	328.00	11/27
Beryllium	1.24	0.30	4.60	14/27
Cadmium	1.60	1.20	2.00	2/27
Cobalt	23.12	3.70	71.70	20/27
Selenium	0.65	0.60	0.70	2/27

Table 5-19
Site 41 - Soil Boring Samples
TAL Distribution

Analytes	Boring #	Samples/Boring	Analytes	Boring #	Samples/Boring
Cobalt	41SB01	3	Beryllium	41SB01	2
	41SB02	3		41SB02	3
	41SB03	3		41SB03	3
	41SB04	1		41SB04	1
	41SB05	2		41SB05	2
	41SB06	2		41SB06	1
	41SB07	3		41SB07	1
	41SB08	3		41SB08	1
Nickel	41SB01	2	Arsenic	41SB02	3
	41SB02	1		41SB03	2
	41SB03	2		41SB04	1
	41SB05	2		41SB05	2
	41SB07	3		41SB06	1
	41SB08	1		41SB07	2
Silver	41SB01	1	Cadmium	41SB02	1
	41SB02	2		41SB05	1
	41SB03	1	Mercury	41SB02	1
	41SB04	2		41SB03	1
	41SB05	2	Selenium	41SB02	1
	41SB06	1		41SB03	1

Soil — TPH: TPH was detected in six soil samples collected from three soil borings. Concentrations range from 12.5 to 143 mg/kg with an average concentration of 37.15 mg/kg. Table 5-20 indicates the TPH results and distribution.

Table 5-20 Site 41 TPH in Soils			
Sample	**mg/kg**	**Sample**	**mg/kg**
41SB0102	17.2	41SB0204	17.7
41SB0201	143.0	41SB0301	16.2
41SB0203	12.5	41SB0402	16.3

Groundwater — VOCs (September-1992): Very low levels of three VOCs were detected in groundwater samples at concentrations below the method detection limits. Trichloroethene was detected in samples 41GW01 (41GW01D) and 41GW03, ranging from 4.0 to 15.0 μg/L and averaging 8.0 μg/L. Trichloroethane was detected in sample 41GW02 at 2.0 μg/L.

Groundwater — VOCs (April-1993): Two VOCs were reported in samples collected from Site 41. Only trichloroethene (TCE) was detected at concentrations above maximum contaminant levels (MCLs) in samples 41GW1D0408 and 41GW030408 at 5.0 and 12.0 μg/L, respectively. Dichloroethlene (DCE) was detected in the sample from well 41MW03 in the 04/1993 data. This compound not was previously detected.

Groundwater — PEST (September-1992): Low levels of five pesticides were detected below method detection limits in sample 41GW01 (and 41GW01D). Table 5-21 summarizes this analytical data. The difference between the reported concentrations of endosulfan II in sample 41GW01 and the duplicate sample 41GW01D is three orders of magnitude; therefore, the reported value for endosulfan II is qualified as an estimate.

Groundwater — PEST (April-1993): Two pesticide compounds were reported below CRDLs and assessment criteria levels.

Table 5-21
Site 41 - Pesticides
Groundwater

ug/l

Parameter	Average	Minimum	Maximum	Frequency[a]
Heptachlor epoxide	0.05	0.05	0.05	2/4
Endosulfan II	37.53	0.07	75.00	2/4
a-Chlordane	0.03	0.03	0.03	2/4
Endrin	0.04	0.04	0.04	2/4
Endosulfan I	0.01	0.01	0.01	1/4

[a] Data include 1 field duplicate sample.

Groundwater — TALs (September-1992): Aluminum, iron, manganese, and nickel were reported at concentrations above the drinking water standards. Table 5-22 indicates the range and average reported concentrations of each analyte detected in groundwater samples.

Groundwater — TALs (April-1993): Aluminum, beryllium, iron, lead, manganese and nickel were reported at concentrations above the FDWS. The average and range of concentration of the analytes detected above current standards are indicated below. As noted in the draft SI elevated levels of analytes may be related to turbidity (suspended solids) in groundwater.

Groundwater — TPH: TPH was not detected in either the September — 1992 or the April — 1993 groundwater samples.

Water Puddle — BNAs: Three BNA compounds — trichlorobenzene, pyrene, and fluoranthene — were detected in the water puddle sample. The reported concentration for each compound was at 1.0 μg/L. These concentrations were below method detection limits.

Water Puddle — PEST: Three pesticide compounds — endosulfan, DDE, and DDD — were detected at low levels. Each of these compounds were reported at concentrations below method detection limits. One PCB compound, aroclor-1260, was detected at 47.0 μg/L (41SW01DL).

Table 5-22
Site 41 - TALs
Groundwater

ug/l

Parameter	Average	Minimum	Maximum	Frequency[a]
Aluminum	2575.00	2190.00	2960.00	2/4
Iron	8925.00	5250.00	12600.00	2/4
Magnesium	11350.00	3300.00	15000.00	4/4
Manganese	400.00	334.00	429.00	4/4
Nickel	84.70	31.80	111.00	4/4
Potassium	6285.00	2170.00	9110.00	4/4
Sodium	30450.00	20600.00	36200.00	4/4
Arsenic	3.40	2.20	4.60	2/4
Barium	65.60	44.70	74.30	4/4
Cobalt	169.05	46.20	218.00	4/4
Zinc	727.25	249.00	1440.00	4/4
Calcium	26025.00	16000.00	39300.00	4/4

[a] Data include 1 field duplicate.

Water Puddle — TALs: Six metal analytes were detected at notable concentrations. The level of metal compounds detected likely are affected by the turbid nature (high sediment load) of the water puddle. The analytical results are:

Analyte	Results µg/L
Aluminum	3740.0
Iron	16700.0
Lead	716.0
Manganese	225.0
Mercury	2.8
Cadmium	104.0

5.3.3 Discussion — Site 41

Trichloroethene was detected at concentrations above MCLs in groundwater samples and DCE was detected at low concentrations in the April — 1993 groundwater samples. Only two pesticide compounds were detected at low concentrations in the April — 1993 groundwater samples in contrast to five compounds that were detected in the September — 1993 groundwater samples. The most noted difference is the indication of endosulfan II at a concentration of 75

μg/L in the sample collected from 41MW01 during September — 1992. Endosulfan II was not detected in the April — 1993 groundwater samples. Four analytes were noted above the drinking water standards in the September — 1992 data. Two additional analytes, beryllium and lead were noted above the drinking water standards in the April — 1993 data.

Analytical results from this study do not indicate significant concentrations of VOCs in sediments and soils; however, various BNA compounds were indicated suggesting possible site contamination. The nature of the BNA compounds detected includes petroleum compounds, mainly components of gasoline and used motor oils. The same BNA compounds were detected in sediment and soil samples collected from borings between the south wall and the creek. Many of the BNA compounds detected, along with other miscellaneous compounds, may influence the TPH analytical results as elevated concentrations of TPH were identified.

Any conclusions correlating BNA contamination in soil with sediment samples may be premature; however, a relationship could exist. The presence of these compounds in sediment samples also may be related to boat traffic along the creek, or previous disposal practices. BNA and VOC compounds in the soil at the site may be from a local release of fuel or solvent spills and/or releases of the residual contents from used storage drums in the scrap yard.

5.3.4 Recommendations — Site 41

Additional field investigation should be completed at Site 41 to define the extent of contamination in surface soils, groundwater, and the creek sediments. The objective should include defining any migration pathways between sediment, soil, and groundwater, and determining the extent of contamination in the affected media. Field activities may include collecting additional sediment samples from Mattawoman Creek, soil samples between the south wall and the creek, and installing and sampling additional monitoring wells. All samples should be analyzed for full TCL. E/A&H recommends combining the sediment studies of Sites 39, 40 and 41. This is discussed in Section 7.0.

Additionally, current storage and handling practices of materials placed in the Scrap Yard should be reviewed. Assurance of adequate storage and handling methods and the design of storage facilities may prevent and/or control future releases.

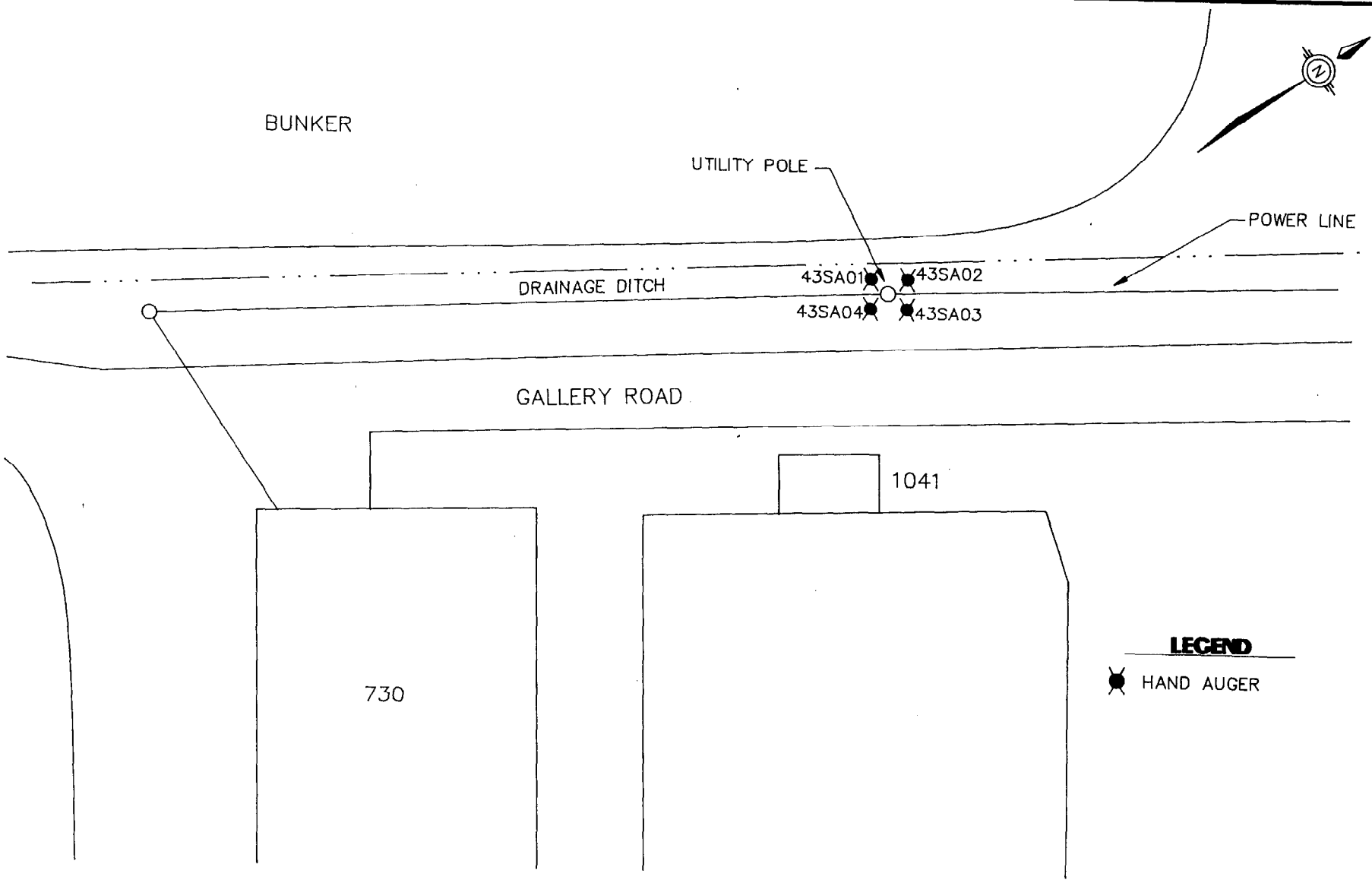
5.4 Site 43 — Toluene Disposal Site

Building 1041 is part of the cast plant and is in the western portion of the facility. An unknown quantity of toluene was reportedly disposed at the base of a utility pole adjacent to Building 1041 (Figure 5-6). The area surrounding the base of the utility pole is Site 43.

Toluene was regularly used to degrease metal parts during the casting process (PA, 1992). A waste solvent (spent solvent) mixture resulted from the degreasing process. The PA reported that the spent solvent was disposed of improperly. Apparently, spent solvent routinely was poured at the base of the utility pole, across Gallery Road from Building 1041. This dumping practice apparently occurred over several years. This site was recommended for an SI based on the reported disposal practices.

5.4.1 Study Description

The objective of this study was to determine if improper dumping of spent solvents had contaminated the soil surrounding the utility pole. This was accomplished by completing a limited soil-gas survey and collecting surface soil samples. Surface soil samples were collected with a hand-auger (Section 3) and a limited soil-gas survey was completed by Target (Appendix B). The sampling and analysis approach is outlined below.



30 15 0 30

SCALE: 1"=30'

SITE 43
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-6
SITE 43
TOLUENE DISPOSAL

DATE: 10/27/92

DWG NAME: 003SIT43

Site 43 — Sampling and Analysis Approach				
Sample Media:	Shallow soil profile (0 to 1) Soil-gas (Vadose Zone)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Soil boring-hand-auger	4	1	4
	Soil-gas borings	10	1	10
Analytical Requirements:	**Media**	**Analyses**		
	Soil (hand-auger)	VOC, BNA		
	Soil-gas	GC, FID Volatile Organic Compounds		

Soil-gas Survey: Ten soil-gas borings were completed approximately 12 feet bls and samples were collected in the area surrounding the utility pole. Soil-gas data and sample locations are indicated in the report by Target, Appendix B. One boring was completed for background (43-1). Five soil-gas borings were completed along the drainage ditch adjacent to the utility pole or on the slope of the bunker across the ditch from the utility pole. Four borings were completed through the asphalt of Gallery Road.

Surface Soil Survey: Four surface soil samples were collected around the base of the utility pole (Figure 5-6). The utility pole is situated on the side of a small drainage ditch. Soil sample locations were evenly placed with two locations up the bank from the utility pole (43SA03 and 43SA04) and two locations within the ditch (43SA01 and 43SA02).

5.4.2 Study Findings — Site 43

Observations

Soil at the base of the pole was sandy silt with some clays and small gravel. There was no visible indication of stained soil, stressed vegetation, or elevated levels (above background) of total organic vapors based on health and safety PID monitoring data.

Analytical Results — Site 43

Analytical data are presented in Appendix C where Section C.1 includes "Hits Only" data.

Soil-gas Survey: GC/FID analysis of soil-gas samples detected total volatiles in three samples and toluene in one sample. Analysis by GC/ECD detected three chlorinated compounds in two samples. Soil-gas results are indicated in Table 5-24.

Table 5-24
Site 43 - Soil-gas Results
µg/L

Parameter Groups	GC/ECD Compounds			GC/FID Compounds	
Sample Number	Trichloroethane	Dichloroethene	dichloroethene (cis-1,2-)	Total VOCs	Toluene
43-6	-	-	-	81	81
43-8	7.3	4.1	-	5.1	-
43-9	17.0	4.7	1.8	8.5	-

Surface Soil Survey: All soil samples were analyzed for VOCs and BNAs. Acetone was detected in 43SA01 (43SA01D and 43SA01Ddl) at an average concentration of 483 µg/kg. Acetone also was detected in the accompanying laboratory blank.

5.4.3 Discussion — Site 43

Soil-gas data indicate the presence of volatile organic vapors. Data distribution suggests a local "hot spot" at sample location 43-6 on the slope of the bunker. Vapors from chlorinated compounds were detected at sample locations 43-8 and 43-9 beneath Gallery Road.

The presence of acetone in soils does not confirm site contamination nor does it suggest the discovery of the toluene dump site. Acetone is used in facility laboratories as a solvent. The presence of acetone and chlorinated solvents vapors suggests that waste solvents, in addition to toluene, may have been improperly disposed of in the vicinity of Site 43.

5.4.4 Recommendations — Site 43

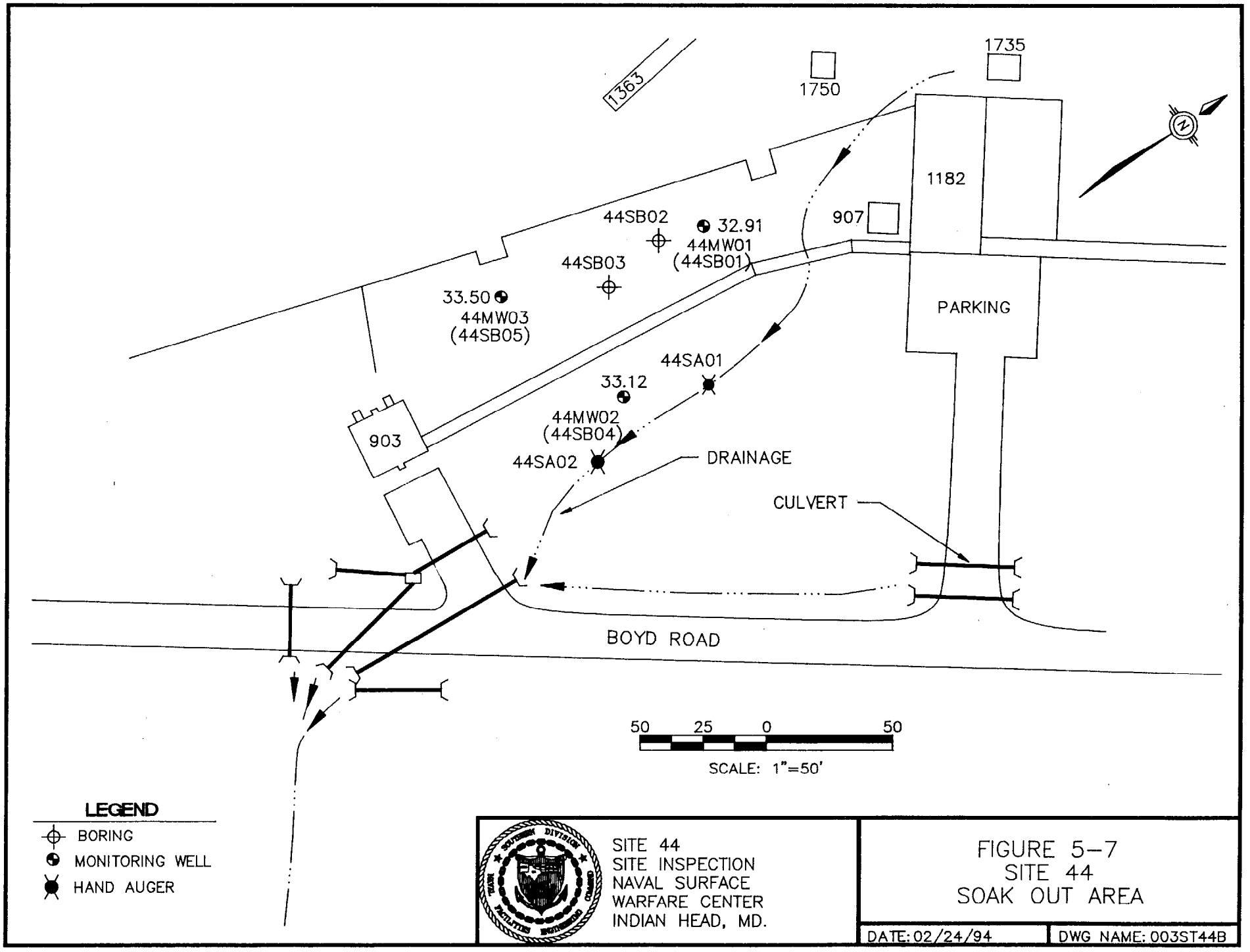
Acetone was detected in soil and soil-gas data indicate toluene and three chlorinated compounds may be present in shallow soils. An additional soil-gas survey should be conducted over a large area of the site to provide additional screening data to aid placing additional soil borings. A series of shallow soil borings should be completed from 0 to 15 feet bls and three to five discrete soil samples should be collected per boring. These borings may be completed by hand-auguring techniques or with a drill rig. Soil samples collected should be field screened for emission of volatile organic vapors by headspace techniques. Samples indicating the highest emissions of volatile organic vapors should be submitted to the laboratory for VOC analysis.

5.5 Site 44 — Soak Out Area

The soak out area is located between Buildings 903 and 1182 in the northwest-central portion of the facility (Figure 5-7). Site topography grades gently to the southwest. A drainage ditch extends along the southeastern edge of the site and discharges to the storm sewer system. Site 44 was recommended for an SI based on reported spills from onsite operations.

Operations here included removing propellant from rocket catapult tubes. Pennchem, a polysulfide solvent containing mercaptan, may have been used during the removal process. This process was conducted in the grassy area between Buildings 903 and 1182.

The PA reported that an unknown volume of the solvent was spilled during the period this process was conducted. The holding tanks for the soak out process reportedly consisted of two 55-gallon drums welded end-to-end. The area was reportedly void of vegetation for several years subsequent to the close of the soak out process.


1363
1750
1735
1182
907
PARKING
44SB02
32.91
44MW01
(44SB01)
44SB03
33.50
44MW03
(44SB05)
44SA01
33.12
44MW02
(44SB04)
903
44SA02
DRAINAGE
CULVERT
BOYD ROAD
50 25 0 50
SCALE: 1"=50'
LEGEND
BORING
MONITORING WELL
HAND AUGER
SITE 44
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.
FIGURE 5-7
SITE 44
SOAK OUT AREA
DATE: 02/24/94
DWG NAME: 003ST44B

5.5.1 Study Description

The objective of this study was to determine if shallow soil and groundwater have been contaminated by spills of solvent used in the soak out process. This was accomplished by completing a limited soil-gas survey, installing soil borings and monitoring wells, and collecting surface sediment samples. All field procedures were completed as described in Section 3. The sampling and analysis approach is outlined below.

Site 44 — Sampling and Analysis Approach

Sample Media:	Shallow soil profile (0-20 feet) Shallow aquifer (water table aquifer) Soil-gas (vadose Zone)			
Sample Procedures:	Type	Number	Sam/Loc	Total
	Shallow soil borings[a]	5	3	15
	Monitoring wells September - 1992	1	1	3
	Monitoring wells April - 1993	1	1	3
	Surface sediments-hand-auger	2	1	2
	Soil-gas borings	15	1	15
Analytical Requirements:	Media	Analyses		
	Soil	VOC, BNA, TPH		
	Groundwater	VOC, BNA, TPH		
	Sediments	VOC, BNA, TPH		
	Soil-gas	GC/FID VOCs		
	[a] Include soil boring samples collected during the completion of soil borings and monitoring well borings.			

Soil-gas Survey: Fifteen shallow soil-gas borings were installed in the grassy area between Buildings 903 and 1182. The soil-gas data and sample locations are indicated in the report by Target, Appendix B. Sample separation was based on a grid consisting of 15-foot centers with three rows of five sample points per row. The average depth of soil-gas borings was approximately 12 feet bls and these borings were confined to the vadose zone.

Sediment Sampling: Two sediment samples were collected from the drainage ditch along the southern boundary of the site. Each sample was collected at a depth interval of 0 to 1 feet bls. Sample 44SA01 was collected upgradient of sample 44SA02.

Soil Borings: Five soil borings were installed and soil samples collected at Site 44. The location of each boring is indicated on Figure 5-7. Borings 44SB01, 44SB02, and 44SB03 were completed in the area where the soak out process was reported to have occurred. Boring 44SB04 was placed downgradient of the site, between the sidewalk and drainage ditch. Boring 44SB05 was placed in a position believed to be downgradient of the soak out area.

Monitoring Wells: Soil borings 44SB01, 44SB04, and 44SB05 were completed as shallow monitoring wells (44MW01, 44MW02 and 44MW03, respectively). Monitoring wells ranged in depth from 15.4 to 18.6 feet bls. Each monitoring well was sampled in September 1992 during the Phase II field work and a second time in April 1993. The April 1993 results are summarized here and a copy of the monitoring report is included as Section A.3 of Appendix A.

5.5.2 Study Findings — Site 44

Observations

The vegetation in a small area around borings 44SB02 and 44SB03 appeared to be sparse or stressed compared to the surrounding area. The area west of boring 44SB05 was a localized depression and was observed to collect surface runoff. There was no apparent stressed vegetation in this area.

Soil textures consist of stiff to soft, brown silty clay. The saturated areas were restricted to the siltier grained lithologies. Saturated soils were encountered approximately 10 to 12 feet bls. Groundwater elevations stabilized at approximately 3 to 5 feet bls after well installation.

Groundwater elevation data from the wells indicate a potentiometric surface sloping down to the northeast. The groundwater gradient parallel to the apparent flow direction was calculated at 7.5×10^{-3} ft/ft. The potentiometric surface map and the groundwater data are presented in Figure 5-8A.

Well recovery to the monitoring wells appeared slow, based on well development pumping data. The average yield was estimated between 1.4 to 2.4 gpm. None of the three wells pumped dry during the development process; however, flow rates were closely monitored and appropriately adjusted to prevent exceeding recharge capacities.

Select water quality measurements were completed during well purging included pH, temperature (°C), specific conductivity (δ, siemens), and, when practical, turbidity (NTU). These data were tabulated and graphed to examine trends and are presented in Figure 5-9. Data trends indicate groundwater conditions were stable at each well during sampling.

Analytical Results — Site 44

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

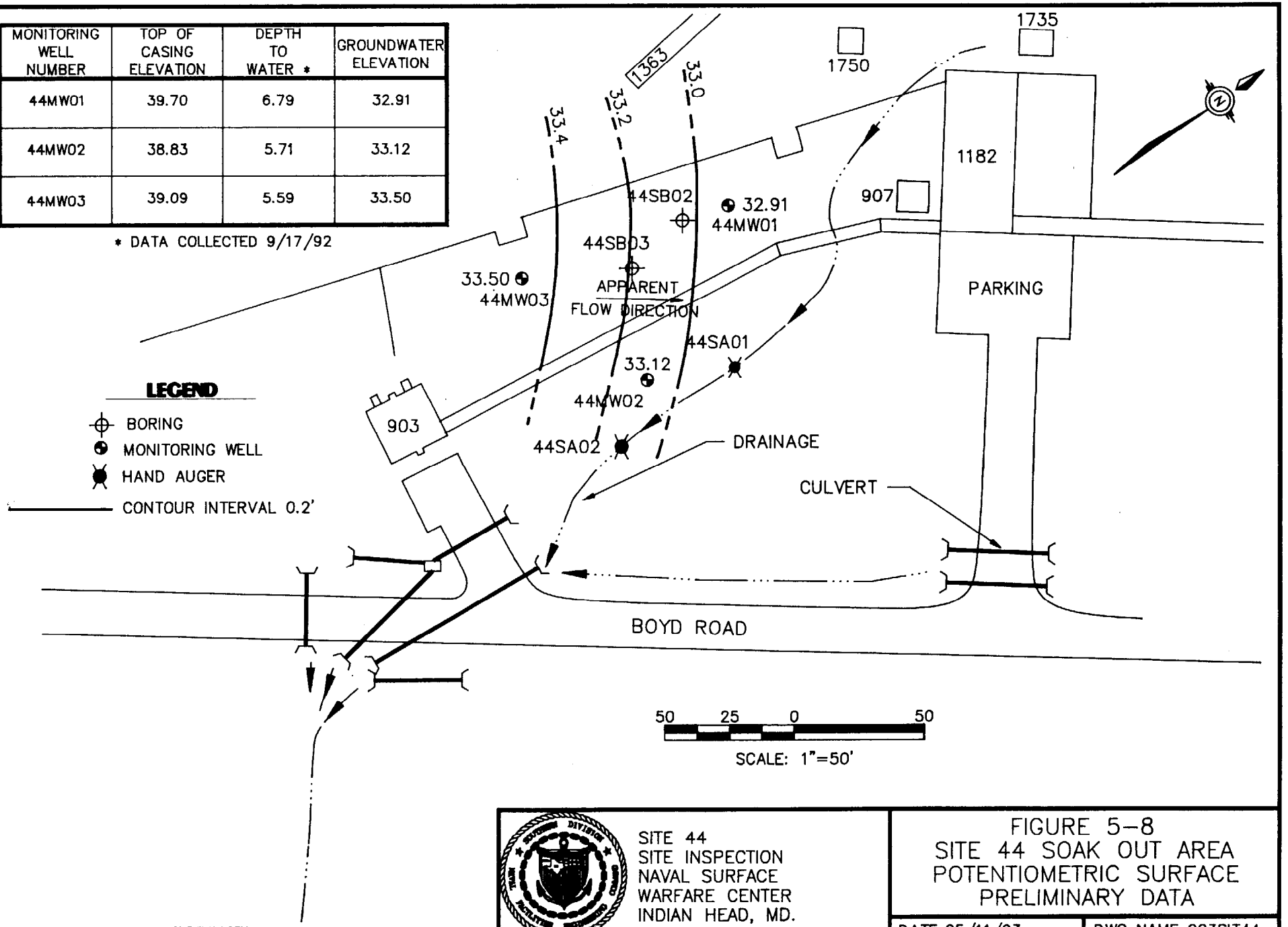
Soil-gas Survey: Very low levels of total GC/FID volatiles were detected in two samples. None of the standardized analytes (GC/FID or GC/ECD) were detected in samples.

Sediment Samples: Acetone was detected in sample 44SA01 at 460 μg/kg. Acetone also was reported in the accompanying laboratory blank. No TPH or BNA compounds were detected above method detection limits.

Soil — TPH: TPH was reported in soil samples from borings 44SB04 and 44SB05 at 14.6 and 17.0 mg/kg, respectively.

MONITORING WELL NUMBER	TOP OF CASING ELEVATION	DEPTH TO WATER *	GROUNDWATER ELEVATION
44MW01	39.70	6.79	32.91
44MW02	38.83	5.71	33.12
44MW03	39.09	5.59	33.50

* DATA COLLECTED 9/17/92



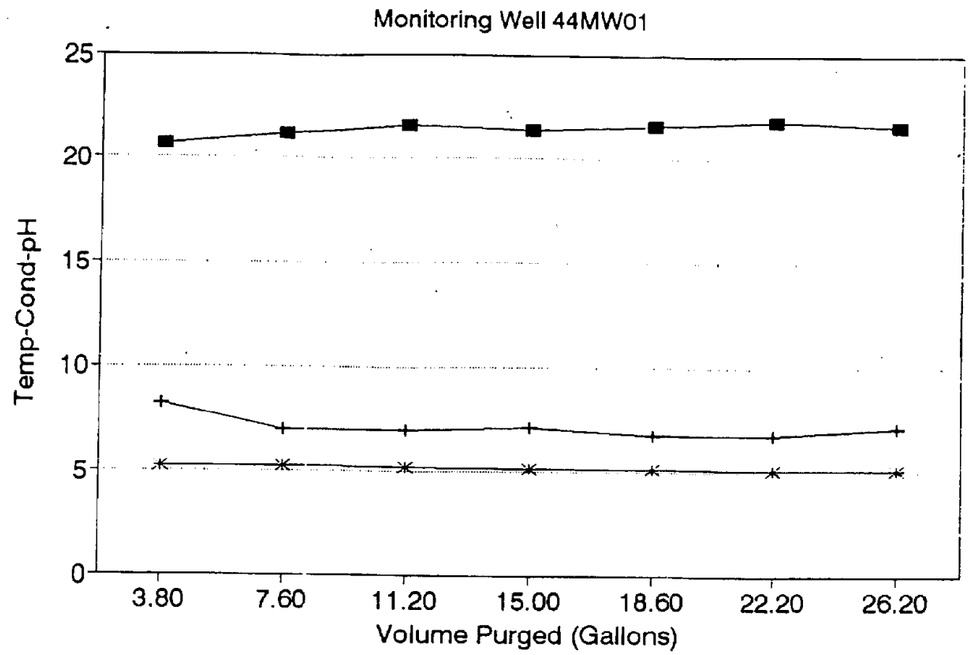
SITE 44
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-8
SITE 44 SOAK OUT AREA
POTENTIOMETRIC SURFACE
PRELIMINARY DATA

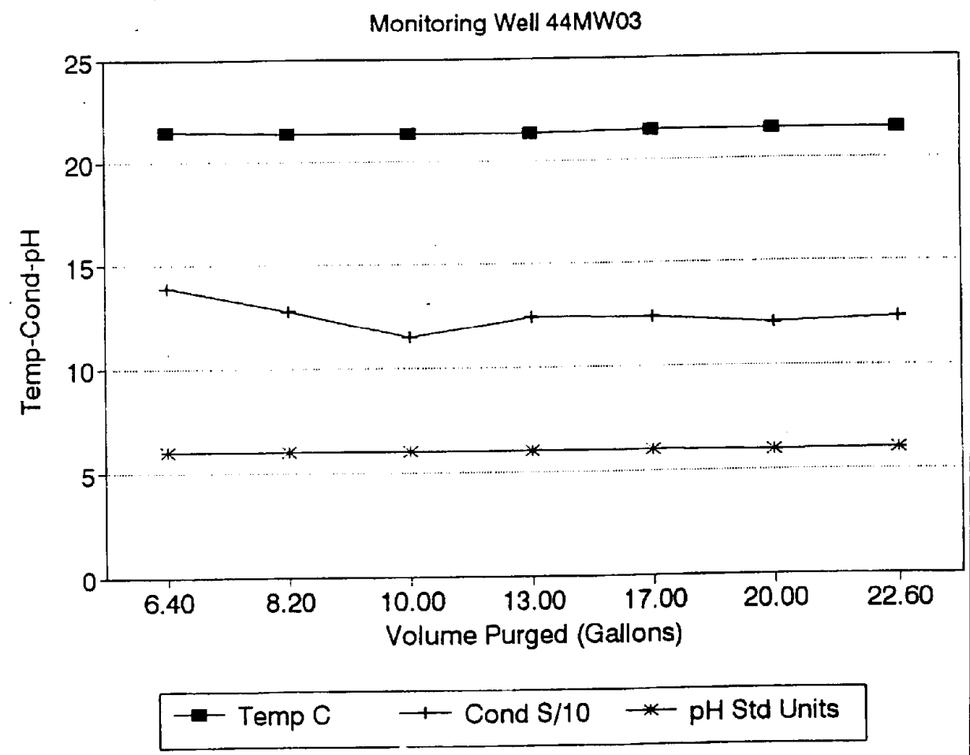
DATE: 05/11/93 | DWG NAME: 003SIT44

VERTICAL DATUM—IHDIVNAVSURFWARCEN

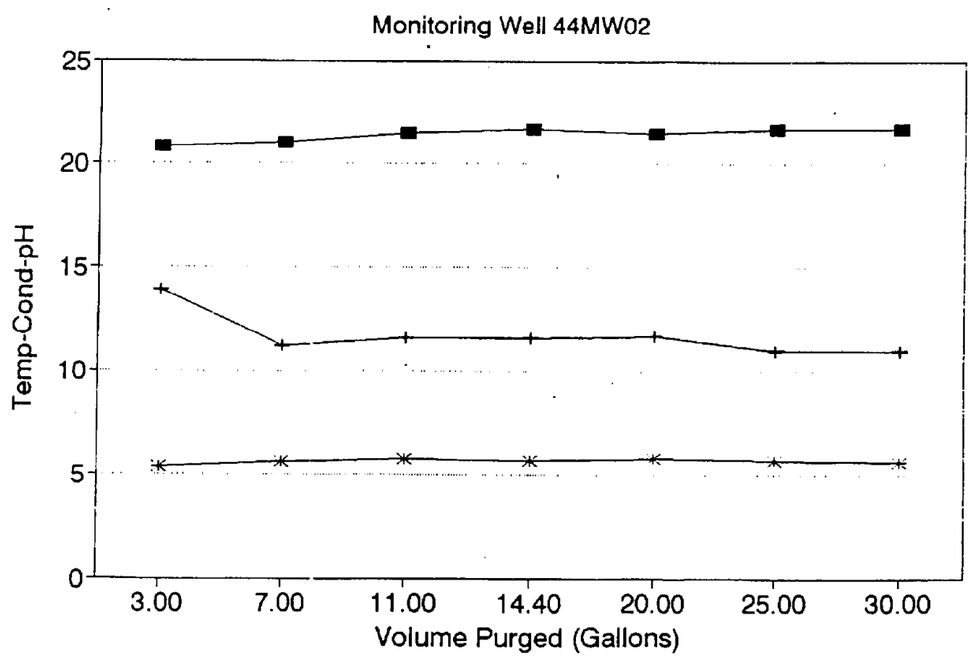
Monitoring Well Data 44MW01					
TIME	TEMP(C)	COND(S)	pH	GAL REM	TURB
915	20.70	82	5.24	3.80	-
925	21.20	70	5.23	7.60	-
933	21.60	70	5.18	11.20	-
938	21.40	71	5.14	15.00	-
944	21.60	68	5.13	18.60	-
950	21.80	68	5.09	22.20	-
956	21.60	71	5.10	26.20	-



Monitoring Well 44MW03					
TIME	TEMP(C)	COND(S)	pH	GAL REM	TURB
1745	21.50	139	5.96	6.40	13.90
1748	21.40	128	5.98	8.20	12.80
1751	21.40	115	5.99	10.00	11.50
1800	21.40	125	6.00	13.00	12.50
1805	21.50	124	5.97	17.00	12.40
1810	21.50	121	5.95	20.00	12.10
1815	21.50	123	5.97	22.60	12.30



Monitoring Well Data 44MW02					
TIME	TEMP(C)	COND(S)	pH	GAL REM	TURB
913	20.80	139	5.36	3.00	-
921	21.00	112	5.62	7.00	-
929	21.50	116	5.71	11.00	-
935	21.70	116	5.69	14.40	-
943	21.50	117	5.79	20.00	-
950	21.70	110	5.68	25.00	-
958	21.70	110	5.64	30.00	-

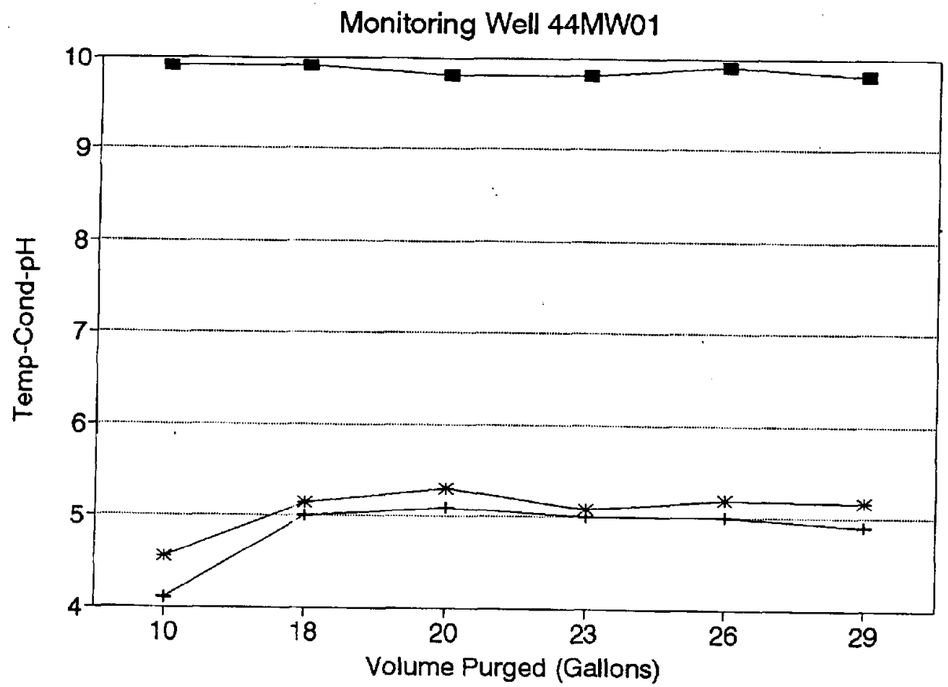


SITE 44
SITE INVESTIGATION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

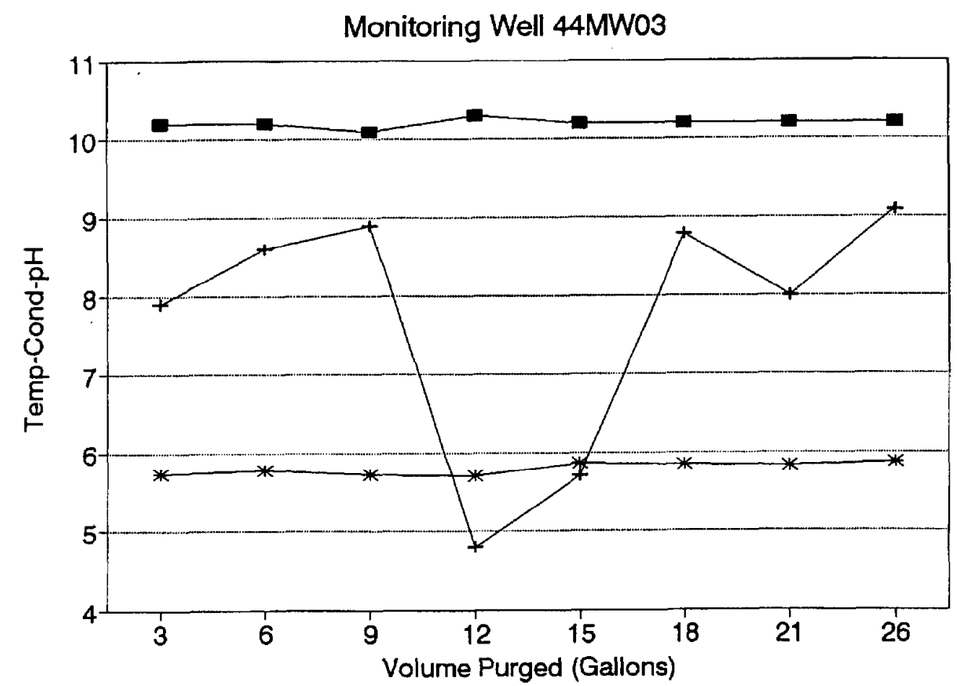
FIGURE 5-9A
SITE 44
WATER QUALITY DATA
September 1992

DWG DATE:03/01/94 | DWG NAME:CLN17X11

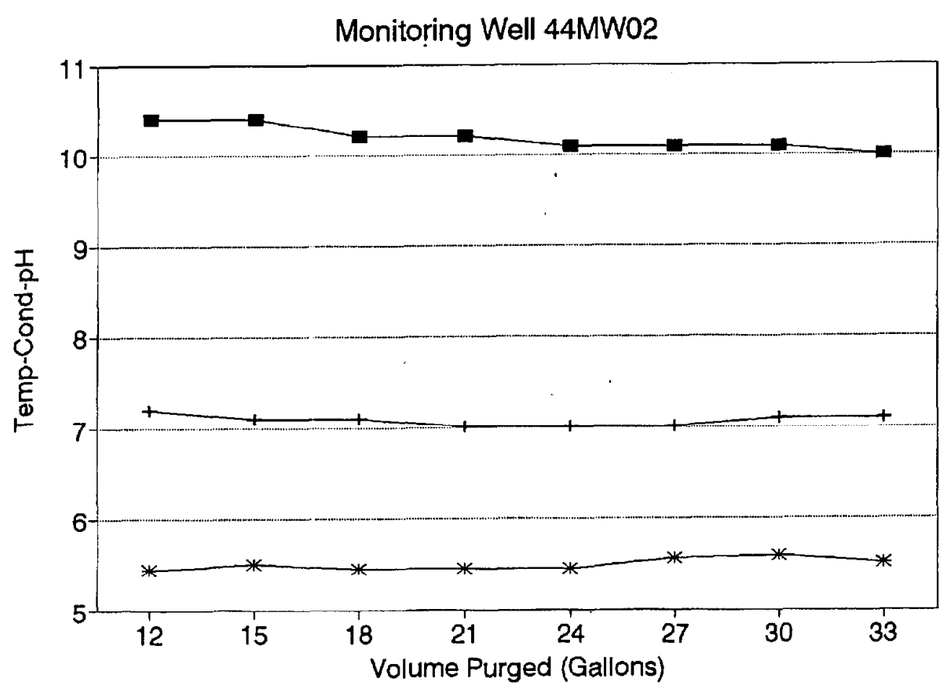
Monitoring Well Data 44MW01				
Time	Temp (C)	Cond (S)	pH	GAL REM
1500	9.9	41	4.55	10
1515	9.9	50	5.14	18
1520	9.8	51	5.30	20
1525	9.8	50	5.08	23
1535	9.9	50	5.19	26
1542	9.8	49	5.16	29



MONITORING WELL DATA 44MW03				
Time	Temp	Cond	pH	GAL REM
1600	10.2	79	5.73	3
1605	10.2	86	5.77	6
1016	10.1	89	5.72	9
1615	10.3	48	5.70	12
1620	10.2	57	5.86	15
1623	10.2	88	5.84	18
1626	10.2	80	5.83	21
1633	10.2	91	5.87	26



MONITORING WELL DATA 44MW02				
Time	Temp (C)	Cond (S)	pH	GAL REM
1504	10.4	72	5.44	12
1511	10.4	71	5.50	15
1517	10.2	71	5.46	18
1526	10.2	70	5.45	21
1530	10.1	70	5.46	24
1551	10.1	70	5.56	27
1558	10.1	71	5.58	30
1605	10.0	71	5.51	33



Temp — Cond/10 — pH Std Units

SITE 44
SITE INVESTIGATION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-9B
SITE 44
WATER QUALITY DATA
April 1993

DWG DATE:03/01/94 | DWG NAME:CLN17X11

Soil — BNAs: Three BNA compounds were detected at low levels in sample 44SB0304 and one BNA was detected in sample 44SB053D. The results for sample 44SB0304 are as follows: phenanthrene, 340 μg/kg; fluoranthene, 61 μg/kg; and, pyrene, 91 μg/kg. Phenanthrene was detected in sample 44SB053D (duplicate of sample 44SB0503) at a concentration of 110 μg/kg. Seven BNA TICs were detected by laboratory analysis; six are unknown and one is an unknown alkane. The remaining compound was reported as hexanedioic acid, a naturally occurring fatty acid with no known environmental significance.

Groundwater — VOCs (September — 1992): Two VOCs were detected in groundwater sample 44GW02 as follows: dichloroethene at 3.0 μg/L and trichloroethene at 13.0 μg/L. The MCLs are 70 μg/L and 5.0 μg/L, respectively. These compounds are common solvents used as degreasers.

Groundwater — VOCs (April — 1993): No VOCs were detected.

TPH: Total petroleum hydrocarbons were not detected in groundwater samples during either sampling event.

5.5.3 Discussion — Site 44

The presence of acetone, TPH, and BNA compounds suggests contamination could be present in shallow soils at Site 44; however, the distribution of these compounds appears limited to isolated areas. Also, the presence of chlorinated solvents at monitoring well 44MW02 indicates the possibility of shallow groundwater system contamination.

The two volatile organic compounds detected in September — 1992 samples from the monitoring wells at Site 44 were not identified in the April — 1993 samples. TCE was reported at 12 μg/L; twice the action level of 5 μg/L in the September — 1992 data.

5.5.4 Recommendations — Site 44

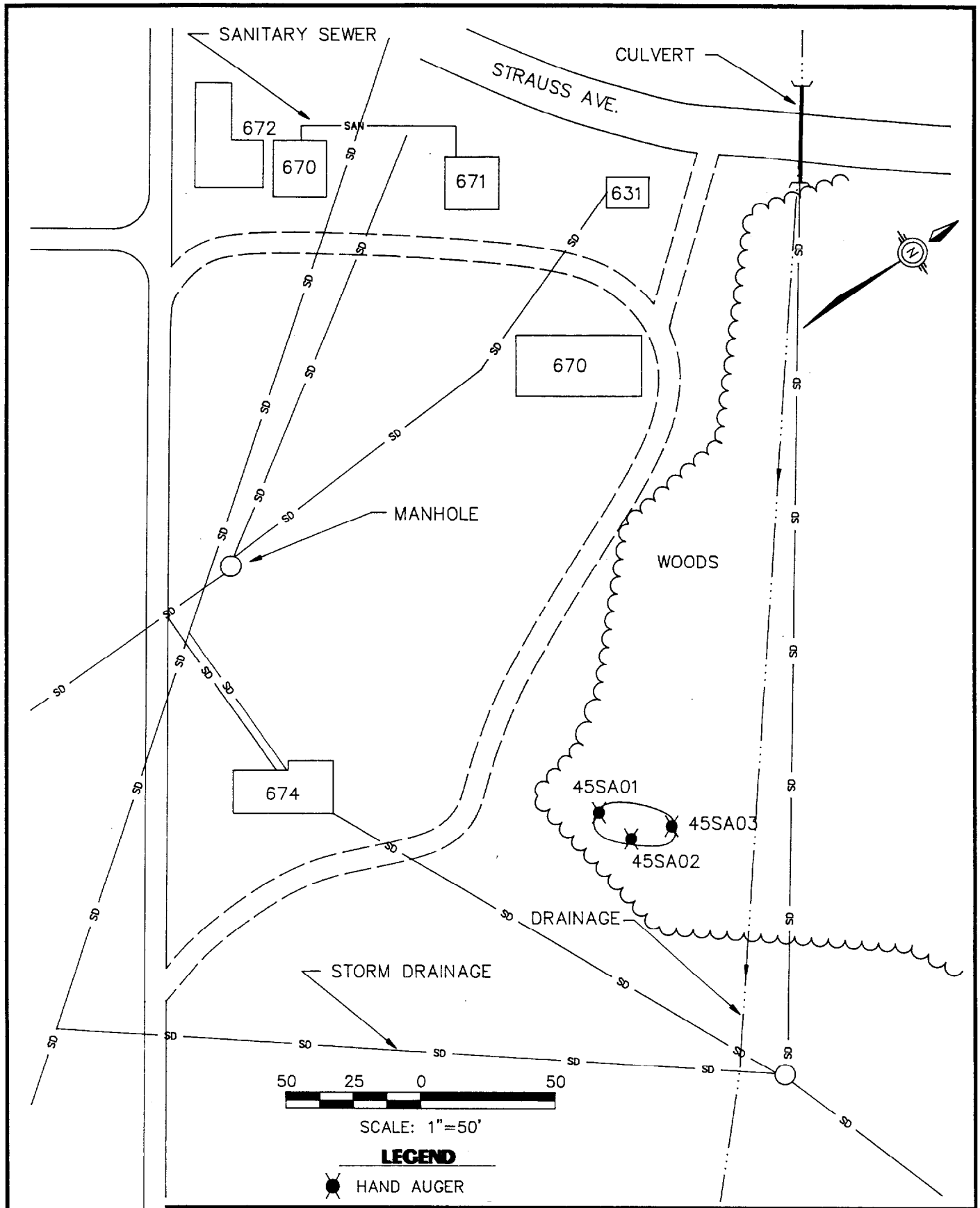
A more comprehensive field investigation will be required to effectively determine the nature and extent of contamination at Site 44. Field activities should include further characterization of areas that exhibited elevated levels of BNAs, as well as supplemental groundwater monitoring.

The presence of elevated concentrations of chlorinated solvents in the shallow groundwater warrants additional monitoring wells. One well should be installed downgradient of the existing wells to assess contaminant migration. Additional wells may be installed in the immediate vicinity of the soak out area to confirm if contamination is a localized phenomenon or if source loading may be occurring.

5.6 Site 45 — Abandoned Drums

Site 45 is located in the woods approximately 125 feet east of Building 674 and 200 feet southeast of Building 670 (Figure 5-10). There are approximately 20 drums at this site and their origin and previous contents are unknown. The PA reported the drums have been in this area for 15 to 20 years and suggested they may have originated from the soak out process at Site 44. Site 45 was recommended for an SI based on the potential for contamination of the surrounding surface soils.

There are no known releases or former operations at this location; however, the drums were noted to be partially rusted and the potential for a release of residual substances to the surface soils is high. Solvents or other compounds not removed from the drums before placement would have likely drained contaminating the surface soil.



SITE 45
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-10
SITE 45
DRUM SITE

DATE: 10/27/92 | DWG NAME: 003SIT45

5.6.1 Study Description — Site 45

A limited study was completed to determine if the surface soils have been contaminated as a result of the placing the drums in this area. This study involved completing a limited shallow soil-gas survey and collecting surface soil samples. The sampling and analysis approach is outlined below. Surface soil samples were collected from 0 to 1 foot bls by hand-auger techniques (Section 3). Soil-gas samples were collected by a manually driven probe. The soil-gas survey was not scheduled for this site, but was added during the pre-field work walkover on August 18, 1992. The soil-gas data and sample locations are indicated in the report by Target, Appendix B.

Site 45 — Sampling and Analysis Approach				
Sample Media:	Shallow soil zone (0-1 feet) Soil-gas (3-4 feet)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Shallow soil zone	3	1	3
	Soil-gas Boring	4	1	4
Analytical Requirements:	**Media**	**Analyses**		
	Soil	TAL, VOC, BNA		
	Soil-gas	Vapor Analysis-GC/FID, GC/ECD		

Surface Soil Survey: Three surface soil samples were collected along the edge of the drums. Sample points were selected in areas where the surface runoff appeared to be downgradient of the drums (Figure 5-10).

Soil-gas Survey: Four soil-gas probes were completed and samples collected in the area surrounding the drums. One boring, 45-1, was completed upgradient to surface runoff of the drum area. Two borings, 45-2 and 45-3, were placed downgradient of the apparent surface runoff direction of the site. The fourth probe boring was completed in the approximate center of the study area.

5.6.2 Study Findings — Site 45

Observations

Site 45 is in a wooded area with a relatively flat topography. Drainage is poor, but appears to be mainly to the east and southeast. There was no indication of stained soil or stressed vegetation in or around the site.

Several drums appeared to have been cut and welded end to end. This fits the description of the drum configuration used in the soak out process (Site 44) near Building 1186. This observation supports the belief that the drums may have been discarded from that process.

Analytical Results — Site 45

Analytical data are presented in Appendix C, where Section C.1 include "Hits Only" data.

Soil-gas Survey: Low levels of total volatile vapors were detected by GC/FID in all four soil-gas samples. Low levels of xylenes were detected in sample 45-4 and low levels of tetrachloroethene (PCE) were detected in samples 45-1, 45-3, and 45-4. Detected results of the GC/FID and GC/ECD analyses are indicated in Table 5-25.

Table 5-25
Site 45 — Soil-Gas Analytical Results
(μg/L gas vapor)

Parameters / Sample #	Total Volatiles	Xylene	PCE
45-1	41	<1.0	1.3
45-2	81	<1.0	<1.0
45-3	26	<1.0	3.7
45-4	20	2.0	2.7

Surface Soil Survey: Acetone was detected in soil sample 45SA01 at 390 μg/kg, and also in the corresponding laboratory blank. Carbon disulfide was reported at an estimated concentration

of 2.0 μg/kg in sample 45SA01. Only one BNA compound, dimethylphenol, was detected in sample 45SA01 at an estimated concentration of 66.0 μg/kg.

Results of the TAL analysis indicate several metals are present in the soils. The concentration of metals detected were within natural backgrounds levels with the exception of cadmium and cobalt (Table 5-5). Cadmium was reported at 1.2 mg/kg in sample 45SA01 and at 1.6 mg/kg in sample 45SA03. Cobalt was detected in 43SA03 at 26.8 mg/kg. Beryllium was detected above risk-based criteria, but at concentrations less-than-background. More discussion is provided in Section 6.

5.6.3 Discussion — Site 45

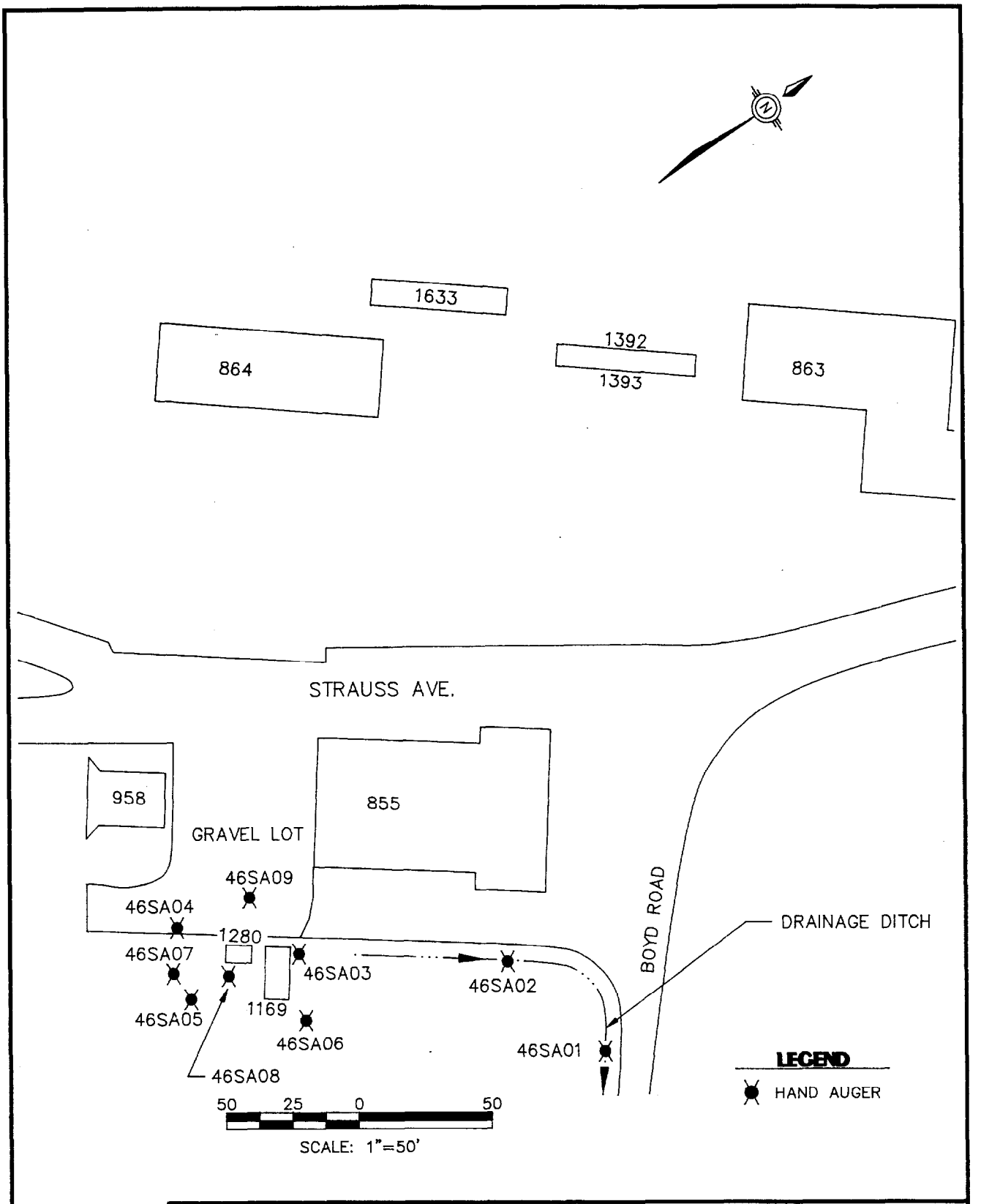
Analysis of soil samples from the 0- to 1-foot interval revealed no significant environmental impact. The soil-gas survey reported trace amounts of total volatiles, xylene, and PCE vapors. Although qualitative, the soil-gas data suggest that volatile constituents may be present in subsurface soils.

5.6.4 Recommendations — Site 45

Additional soil sampling should be completed to determine if contaminants exist at depth intervals consistent with the soil-gas data (3 to 5-foot interval range). All said samples should be analyzed for VOCs. Before subsequent field activities, all drums at Site 45 should be removed and disposed of in accordance with applicable state and federal requirements.

5.7 Site 46 — Cadmium Sandblast Grit Area

Site 46 is located southwest of Building 855 (Figure 5-11). Rocket catapult tubes were resurfaced at this site. Resurfacing involved removing paint that subsequently removed the cadmium plating. This process produced a cadmium-containing grit. This grit reportedly was disposed of in the wooded area southwest of Building 855 and in the gravel lot south of the



SITE 46
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-11
SITE 46
CADMIUM SANDBLAST AREA

DATE: 11/21/92 | DWG NAME: 003SIT46

building. The PA reported that disposal was occasional from the mid 1970s to the early 1980s. The total volume of grit disposed of has not been determined.

5.7.1 Study Description — Site 46

The study objective was to determine if disposal of sandblast grit from the resurfacing process had contaminated the surface soils behind Building 855. Achieving this objective involved collecting surface soil samples from suspect disposal areas and the drainage ditch behind Building 855. The sampling and analysis approach is outlined below.

Site 46 - Sampling and Analysis Approach				
Sample Media:	Surface soil (0-1 feet)			
Sample Procedures:	Type	Number	Sam/Loc	Total
	Soil boring-hand-auger	9	1	9
Analytical Requirements:	Media	Analyses		
	Soil	TAL		

Nine surface soil samples were collected by surface soil sampling techniques. Two samples were collected from the drainage ditch behind Building 855. Sample 43SA01 was collected in the ditch parallel to Boyd Road and 43SA02 was collected in the ditch behind Building 855. Samples 43SA04 and 43SA09 were collected from the gravel parking lot on the southwest end of the Building 855. The remaining five surface soil samples were collected in the wooded area behind Buildings 1280 and 1169. Areas of mounded soils or other areas believed to represent disposal sites were targeted for sampling. Sample locations are indicated on Figure 5-11.

5.7.2 Study Findings — Site 46

Observations

The area topography is relatively flat and drainage is poor. A drainage ditch extends along the back of Building 855 and turns southeast paralleling Boyd Road. The majority of surface runoff leaving the site moves to the east and then to the southeast via the drainage ditches.

Several mounds in the wooded area behind Building 855 are composed of a fine-grained sand. It is believed that these mounds are local dump sites of spent sandblast grit.

Analytical Results — Site 46

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

All samples were analyzed for TAL constituents. Numerous analytes were detected in every sample; however, only four were above background concentrations (Table 5-5). These metals are cadmium, lead, mercury, and nickel. Low levels of cadmium were detected in seven of the nine samples. Lead was reported in all nine samples; however, only the reported concentrations of three samples exceeded background levels with a range of 52.5 to 407 mg/kg. Mercury was indicated in samples 46SA01 and 46SA08 and nickel was indicated in only one sample, 46SA05. The overall range and average of concentrations of each analyte are indicated in Table 5-26.

5.7.3 Discussion — Site 46

Low levels of cadmium were detected at all but two sample locations, but at concentrations well below the proposed action level. Cadmium occurring at low concentrations does not suggest extensive contamination; however, localized cadmium contamination may be possible.

Lead was noted at low to moderate levels at three sample locations. Currently, there are no established or proposed action levels for lead in soil. Risk-based criteria suggest lead is bioavailable at concentrations above 200 mg/kg in soils. Lead was detected above 200 mg/kg

Table 5-26
Site 46 - TALs
Soil-Hand Auger

mg/kg

Parameter	Average	Minimum	Maximum	Frequency
Lead	78.47	8.80	407.00	9/9
Mercury	2.32	0.35	4.30	2/9
Nickel	14.51	3.60	57.40	7/9
Arsenic	2.96	0.95	9.40	8/9
Cadmium	5.57	1.30	12.00	7/9

at only one sample location, 46SA01.

Nickel was detected at 57.4 mg/kg in sample 46SA05, just slightly above the upper range limit of the typical background levels (48.5 mg/kg). The proposed action level for nickel is 200 mg/kg (FR 55, No. 145, July 27, 1990). The concentration detected was below the proposed action level.

5.7.4 Recommendations — Site 46

Possible localized lead contamination is indicated by the data collected during this study. Additional surface soil samples should be collected to verify the presence of lead in the surface soils. Additional sampling should involve completing additional soil borings to a depth of 3 feet in suspected target areas. Discrete samples should be collected at 1-foot intervals. All samples should be analyzed for cadmium and lead.

5.8 Site 47 — Mercuric Nitrate Disposal Area

Site 47 is in the northwest portion of the facility behind Building 856. The PA reported that a disposal pit near the southwest corner of the building was active at this site from 1957 to 1965. Site 47 was recommended for an SI to determine if mercury compounds contaminated the soils adjacent to the disposal pit.

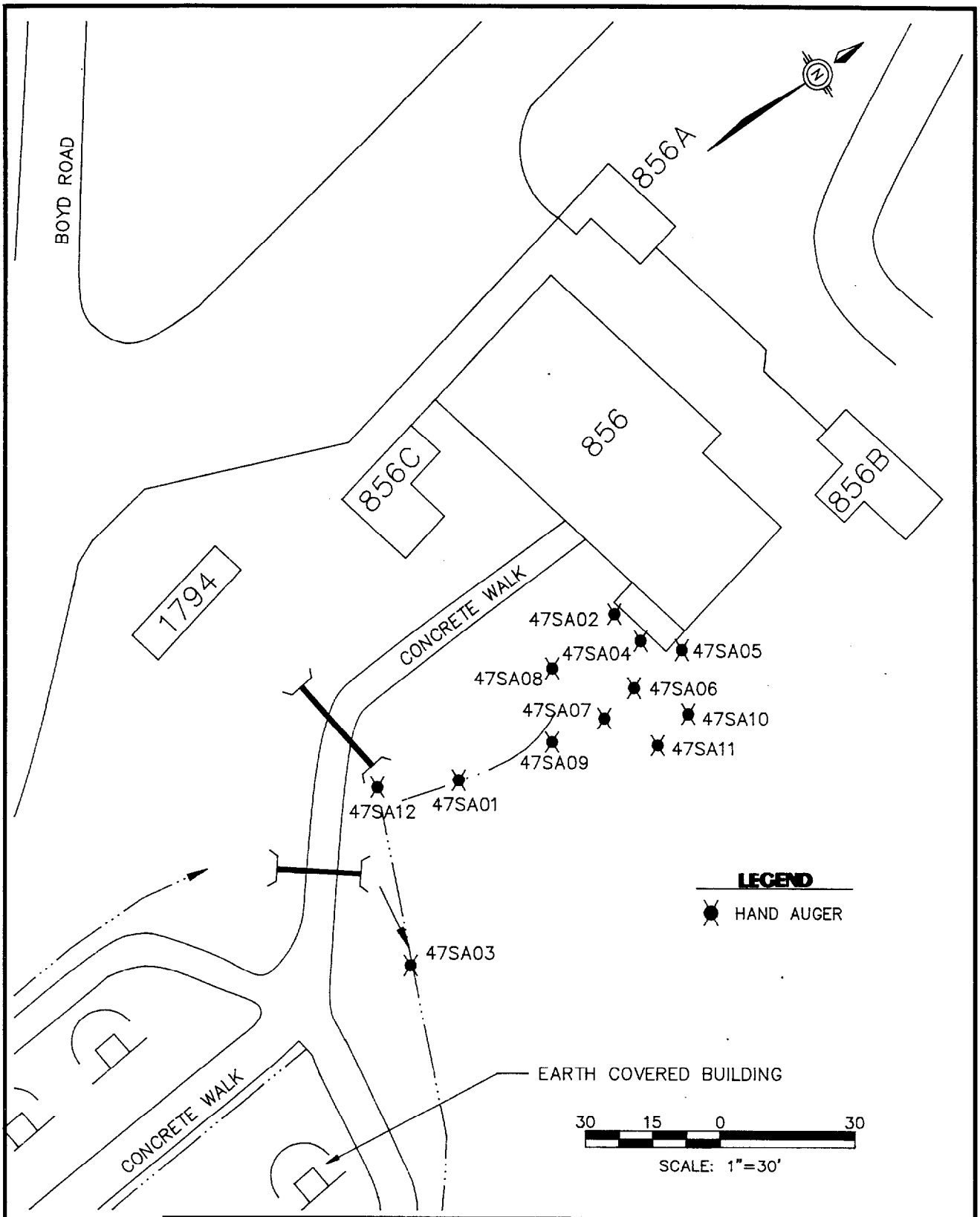
A missile propellant, hydrazinium nitroformate, was produced at Building 856. Mercuric nitrate was used as a catalyst in the production process. Spent catalyst was disposed in a 4-foot by 6-foot limestone pit adjacent to Building 856 (Figure 5-12). The limestone neutralized spent nitric acid solution containing mercuric nitrate. An estimated 150 to 200 pounds of mercuric nitrate were placed into the pit. Data collected during the PA suggested mercuric nitrate and/or associated compounds and solvents used in the production processes may have impacted the shallow soil zone.

5.8.1 Study Description — Site 47

The study objective was to determine if contamination was present in the shallow soil zone as a result of the past disposal practices at Site 47. Hand-auger soil borings were completed in and around the former pit and to probe the shallow subsurface in an attempt to locate the former pit. The sampling and analysis approach is outlined below.

Site 47 — Sampling and Analysis Approach				
Sample Media:	Shallow soil zone (0-1 feet) Probe borings (0-8 feet)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Soil boring-hand-auger	12	1	12
Analytical Requirements:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL		

Shallow soil borings and soil samples were completed August 26, 1992, by hand-auger techniques (Section 3). The hand-auger also was used to extend each boring to approximately 8.0 feet in depth in an effort to locate the former limestone pit.



SITE 47
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-12
SITE 47
MERCURIC NITRATE DISPOSAL AREA

DATE:10/27/92 | DWG NAME: 003SIT47

Twelve soil samples were collected for this study. Three surface soil samples were collected from the drainage ditch in areas appearing as low energy points — points of deposition. The nine remaining surface soil samples were collected in and around the suspected location of the former limestone pit. Sample locations were approximated on a grid system with 3- to 5-foot point separation.

5.8.2 Study Findings — Site 47

Observations

Surface drainage is southward and eventually discharges to Mattawoman Creek. Ditch sediments were saturated and poorly sorted, ranging from silty sand to fine sand and small gravel. The soil profile from 0 to approximately 8 feet bls consisted of well sorted, medium-grained sand. There were no indications of the former limestone pit location in the area sampled. A concrete pad approximately 5 feet by 10 feet recently had been constructed at the northern corner of Building 856. The pad may be situated on or near the former pit, due to the relatively new appearance of the concrete.

Analytical Results — Site 47

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

VOCs: Eight VOCs were detected in soil samples from Site 47. Table 5-27 reports the range and average concentration. Tetrachloroethene, carbon tetrachloride, and chloroform were reported at elevated concentrations. These compounds were detected in samples 47SA01, 47SA02, and 47SA12. Samples 47SA01 and 47SA12 were collected from the drainage ditch and sample 47SA02 was collected adjacent to the concrete pad.

BNAs: Twenty one compounds were detected in samples from 12 locations, with five compounds detected at concentrations above risk-based criteria. These compounds are

Table 5-27
Site 47 - VOAs
Soil-Hand Auger

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Tetrachloroethene	631.86	2.00	3100.00	7/17
1,2-Dichloroethene (total)	7.00	7.00	7.00	1/17
Carbon Tetrachloride	107.60	5.00	370.00	5/17
Acetone	9.50	5.00	14.00	2/17
Chloroform	144.40	55.00	360.00	5/17
Carbon Disulfide	1.50	1.00	2.00	2/17
2-Butanone	2.00	2.00	2.00	1/17
Trichloroethene	27.33	11.00	39.00	3/17

[a] Includes 2 duplicates, 1 re-analysis and 2 diluted samples.

indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and benzo(a) anthracene. Table 5-28 summarizes the analytical data.

TAL: Laboratory analysis detected several metal analytes; however, only four metals were at concentrations above background: cadmium, lead, mercury, and silver. Table 5-29 summarizes of the data. Silver was the only analyte detected above the proposed action level at 28.9 and 65.3 mg/kg in samples 47SA01 and 47SA01D, respectively.

5.8.3 Discussion — Site 47

Data from the shallow soil borings did not conclusively identify the location of the former mercuric nitrate disposal pit. There was no evidence in subsurface soils (0-3 feet) indicating that a pit filled with limestone chips was present.

The presence of VOCs at the reported concentrations does not conclusively indicate site contamination because no single compound exceeded action levels. Several BNA compounds were detected above action levels and/or risk-based criteria. The cumulative totals of BNAs also may exceed current Maryland action levels for TPH in soil.

Table 5-28
Site 47 - BNAs
Soil-Hand Auger

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Anthracene	250.60	73.00	430.00	5/14
Pyrene	285.23	21.00	1100.00	13/14
Dibenzofuran	32.50	20.00	43.00	4/14
Benzo(g,h,i)perylene	123.71	19.00	220.00	7/14
Indeno(1,2,3-cd)pyrene	211.57	22.00	470.00	7/14
Benzo(b)fluoranthene	326.92	19.00	1200.00	12/14
Fluoranthene	328.38	28.00	1200.00	13/14
Benzo(k)fluoranthene	275.33	19.00	1100.00	12/14
Acenaphthylene	97.40	26.00	180.00	5/14
Chrysene	249.42	22.00	820.00	12/14
Benzo(a)pyrene	301.86	19.00	570.00	7/14
Dibenz(a,h)anthracene	120.17	19.00	220.00	6/14
Benzo(a)anthracene	268.56	19.00	660.00	9/14
2,6-Dinitrotoluene	250.00	250.00	250.00	1/14
Acenaphthene	46.75	30.00	54.00	4/14
Phenanthrene	409.29	20.00	820.00	7/14
Fluorene	73.80	24.00	120.00	5/14
Carbazole	69.20	36.00	88.00	5/14
Pentachlorophenol	102.33	71.00	150.00	3/14
Naphthalene	19.00	19.00	19.00	1/14
2-Methylnaphthalene	20.00	20.00	20.00	1/14

[a] Includes 2 duplicate samples.

Table 5-29
Site 47 - TALs
Soil-Hand Auger

mg/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Lead	23.08	5.10	61.40	13/14
Mercury	2.24	0.10	15.90	13/14
Silver	15.61	1.90	65.30	10/14
Cadmium	3.33	1.10	4.60	3/14

[a] Includes data from 2 field duplicate samples.

Metals are present at low levels; but except for silver, they do not indicate significant metals contamination. The distribution of mercury "hits" did not indicate the location of the former mercuric nitrate disposal pit.

5.8.4 Recommendations — Site 47

Additional study should be completed to determine the nature and extent of the possible VOC, BNA, and silver contamination. This should include additional soil borings and collecting soil samples from the drainage ditch. Soil borings should be completed beneath the concrete pad and the building floor adjacent to the pad. Soil samples should be collected at discrete depth intervals from 0 to 10 feet bls.

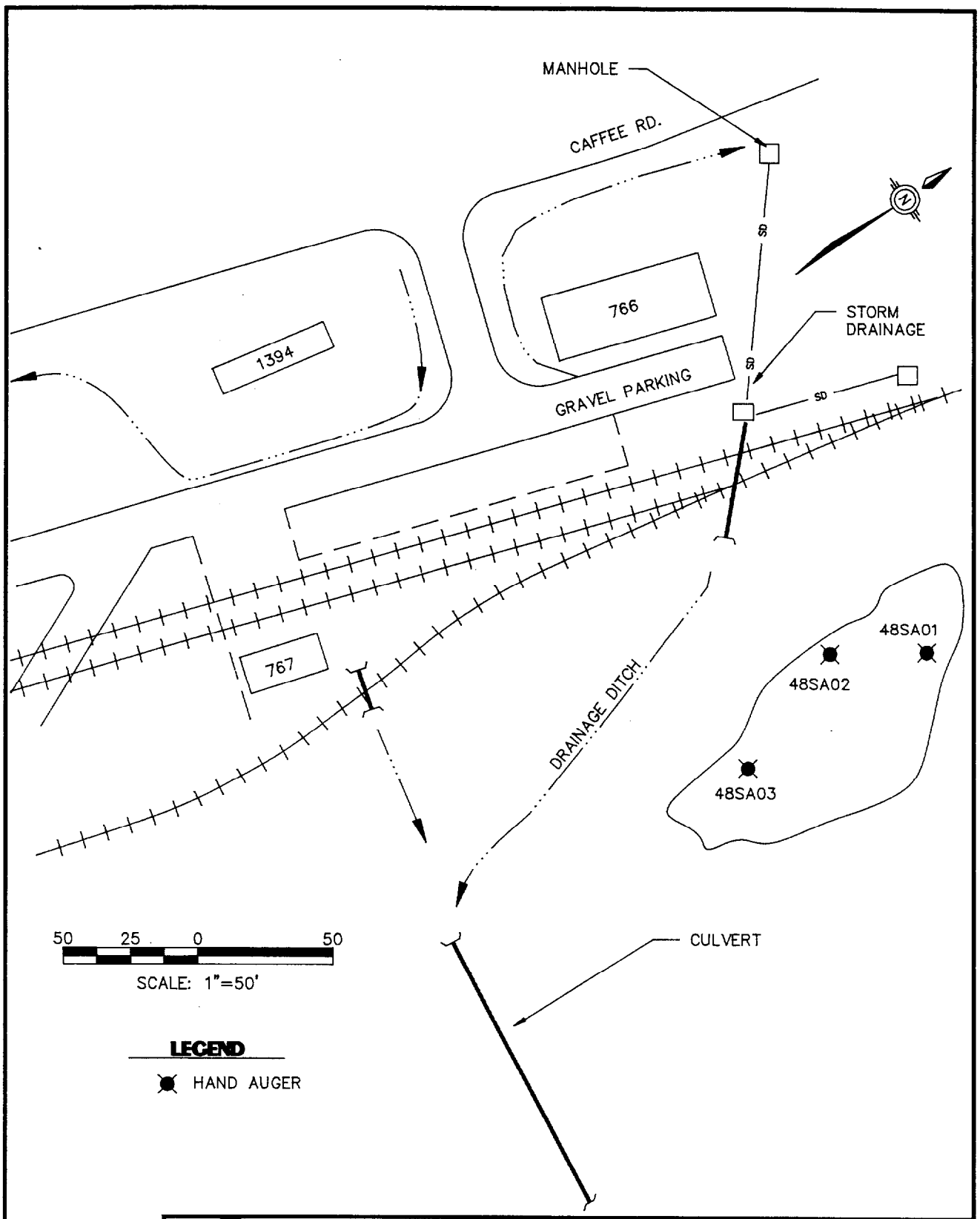
The potential threat to the shallow groundwater system should be determined. This may include collecting data on soil properties (permeability, total organic carbon, cation exchange capacity, etc.), installing shallow monitoring wells, and subsequently determining aquifer characteristics, if necessary.

5.9 Site 48 — Dump Site (Nitroglycerine Plant Disposal Area)

Site 48 is located in the woods northeast of Building 766 and consists of several miscellaneous laboratory containers dispersed about the woods (Figure 5-13). The PA reported the origin of these containers is suspected to be the nitroglycerine plant, Building 766; however, no information confirming their origin was disclosed during the PA. There is no record of a release at this site; however, the possibility exists that these containers may have once held hazardous substances. Any residual solutions in the containers would have drained onto the ground surface.

5.9.1 Study Description

The study objective was to determine if contamination is present as a result of the disposal of the laboratory containers. To satisfy this objective, soil borings were completed and sampled.



SITE 48
SITE INSPECTION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-13
SITE 48
NG DISPOSAL AREA

DATE: 10/28/92 | DWG NAME: 003SIT48

The sampling and analysis approach is outlined below. Soil borings at Site 48 originally were planned to be completed using a truck-mounted drill rig. This approach was altered in the field due to lack of accessibility for the drill rig. As a result, soil samples were collected employing hand-auger techniques.

Site 48 — Sampling and Analysis Approach				
Sample Media:	Shallow soil zone (0-8 feet)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Soil boring-hand-auger	3	3	9
	Depth Intervals	0-1	5-6	7-8
Analytical Requirements:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL		

Three soil borings were completed along the slope of the hill and three soil samples per boring were collected. Boring 48SA01 was placed on the uphill side of the waste pile and sample boring 48SA03 was on the downhill side of the waste piles (Figure 5-13). Samples were collected at three depth intervals per boring. Sample numbers correspond to depth intervals as follows:

Sample No.	Depth Interval
01	0-1 feet
02	5-6 feet
03	7-8 feet

Site 48 was initially sampled September 3, 1992. All soil samples were shipped to the laboratory via overnight courier. The courier failed to deliver the samples overnight and as a consequence sample temperatures were above the acceptable limit. Site 48 was resampled on September 12, 1992. The second sample set arrived at the laboratory in good condition.

5.9.2 Study Findings — Site 48

Observations

Site topography consists of a gentle slope to the southeast where a steep bank leads to a large drainage ditch. Area drainage is controlled by this ditch, which eventually discharges into Mattawoman Creek.

Soil texture at each boring was consistently fine- to medium-grained, moderately well-sorted sand. There were no indications of stressed vegetation or apparent soil staining. The containers were dispersed in several small piles, suggesting the possibility of several dumping episodes over time.

Analytical Results

Analytical data are presented in Appendix C. No VOCs were detected at significant concentrations above method detection limits. Three unknown BNA TICs were detected in five soil samples at estimated concentrations. No TAL compounds were detected at significant concentrations above background.

5.9.3 Discussion — Site 48

Data collected during this study do not indicate Site 48 has been contaminated with compounds from the VOC or TAL parameter lists. The significance of the detected BNA TICs is not clear because the compounds were not identified; however, these compounds may be naturally occurring. No BNA compounds were detected from the standard parameter list.

5.9.4 Recommendations — Site 48

Unknown BNA TIC were detected. TIC data should undergo laboratory review in an attempt to identify these compounds. If necessary, additional soil samples should be collected and submitted for comprehensive laboratory analysis to identify TICs.

5.10 Site 49 — Chemical Disposal Pit

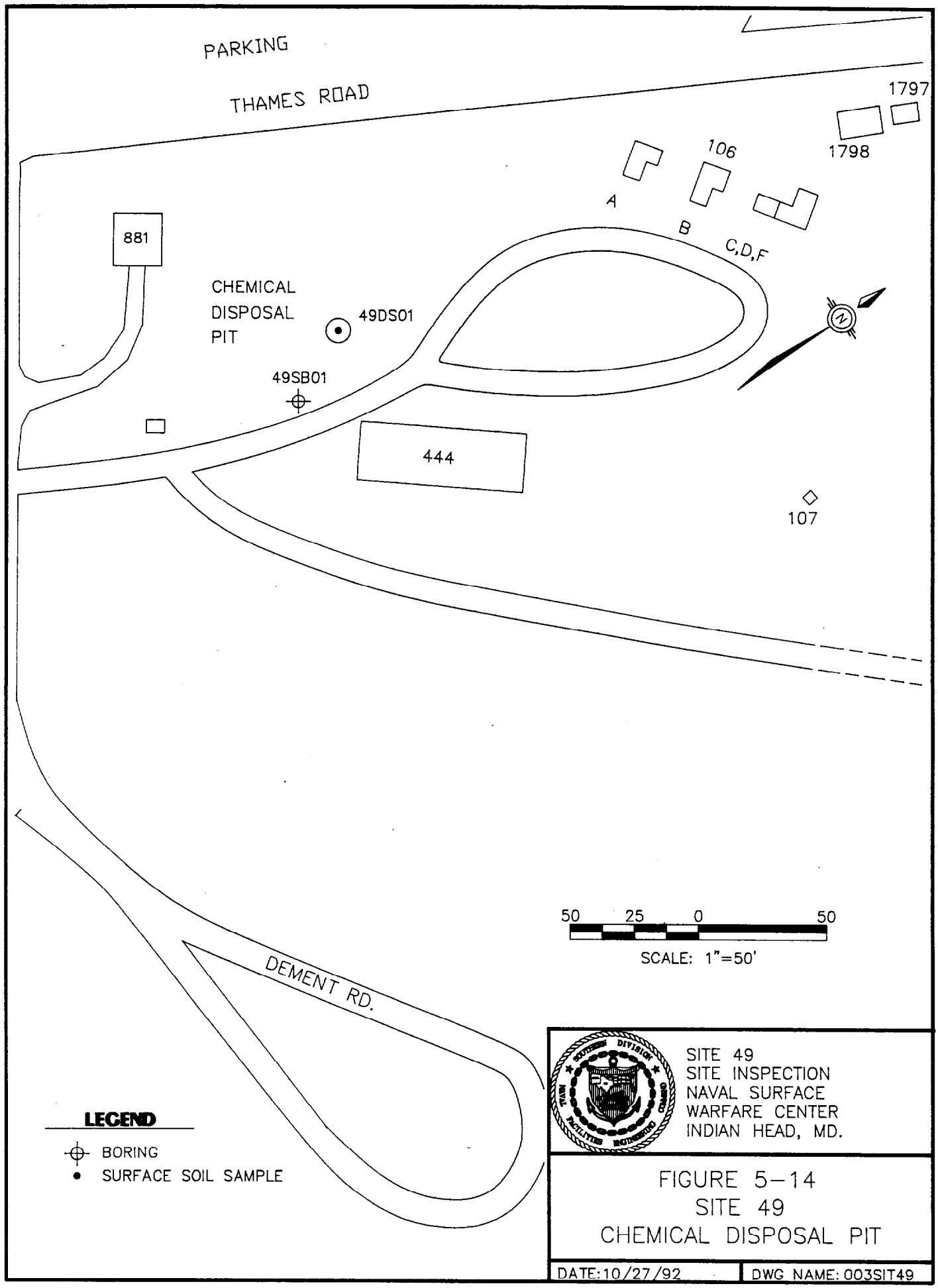
Site 49 is small concrete pit approximately 2.5 feet in diameter by 3 feet in depth located near Building 444 (Figure 5-14). The pit was designed for the disposal of laboratory containers without exposing personnel to the hazardous contents. Laboratory containers were placed on a steel grate in the pit and a steel plate was dropped, crushing the container. Fragments of the shattered containers were caught in a wire basket and the contents of the container would drain into the bottom of the pit.

The PA reported that the pit had limited use in the early 1970s. It is unclear if any of the waste solutions were released to the soil adjacent to the pit. The PA stated the pit was drained through an underground pipe to the storm sewer. As a result, the potential for an uncontrolled release through these lines is high. Site 49 was not recommended for an SI in the PA; however, at the request of the state, this site was included in the scope of work for the SI.

5.10.1 Study Description

The study objective was to determine if contamination was present in pit sediments or in the shallow soil zone adjacent to the pit. This objective was completed by installing a soil boring adjacent to the pit and collecting a sediment sample from the pit bottom. Soil samples were collected by soil boring sample methods and from the disposal pit by surface soil methods (Section 3). The sampling and analysis approach is outlined below.

Site 49 — Sampling and Analysis Approach				
Sample Media:	Shallow soil zone (0-20 feet) Sediment in pit			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Soil boring	1	3	3
	Soil boring-hand-auger	1	2	2
Analytical Requirements:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL, Nitrate Esters		
	Sediment	VOC, BNA, TAL, Nitrate Esters		


PARKING
THAMES ROAD
1797
1798
106
A
B
C,D,F
881
CHEMICAL
DISPOSAL
PIT
49DS01
49SB01
444
107
N
50 25 0 50
SCALE: 1"=50'
DEMENT RD.
LEGEND
BORING
SURFACE SOIL SAMPLE
SITE 49
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.
FIGURE 5-14
SITE 49
CHEMICAL DISPOSAL PIT
DATE:10/27/92
DWG NAME: 003SIT49

Pit Sampling: Sample 49DS01 was collected from sediments at the bottom of the chemical disposal pit. The sediments consisted of a thin layer, less than 4 inches thick. The pit was scheduled for two samples to be collected at discrete depth intervals of 0 to 1 and 1 to 2 feet; however, only one depth interval sample could be collected. Because the surface area at the pit bottom was small, additional lateral sample locations were not designated.

The chemical disposal pit was initially sampled on August 28, 1992. Because sample 49DS01 arrived at the laboratory with the temperature above the acceptable range, it was disposed of by the laboratory. The pit was resampled on September 4, 1992, and sample 49DS01 arrived at the laboratory a day late. Again the sample temperature was above the acceptable range, but unfortunately, there was not enough sediment remaining in the pit for even a partial sample. The project geologist requested that the September 4th sample be analyzed and the check-in temperature noted in the data-reporting package.

Soil Boring: Soil boring 49SB01 was located approximately 25 feet south of the pit. This boring was completed to 32 feet bls and split-spoon samples were collected at 5-foot intervals. Placement of boring 49SB01 was restricted by both underground and overhead utilities. This boring was designated as one of six monitoring wells for Site 53 (Site 49 is at the south corner of Site 53). No saturated conditions were encountered throughout the entire depth of boring 49SB01.

5.10.2 Study Findings — Site 49

Observations

A layer of sediments, less than 4 inches thick, lined the bottom of the pit. There was very little glass or other container fragments in the sediment. The shallow soil zone consists of silts and silty clays extending to a depth of approximately 28 feet. The soil sample collected at 30 to 32 feet included fragments of a loosely cemented reddish, medium-grained sand layer. Penetration by the split-spoon sampler was rejected after 9 inches (38 percent recovery). The gravel-sand

unit proved unpenetrable by hollow-stem auguring techniques. This sandstone unit was later identified as a marker bed positioned on top of the upper Patapsco formation.

Analytical Results — Site 49

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

Chemical Disposal Pit: Elevated levels of tetrachloroethene were detected at 90.0 μg/kg in the sample collected from the pit bottom. Six BNA compounds were detected by laboratory analysis at varying levels of concentrations. Table 5-30 summarizes of the analytical results. Eighteen BNA TICs were indicated 10 identified and eight unknown.

Table 5-30
Site 49
Sediments BNAs ug/kg

Parameter	Results
Pyrene	235.00
Fluoranthene	69.00
Chrysene	89.50
Benzo(a)anthracene	58.00
Phenanthrene	78.00
N-Nitrosodiphenylamine (1)	265.00

Eight metal compounds were detected by TAL analysis at levels above the average range in soils. Mercury and cobalt were reported at elevated concentrations. The reported concentrations of the TAL analytes are presented in Table 5-31. HMX, the only explosive derivative compound detected, was reported at 2.25 μg/g.

Soil Boring Samples: No VOC, BNA, TAL or explosive-derivative compounds were detected at notable concentrations by laboratory analysis of soil samples collected from boring 49SB01.

5.10.3 Discussion — Site 49

Tetrachloroethylene, numerous BNAs and metals were identified in the sediments at the pit bottom. The structural integrity of the pit is unknown. The possibility exists that contaminants could migrate through cracks and/or fractures in the pit structure into the adjacent soils. If the

discharge line is constructed of clay and/or concrete, there is a possibility of exfiltration due to the porous nature of these materials. Moreover, if fractures/cracks exist along the line, the potential for contaminant migration would increase.

Table 5-31
Site 49 - TALs
Sediments-PIT

mg/kg

Parameter	Results	Parameter	Results
Aluminum	6950.00	Mercury	2690.00
Iron	23100.00	Nickel	44.50
Lead	110.00	Potassium	507.00
Magnesium	938.00	Silver	16.40
Manganese	1120.00	Sodium	299.00
Arsenic	10.40	Cobalt	462.00
Barium	393.00	Copper	298.00
Cadmium	4.50	Zinc	195.00
Chromium	131.00	Calcium	6760.00

The pathway and/or discharge point of the pit drainage system remains uncertain. The PA reported that this discharge line connects to the storm sewer system. Potential contamination of shallow groundwater is not considered high, based on subsurface soil data from boring 49SB01.

5.10.4 Recommendations — Site 49

The soil zone directly adjacent to the pit and along the pit drainage pipe should be sampled and analyzed to determine if these areas have been impacted. A series of shallow hand-auger borings should be completed to a depth beneath the drainage system and soil samples collected. The discharge point and fate of solutions introduced into the pit must be determined and all potential media impacts investigated.

5.11 Site 50 — Building 103 Crawl Space

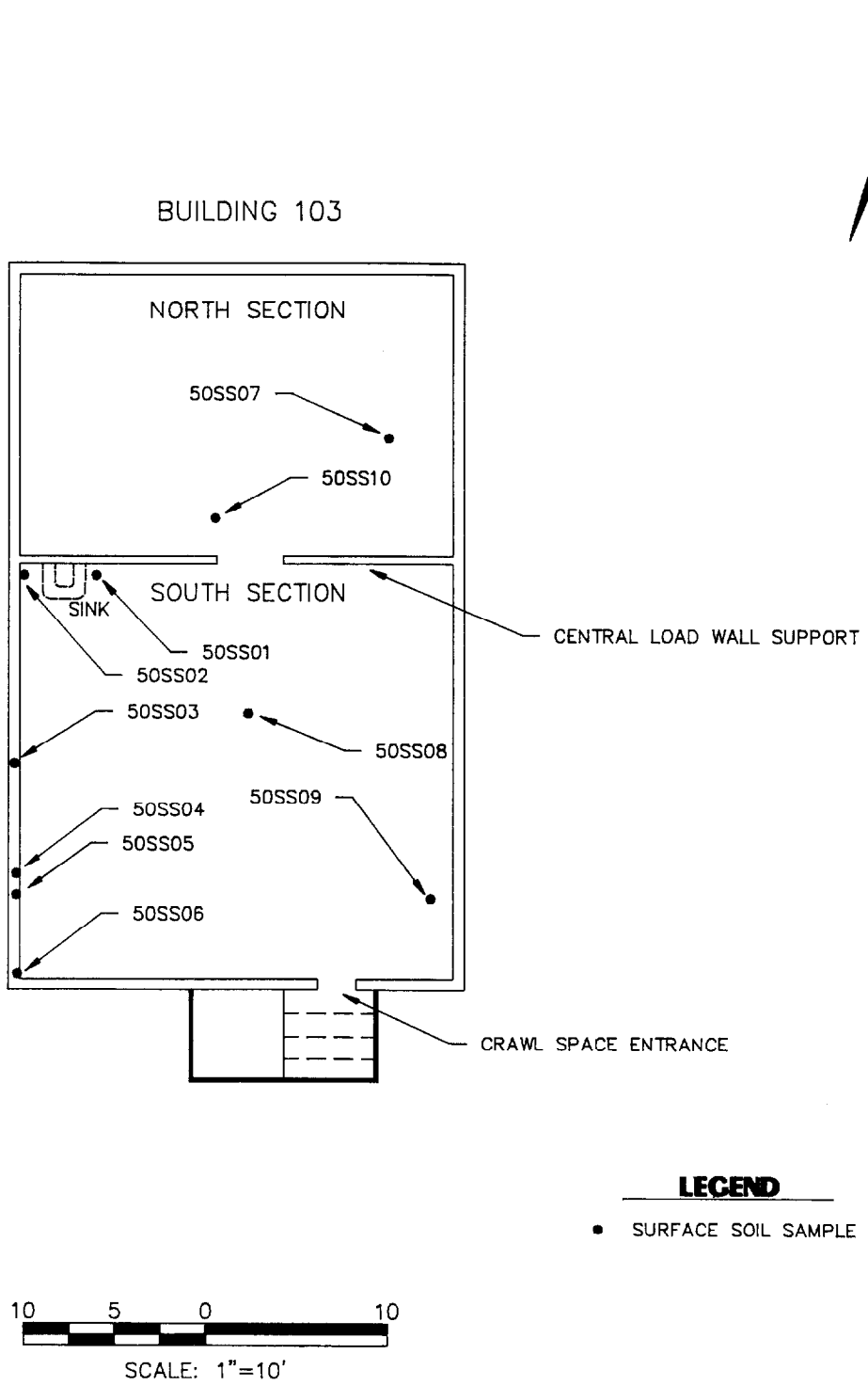
Site 50 consists of the crawl space beneath Building 103 (Figure 5-15), a small one-story wood-frame structure on a raised concrete block foundation located in the general laboratory area. While replacing two sinks in the building, workers discovered that drain pipes discharged directly to the soil beneath the building. Apparently, the sinks had been draining onto the soil since 1902, when the building was constructed, until 1988, when the sinks were replaced.

It is possible an unknown volume of solvents, including mercury and nitrate esters, was released to the soil beneath Building 103 via the open drain pipes. Building processes used mercury-containing equipment that produced a spent solution containing mercury and sulfuric acid. This mixture was routinely poured into a "slop jar." The sulfuric acid was removed from the slop jar by adding tap water while the jar was in the sink, and the overflow was allowed to spill into the sink. This, along with small spills into the sink while transferring mercury to the slop jar and the occasional breakage of the jars, resulted in releases through the sink drain.

5.11.1 Study Description

The study objective was to determine if contamination was present in the surface soil beneath Building 103. This objective was achieved by collecting surface soil samples from beneath the building. The sampling and analysis approach is outlined below.

Sampling was completed using surface soil sampling techniques (Section 3) on August 19, 1992. Field work was conducted under Level C personal protective equipment protocols because of the presence of friable suspect asbestos-containing materials (pipe insulation) on the pipes and scattered on the soil surface beneath the building. Area and personnel air monitoring was conducted during all sampling activities.



SITE 50
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-15
SITE 50
SAMPLE LOCATIONS

DATE: 12/15/92 | DWG NAME: 003SIT50

Site 50 — Sampling and Analysis Approach				
Sample Media:	Surface soil			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Surface soil	10	1	10
Analytical Requirements:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL, Nitrate Esters		

The crawl space beneath Building 103 is an open space below the building floor divided by a central load wall support, forming the north and south sections (Figure 5-15). The northern section is relatively flat in contrast to the south section, which has a southward slope toward the southwest and local depressions at the southwest corner. The sink drained onto the soil at the northwest corner of the south section. A small ditch parallels the west wall extending to a shallow depression at the southwest corner, forming a collection point for runoff.

Samples 50SS01 through 50SS06 were collected in sequence from directly below the sink (50SS01), at the corner of the west foundation wall and the central wall (50SS02) and along the shallow depression down to the southwest corner (50SS03 to 50SS06). Sample 50SS07 was collected near the east-central portion of the north section. Sample 50SS08 was collected near the center of the south section and sample 50SS09 was collected near the southeast corner of the south section. 50SS10 was collected from the south-central area of the north section.

5.11.2 Study Findings — 50

Observations

The sink apparently drained onto the soil beneath the building and the runoff flowed into the trench along the west wall, collecting in the depression at the southwest corner. The sampled soils generally consisted of a brown silty clay; but, directly below the sink area soil, was a silty-clayey sand. Soils at sampling location 50SS01 through 50SS06 were moist to saturated.

Analytical Results — Site 50

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

VOC: Two VOCs were reported in soil samples from Site 50. Acetone was detected in sample 50SS10 at 530.0 μg/kg. Acetone was also indicated in the laboratory blank. Trichloroethane was reported at an estimated concentration of 10.0 μg/kg in sample 50SS05.

BNAs: Seventeen BNA compounds reported by the laboratory are presented in Table 5-32. Only two compounds — Benzo(a)pyrene and benzo(a)anthracene — were indicated above assessment criteria values.

Table 5-32
Site 50 - BNAs
Surface Soil

ug/kg

Parameter	Average	Minimum	Maximum	Frequency[a]
Anthracene	41.67	26.00	65.00	3/12
2,4-Dinitrotoluene	4950.00	4200.00	5700.00	2/12
Pyrene	96.67	29.00	280.00	6/12
Benzo(g,h,i)perylene	46.50	33.00	60.00	2/12
Indeno(1,2,3-cd)pyrene	46.50	32.00	61.00	2/12
Benzo(b)fluoranthene	96.50	28.00	150.00	4/12
Fluoranthene	176.83	28.00	440.00	6/12
Benzo(k)fluoranthene	73.00	20.00	130.00	3/12
Chrysene	63.71	28.00	200.00	7/12
Benzo(a)pyrene	76.00	52.00	100.00	2/12
Dibenz(a,h)anthracene	37.00	37.00	37.00	1/12
Benzo(a)anthracene	59.20	17.00	160.00	5/12
2,6-Dinitrotoluene	290.00	290.00	290.00	1/12
Di-n-butylphthalate	5350.00	3900.00	6800.00	2/12
Phenanthrene	112.50	29.00	370.00	6/12
N-Nitrosodiphenylamine (1)	290.00	280.00	300.00	2/12
Carbazole	53.00	31.00	75.00	2/12

[a] Data include one field duplicate and one diluted sample.

TAL: Eight metal analytes were reported at concentrations above the background levels. These metals were iron, lead, mercury, silver, arsenic, cadmium, copper, and zinc. Table 5-33 indicates the range and average concentration of each noted analyte.

Table 5-33
Site 50 - TALs
Surface Soil

mg/kg

Parameter	Average	Minimum	Maximum	Frequency
Iron	25753.64	1780.00	142000.0	11/11
Lead	425.57	61.60	1260.00	11/11
Mercury	24.00	1.80	100.00	11/11
Silver	6.40	4.20	8.60	2/11
Arsenic	8.39	3.40	18.10	11/11
Cadmium	4.80	3.00	7.20	4/11
Copper	40.36	7.90	155.00	11/11
Zinc	792.09	125.00	3170.00	11/11

5.11.3 Discussion — Site 50

Low levels of BNA compounds were detected in soil samples collected from beneath Building 103. Notable levels of several metal analytes indicate possible soil contamination. There are no apparent trends or local hot spots based on data distribution. The lack of a trend may be a product of the biased selection of sample points; however, low level site soil contamination could be extensive, possibly extending beyond the building foundation.

5.11.4 Recommendations — Site 50

This site should be subject to additional surface and subsurface investigation to determine if shallow soil contamination extends beyond the foundation walls of Building 103. Further investigation should include completing a series of shallow hand-auger borings from 0 to 3 feet bls. Discrete soil samples should be collected at intervals from 0 to 1, 1 to 2, and 2 to 3 feet. The analytical objectives should include, but not be limited to, BNA and TAL.

5.12 Site 53 — General Laboratory Area

The general laboratory area is located on the upland in the northcentral portion of the facility and includes several buildings used for laboratory research. Processes in this area include research and development and the use of solvents, explosives, and mercury-related compounds. The sanitary sewer lines serving these buildings are defined as Site 53.

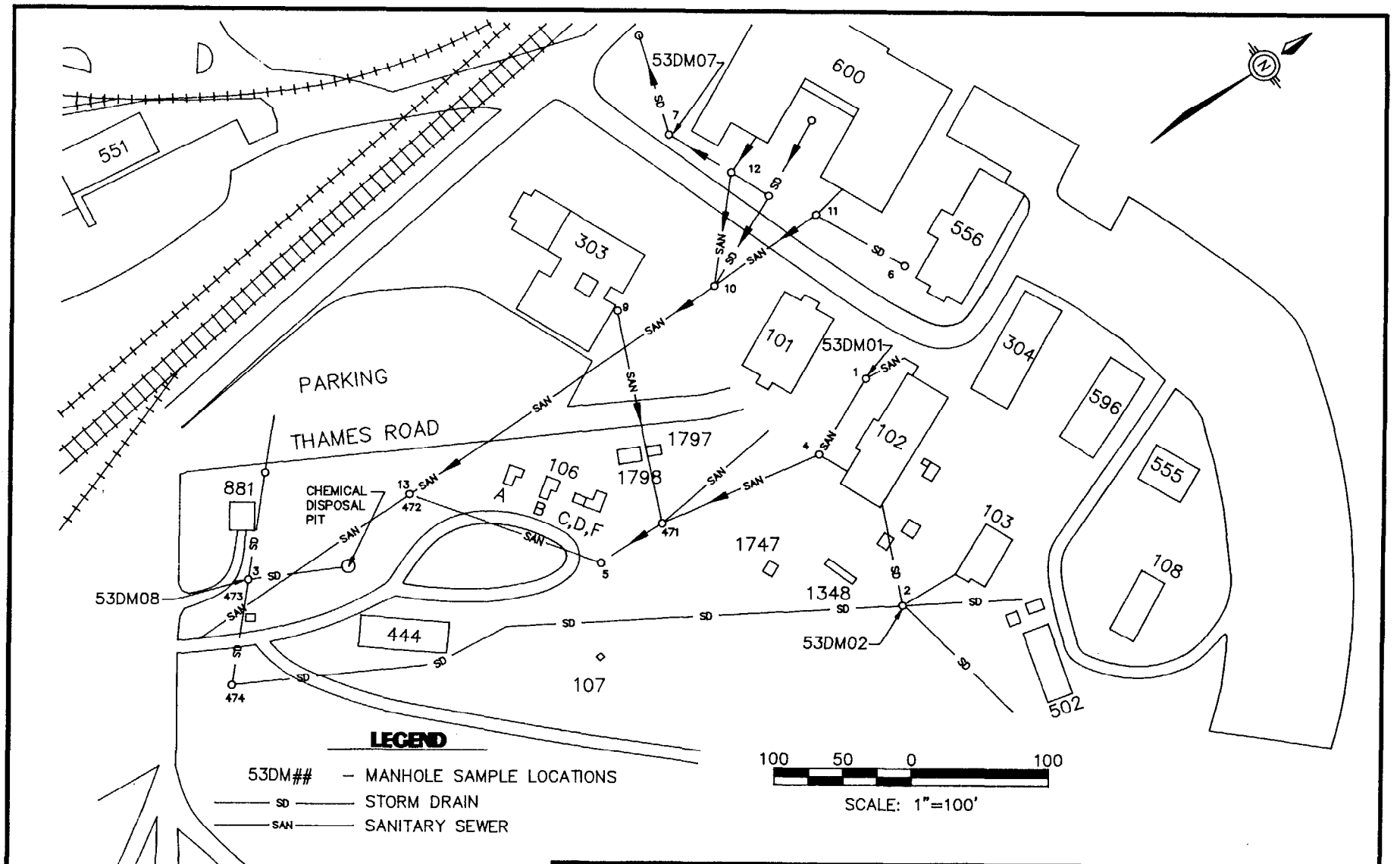
The PA reported that an estimated 28,000 pounds of mercury may have been released through the sewers. A survey conducted by facility personnel found these lines to be in poor condition. Consequently, any mercury or solvents released through these sewer lines possibly could contaminate the surrounding soils.

5.12.1 Study Description — Site 53

The study objective was to determine if the shallow soil and/or the shallow groundwater systems have been contaminated as a result of the poor state of the sanitary sewer. In particular, areas directly adjacent to the sewer lines were sampled by installing a series of soil borings adjacent to and downgradient of the sewer lines and collecting sediments samples from several manholes. The sampling and analysis approach is outlined below.

Manhole Sediments: Manholes were sampled on September 17, 1992. Thirteen were scheduled for sampling, but only four contained a sufficient quantity of sediment for the required analysis. Samples locations are indicated on Figure 5-16 and described in Table 5-34.

Sediment samples were collected by scooping the bottom of the manhole chamber with a dipper. Points of low energy were targeted, as these areas are potential collection points for heavy mercury contaminants. The dipper was constructed of a plastic sample container attached to an aluminum extension handle. It was decontaminated between each sample (and sampling attempt) by a potable water wash followed by an alcohol rinse and a final deionized water rinse.



SITE 53
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5–16
SITE 53
GENERAL LABORATORY AREA
MANHOLE SAMPLE LOCATIONS

DATE: 11/21/92 | DWG NAME: 003SIT53

Site 53 — Sampling and Analysis Approach				
Sample Media:	Shallow soil profile (0-12 feet) Shallow aquifer (water table aquifer) Sediment (sewer lines)			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Shallow soil borings (adjacent to sewer lines)	12	2	24
	Shallow soil borings (monitoring wells)	6	3	18
	Monitoring wells[a]	6	2	12
	Sediment (from sewer manholes)	12	1	12
Analytical Requirements:	**Media**	**Analyses**		
	Soil (adjacent to sewer lines)	Mercury, Nitrate Esters		
	Soil (monitoring wells borings)	VOC, BNA, TAL, TPH		
	Groundwater	VOC, BNA, TAL, TPH		
	Sediment (sewer manhole)	Mercury, Nitrate Esters		
	[a] Monitoring wells include one background well and the well installed at Site 49.			

Table 5-34
Site 53
Sediment Samples-Manholes

Sample Number and Location		Results: Hg mg/kg	Results: NE µg/g
53DM01	North manhole, between Buildings 101 and 102, sewer line serving Building 102.	81.4	BDL
53DM02	Manhole south of Building 103, sewer line serving Buildings 102, 103, and 502.	52.0	RDX 2.67 1,3,2-trinitrobenzene 0.516 nitroglycerin 88.3 2,4-dinitrotoluene 0.502 2-nitrotoluene 0.975 4-nitrotoluene 0.500 3-nitrotoluene 0.426 PETN 395
53DM07	Manhole, southwest corner of building 600, sewer line serving Building 600.	BDL	BDL
53DM08	Manhole (#473) southeast of Building 881.	2.5	BDL

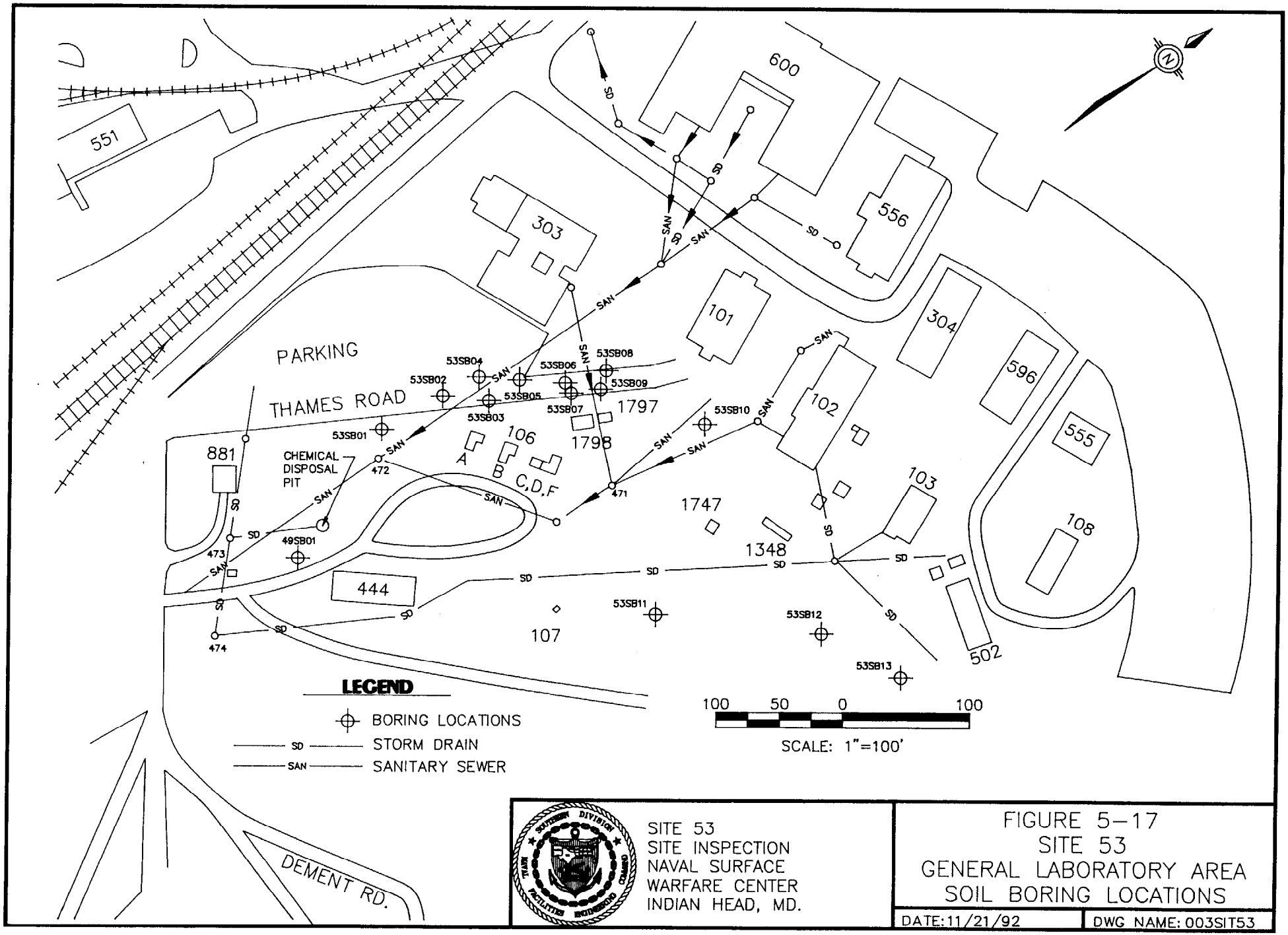
Notes:
Hg = Mercury
NE = Nitrate Esters
BDL = Below Detection Limits

Soil Borings: Thirteen soil borings were installed from September 11 through 15, 1992. Two borings were completed at total depths of 30 to 40 feet. The remaining borings were completed to a total depth of 12 feet bls. Six shallow groundwater monitoring wells were scheduled for Site 53; however, because no shallow water-bearing zone was encountered in the borings, no monitoring wells were installed.

Soil boring 53SB01 was south of Thames Road and Building 303 (Figure 5-17) and was completed to approximately 42 feet bls. At approximately 41 feet, the marker bed was encountered, indicating the bottom of the Lowland Deposits, thus suggesting that no shallow water-bearing zones would be present (Section 2). This same marker bed was encountered in boring 53SB13 and at Site 49 (southwest corner of Site 53). The marker bed was encountered at approximately 32 feet bls in boring 49SB01, in which boring 53SB01 was located topographically 6 to 7 feet above 49SB01. The marker bed was found at 35 feet bls in boring 53SB13.

Eight shallow soil borings (53SB02 through 53SB09) were completed directly adjacent to the sewer lines to a depth estimated below the bottom grade of the sewer lines (approximately 12 feet). These borings were located along Thames Road, between Buildings 303 and 101. Two soil samples per boring were collected and submitted for laboratory analysis for mercury and nitrate esters.

Area utility plans indicated several underground lines between Buildings 101 and 102. Due to area congestion and the inaccuracies in the location of area underground utilities, four borings were relocated to areas downgradient of Buildings 101, 102, and 103 and the sewer lines serving these buildings. These borings were placed as close as practical to the sewer lines.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PARKING
THAMES ROAD
DEMENT RD.
CHEMICAL DISPOSAL PIT
53SB01
53SB02
53SB03
53SB04
53SB05
53SB06
53SB07
53SB08
53SB09
53SB10
53SB11
53SB12
53SB13
49SB01
472
471
473
474
SD
SAN
LEGEND
BORING LOCATIONS
STORM DRAIN
SANITARY SEWER
100 50 0 100
SCALE: 1"=100'
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
TRANSPORTATION
SITE 53
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.
FIGURE 5-17
SITE 53
GENERAL LABORATORY AREA
SOIL BORING LOCATIONS
DATE:11/21/92
DWG NAME: 003SIT53

Soil boring 53SB10 was placed behind Building 101, adjacent to the sewer line extending toward the south from between Buildings 101 and 102. Soil borings 53SB11, 53SB12, and 53SB13 were placed to the southeast of Buildings 101, 102, and 103 and downgradient of the sewer lines serving these buildings. Borings 53SB10 through 53SB12 were completed to 12 feet and boring 53SB13 was completed to 32 feet (Figure 5-17).

5.12.2 Study Findings — Site 53

Observations

Construction materials varied from one manhole to another. Some of the manholes were constructed of hand-laid brick, suggesting they were several decades old. The different materials suggest multiple additions to the system, including the sewer pipes. This observation suggests that some pipes may have been in service for several decades, which could account for the poor condition of the pipes reported in the PA.

Flow rates varied from manhole to manhole and some were partially flooded. Generally, the manholes with no sediment accumulation had a moderate flow rate. Other manholes apparently were not frequently (or recently) used. Sediment sample textures consisted of fine to coarse-grained sand.

Soil textures from soil boring samples were consistent across the site, comprising stiff to hard brown and green silty clay with little moisture. Blow counts in these clays ranged from 15 to 81 blows per foot (bpf) with an average of 40 bpf. The high blow counts indicate the stiffness of the clay.

A marker bed was encountered that was subsequently identified as a unit of the Tertiary Brandywine Formation, which is on top of the Patapsco Formation. This unit is a medium- to fine-grained, reddish to white quartz sand and is moderately cemented and very hard. This unit was impenetrable by split-spoon sampling. The presence of this unit confirms the stratigraphic

position of the soils at Site 53. This site is situated along the thinning southern edge of the Tertiary sediments, which unconformably overlie the Upper Patapsco Formation as outlined in Section 2.

Analytical Results — Site 53

Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

Boring 53SB01: Soil samples collected from boring 53SB01 were analyzed for VOC, BNA, TAL, and TPH. No VOCs, BNAs, or TPHs were reported above method detection limits. Arsenic was detected in soil sample 53SB0102 at 9.3 mg/kg. This concentration is slightly above the published average background in soil of 7.1 mg/kg; however, not above current action levels and is probably naturally occurring.

Borings 53SB02 through 53SB13: Soil samples collected from these borings were analyzed for mercury and nitrate esters; no target compounds were detected.

Sediment Samples: Sediment samples were collected from manholes and were analyzed for mercury and nitrate esters. Mercury was detected in three of four samples ranging from 2.5 to 81.4 mg/kg, with an averaged of 45.3 mg/kg. Eight nitrate ester compounds were detected in sample 53DM07. Table 5-34 in Section 5.12.1 summarizes the results.

Soil Properties: Two Shelby tube samples were collected from soil borings and analyzed to estimate soil vertical hydraulic conductivities. This was determined by a flexible wall permeameter (ASTM method D.5084). Shelby tube sample B1S9 was collected from boring 53SB01 at a depth of 20 to 22 feet bls into the Tertiary Brandywine Formation. Shelby tube sample B13S was collected from boring 53SB13 also in the Tertiary sediments from 7 to 9 feet. Test results indicated hydraulic conductivities of 7.1×10^{-8} cm/sec for sample B1S9 and 1.0×10^{-6} cm/sec for sample B13 (Appendix C, Section C.4).

Soil samples 53SB0103 and 53SB1303 were analyzed for cation exchange capacity (CEC) and total organic carbon (TOC). These samples were collected at a depth interval of 10 to 12 feet at each boring location. The results are presented in Appendix C, Section C.5, and summarized here as follows:

	Units	MDL	53SB0103	53SB1403
CEC	meq/100g	—	13.6	10.5
TOC	mg/kg	513	852	1160

MDL = Method Detection Limit

The CEC values (milli-equivalence per 100 grams) are within the typical range for silty clays (10 to 40 meq/100g) (Drever, 1988). A higher CEC value indicates that more sites are available for bonding. A high number of bonding sites increases the potential for adsorption of contaminants and a retarded rate of contamination migration. CEC values are affected by several factors, including composition of clay minerals, pH, and the nature of the cations present. TOC concentrations are average in range for silty clays (Drever, 1988). The potential for a contaminant to partition to or become adsorbed to the soil particles increases as TOC content increases. In other words, the potential distance for contaminant migration decreases with increasing TOC.

5.12.3 Discussion — Site 53

Results of this limited study do not indicate significant contamination in the soils adjacent to or downgradient of the sanitary sewer lines at Site 53. Mercury and nitrate ester compounds were detected in sediment samples from manholes at Site 53. The levels of mercury may represent residual quantities released during operations at Building 102.

No shallow water-bearing zone was detected and there was no indication that groundwater contamination was likely. The shallow soil units were identified as the Tertiary sediments and

the Upper Patapsco Formation (confining unit). The Patapsco Confining Unit is believed to be about 100 feet thick in this area (Hiortdahl, USGS, Personal Communication, September 1992).

Shelby tube tests indicate low to very low vertical hydraulic conductivities in soils. CEC levels are moderate to low, and TOC concentrations are average. These data indicate that the rate of contaminant migration would likely be low in this media. If contamination, particularly mercury, had entered the soil system via the sewer lines, the extent of contamination would be limited to the soil in contact with joints and/or fractures in the pipes by the natural soil properties.

5.12.4 Recommendations — Site 53

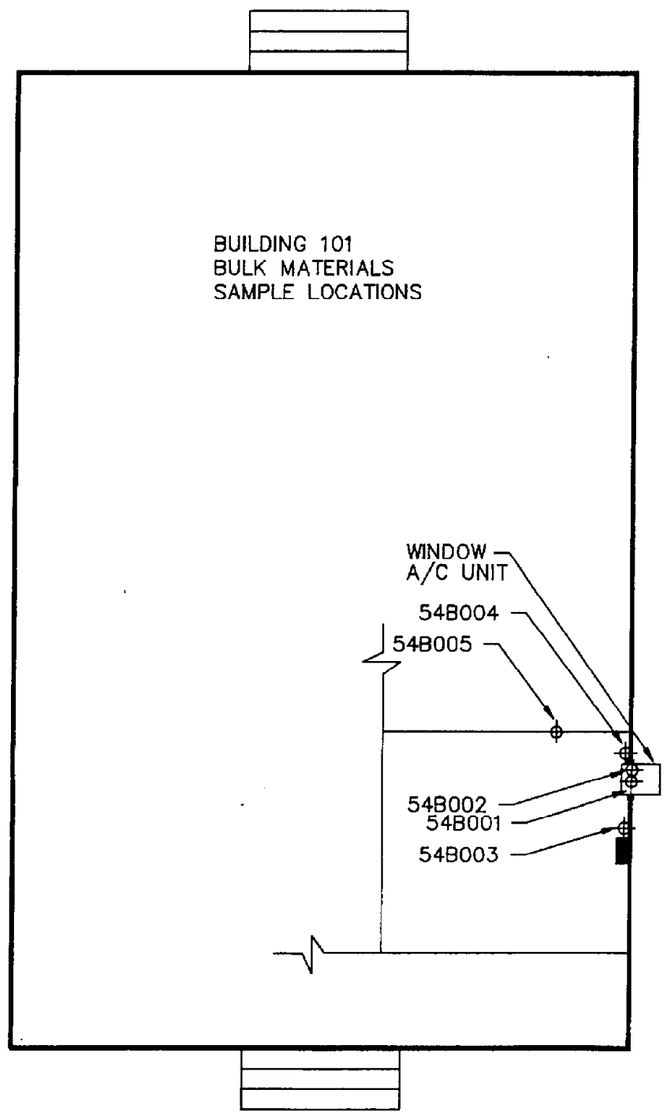
Any free mercury should be recovered from the manholes. Recovery may be accomplished easily and cost effectively with mercury adsorbent sponges. These sponges should be properly disposed of in accordance with all applicable state and federal regulations.

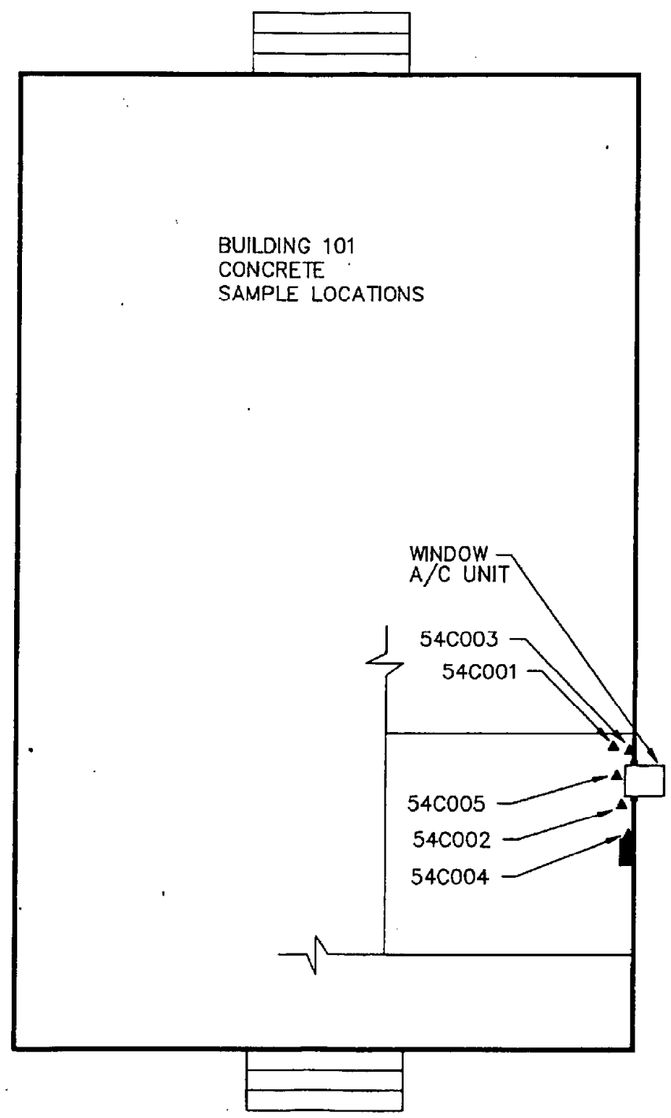
5.13 Site 54 — Building 101 Mercury Contamination

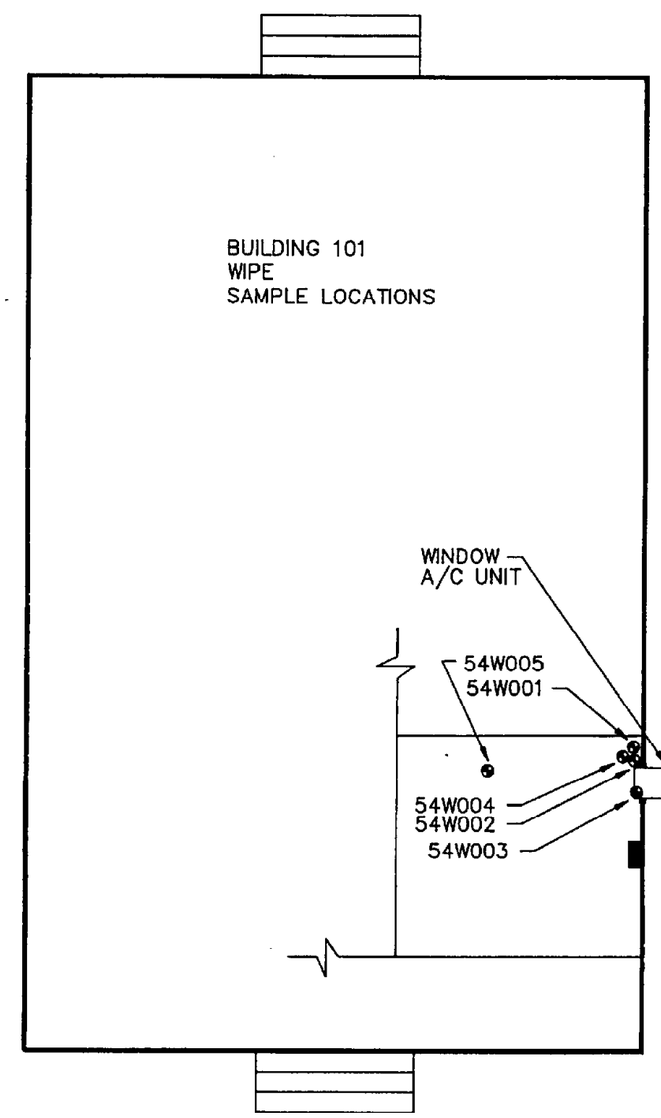
Building 101 is a two-story brick building where mercury compounds were used in research and development. The room in the southeast corner of the first floor is the area under study (Figure 5-18). Site 54 was recommended for an SI based on the discovery of mercury on the steam pipes and mercury vapors detected in the room by facility safety personnel.

Operations are still active in Building 101 and include sensitivity testing using a nitrometer in a process that produces a spent solution of mercury and sulfuric acid. The spent solution is poured into a "slop jar" and filled with tap water to remove the sulfuric acid from the mercury. There were frequent spills and occasional breakage of the slop jars into the sink.

Droplets of mercury were detected on steam pipes in the study area. The PA concluded that the source of the mercury droplets may be leaks and spills associated with the equipment and







LEGEND

- BULK MATERIAL SAMPLE POINTS
- CONCRETE SAMPLE POINTS
- WIPE SAMPLE POINTS

10' 5' 0' 10'

SCALE: 1"=10'

SITE 54
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

FIGURE 5-18
SITE 54
SAMPLE LOCATIONS

DATE: 12/12/92 | DWG NAME: 003SIT54

operations on the second floor. Old blueprints indicated four nitrometers were once used on the second floor above the study area (PA). Also, an employee noticed a solvent odor in the study area while solvents were being flushed down the upstairs sink, suggesting the drainage system was leaking.

5.13.1 Study Description — Site 54

The objective of this study was to determine if select horizontal surfaces, bulk building materials, and the concrete floor had been contaminated by mercury spills and releases. The concrete floor also was analyzed for nitrate esters. Achieving this objective involved collecting five wipe samples from the horizontal surfaces of selected building materials, collecting five bulk samples from selected building materials, and collecting five concrete samples of the basement floor. The sampling and analysis approach is outlined below.

Site 54 — Sampling and Analysis Approach				
Sample Media:	Horizontal surfaces Building materials Concrete Floor			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Wipe (horizontal surfaces)	5	1	5
	Bulk building materials	5	1	5
	Concrete	5	1	5
Analytical Requirements:	**Media**	**Analyses**		
	Wipe	Mercury		
	Bulk building materials	Mercury		
	Concrete	Mercury, Nitrate Esters		

Wipe, bulk materials, and concrete samples were collected August 22, 1992, using methods described in Section 3. Sample locations are indicated on Figure 5-18 and a description of each location is indicated in Table 5-35. Sample location were mainly limited to the northeast corner of the room, referred as "corner" in Table 5-35.

Table 5-35
Site 54
Sample Locations
and
Analytical Results

Wipe Samples	Sample Locations	Hg Results µg/100cm²	Bulk Samples	Sample Location	Hg Results mg/kg	Concrete Samples	Sample Locations	Results	
								Hg mg/kg	NE µg/g
54W001	On conduit above ceiling tile in NE corner.	8.6	54B001	Ceiling tile, above air conditioner at east wall.	776	54C001	Corner 1.5 feet from east wall.	BDL	BDL
54W002	On drainage pipe above ceiling tile in NE corner.	3.0	54B002	Pipe insulation, steam pipe above air conditioner at east wall.	0.45	54C002	Near the center of the area between the north wall and the load column.	0.59	BDL
54W003	Top right corner of air conditioner, east wall.	75.4	54B003	Floor tile, near the center of the east wall, at corner of load column and east wall.	3.5	54C003	At drain pipe, north wall.	0.38	BDL
54W004	On water line at east wall.	0.53	54B004	Pipe mortar, steam pipe elbow on 6-inch steam pipe at east wall.	2.1	54C004	Corner at east wall and load column, below air conditioner.	0.56	BDL
54W005	Steam pipe above ceiling, 10 feet from east wall at northcentral section of room.	14.1	54B005	Sheet rock, 10 feet from air conditioner, top of north wall.	5.8	54C005	Directly between 54C001 and 54C002.	0.21	BDL

NOTES:
Hg = Mercury
BDL = Below Method Detection Limits
NE = Nitrate Esters

5.13.2 Study Findings — Site 54

Observations

The floor was carpeted and appeared stained in the northeast corner. Several ceiling tiles and the sheet rock wall also appeared stained. There were no visible mercury droplets on the horizontal surfaces sampled. Mercury vapors were monitored during the sampling process. There were two brief intervals when mercury vapors were as high as 0.33 mg/m^3. No significant levels of mercury vapors were detected during the remainder of the sampling process.

Analytical Results — Site 54

Analytical results are summarized in Table 5-35; complete analytical data are presented in Appendix C. There appears to be a significant variation in the detected levels of mercury in both the wipe samples and the bulk material samples. The detected concentration of mercury from wipe tests range from 0.53 to 75.4 $\mu g/100\ cm^2$. The overall range of mercury concentration in bulk materials is 0.45 to 776 mg/kg. The highest reported level of mercury for wipe and bulk material samples was detected in samples collected adjacent to one another. This may suggest a local "hot spot."

The range of mercury detected in concrete samples is relatively narrow from 0.21 to 0.59 mg/kg, with an average concentration of approximately 0.46 mg/kg. No nitrate esters were detected in concrete samples.

5.13.3 Discussion — Site 54

The apparent similarities between the wipe and bulk analytical data are not entirely coincidental. The sample locations for the highest detected concentration of mercury in wipe and bulk samples are proximate. This suggests that a local "hot spot" (or source reservoir) is near the air conditioner and/or above the ceiling in this area.

5.13.4 Recommendations — Site 54

This area should remain closed to personnel. Data collected during this study indicate detectable levels of mercury are present in the building materials and as residue on surfaces in the area. Additional study should be completed to determine the extent of mercury contamination in building material with the final objective of safe and adequate removal of the contaminated building materials.

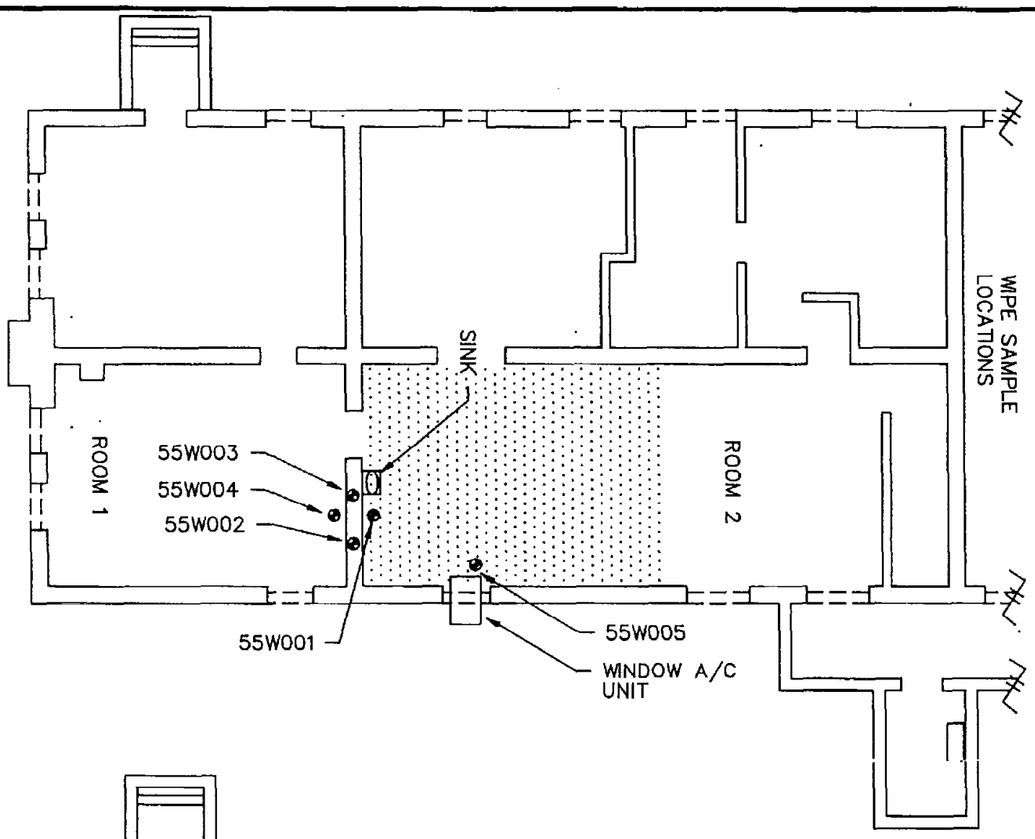
Further investigation will require the statistical collection of bulk materials samples from all building materials. Nonimpervious materials, (metal pipes and other metal materials, only) could possibly be decontaminated and reused. Other porous building materials, (ceiling tiles, sheet rock, floor tile, etc.) will likely require removal and disposal.

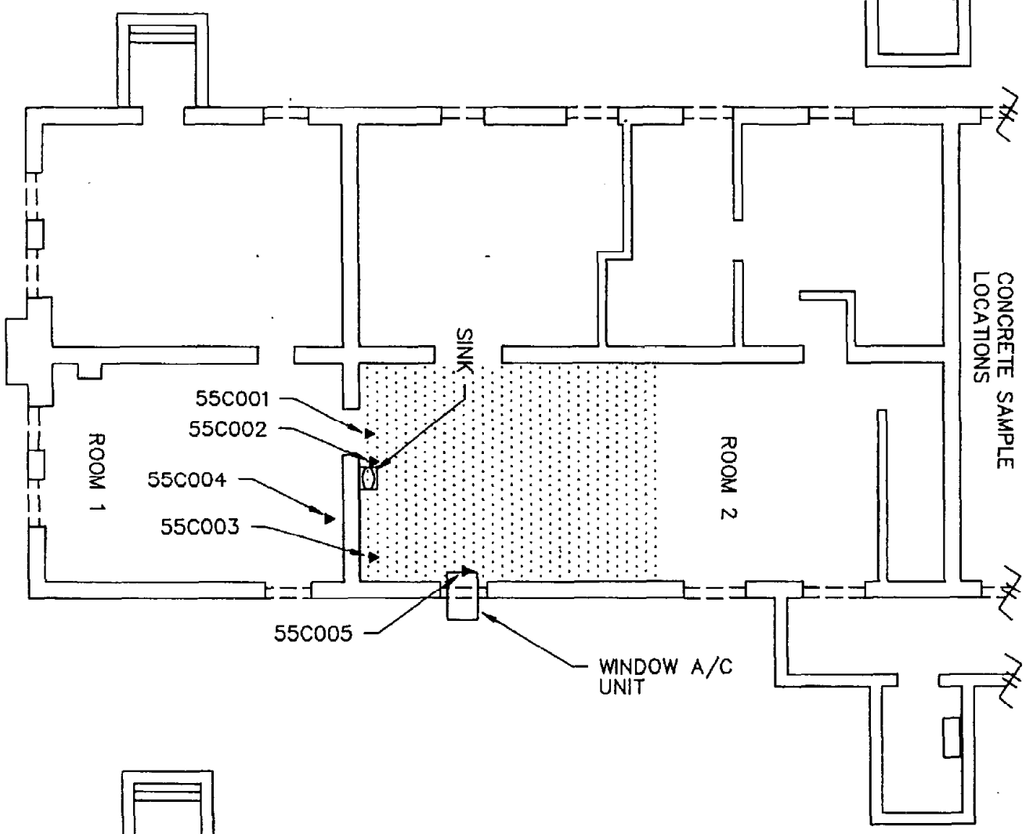
5.14 Site 55 — Building 102 Mercury Contamination

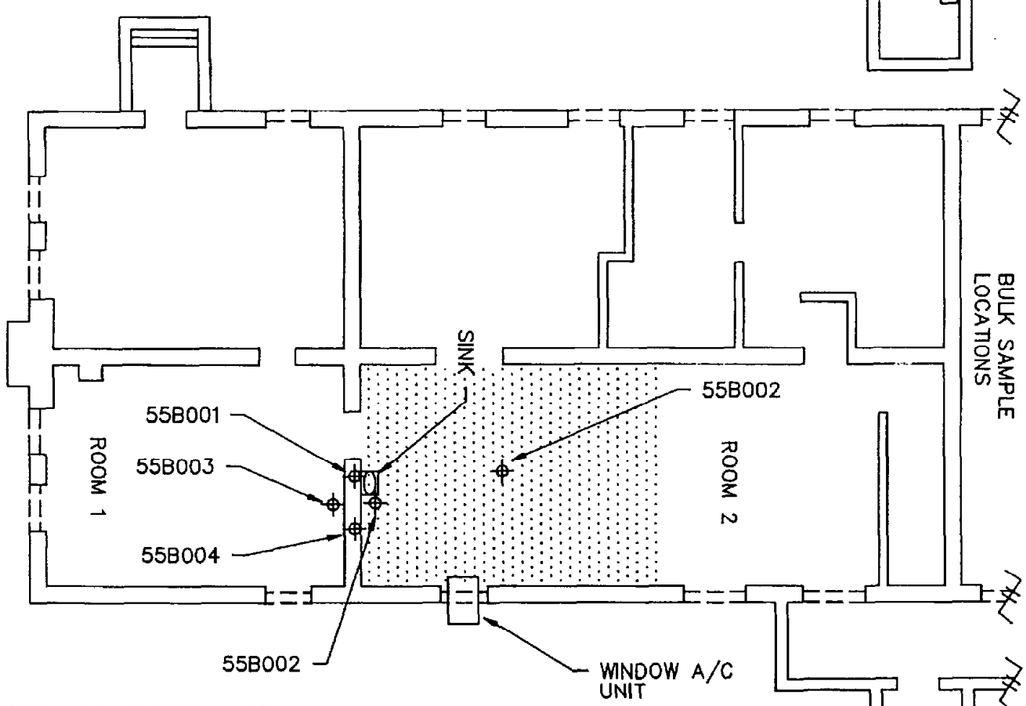
Building 102 is a two-story brick building in the general laboratory area between Buildings 101 and 103. Building 102 was recommended for an SI due to the discovery of mercury permeating through the floor and entering the basement.

The study area includes two rooms in the basement from the northwest corner (Room 1) to the west central basement area (Room 2) (Figure 5-19). The study mainly focused on Room 2 and the wall separating the two rooms based on recounts of releases and/or the discovery of mercury spills. A sink was located in Room 2 near the center of the divider wall. An air conditioner window unit is located in a Room 2, approximately 10 to 12 feet from the divider wall.

According to the PA, the building was used for a number of processes involving mercury for nearly 80 years. Some of these operations involved sensitivity tests that incorporated the use of nitrometers in a process that produced a spent solution of mercury and sulfuric acid. This spent mixture was poured into a slop jar and filled with tap water to remove the sulfuric acid from the mercury. There were frequent spills and occasional breakage of the slop jars into the







BUILDING 102

LEGEND

- BULK MATERIAL SAMPLE POINTS
- CONCRETE SAMPLE POINTS
- WIPE SAMPLE POINTS

SITE 55
SITE INSPECTION
NAVAL SURFACE
WARFARE CENTER
INDIAN HEAD, MD.

10' 5' 0 10'
SCALE: 1"=10'

FIGURE 5-19
SITE 55
SAMPLE LOCATIONS

DATE: 12/12/92 | DWG NAME: 003SIT55

sink. Old blueprints of the building indicate a nitrometer was once located on the second floor, above the study area.

In 1987 mercury was discovered dripping from the ceiling onto the coffee mess located by the sink in the basement (Figure 5-19). An estimated teaspoon of mercury was discovered by a plumber in the "P-trap" of a sink drain while installing a mercury trap on the sink in 1986.

5.14.1 Study Description — Site 55

The objective of this study was to determine if select horizontal surfaces, bulk building materials, and the concrete floor have been contaminated by mercury spills and releases. The concrete floor also was analyzed for nitrate esters. Achieving this sampling objective involved collecting wipe samples from the horizontal surfaces, bulk samples from selected building materials, and concrete samples from the basement floor. The sampling and analysis approach is outlined below.

Site 55 — Sampling and Analysis Approach				
Sample Media:	Horizontal surfaces Building materials Concrete floor			
Sample Procedures:	**Type**	**Number**	**Sam/Loc**	**Total**
	Wipe (horizontal surfaces)	5	1	5
	Bulk building materials	5	1	5
	Concrete	5	1	5
Analytical Requirements:	**Media**	**Analyses**		
	Wipe	Mercury		
	Bulk building materials	Mercury		
	Concrete	Mercury, Nitrate Esters		

Wipe, bulk materials, and concrete samples were collected August 19, 1992, from the locations indicated on Figure 5-19 and described in Table 5-36. Sample locations were mainly concentrated in Room 2. In Table 5-36, the term "divider wall" refers to the wall between Rooms 1 and 2.

5.14.2 Study Findings — Site 55

Observations

No mercury was observed while selecting sample sites; however several areas appeared stained, indicating leaks in the piping above the ceiling and/or through the floor above. Air monitoring was conducted for mercury vapors during the sampling process, but no significant vapor levels were detected.

Analytical Results — Site 55

Analytical results are summarized in Table 5-36; complete analytical data are presented in Appendix C. A wide range of mercury levels were detected by wipe test: 0.10 to 368 $\mu g/100cm^2$ with an average of approximately 65.1 $\mu g/100\ cm^2$. Results of 5W002 suggest a local "hot spot" where mercury was indicated at 368 $\mu g/100\ cm^2$.

Mercury was detected in bulk materials ranging from 0.16 to 30.4 mg/kg with an average concentration of 16.8 mg/kg. The highest levels were detected in samples from locations 55B001 and 55B002. No mercury was detected in the sample from location 55B004.

A wide range of mercury concentrations were detected in concrete samples. This range was from 2.5 to 86.8 mg/kg with an average concentration of 26.45 mg/kg. Mercury was detected at concentrations above 20 mg/kg in samples from locations 55C001 (55C001D), 55C002, and 55C003 at 35.2, 21.4, and 86.8 mg/kg, respectively.

Table 5-36
Site 55 Sample Locations
and
Analytical Results

Wipe Samples	Sample Location	Hg Results µg/100cm²	Bulk Samples	Sample Locations	Hg Results mg/kg	Concrete Samples	Sample Locations	Results Hg mg/kg	Results NE µg/g
55W001 55W01D	Room 2, floor tile surface, halfway between the sink and the west wall, 2 feet from divider wall.	4.2 4.6	55B001 55B01D	Room 2, Sheet rock-top center of divider wall, above sink.	29.6 19.1	55C001 55C01D	Room 2, left of doorway between rooms 1 & 2, next to divider wall, under former sink location.	4.9 35.2	HMX 1.940 C 2.580 C
55W002	Room 2, steam pipe surface at divider wall above ceiling.	368	55B002	Room 2, Floor tile-center of divider wall, below sink.	30.4	55C002	Room 2, 1 foot left of C001, along divider wall.	21.4	HMX 3.830 C
55W003	Room 2, conduit surface at divider wall, near towel dispenser.	0.44	55B003	Room 1, Ceiling tile-at intersection of divider wall and copper water pipe.	4.6	55C003	Room 2, next to divider wall, at corner of divider wall and west wall.	86.8	BDL
55W004	Room 1, copper water line surface at east wall.	1.3	55B004	Room 2, Pipe insulation-steam pipe at divider wall.	BDL	55C004	Room 1, at center of divider wall, at wall.	7.9	BDL
55W005	Room 2, floor tile surface 8 feet from divider wall by air conditioner.	0.10	55B005	Room 2, Ceiling tile-near center of room next to second sprinkler from divider wall.	0.16	55C005	Room 2, below air conditioner.	2.5	BDL

NOTES:
Hg = Mercury
BDL = Below Method Detection Limits
NE = Nitrate Esters

One nitrate ester compound, HMX, was detected in concrete samples 55C001, 55C01D, and 55C002 at 1.94, 2.58, and 3.83 μg/g, respectively.

5.14.3 Discussion — Site 55

Review of the analytical data indicates the presence of mercury and HMX contamination in Room 2. A general area of concern is along the divider wall, below the former location of the sink and above the ceiling at the divider wall.

5.14.4 Recommendations — Site 55

Building 102 should remain closed to area personnel. Data collected during this study indicate that low levels of mercury are present in the building materials and as residue on the surfaces in the area, and that HMX is present in concrete samples. Additional study should be completed to determine the extent of mercury and HMX contamination in the building materials with a final goal being the safe and adequate removal of all contaminated materials.

This additional study will require statistically collecting bulk materials samples from all building materials. Nonimpervious materials, (metal pipes and other metal materials, only) could possibly be decontaminated and reused. Other porous building materials, (ceiling tiles, sheet rock, floor tile, etc.) likely will require removal and disposal.

5.15 Production Wells

Eleven facility production wells were sampled in September 1992 and again in April 1993 as part of the SI. These wells are dispersed throughout the facility and all but one well are currently used as potable water sources (Figure 5-20). Each well is screened in the Patapsco or Patuxent Aquifers with screen depths ranging from 190 to 490 feet bls. There are no known releases into the Patapsco or Patuxent Aquifers on the Indian Head Peninsula. The Patapsco Formation includes a series of alternating confining layers and water-producing zones. These confining units, where present, serve as an effective aquitard between the surficial aquifers and

the subordinate water-producing zones. The regional geology and hydrology are discussed in detail in Section 2.

5.15.1 Study Description — Site PW

The study objective was to collect data on the water quality of the facility wells. The sampling and analysis approach is outlined below. One sample from each well was collected on September 17, 1992, with Well 3A being resampled on September 22 due to a laboratory error. Groundwater samples were collected from a port located on each well directly into the sample container. There were no noted problems during the April-1993 sampling event.

Production Wells — Sampling and Analysis Approach				
Sample Media:	Groundwater (deep aquifers)			
Sample Procedures:	**Type**	**Number**	**No/Loc**	**Total**
	Existing Well September-1992	11	1	11
	Existing Well April-1993	11	1	11
Analytical Requirements:	**Media**	**Analyses**		
	Groundwater	TCL, TAL		

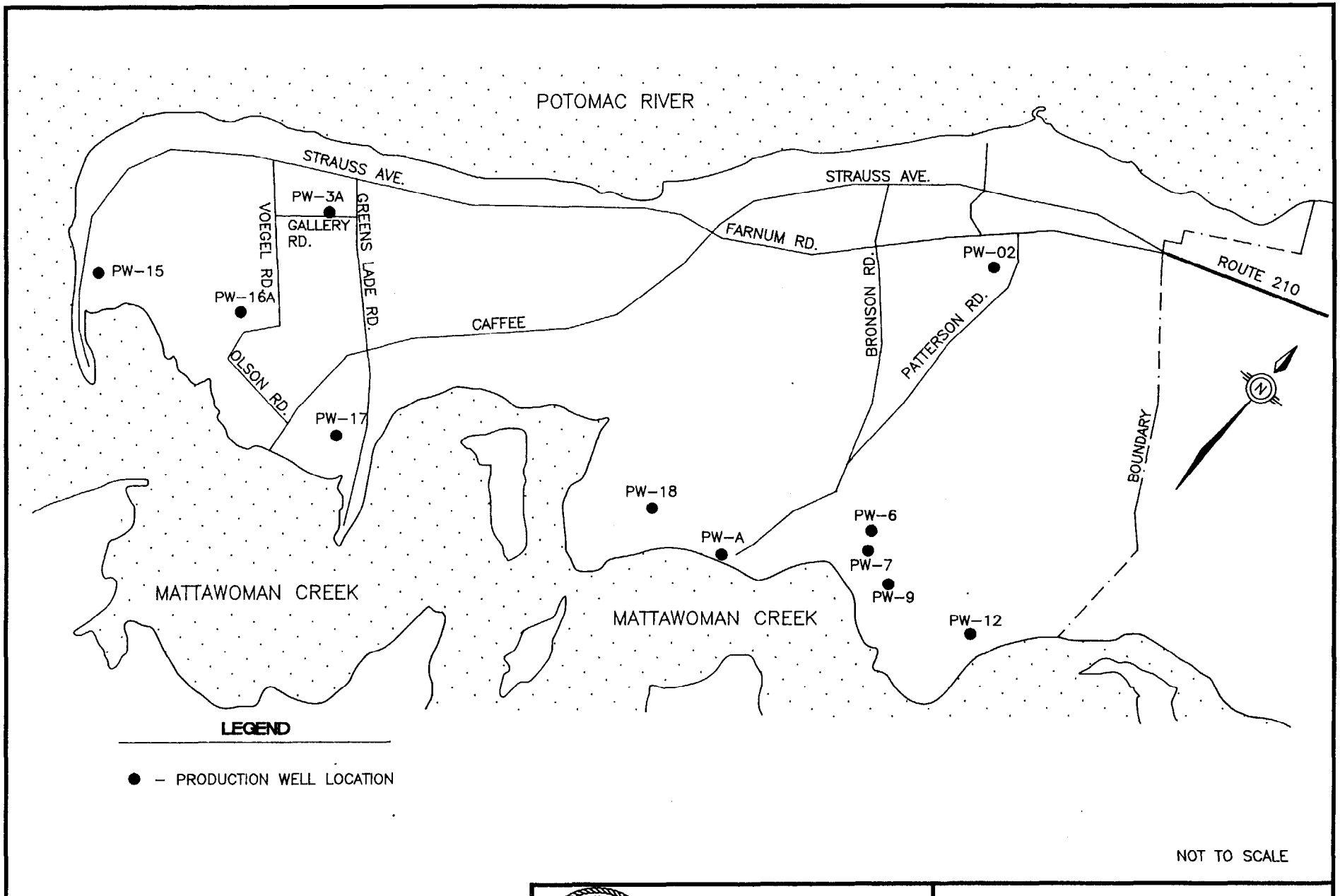
5.15.2 Study Findings — Site PW

Observations

The sampled water appeared to be very clear. There were no particular odors noted except in the sample from PW 3A, which exhibited an odor consistent with hydrogen sulfide gas.

Analytical Results — Site PW

All groundwater samples from the production wells were analyzed for TCL and TAL.



SITE INSPECTION
INDIAN HEAD DIVISION,
NAVAL SURFACE
WARFARE CENTER

FIGURE 5-20
PRODUCTION WELL LOCATIONS

DATE: 02/24/94 | DWG NAME: INDH0320

VOCs (September — 1992): Tetrachloroethylene was detected in well PW07 at 3.0 μg/L, which is below the established MCL of 5.0 μg/L. Analytical data are presented in Appendix C, where Section C.1 includes "Hits Only" data.

VOCs (April — 1993): Acetone was the only VOC detected and was reported in IW06. The concentration is below CRDL. The compound is "J" flagged as an estimated value, and probably represents a laboratory artifact.

PEST: No pesticide compounds were detected in groundwater samples from either the September — 1992 or the April — 1993 sampling events.

TALs (September — 1992): Reported concentrations of aluminum, iron, and manganese were above secondary MCLs in samples from six of the production wells. Iron was detected in six wells with concentrations ranging from 345 to 2710 μg/L and an average concentration of 1080 μg/L. Wells PW3A and PW09 were indicated with the highest levels of iron at 2710 and 1350 μg/L, respectively. The average concentration of iron excluding these two points is 605 μg/L, somewhat lower than the overall average. The iron concentrations indicated by laboratory data could conceivably represent background. There is no apparent trend in this data based on well location unless some unknown geohydrologic factor is influencing conditions at these wells.

Aluminum was detected in a sample from well PW09 at 445 μg/L above the established MCL of 50 μg/L. Manganese was detected in wells PW3A (337 μg/L) and PW07 (98.6 μg/L) above the established MCL of 50 μg/L.

TAL (April—1993): Nine analytes were reported in samples from the production wells. Only two analytes were reported at concentration above FDWS — iron and manganese. Iron was reported in three samples above the FDWS of 300 μg/L, ranging from 593 to 15100 μg/L. Manganese was reported in only one sample at 1830 μg/L.

5.15.3 Discussion — Site PW

The analytical data indicated that three metals and the VOC tetrachloroethylene were present at elevated concentrations in the production well samples. These data do not necessarily indicate widespread contamination in the Patapsco Aquifer. The presence of tetrachloroethylene in well PW07 may indicate possible localized contamination or a laboratory artifact. Tetrachloroethylene was not detected in the collected sample from PW07 during the second sampling event. It is unclear at this time what effect the pumping period of well PW07 has had on the sample results.

The detected metals concentrations may represent natural background levels in groundwater. There were no data collected during this SI linking the potential contamination of any of the IR sites to the presences of tetrachloroethylene detected in the groundwater sample from production well PW07.

5.15.4 Recommendations — Site PW

Well PW07 should be sampled quarterly to monitor the level of tetrachloroethylene and metals. If no contamination is indicated at the end of this monitoring period, the sampling program may be terminated. However, if contamination is indicated then, further investigation should be completed to determine the source and extent of contamination. Furthermore, any additional investigation of PW07 should include time-elapsed sampling to determine what, if any, effect the pumping period may have in sampling results.

6.0 PRELIMINARY RISK ASSESSMENT

As part of the SI for this facility, a PA was performed to determine the potential human health and/or environmental risk posed by each site. These preliminary risk assessments are semi-quantitative; that is, observed concentrations of potential contaminants of concern were compared to published risk-based threshold concentrations. Proposed Subpart S of 40 CFR 264 (FR Vol. 55, No. 145, July 27, 1990), USEPA, Office of Water MCLs, and the Agency for Toxic Substances and Disease Registry. Tables of health assessment comparison values from the following were used to compare observed values with proposed and/or promulgated guidance values and standards. The USEPA Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) were also reviewed for comparison.

A guidance risk-based value of 200 mg/kg lead in soil was used. Lead in soil below this concentration is not considered to be bioavailable (Personal communication USEPA, Environmental Criteria and Assessment Office (ECAO), November 1992).

A formal background sediment sample was not included in the sampling and analysis of the media at Site 41. However, for purposes of comparison, sample location 41DP09 was selected to best represent background conditions from the sediment sample population. The concentrations of all parameters at each sample location were compared to the results for Sample 41DP09, defined as the upstream background sediment sample in Mattawoman Creek. Any significant deviations from background concentrations was assumed to indicate a site-related impact. This assumption is made only for the purpose of preliminary assessment and is not intended to be a basis for any final evaluation. Furthermore, any future investigation must include establishing proper background control to adequately assess all potential risks.

For purposes of the preliminary risk assessments, it was assumed that a potential human health or environmental threat existed (for a particular medium) if:

- The concentration of a parameter observed in at least one sample from a medium exceeded a corresponding risk-based threshold.

  or

- The concentration of a parameter observed in at least one sample from a medium exceeded the corresponding background concentration.

This algorithm is extremely conservative because single sampling point exceedances would not necessarily result in significant potential calculated risk for the entire site. Due to the limited body of data currently available however, this approach was deemed appropriate. It also should be noted that the risk-based thresholds used for comparison were the most conservative values reported in the referenced publications. Performance of site-specific risk assessments using site-specific exposure criteria would likely result in less stringent risk-based action levels. Subsequent studies at each of the sites posing a potential concern will serve to support or refute these preliminary conclusions regarding risk.

The concentrations of metals in soil during the SI represented potential areas of concern only. Soil risk-based thresholds for metals were exceeded at numerous sites. Additionally, it was assumed that all chromium reported in each sample was hexavalent chromium, which has a lower risk-based threshold. It is possible, however, that the observed concentrations indicate naturally occurring background concentrations even though they exceeded conservative risk-based thresholds. At many sites, determining background metals concentrations could show that observed concentrations in the areas of concern do not differ significantly from background. To provide a general evaluation of the significance of metals concentrations, observed values were compared to reported Maryland average soil concentrations (for each metal found above risk-based thresholds). The Maryland average concentration and range for each potential metal of concern are shown in Table 6-1. The significance of observed values (relative to these reported averages and ranges) is discussed for each site.

Table 6-1
Average Concentrations and Ranges for Potential Metals of Concern[a]

Parameter	Reported Average mg/kg	Range (ppm) mg/kg
Manganese	640[b]	<2.0-7,000
Nickel	12.0-16.7	ND-5.0[c]
Silver	NA	ND-5.0[c]
Arsenic	3.8	1.1-7.1
Chromium	48	15-100
Beryllium	1.0	ND 3.0
Cadmium	0.25-0.34	<0.01-0.83
Lead	22	10-50
Mercury	0.07	0.04-0.14
Barium	393	150-700

Notes:
a = Values excerpted from Dragun, J. and A. Chiasson. *Elements in North American Soils*. Hazardous Materials Control Resources Institute-Greenbelt, Maryland, 1991.
b = Average concentration and range for manganese are for Eastern U.S. soil and are not specific to Maryland, (Dragun, 1988).
c = Conterminous U.S. soil, (Dragun, 1988).
ND = Not detected above the sample detection limit
NA = Not available

Site-Specific Results:

Each site investigated during the SI is discussed separately in the following section. Only parameters or groups of parameters for which positive results were reported on a medium-specific basis are addressed. If a parameter or group of parameters is not discussed in the following section, the parameter was either not detected in any sample in the medium or was not analyzed as part of the SI.

Site 39 — At Site 39, UDMH, PNC, and HBNQ were identified in sediment. These compounds can be directly correlated with site discharges in the area. Based on the slope factor provided in HEAST for UDMH, it appears that sediment UDMH represents a potential health threat. No toxicological data were available for either PNC or HBNQ. Several SVOCs were detected in sediments at Site 39. These compounds generally partition to the sediment phase and do not represent a significant source of surface water contamination at the concentrations observed. These compounds may, however, pose a significant threat to benthic organisms and/or humans directly exposed to sediments. The concentrations of silver, mercury, and nickel observed in Site 39 sediments were above corresponding background concentrations.

Site 40 — No sediment samples from Site 40 were found to contain palladium above the reporting limit. Palladium was the only parameter for which sediments were analyzed in this area. As detailed in previous sections, there is a potential for explosive-derivative contamination in this area. Additional data regarding these additional parameters are essential to fully evaluate risk at Site 40.

Site 41 — Semivolatile and pesticide compounds were detected in sediments at Site 41 at concentrations exceeding apparent background. These compounds generally partition to the sediment phase and do not represent a significant source of surface water contamination at the concentrations observed. These compounds may, however, pose a significant threat to benthic organisms and/or humans directly exposed to sediments. Low concentrations of TPH also were detected in sediment samples. No metals were observed at concentrations above corresponding background.

In soils, semivolatiles and metals were detected at concentrations above risk-based standards. The metals detected were manganese, arsenic, and beryllium. The concentrations of manganese were within the reported range shown in Table 6-1, and do not appear to indicate site impacts.

The reported concentrations of arsenic and beryllium were above the risk-based standards. Volatile and pesticide compound concentrations in soils were below risk-based standards.

A single surface water sample was collected from Site 41. This sample was found to contain semivolatiles, PCBs, and metals exceeding risk-based standards. The metals of concern in surface water were manganese, mercury, lead, and cadmium. Aluminum and iron concentrations also were above secondary MCLs. Although the surface water body from which the sample was collected was actually standing water, the presence of these compounds/analytes presents a potential cross-media transfer pathway by surface runoff to surface water.

Groundwater at Site 41 was found to contain trichloroethylene, heptachlor epoxide, and endosulfan II exceeding risk-based standards. Aluminum and iron concentrations also exceeded secondary MCLs, although these exceedances are assuredly due to moderate turbidity in the samples.

Site 43 — Volatile and semivolatile concentrations in soil samples collected from Site 43 were below risk-based standards. Low concentrations of TPH were detected in soil samples from this area. No significant potential risk was apparent based on these data.

Site 44 — No volatile compound was found in Site 44 soil above the respective risk-based thresholds. Trichloroethylene was detected in Site 44 groundwater at concentrations exceeding the MCL. As a result, a potential groundwater-related human health risk does exist at Site 44.

Site 45 — No volatile or semivolatile compounds were found in Site 45 soils above corresponding risk-based thresholds. The concentrations of beryllium in Site 45 soil exceeded the most conservative risk-based threshold. Beryllium concentrations detected in Site 45 soil were below the reported Maryland range; therefore, the presence of beryllium in soil does not indicate site-related impacts.

Site 46 — The concentrations of lead, manganese, and beryllium exceeded risk-based thresholds in at least one soil sample from Site 46. The concentrations of manganese and beryllium detected in Site 46 soil were within the range shown in Table 6-1. The presence of these metal analytes in soil does not appear to indicates site-related impacts.

Site 47 — No volatile compound detected in soil from Site 47 exceeded risk-based thresholds for direct contact. However, the concentrations of tetrachloroethylene, carbon tetrachloride, chloroform, and trichloroethylene detected in this soil may represent a potential cross-media transfer threat (vadose zone soil to groundwater). Additional studies are warranted on the basis of these findings. SVOCs and metals were detected at concentrations exceeding risk-based thresholds. The metal of concern was beryllium. The beryllium concentrations observed were within the reported concentration ranges for these elements. The presence of beryllium in soil does not indicate a site-related impact.

Site 48 — Beryllium was detected in soil at concentrations exceeding risk-based thresholds. However, it was not found to have a concentration above the reported Maryland range. It does not appear that the presence of beryllium in soils indicates site-related impacts.

Site 49 — Results and conclusions for beryllium were similar to those of Site 48.

Site 50 — A combined potential health threat is posed by soil semivolatiles at Site 50. In addition, lead, manganese, mercury, and beryllium concentrations were found to exceed corresponding risk-based thresholds. The concentrations of manganese and beryllium in Site 50 soils were within the reported range for each element. It does not appear that the presence of these metal analytes in soil indicates site-related impacts.

Site 53 — Soil concentrations of beryllium exceeded risk-based thresholds, but they were within the reported range. It does not appear that the presence of beryllium in soils indicates site-related impacts.

Mercury and nitrate ester (explosive-derivative) compounds were identified in sediments collected from sewer manholes at Site 53. The presence of these compounds indicates a possible historic discharge. The mercury concentrations in the sediments are above risk-based thresholds for soil. This comparison was made because the potential exposure pathway (direct ingestion/dermal contact) is similar to that for soil. RDX (an explosive-derivative compound) also was found in manhole sediments. According to HEAST, the compound has a low reference dose and moderate slope factor (cancer potency factor) indicating that it could present a significant carcinogenic and non-carcinogenic risk to exposed individuals. As a result, these sediments could pose a significant risk to human health (through direct ingestion and dermal contact) for both mercury and nitrate esters compounds. Furthermore, depending on the ultimate discharge point of water flowing through the sewer system, the presence of these contaminants may pose additional threats through cross-media transfer (to surface water).

Site 54 — Wipe samples were collected at Site 54 for mercury analysis. The maximum mercury concentration on Site 54 surfaces was 75.4 μg/100 cm^2. This level is below the proposed risk-based threshold of 240 μg/100 cm^2. Mercury was also detected in ceiling tile material and concrete samples collected at Site 54. The range of mercury concentrations in these materials was from below detection limits to 776 mg/kg in a ceiling tile sample. Although these data cannot be specifically correlated with a potential exposure scenario, the presence of mercury (and potentially mercury vapor) at this site may be cause for concern. This is particularly important with respect to the ultimate disposition of any materials discarded from Site 54, as pertains to hazardous waste disposal regulations.

Site 55 — Wipe sample 55W002 collected at Site 55 was found to have a mercury concentration above the proposed risk-based threshold at a concentration of 368 μg/100 cm^2. A significant risk may be posed to human health if individuals contact the affected surfaces. Ceiling tile mercury concentrations ranged from below detection limits to 30.4 mg/kg. Bulk concrete sample mercury concentrations ranged from 2.5 to 35.2 mg/kg. HMX also was detected in one concrete sample at Site 55. Although these data cannot be specifically correlated with a potential exposure scenario, the presence of mercury (and potentially mercury vapor) at Site 54 may be cause for concern. This concern is particularly important with respect to the ultimate disposition of any materials discarded from Site 54, as pertains to hazardous waste disposal regulations.

Production Wells — Tetrachloroethylene was observed in one of 11 production wells sampled during the SI. Additional monitoring of this well is warranted to determine potential fluctuations in tetrachloroethylene concentrations over time. The observed concentration of 3.0 μg/L was below the MCL of 5.0 μg/L.

7.0 SUMMARY

Sampling was completed at 14 sites and 11 production wells during Phase II of the SI. Media samples from 13 sites and three production wells were identified as having contaminant concentrations above established assessment criteria benchmarks. Further study was recommended at these sites and quarterly groundwater sampling was recommended for one production well (PW07) and six monitoring wells (Sites 41 and 44).

Sediments: BNAs, UDMH, HBNQ, and PNC were detected in sediment samples from Mattawoman Creek at Sites 39 and 41. Additional investigation is recommended to assess the nature and extent of creek sediment contamination.

VOCs, BNAs, and metals were detected in sediment samples collected in the sewer system at Site 49 and Site 53. Additional investigation is recommended to assess the nature and extent of media potentially inspected by the sewer sediment contamination.

Groundwater: Trichloroethylene, heptachlor epoxide, and endosulfan II were detected in groundwater samples from Site 41, and trichloroethylene was detected in groundwater samples from Site 44. Elevated concentrations of metals were detected in samples from production wells PW3A and PW09, and a low concentration of tetrachloroethylene was detected in production well PW07. Quarterly groundwater sampling to monitor contaminant concentrations is recommended for Sites 41 and 44, and production well PW07.

Soil Contamination: Soil contamination was indicated at Sites 41, 43 through 48, and 50. The range of contaminants includes VOCs, BNAs, metals, and TPH. Additional data are required at each site to assess the nature and extent of contamination.

Building Contamination: Mercury contamination was indicated in the building materials at Sites 54 and 55. Additional study was recommended at both sites to provide data to assess an appropriate removal method.

Site 39: Data indicate low concentrations of VOC, BNA, PNC, and nitrate ester compounds in the creek sediments adjacent to Site 39. Further investigation should be completed to evaluate the nature and extent of contamination. Upstream samples should be collected to establish background concentrations to be used in further assessment.

Site 40: Palladium was not detected in sediment samples from Mattawoman Creek. Based on current data, no further study is recommended at Site 40.

Site 41: BNA contamination was indicated in soil, sediment and groundwater at Site 41. Additional field investigation should be completed to assess the nature and extent of contamination to surface soil, groundwater, and the creek sediments. This may involve installing additional soil borings and groundwater monitoring wells. Quarterly groundwater monitoring also is recommended for the three monitoring wells at Site 41.

E/A&H recommends combining Sites 39, 40, and the sediment study of Site 41 into one site to assess the impact to Mattawoman Creek. The study objective could then shift from investigating areas of the creek based on known point source(s) to addressing the bigger issue of impact to Mattawoman Creek by all three sites. This approach should reduce duplication between site studies (Sites 39, 40, and 41) and better facilitate assessing the hydrology and hydrogeology of the area on a larger scale. The advantages here are numerous, especially in assessing the tidal influence and assessment of ecological receptors. Further study should include a comprehensive sampling and analysis plan including modification to the boundaries of the study area.

Site 43: Acetone was detected in soil samples, and soil-gas data indicated that toluene and three chlorinated compounds may be present in shallow soil. A series of shallow soil borings should be completed to assess the nature and extent of residual soil contamination, if any.

Site 44: Acetone, TPH, and BNAs were detected in the shallow soil zone, indicating contamination. Trichloroethylene was detected in a sample from monitoring well 44MW02, indicating possible contamination of the water table aquifer. A more comprehensive field investigation will be required to evaluate the nature and extent of soil and groundwater contamination. Also, quarterly groundwater sampling is recommended for the three monitoring wells at Site 44.

Site 45: A soil-gas survey indicated trace amounts of total volatiles, toluene, and PCE vapors in the shallow soil (3 to 4 feet in depth). Analysis of surface soil samples from the 0- to 1-foot depth interval revealed no volatile constituents. The soil-gas data suggest volatile constituents may be present in subsurface soils. Additional soil sampling should be completed to assess the nature and extent of contamination, if any. Before subsequent field activities, drums at this site should be removed and disposed of in accordance with applicable state and federal requirements.

Site 46: Elevated concentrations of lead, and (to a lesser extent), nickel and cadmium, were detected in surface soil. Additional surface soil samples should be collected to assess the nature and extent of metals in soil.

Site 47: Silver contamination was indicated and VOCs and BNAs were detected below action levels in surface soil samples. Additional soil analysis is needed to further assess metals, VOC, and BNA concentrations. If additional shallow soil studies identify significant soil contamination, the investigation should be expanded to assess possible impacts to the shallow groundwater system.

Site 48: Analytical data indicated BNA TICs in soil samples. The significance of the detected BNA TICs is not clear because the compounds were not positively identified. Additional soil samples may be needed to assess the nature and magnitude of the contaminants.

Site 49: Tetrachloroethylene, BNAs and metals were identified in the sediments from the chemical disposal pit. The presence of these compounds in the pit sediments suggests contaminants were placed in the pit and released, through the pit drain, to the storm drainage system. Contaminants may have been released to the soil through fractures and/or pipe fittings in the storm drain system. Additional soil sampling is required to assess the nature and extent of contamination.

Site 50: Low concentrations of BNA compounds and metals indicate soil contamination beneath Building 103. Additional study should be completed to assess shallow soil contamination beyond the foundation walls of Building 103.

Site 53: Mercury and nitrate esters were detected in sediment samples from the sanitary sewer manholes. The concentration detected may represent residual levels of discharges from Building 102. Contaminants may have been released to the soils adjacent to sewer lines via fractures and/or pipe fittings. The soil directly adjacent to the sewer pipes from Buildings 101, 102, and 103 should be further sampled for mercury and nitrate esters to assess the potential for impact.

Site 54: Data indicate detectable concentrations of mercury in the building materials of Building 101 and as residue on area surfaces. This area of Building 101 should remain closed to personnel. Additional study should be completed to evaluate the extent of mercury with the final objective being the safe and adequate removal of contaminated building materials.

Site 55: Data indicate that low concentrations of mercury are present in the building materials of Building 102 and as residue on area surfaces. Building 102 should remain closed. Additional

investigation should be completed to evaluate the extent of mercury contamination with the final objective being the safe and adequate removal of contaminated building materials.

Site PW: Iron and aluminum were detected at elevated concentrations in production wells PW3A and PW09. These metals are not believed to represent environmental impacts and could possibly represent background concentrations. Tetrachloroethylene was detected at low concentrations in the groundwater sample from production well PW07. Quarterly sampling is recommended for this well to monitor fluctuations in VOC concentrations.

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DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
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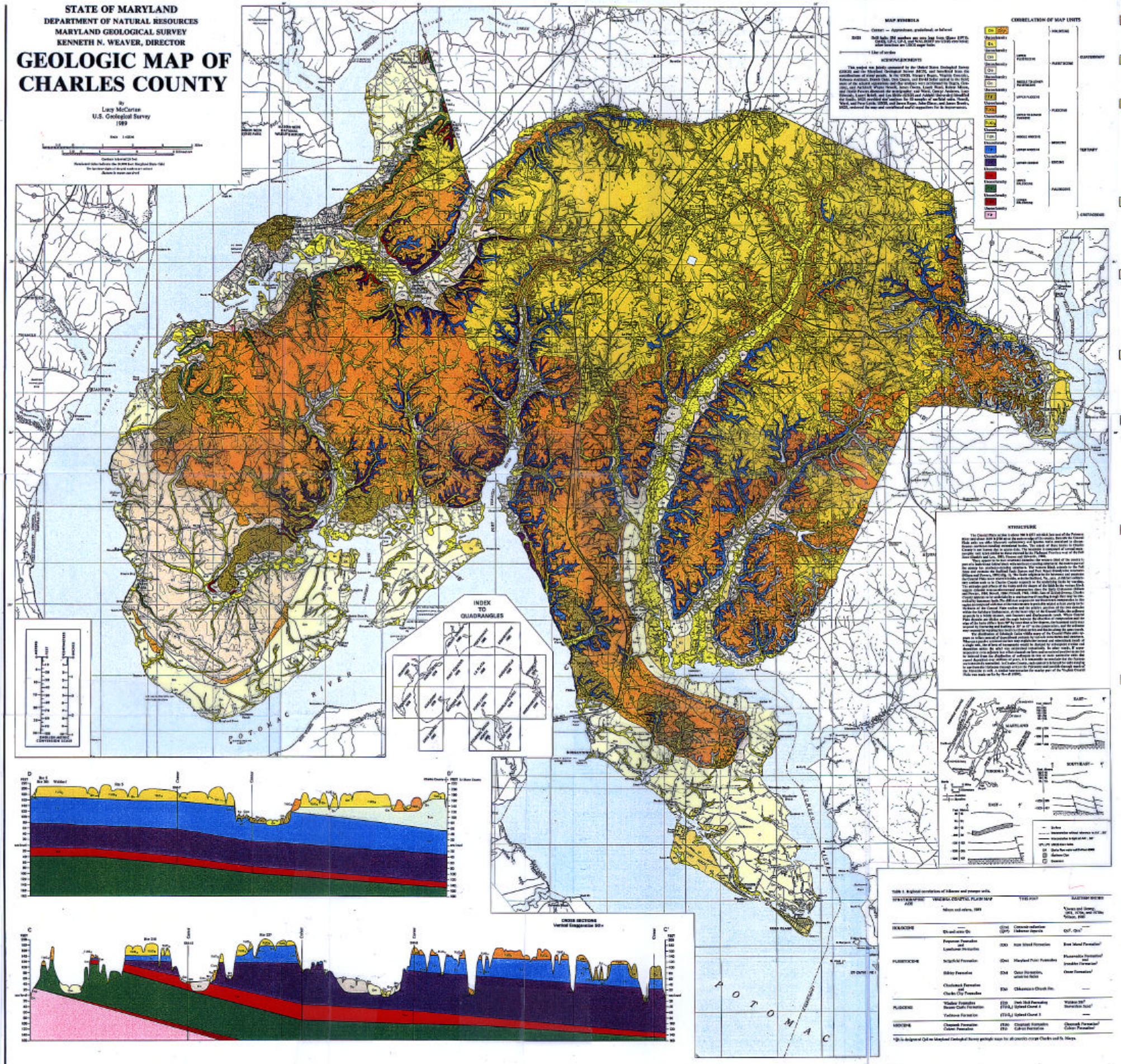
GEOLOGIC MAP OF CHARLES COUNTY

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