UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION III

STATEMENT OF BASIS

United States Naval Academy
ANNAPOLIS, MARYLAND

Prepared by
Office of Remediation
Land and Chemicals Division
November 2014

Table of Contents

Tables

Figures

Attachments

Acronyms

AOC	Area of Concern
AR	Administrative Record
AST	Aboveground Storage Tank
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act
CMS	Corrective Measures Study
COC	Contaminants of Concern
COMAR	Code of Maryland Annotated Regulations
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
FDRTC	Final Decision and Response to Comments
HSWA	Hazardous and Solid Waste Amendments
HBN	Health Based Number
IC	Institutional Controls
IM	Interim Measures
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NOV	Notice of Violation
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic Aromatic Hydrocarbon
PQL	Practical Quantification Limit
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RSL	Regional Screening Level
SB	Statement of Basis
SDWA	Safe Drinking Water Act
SWMU	Solid Waste Management Unit
µg/L	Micrograms per Liter
USNA	United States Naval Academy
UST	Underground Storage Tank
VI	Verification Investigation
WGS	World Geodetic System

Section I: Introduction

The United States Environmental Protection Agency (EPA) has prepared this Statement of Basis (SB) to solicit public comment on its proposed remedy for the United States Naval Academy (USNA) located in Annapolis, Maryland (Facility) (see Figure 1). In September 1990, EPA issued a RCRA Corrective Action Permit (Permit) to the United States Department of the Navy on behalf of USNA to, among other things, characterize the extent of contamination at the Facility and evaluate remedy options. For purposes of this document, the Permittee shall be referred to as USNA. The proposed remedy addresses all known corrective action units (Units) consisting of both Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified in the Permit, as summarized in Table 1 and shown on Figures 2 and 4 attached hereto. EPA's proposed remedy consists of No Further Action (NFA) for the Units that have been investigated pursuant to the Corrective Action Program and where the investigations revealed that the Units pose no unacceptable risk to human health and the environment. EPA is also proposing the implementation of, compliance with, and maintenance of land use restrictions. This SB highlights key information relied upon by EPA in making its proposed remedy.

The Facility is subject to EPA's Corrective Action Program under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. §§ 6901 et seq. (Corrective Action Program). The Corrective Action Program is designed to ensure that certain facilities subject to RCRA have investigated and cleaned up any releases of hazardous waste and hazardous constituents that have occurred at their property. Maryland is not authorized for the Corrective Action Program under Section 3006 of RCRA. Therefore, EPA retains primary authority in the State of Maryland for the Corrective Action Program.

This document summarizes the information that can be found in the work plans and reports submitted by the USNA to EPA during the Verification Investigation (VI), RCRA Facility Investigation (RFI), Interim Measures (IM) Study/Corrective Measures Study (CMS) processes. This document explains EPA's rationale for recommending the proposed remedy. The Administrative Record (AR) for the Facility contains all documents, including data and quality assurance information, on which EPA's proposed remedy is based. See Section V, Public Participation, for information on how you may review the AR. The index to the AR is an attachment to this SB (Attachment 2).

Information on the Corrective Action Program, as well as a fact sheet for the Facility, can be found by navigating to http://www.epa.gov/reg3wcmd/ca/ca_facilities.htm.

Section II: Facility Background

A. Academy Campus – Perry Center

The USNA was founded in 1845 as the Naval School and encompassed 10 acres of Old Fort Severn in Annapolis, Maryland. In 1850, the Naval School became the USNA. The USNA eventually expanded to 338 acres after filling in shoreline along the Severn River. The USNA is a four-year service academy that prepares midshipmen to be professional officers.

The USNA is located between the south bank of the Severn River and historic downtown Annapolis, Maryland. The Perry Center is located in the northwest portion of the USNA campus. The Perry Center consists of several buildings utilized for material storage, USNA vehicle repairs, bus parking, and construction equipment storage. Two SWMUs [SWMU 6 (Perry Center Dry Cleaning Plant) and SWMU 8 (Perry Center Gasoline Station)] and four AOCs [AOC 3 (Perry Center Wash Rack), AOC 4 (Perry Center Ready Room), AOC 12 (Perry Center Bus Heater Power Feeder Site), and Storm Water Sewer System] are located within the Perry Center. A summarized description of these Units and AOCs is provided below, in Table 1, and on Figure 3. The history of the SWMUs and AOCs is discussed in further detail in Section III.

1. SWMU 6

SWMU 6, the Perry Center Dry Cleaning Plant, is the campus laundry and is housed within Building 580. SWMU 6, built in 1970, provides dry cleaning services for active and retired Navy personnel. Three underground storage tanks (USTs) were used in the dry cleaning process to store naphtha before being replaced by aboveground storage tanks (ASTs). The USTs were removed in April 1990 after being in service for 20 years. Depth to groundwater at SWMU 6 varies from 11 to 14 feet below grade. Groundwater flows from SWMU 6 towards SWMU 8 in the direction of College Creek.

2. SWMU 8

SWMU 8, the Perry Center Fueling Station, is located in the northwest portion of the USNA campus situated between Buildings 571 and 579. The SWMU surface is primarily constructed of concrete and asphalt. SWMU 8 housed the repair facilities for USNA vehicles. Four USTs, two containing gasoline, one containing diesel, and one containing waste oil, and the pumping station were situated at the highest elevation at this SWMU. The Unit gently slopes off to the south and southwest and a steeper slope off to the east of the USTs. Employee parking was formerly located to the east and north of the USTs, and parking for USNA vehicles occurred southwest of the USTs.

3. AOC 3

Installed in about 1974, AOC 3, the Perry Center Wash Rack, is located in the western end of the USNA campus. AOC 3 consists of a concrete pad with a center drain that was tied into the sanitary sewer system since approximately 1986. The drain collected runoff from the concrete pad to the sanitary sewer and discharge from the bus toilets. AOC 3 also contains a steam generator and a 165-gallon tank (cleaning solution storage tank) housed in a small building adjacent to the concrete pad. The area is primarily used for washing USNA vehicles and, on occasion, for steam cleaning.

4. AOC 4

AOC 4, the Perry Center Ready Room and Surrounding outside Storage Yard, is situated just south of the AOC 3 on the western side of the Perry Center. The Public Works Shop uses the drain-free Ready Room to store latex and oil based paints, cleaning solutions, sealers, thinners, roof coatings, etc. and the surrounding yard area for storage of wood and metal building material. All material is new construction building material stored in its original packaging.

5. AOC 12

AOC 12, the Perry Center Bus Heater Power Feeder Site, is paved with asphalt that slopes slightly to the southwest with surface runoff flowing southerly to College Creek. AOC 12 was initially used for parking vehicles. In addition, it is believed that a concrete batch plant was operated at this AOC. Currently the AOC is used for storage of construction material and equipment.

From sometime in 1991 to1992, workers excavating a trench while installing electrical conduit noticed a "shoe polish" type odor and several small patches (less than 1 foot diameter in size) of discolored soil. On December 12, 1991, USNA conducted an inspection and confirmed the presence of discolored soil on the northern end of a 2 feet wide by 1.5 feet deep by 100 feet long trench.

6. Storm Water Sewer System

The Perry Center sewer system discharges to the College Creek. To evaluate the potential impact of the Facility operations on College Creek, the Permit required the characterization of run-off and discharges to the Perry Center storm water sewer system. The Permit further required the USNA to collect sediment and surface water samples of the sewer system.

B. SWMU 13 - Arundel Estates Area (formerly Wherry Housing Area)/Former Storage Yard One, Incinerator, and Rubbish Pile

The Arundel Estates Area is located northwest of the main USNA campus. SWMU 13 encompasses approximately 7 acres in the vicinity of the Arundel Estates Area along the southern shore of Shady Lake (Figure 4).

Beginning in the early 1900s, wet garbage and refuse generated at the various Severn River Naval Command activities were burned in an incinerator located in this area. During the time of incinerator operations, some refuse, wood, and scrap metal were deposited along the lake shoreline. Several written complaints about operations in the area (heavy smoke, odors, floating refuse, and scattered debris) are documented in the historic records. Results from the remedial investigation indicate that SWMU 13 is underlain by a thick sequence of fill with cinders and layers of ash. Beginning August 30, 1937, garbage from the USNA was routed to the Annapolis Municipal incinerator. The incinerator operations at SWMU 13 were discontinued on September 1, 1937. Sometime after September 1, 1937, SWMU 13 was used as a scrap metal storage area until September 1944 when the storage sheds at the Unit were scheduled to be dismantled. No

structures related to historic operations currently exist at SWMU 13, and a portion of the Unit is currently occupied by the Arundel Estates housing complex.

C. Geology and Hydrology

Beneath the USNA campus there are four significant aquifers. The two major geology groups underlying the USNA campus are comprised of Quaternary Holocene and the Tertiary Paleocene. The Quaternary Holocene is classified as artificial fill and is described as heterogeneous un-stratified material, such as sand, gravel, clay, slag, construction debris, and dredge spoil. Most of this material is situated along the shoreline. The Tertiary Paleocene (Aquia Formation) consists of sand, clean to moderately clayey, and calcareous sandstone.

Two of the aquifers are in the Patapsco Formation in sands. The third aquifer is in a sand layer in the Magothy and Raritan Formation. The fourth aquifer is the uppermost and in the Aquia Greensand.

The geology in the area of SWMU 13, as documented by the VI prior to the installation of a soil cover, consisted of grass and topsoil at grade, followed by sand and silt in the next 4 to 7 feet below grade. Fill material consisting of sand, silt, gravel, ash, glass fragments, burnt wood, cinders and other unidentifiable debris were found from about 4 to 16 feet below grade. Below the fill material, either, sand, silt or clay was encountered.

At lower elevations in SWMU 13, groundwater was encountered at approximately 15 feet below grade and under unconfined conditions. Under confined conditions at higher elevations, groundwater was encountered at approximately 29 feet below grade. Water levels were observed predominately below the ash and cinder layers and occurred in fill or the native material. Based on the groundwater elevation measurements, the groundwater flow direction is north-northeasterly toward Shady Lake. The estimated groundwater flow rate, based on a gradient of 0.01 feet per foot, is 0.009 feet per day (approximately equivalent to 3 feet per year), which makes it a low yielding aquifer.

Section III: Summary of Environmental History and Investigations

A. Environmental History

Initially, three SWMUs (6, 8, and 13) and two AOCs (3 and 4), and the sewer system were identified as requiring further assessment. In accordance with Reporting Requirements of Part I Section B.11 of the Permit, USNA reported an additional release. The release area was later classified as an additional AOC for the Facility (AOC 12) and addressed under the Permit. EPA currently is overseeing corrective action at the Facility under the Permit. Numerous investigations and actions have been completed and documented in various reports since the issuance of the Permit, as summarized below.

The Corrective Action requirements for the SWMUs and AOCs identified in the Permit have been completed, as summarized in Table 1. Figures 3 and 4 show the general location of each Correction Action Unit and AOC relative to the boundaries of the current Permit and investigations.

Table 1
Permitted Parcels (SWMUs and AOCs Investigated Under Permit)

Solid Waste Management Units/Areas of Concern	Description	Current status
SWMU 6 – Perry Center Dry Cleaning Plant	Dry cleaning services in Building 580. Three 20 year old USTs used to store naphtha. Replaced with three ASTs in 1990.	Sampling results from the VI and confirmatory sampling indicate no need for further action.
SWMU 8 – Perry Center – Gasoline Station, abandoned underground storage tanks	Fueling station servicing the USNA campus with four USTs.	Results of MDE lead agency investigations, remedial actions, and groundwater monitoring addressed the health risks due to the release identified, therefore, no need for further action.
SWMU 13 – Arundel Estates (formerly Wherry Housing Area, storage Yard Number One, old incinerator and former rubbish pile)	A 55-gallon drum that was used, starting in 1988, to collect used paint thinner in the Carpenter Shop in Building 15.	RFI Phase II identified potentially unacceptable ecological risks in surface soil and potentially unacceptable human health risks in subsurface soil and groundwater.
AOC 3 – Perry Center – Steam Cleaning Unit	Vehicle washing and steam cleaning. Concrete pad with center drain used to collect runoff from cleaning processes and discharge from bus toilets. Adjacent to the pad is a small building containing a steam generator and 165-gallon cleaning solution tank.	No evidence of release.
AOC 4 – Perry Center – Supply Storage, ready room and surrounding outside storage yard	Building and yard area utilized by the Public Works Shop for storage of latex- and oil-based paint, cleaning solutions, sealers, thinners, roof coatings and wood and metal building material.	No evidence of release.
AOC 12 – Perry Center – Bus Heater Power Feeder Site	Formerly used for vehicle parking and presently used for storage of construction material and equipment. A nitrobenzene release to soil was identified during excavation of a trench for the installation of an electrical conduit in 1991-1992.	RFI Phase I data demonstrated no need for further action.
Perry Center – Storm Sewer System	The Permit required an assessment of the impact to surface waters and sediments adjacent to the Facility. The characterization of the discharge from the storm sewer system was included in this assessment since the sewer discharged to the adjacent surface water.	RFI Phase I indicates no need for further action.

Complete details, including sampling data, can be found in the individual reports that are listed in the Administrative Record, Attachment 2.

B. Environmental Investigations

In accordance with the Permit, USNA was required to conduct a VI to determine whether there was a release of hazardous waste or hazardous constituents requiring further action at the Units. A VI was conducted at SWMU 6, SWMU 13, AOC 3, and AOC 4. A release had already been documented at SWMU 8. Therefore, SWMU 8 underwent remediation, and a VI was not required to be performed at this SWMU. However, storm water sampling of Perry Center, which includes SWMU 8, was performed as part of the VI. All investigative results were compared against the Permit-specified Health Based Numbers (HBNs) and Permit Practical Quantification Limits (PQLs) listed in Attachment 1.

1. Perry Center

The EPA-approved VI Report and Final Preliminary RFI Report recommended No Further Action (NFA) for the Perry Center AOCs and SWMUs by USNA, as described below.

a. SWMU 6

Two investigations were conducted at SWMU 6 to assess whether there was a release from the SWMU 6 dry cleaning operation and UST systems. The investigations were conducted in August 1992 and June 1994. In 1992, during the VI, subsurface soil and groundwater samples were collected and analyzed for volatile organic compounds (VOCs) and inorganic compounds listed in Attachment 1. Methanol and several inorganic constituents were detected above the applicable constituent PQL and/or HBNs in the soil. Methanol was the only constituent detected that required further characterization assessment. The inorganic constituent concentrations were very low and considered to be indicative of natural soil conditions in the area since these constituents were not associated with the types of activities performed at this SWMU. Therefore, the VI report recommended no further assessment of the inorganic constituents. However, further investigation for methanol during the RFI Phase I was recommended to verify its presence. Confirmatory soil sampling for methanol was conducted prior to the RFI Phase I in 1994 during the Perry Center SWMU 6 soil investigation. Methanol was not detected in the confirmatory soil sample results. No further action was recommended for the assessment of the soil as a result of the confirmatory soil sampling.

Several inorganic constituents exceeded the Permit PQL and HBN total and dissolved phase concentrations in the VI groundwater samples. The concentrations of these constituents are considered to be representative of natural groundwater concentrations and not associated with the activities at SWMU 6. Therefore, no further assessment of the groundwater in the SWMU 6 area was recommended.

b. SWMU 8

Maryland Department of the Environment (MDE) tank closure summary records from 1989 state that tank testing of three (3) 10,000-gallon USTs containing gasoline and diesel; and one (1) 550-gallon UST containing waste oil, showed a leak from the diesel tank piping resulting in a release to soil and groundwater. The 4 USTs, associated piping, and approximately eight tons of petroleum-contaminated soil were removed in April 1990. After the removal of the waste oil

UST, waste oil leaked from an uncapped pipe leading from the service station to the UST for over a year. It was reported that the leakage caused the contamination of a small volume of soil.

New tanks were installed in June 1991 to replace those that were removed in 1990. MDE conducted an inspection of the Facility and, as a result, issued a Notice of Violation (NOV) on April 29, 1992. The NOV required USNA to develop and implement a remediation plan for SWMU 8. EPA deferred the Permit RFI requirements to MDE to address SWMU 8 pursuant to the requirements the NOV. Under the requirements of the NOV, USNA conducted precision tests for the UST system and a Hydrogeologic Study and Remediation Investigation. Eight (8) monitoring wells were installed and sampled during the investigations conducted in the early 1990s. The investigations revealed the presence of free product in two wells, volatile and semi-volatile organics typical of fuels and waste oils in two other wells, and no compounds observed in the remaining four wells that were sampled. An extraction and groundwater remediation treatment system was installed and operated from 1992 to 1993. The remediation system was discontinued with MDE-approval, due to its ineffectiveness in removing free product. As a result, the free product was hand bailed for several years until the product was no longer detected. On October 14, 1998, MDE issued a letter notifying USNA that, based on the removal of liquid phase hydrocarbons from the monitoring wells and site observations, no further remediation was necessary. In November 2006, USNA removed the USTs permanently without replacing them.

c. AOC 3

In accordance with the Permit, USNA performed a waste analysis during the VI to determine whether waste managed at the AOC 3 contained hazardous waste or hazardous waste constituents. The waste analysis, which included a materials inventory and document review, identified that cleaning solution and deodorizing solution were discharged onto the ground at this Unit. Also based on the waste analysis, it was determined that: 1) the cleaning solution contained four constituents that did not meet the definition of a hazardous constituent, 2) the deodorizing solution contained three hazardous constituents listed in the Permit, and 3) the deodorizing solution contained less than one percent solvents and those solvents were in concentrations well below the applicable Permit HBN. Thus, no investigative activities were required at this AOC.

d. AOC 4

A waste analysis, which included a materials inventory and document review, was performed at AOC 4 during the VI, as required by the Permit. Materials such as latex and oil-based paints, cleaners, and solvents were stored in the Ready Room. Although many of these materials contain hazardous constituents, they were products in the original manufacturer's packaging, and there were no signs of leaking or spillage. Therefore, no investigative activities were required at this AOC.

e. AOC 12

i. Preliminary Assessment and Verification Investigation

Two inspections and three soil sampling events were conducted at AOC 12. Workers excavating a trench for an electrical conduit noted several small patches of discolored soil with a "shoe polish" odor. USNA collected a sample of the soil. The results of the analysis indicated the contaminated soil contained nitrobenzene.

On December 12, 1991, USNA conducted the first inspection of the AOC 12 trench area and collected additional soil samples and performed biased semi-volatile analyses. The results of the analysis confirmed the presence of nitrobenzene.

During the second inspection on March 25, 1992, it was noted that the contaminated soil was removed and later disposed of off-site after being temporarily stockpiled on-site. The 2 x 2.5 x 250 foot trench was excavated and backfilled with gravel. Based on the observations of a second inspection, further verification sampling and remediation was proposed and documented in the Soil Sampling and Removal Plan dated June 12, 1992. The VI was implemented from July to August 1996. The VI consisted of a 60 x 60 foot grid subsurface soil sampling and removal plan to address the contaminated soil identified by the inspections. It was determined from this investigation that the areal extent and nature of soil contamination was adequately characterized. Nitrobenzene was not detected in these soil sample results.

Nitrobenzene is a semi-volatile organic chemical which is not very mobile in the soil due to its high organic carbon partitioning coefficient and low volatility. Thus, in groundwater, nitrobenzene would migrate very slowly. College Creek is approximately 200 feet down-gradient of this AOC. Therefore, the concentration of nitrobenzene would considerably reduce when it reaches College Creek, 200 feet down-gradient. As a result, no further investigation of AOC 12 was proposed based on the chemical nature of the contaminant.

f. Perry Center - Storm Water System

ii. RFI Phase I

Two rounds of sediment and surface water samples were scheduled to be collected from the Perry Center Storm Water System during the VI, in accordance with the VI work plan. An inspection of the sewer system in September 1992 revealed the absence of sediment, therefore, the VI report recommended collecting sediment samples from College Creek to evaluate the potential impact of the Facility operation on the Creek.

In November 1992, USNA collected storm water samples. During the VI, several volatile compounds (chloroform, 4-methyl-2-petanone, ethylbenzene, methanol and xylenes) were detected in the storm water samples below the Permit-specified HBNs. Three inorganic compounds (barium, chromium, and lead) were detected in the storm water; two were below the Permit-specified HBNs in the unfiltered analysis. Lead was detected in the unfiltered samples below the Permit HBNs, but was not detected in the filtered samples. The absence of lead in the filtered samples suggested that it was absorbed to suspended particulate material in the storm water.

The second round of storm water and College Creek sediment sampling was performed during the RFI Phase I in 1996. Three sediment and storm water samples were collected from the same locations, two from manholes within the Perry Center and one at the Facility outfall, which discharges to the College Creek. Several inorganic constituents were detected in the sediment samples below the Permit-specified HBNs. The storm water samples also contained several inorganic constituents. Lead was detected at concentrations slightly exceeding the Permit-specified HBN, however, no source of the lead in the storm water was identified. It was further determined that lead concentrations would be significantly reduced by the discharge into College

Creek, which is tidal and more than 400 feet wide at discharge points. Thus, no further investigation of the storm water system was recommended.

2. SWMU 13 - Arundel Estates Area (formerly Wherry Housing Area)/Former Storage Yard One, Incinerator, and Rubbish Pile

a. Preliminary Assessment and Verification Investigation

A Preliminary Assessment, three comprehensive investigations, and two sampling events were performed at SWMU 13. The Preliminary Assessment was a compilation of correspondence taken from the Facility archives regarding the Facility background information. The VI was conducted at SWMU 13 in August 1992. Five borings and three groundwater wells were installed. Twenty-five soil samples, three groundwater samples, and two surface water and sediment samples of Shady Lake were collected and analyzed for VOCs listed in the Permit and inorganic compounds listed in Attachment 1.

The boring data showed that the subsurface geology consisted of grass and topsoil at grade, followed by sand silt in the next four to seven feet below grade. Fill material, consisting of sand, silt, gravel, ash, glass fragments, burnt wood, cinders, and other unidentifiable debris, was encountered from 4 to 6 feet below grade. Below the fill material, either sand, silt or clay was found.

There were three VOCs detected in the groundwater samples, of which two of the compounds were not detected in concentrations above their respective PQLs. The third VOC, methylene chloride, was detected in several laboratory blanks and one well sample above the Permit-specified PQL. An explanation could not be provided for the detection in the well, and it was assumed that laboratory contamination caused the detection in the lab blanks. For the total inorganic analysis, several inorganic constituents were detected in at least one of the wells exceeding the Permit-specified PQLs. The Permit-specified HBNs for four inorganic constituents were exceeded in at least one total inorganic groundwater sample. There was only one exceedence above the Permit-specified PQLs in the dissolved inorganic analyses (barium). These elevated concentrations of constituents detected in the total and dissolved inorganic analyses were representative of groundwater and soil and not solely groundwater due to the silty nature of the samples.

Within the soil, trace to low levels of volatile organics, including methylene chloride were detected in several samples. Methylene chloride was detected in concentrations above its PQL in a number of samples, however, the results were not substantially above the level reported in the lab or field banks. Methanol was also detected in several samples, and the concentrations were above its PQL, but not its HBN. Inorganics constituents were detected in most samples, and a number of these constituents were above their PQLs (arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, and silver) and their HBNs (arsenic, barium, beryllium, cadmium, and lead). The major contaminant of concern identified in the soil at SWMU 13 was lead. It was detected at 4.5 feet and greater depths at levels greatly exceeding the Permit-specified PQLs and HBNs.

Within the sediment, only one volatile organic constituent was detected (acetone), but it was below its PQL. A number of inorganic constituents were detected, and a number of constituents were above their PQLs (antimony, barium, beryllium, cadmium, chromium, lead, mercury, and

nickel) and their HBNs (antimony, beryllium, cadmium, and lead). Similar to that of the results in the soil, the major contaminant of concern was lead, as it was detected in concentrations significantly above its HBN.

Results from the three surface water samples of Shady Lake showed no detected organic volatile constituents. A number of inorganic constituents were detected. Of those detected, only barium and lead were above their Permit-specified PQLs. Lead was the only constituent to exceed its HBN. The results were also compared against MDE's Toxic Substance Criteria for Ambient Surface Water, which are based on dissolved concentrations, and only lead exceeded the Toxic Substances Criteria for Aquatic Life, Chronic Exposure. Because these lead exceendences were associated primarily with unfiltered samples, it is probable that the contamination was associated with the presence of sediment in water.

Based on the findings of the VI, it was recommended that a RFI be performed that included conducting groundwater monitoring, an ecological risk assessment, human health risk assessment, and a geophysical investigation.

b. Phase I RCRA Facility Investigation

In 1996, the Phase I RFI was conducted and consisted of periodic groundwater monitoring and an ecological assessment to evaluate the potential impact of SWMU 13 contaminant migration to the Shady Lake and Severn River. The Phase I RFI also included a Human Health Risk Assessment to evaluate the potential risk posed by SWMU contamination on the Wherry Housing Area residents. The analytical data results were compared to contaminants of concern (COC) screening values. The COC screening values were derived from the Regional Screening Level (RSL, formerly referred to as USEPA Region III Risk Based Concentrations (RBC)). Where screening values were not available in the RBC tables (i.e., lead), the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (OSWER Directive 9355.4-12, August 1994) was used for soil screening. For groundwater, the action level provided in the RBC table was applied. Sediment results were compared to guidelines established by the National Oceanic and Atmospheric Administration (NOAA).

To determine the lateral and vertical extent of the fill material, a geophysical investigation was also performed. The objective of the geophysical investigation was partially accomplished. The areal extent of the fill material was determined utilizing the data from the geophysical investigation in combination with the boring log data and subsurface soil analytical results. Fill material comprised of demolition or construction debris at a depth of approximately three to four feet below grade surface was identified in the eastern corner of the playground. In the center of SWMU 13, another three areas measuring approximately 120 feet long by 60 feet wide in total were identified. One area surrounded the shed, the second area was northwest of the first area, and the third area was adjacent to the second area extending to the northwest. The fill material in these areas was believed to be made up of brick or other debris, such as concrete. The thickness of the fill material was not determined with the geophysical equipment.

The groundwater monitoring samples were analyzed for total and dissolved inorganic compounds. Methylene chloride was analyzed at the well where it was detected during the VI to verify its presence. The concentration of methylene chloride did not exceed the COC screening value and was, therefore, considered a laboratory error. Numerous inorganic constituents were detected in the groundwater samples at low levels in both the totals and dissolved phase samples.

Antimony, arsenic, barium, iron, and manganese exceeded the COC in both the total and dissolved phases, but were below the appropriate Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act. As with the VI, the total suspended solids and total dissolved solids content was elevated and may have influenced the increased concentrations in the inorganic groundwater samples. Lead, a COC in the subsurface soil, was only detected in the groundwater at concentrations below its MCL.

Surface and subsurface soil analytical results revealed multiple inorganic constituents (aluminum, arsenic, beryllium, chromium, iron, lead, manganese, magnesium, mercury, thallium, and vanadium) above their applicable COC screening values. Areas with elevated levels of COCs in the soil correspond to the areas identified by the geophysical investigation as locations of demolition/construction debris. Thus, EPA determined that past Facility operations, such as the former incinerator, contributed to the surface and subsurface soil elevated inorganic constituents detected.

There were elevated concentrations of several inorganic constituents, including lead concentrations, in the sediment samples near the northern fence line of the SWMU. These results indicated that the Shady Lake sediments were possibly significantly impacted by past operational activities. Therefore, further investigation of sediments in Shady Lake was recommended to assess the vertical and lateral extent of the lead contamination and quantify the human health risk. In addition, the development of a risk-based cleanup for lead was recommended.

c. Phase II RCRA Facility Investigation

The Phase II RFI Report was drafted in 2004 and was based on the following data: fish tissue sampling in 1998 and 2000, fish and crab sampling in 2002, surface soil, subsurface soil, sediment, and surface water sampling in 2003. The Phase II RFI was used to develop an ecological and human health risk assessment.

i. Surface Soil

During the Phase II RFI, two exposure areas were established to assess human health risks in surface soil based on the location relative to the fence line. The first exposure area, located north of the fence line, was evaluated for recreational use due to restricted access associated with the fence and a steep slope adjacent to Shady Lake. The second exposure area, located south of the fence line adjacent to the housing areas, was evaluated for residential and construction worker use. North of the fence line area, no potentially unacceptable human health risks were identified. South of the fence line area, potentially unacceptable human health risks were identified under the residential use scenario; primarily associated with concentrations of select inorganic constituents (vanadium and iron). However, the concentrations of these two constituents pose no greater risk to human health than background soil conditions located outside of SWMU 13.

ii. Subsurface Soil

The Phase II RFI identified potential human health risks associated with exposure scenarios that involved future construction and/or maintenance activities at SWMU 13. The primary constituents that drive these risks include select inorganic constituents, primarily lead, and Polycyclic Aromatic Hydrocarbons (PAHs). The elevated concentrations of these constituents are typically associated with subsurface ash and cinder material.

iii. Groundwater

Groundwater monitoring at SWMU 13 indicated that groundwater is contaminated within the boundaries of this Unit. The constituents, mostly metals, were present in both unfiltered and filtered analyses (represented in data tables as Total Metals and Dissolved Metals). For lead, the concentrations present in the unfiltered results were much higher than in the filtered results, indicating that the constituent is present as a suspended solid, not dissolved. The levels for lead in the unfiltered samples exceeded the MCL in some wells, but did not exceed the MCL in any of the filtered samples. For other constituents (e.g., iron and manganese), the unfiltered and filtered results were essentially the same, indicating the constituent is present mostly in solution (dissolved). Both iron and manganese were detected in some of the wells above applicable Secondary MCLs. There are three groundwater monitoring wells within the Unit, two of which are screened only within the fill material (MW-01 and MW-02). The third well, MW-03, is upgradient to the other two wells and is screened in native soils (the Aquia Formation) below the fill material (the fill material lies above the water table at that location). SWMU 13 extends to the edge of Shady Lake, and the contaminated groundwater discharges into Shady Lake.

EPA expects to return usable groundwater to its maximum beneficial use, which is generally selected to be levels acceptable for drinking. However, when waste is left in place, final cleanups should achieve groundwater cleanup levels at and beyond the waste unit boundary. This means that EPA does not expect to clean up groundwater located within the boundaries of a waste management unit itself to drinking water levels. In the case of SWMU 13, groundwater monitoring within SWMU 13 indicates that groundwater is contaminated at certain locations within the boundaries of the Unit, especially where the groundwater is in contact with the waste material. SWMU 13 extends to the edge of Shady Lake, and the contaminated groundwater discharges into Shady Lake. Since there is no location downgradient of SWMU 13 where groundwater could be used, the appropriate analysis is to determine if the groundwater discharge into Shady Lake represents a risk to human health or the environment that must be addressed.

Surface water in Shady Lake was evaluated for human health and ecological risks during the Phase II RFI. The ecological risk assessment (ERA) found that manganese was above the screening toxicity value for surface water. Groundwater discharging from SWMU 13 could be contributing to the surface water manganese load because groundwater concentrations for manganese at the groundwater well closest to Shady Lake (MW-01), which ranged in concentration from 145 micrograms per liter (µg/L) to 212 µg/L, exceeded the manganese concentrations measured in Shady Lake surface water, which ranged from 21.9 to 38.7 µg/L. Manganese concentrations in well MW-02 ranged from 12.2 to 30.9 µg/l, and in well MW-03 (the well screened in native soil below the waste) manganese ranged in concentrations from 5,030 to 8,070 µg/l. The Phase II RFI conducted an analysis comparing soil and sediment data to background. The Phase II RFI concluded that manganese was not detected above background in either SWMU 13 soils or the Shady Lake evaluation in the ERA. A background evaluation of manganese in groundwater was not conducted in sediments. The ERA further concluded that manganese is not a site-related COC, but instead such levels of manganese are expected to occur in brackish marine waters. The ERA concluded that manganese does not warrant further action. However, at SWMU 13, the well with the highest manganese concentration was the furthest upgradient well (MW-03), was screened below waste material in native soil (Aquia Formation). The wells screened within the waste material (MW-01 and MW-02), have lower concentrations, which suggests they are being impacted from an upgradient groundwater

manganese load from the Aquia Formation, rather than from the ash and cinder waste at SWMU 13. Therefore, cleanup of groundwater to protect surface water from waste migration from SWMU-13 is not needed.

iv. Sediment

PAHs and lead were initially identified in the Phase II RFI as a potential concern for ecological receptors in Shady Lake. During a June 28, 2007 meeting among EPA, MDE and USNA, EPA indicated that the risk to aquatic organisms associated with the PAHs is not unacceptable with consideration of the bioavailability of these constituents to aquatic organisms. Consistent with the final conclusions of the Phase II RFI Ecological Risk Assessment, risks to aquatic wildlife populations from the presence of lead in sediments are also considered to be negligible. Therefore, no further action is proposed for the sediment within Shady Lake.

v. Surface Water

Surface water in Shady Lake was evaluated for human health and ecological risks during the Phase II RFI. The results for the Human Health and Ecological Risk Assessments indicated that there were no Facility related COCs above either human health or ecological risk screening levels. Therefore, no further action was identified for the surface water within Shady Lake.

d. Interim Measures

During the June 28, 2007 meeting, EPA expressed concern regarding potentially unacceptable ecological risks associated with elevated lead concentrations in surface soil located in the northern portion of SWMU 13 and recommended an interim measures (IMs) remedial action to address the issue. The soil cover IMs remedial action was undertaken to address the potentially unacceptable ecological risk associated with elevated lead concentration in surface soil located in the northern portion of SWMU 13. The IMs consisted of excavating and re-grading the existing steep and irregular slope along Shady Lake to create a stable slope with the placement of: 1) an engineered clean soil cover over designated areas with elevated lead concentration in surface soil; 2) a vegetative layer consisting of grass seeding; and 3) a temporary irrigation system. USNA added landscaped shrubs and trees for aesthetics. The IM construction was completed in Summer/Fall 2009, as documented in the *Interim Measures Completion Memorandum.*

Section IV: Proposed Remedy

A. Proposed Remedy

EPA's proposed remedy for the Facility consists of the following:

1) SWMUs 6 and 8; AOCs 3, 4, and 12; and the Perry Center Storm Water Sewer

EPA is proposing a Corrective Action Complete without Controls determination for these Units. The results from the VI and RFI Phase I sampling and investigations show that constituent concentrations were either remediated to within Permit-specified HBNs or PQLs, not present above Permit-specified HBNs or PQLs, or representative of natural and background conditions in

groundwater and soil. The conditions at these Units do not present an unacceptable risk to human health and the environment.

2) SWMU 13

EPA's proposed remedy for SWMU 13 consists of the continued maintenance of the soil cover system in accordance with an EPA-approved Operation and Maintenance Plan and the implementation of and compliance with the following land and groundwater use restrictions and access and reporting requirements because some contaminants will remain in the soil and groundwater at SWMU 13 above levels appropriate for residential exposure and domestic uses:

a. Land Use Restrictions

i. SWMU 13 shall not be used in a way that will adversely affect or interfere with the integrity and protectiveness of the soil cover, including a restriction on the disturbance of surface and subsurface soil within the SWMU 13 area, and a requirement to monitor and maintain the soil cover system in the northern portion of SWMU 13.

ii. SWMU 13 shall not be used for residential purposes. Residential use refers to use for residential purposes, including single-family homes, town homes, apartment complexes and condominiums, and child/elder care facilities.

b. Groundwater Use Restriction

i. Groundwater under SWMU 13 shall not be used for any purpose other environmental monitoring and testing.

c. General

i. An annual written certification that contains a statement that land use restrictions are in place and effective shall be submitted to EPA.

ii. EPA, MDE, and/or their authorized agents and representatives, shall be provided access to the Facility property to inspect and evaluate the continued effectiveness of the final remedy and, if necessary, to conduct additional remediation to ensure the protection of the public health and safety and the environment based upon the final remedy to be selected by EPA in the Final Decision and Response to Comments (FDRTC).

B. Implementation

The proposed components of the final remedy for the Facility shall be instituted through an enforceable mechanism such as a permit, order and/or an environmental covenant. If EPA determines that an environmental covenant is necessary, it shall be implemented at the time of transfer of the Facility to a non-federal entity and pursuant to the Maryland Uniform Environmental Covenants Act, Maryland Environment Code, Section 1-801 to 1-815 (UECA), and through compliance with the State of Maryland Well Construction Regulation, Article Title

9, Subtitle 13, Annotated Code of Maryland; Code of Maryland Regulation (COMAR), Title 26, Subtitle 4, Chapter 4, COMAR 26.04.04.

Under the proposed remedy, USNA will be required to provide a coordinate survey, as well as a metes and bounds survey, of the soil cover system, restricted soil, restricted groundwater and Facility boundaries as follows:

1. The boundary of each use restriction shall be defined as a polygon; and

2. The longitude and latitude of each polygon vertex shall be established as follows:

    a. Decimal degrees format;
    b. At least seven decimal places;
    c. Negative sign for west longitude; and
    d. World Geodetic System (WGS) 1984 datum.

Mapping the extent of the land and groundwater use restrictions will allow for presentation in a publically accessible mapping program such as Google Earth or Google Maps.

If USNA or any subsequent owner fails to meet its obligations under the enforceable mechanism selected or if EPA, in its sole discretion deems that additional corrective measures and/or land or groundwater use restrictions are necessary to protect human health or the environment, EPA has the authority after public comment, to require and enforce such additional corrective measures and use restrictions.

C. Evaluation of EPA's Proposed Remedy

This section provides a description of the criteria EPA used to evaluate the proposed remedy, according to EPA guidance. The criteria are applied in two phases. In the first phase, EPA evaluates remedy alternatives using three decision threshold criteria as general goals. In the second phase, EPA evaluates the remaining alternatives using seven balancing criteria.

The following is a summary of EPA's evaluation of the three Threshold Criteria:

a. Threshold Criteria

i. Protect Human Health and the Environment – EPA's proposed remedy protects human health and the environment by adequately eliminating, reducing, or controlling unacceptable risk through a combination of continued maintenance of a soil cover system, and the implementation of land and groundwater use restrictions to prevent potential current and future exposure to contaminants that remain in the soil and groundwater at the Facility. The controls prevent the use of impacted groundwater at the Facility and prevent or control the exposure to impacted soil remaining in place where contamination is above ecological and/or residential screening levels.

ii. Achieve Media Cleanup Objectives – EPA's proposed remedy meets the appropriate objectives based on assumptions regarding current and reasonably anticipated future land and groundwater uses. The anticipated land use for

SWMU 13 is non-residential. The Unit has contaminant concentrations in the subsurface soil above residential soil screening levels. The soil cover and the proposed ICs will control potential direct contact risks. Implementation of proposed ICs also will restrict use of and exposure to the groundwater containing contaminants above Permit-specific HBNs and PQLs.

iii. Remediating the Source of Releases – In all remedy decisions, EPA seeks to eliminate or reduce further releases of hazardous wastes or hazardous constituents that may pose a threat to human health and the environment. The majority of surface soil containing contamination above ecological screening levels was excavated and disposed of off-site. Soil migration and/or infiltration of runoff in the area of the contaminated subsurface soil is reduced by the soil cover. Implementation of ICs will ensure the integrity and maintenance of the soil cover.

b. Balancing Criteria

i. Long-Term Effectiveness – EPA's proposed remedy will maintain protection of human health and the environment by controlling exposure to any hazardous constituents that may remain in the soil and groundwater. The existing soil cover over SWMU 13 minimizes further migration of contaminants from soil into groundwater and prevents contact with soil. In addition, soil and groundwater use restrictions will be implemented through an enforceable mechanism.

ii. Reduction of Toxicity, Mobility, or Volume of the Hazardous Constituents – The reduction of toxicity, mobility and volume of hazardous constituents at SWMU 13 has already been achieved by soil excavation and off-site disposal of contaminated soil. Any residual contaminated soil will be covered by the soil cover which also reduces leaching of residuals into groundwater.

iii. Short-Term Effectiveness – EPA's proposed remedy does not involve any additional activities, such as construction or excavation that would pose short-tern risks to workers, residents or the environment.

iv. Implementability – EPA's proposed remedy is readily implementable. Land and groundwater use restrictions will be implemented and maintained. The implementation of the use restrictions is the only remaining requirement to be completed as part of the proposed remedy. Therefore, EPA does not anticipate any regulatory constraints in implementing its proposed remedy.

v. Cost – The future costs associated with this proposed remedy are operation and maintenance of the soil cover over SWMU 13 and the implementation of land and groundwater use restrictions and access and reporting requirements. The costs associated with those activities are minimal, and, therefore, EPA has determined that the proposed remedy is cost effective.

vi. Community Acceptance – EPA will evaluate community acceptance of the proposed remedy during the public comment period, which will be described in the FDRTC.

vii. State/Support Agency Acceptance – MDE is reviewing EPA's proposed remedy for the Facility and will comment or concur during the public comment period.

Section V: Public Participation

Before EPA makes a final decision on its proposed remedy for the Facility, the public may participate in the remedy selection process by reviewing this SB and documents contained in the AR for the Facility. The AR contains all information considered by EPA in reaching this proposed remedy. It is available for public review during normal business hours at:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact: Luis Pizarro
Phone: (215) 814-3444
Fax: (215) 814-3113
Email: pizarro.luis@epa.gov

Interested parties are encouraged to review the AR and comment on EPA's proposed remedy. The public comment period will last forty-five (45) calendar days from the date that notice is published in a local newspaper. You may submit comments by mail, fax, or e-mail to Mr. Luis Pizarro. EPA will hold a public meeting to discuss this proposed remedy upon request. Requests for a public meeting should be made to Mr. Luis Pizarro.

EPA will respond to all relevant comments received during the comment period. If EPA determines that new information warrants a modification to the proposed remedy, EPA will modify the proposed remedy or select other alternatives based on such new information and/or public comments. EPA will announce its final remedy and explain the rationale for any changes in a document entitled the Final Decision and Response to Comments (FDRTC). All persons who comment on this proposed remedy will receive a copy of the FDRTC. Others may obtain a copy by contacting Mr. Luis Pizarro at the address listed above.

Date: 11.4.14

John A. Armstead, Director
Land and Chemicals Division
US EPA, Region 3

Attachment 1. Health-Based Numbers and Practical Quantitation Limits

Inorganic Constituents	HBNs		PQLs	
	Soil (mg/kg)	Water (µg/l)	Soil (mg/kg)	Water (µg/l)
Antimony	30	10	20	30
Arsenic	20	50	30	10
Barium	1,000	2,000	1	20
Beryllium	0.3	1	0.2	3
Cadmium	40	5	2	1
Chromium	400	100	4	10
Lead	500	15	2	10
Mercury	20	2	0.1	2
Nickel	1,000	100	3	50
Selenium	400	50	40	4
Silver	400	200	4	2
Thallium	6	2	20	10

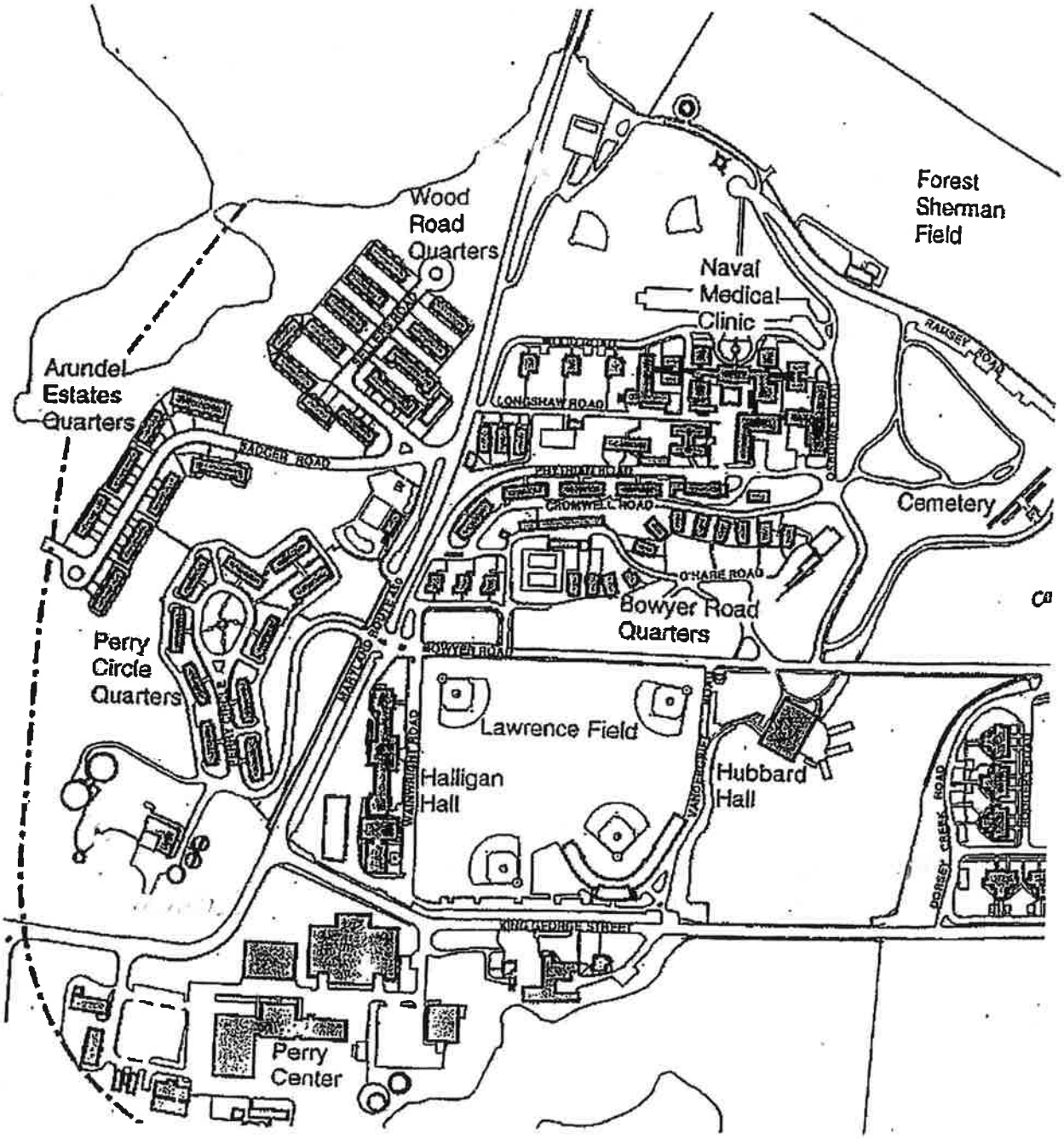
Organic Constituents	HBNs		PQLs	
	Soil (mg/kg)	Water (µg/l)	Soil (mg/kg)	Water (µg/l)
Chloromethane	90,000	3	10	10
Acetaldehyde	90,000	5	100	100
Vinyl chloride	600	2	10	10
Cumene	1,000,000	1,000	5	5
Methylene chloride	100,000	5	5	5
Acetone	1,000,000	4,000	100	100
Butanol	1,000,000	4,000	100	100
1,1-dichloroethene	2,000	7	5	5
1,1-dichloroethane	1,000,000	4,000	5	5
Total-1,2-dichloroethene	1,000,000	100	5	5
Chloroform	200,000	6	5	5
1,2-dichloroethene	10,000	5	5	5
2-butanone (MEK)	1,000,000	2,000	100	100
1,1,1-trichloroethane	1,000,000	200	5	5
Carbon tetrachloride	9,000	5	5	5
Ethyl acetate	1,000,000	30,000	100	100
Bromochloromethane	9,000	0.3	9,000	0.3
1,2-dichloropropane	20,000	5	20,000	5
Cis-1,3-dichloropropene	6,000	0.2	6,000	0.2
Trichloroethene	100,000	5	100,000	5
Dibromochloromethane	1,000	0.4	1,000	0.4
1,1,2-trichloroethane	20,000	5	20,000	5
Benzene	40,000	5	40,000	5

Trans-1,3-dichloropropene	6,000	0.2	10	10
Acrolein	1,000,000	700	5	5
4-methyl-2-pentanone (MIBK)	1,000,000	7,000	100	100
Ethyl ether	1,000,000	7,000	100	100
Tetrachloroethene	80,000	5	500	500
Toluene	1,000,000	1,000	5	5
1,1,2,2-tetrachloroethane	6,000	0.2	5	5
Isobutyl alcohol	1,000,000	10,000	100	100
Ethylbenzene	1,000,000	700	5	5
Methanol	1,000,000	20,000	100	100
Xylenes (total)	1,000,000	10,000	5	5

Attachment 2. Index to Administrative Record

September 28, 1990	Corrective Action Permit issued to USNA by EPA
November 27, 1991	EPA Letter to USNA for Notice of Deficiency Re: Perry Center Fuel Station (SWMU 8)
March 25, 1992	USNA Letter to EPA Re: Perry Center Fuel Station (SWMU-8)
April 30, 1992	EPA Letter to USNA Re: Perry Center Fuel Station (SWMU-8)
May 11, 1992	USNA Letter to MDE in Response to MDE Notice of Violation Letter
June 10, 1992	USNA Precision Test Results for USTs at Perry Center Fuel Station
July 2, 1992	Hydrogeologic Study and Remediation Plan for the Perry Center Fuel Station
March 5, 1993	Installation/Pilot Test Report Perry Center Fuel Station
April 15, 1993	MDE Letter to USNA Re: Petroleum Recovery System at Perry Center Fuel Station
February 22, 1994	Final RCRA Verification Investigation Report
July 29, 1994	Final Soil Sampling Report SWMU 6- USNA Laundry
June 12, 1998	Final Preliminary RFI Report
August 26, 1998	EPA Letter to USNA Approval of the Final Preliminary RFI Report
October 14, 1998	MDE Letter to USNA Regarding Perry Center Fuel Station
June 10, 1999	Fax Transmittal from USNA to EPA Regarding and Including October 29, 1998 Technical Memorandum Fish Ingestion Risk Evaluation, Shady Lake
August 13, 1999	EPA Letter to USNA Comments on the Fish Ingestion Risk Evaluation for Shady Lake
December 10, 1999	EPA Letter to USNA Re: Corrective Action Permit Expiration and Continuance
June 30, 2000	EPA Letter to USNA Re: Continuation of Corrective Action Permit
July 10, 2000	EPA Memorandum to the File Re: Continuance of Corrective Action Permit

July 27, 2000	EPA Letter to USNA Re: Status of Corrective Action Permit
September 20, 2000	USNA Letter to EPA Re: Status of Corrective Action Permit
December 6, 2000	EPA Letter to USNA Re: Status of Corrective Action Permit
September 27, 2002	Environmental Indicator Determination for Migration of Groundwater Under Control
November 4, 2003	EPA Letter to USNA Transmitting the Document of Environmental Indicator Determination for Current Human Exposures Under Control
June 2006	Final SWMU-13 Phase II RCRA Facility Investigation Report
October 23, 2006	EPA Letter to USNA Re: Comments on the Draft Final SWMU 13 RFI Report
December 26, 2006	Underground Storage Tank Closure Assessment Report for Perry Center Fuel Station
April 3, 2007	USNA Letter to MDE and Forms for De-registering Underground Storage Tanks for Perry Center Fuel Station
June 28, 2007	Meeting Minutes (EPA, USNA, and MDE)
August 22, 2007	EPA Letter to USNA Approval of Final SWMU 13 Phase II RCRA Facility Investigation Report with Enclosed Addendum
March 2, 2010	Interim Measures Completion Memorandum for SWMU 13
July 22, 2010	Final Addendum to Contractor Closure Report for SWMU 13 Interim Measures
July 22, 2013	E-mail from USNA to EPA Re: USTs at Perry Center Fuel Station (including the attachment UST Facility Summary for Perry Center Fuel Station)



N

0 200 400 600
Scale in Feet

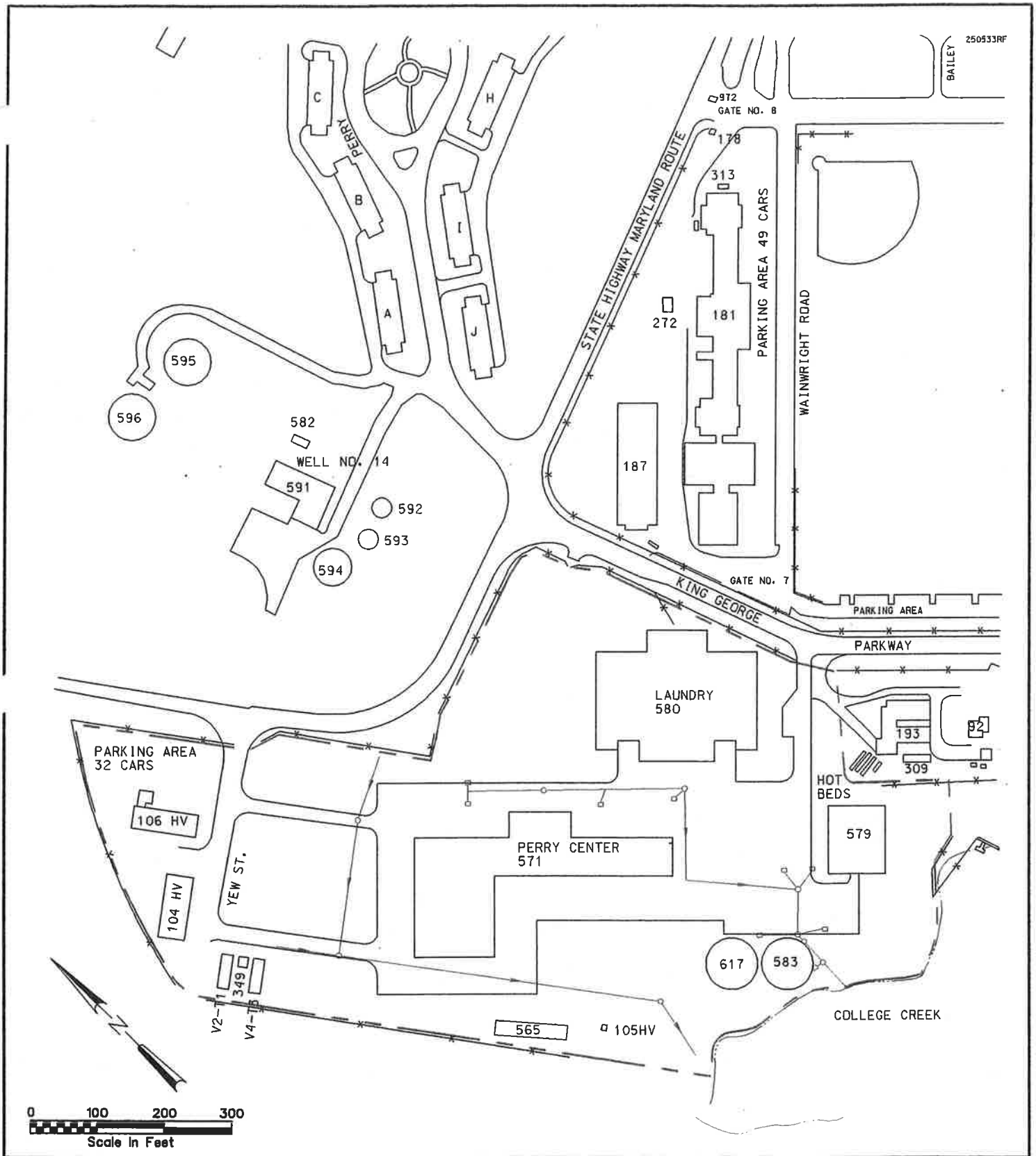
SOURCE: THE ONYX GROUP, SEPTEMBER 1996
UNITED STATES NAVAL ACADEMY
MASTER PLAN UPDATE, PG 82

FIGURE 1
USNA FACILITY

U.S. NAVAL ACADEMY
ANNAPOLIS, MARYLAND

CH2MHILL

5505s014.dlv 10-MAY-2001



LEGEND

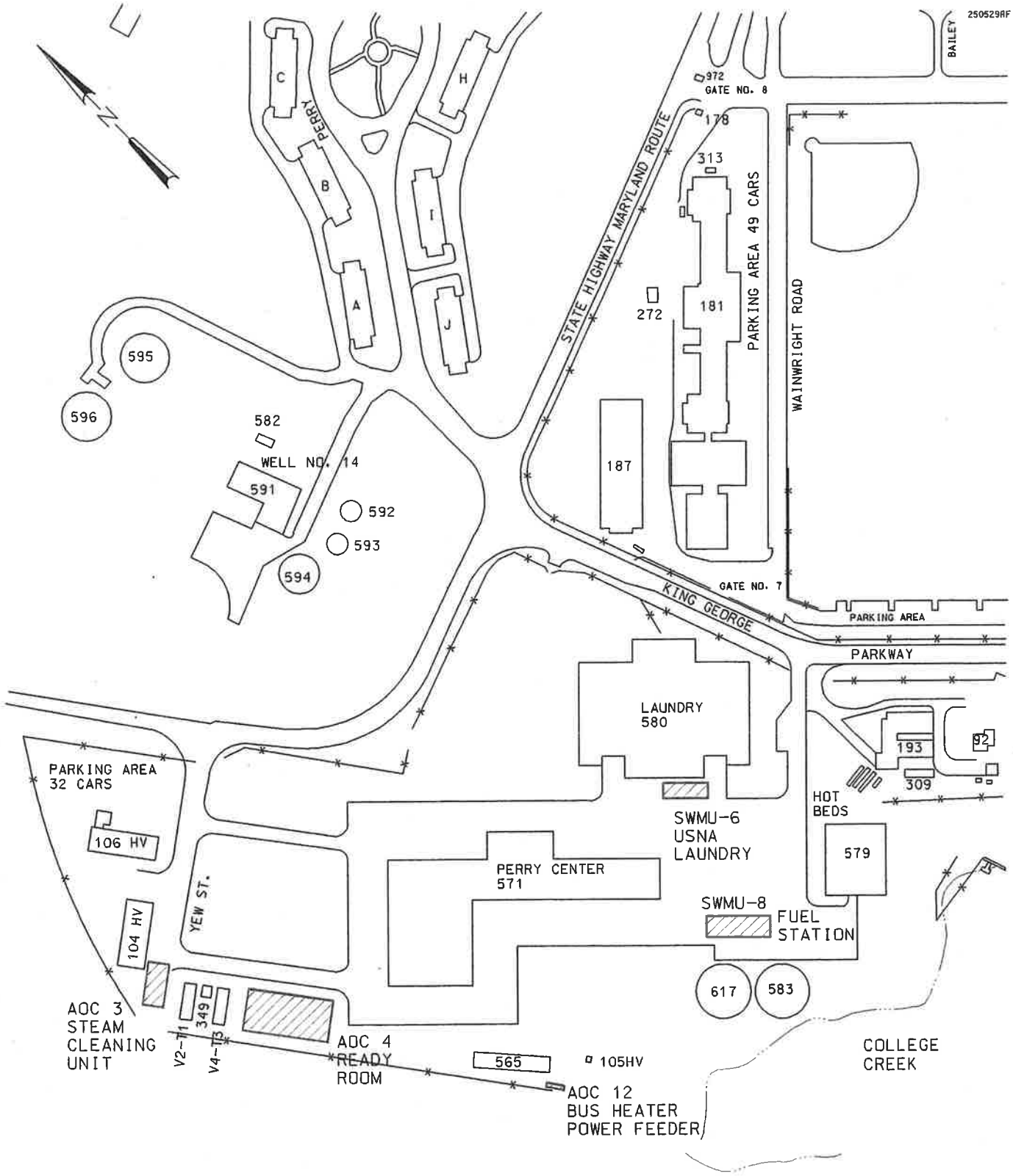
- STORM SEWER
- MANHOLE
- INLET
- SITE BOUNDARY
- SURFACE WATER BOUNDARY

FIGURE FROM BAKER ENVIRONMENTAL, 1997.

FIGURE 2
SITE LOCATION
PERRY CENTER
U.S. NAVAL ACADEMY
ANNAPOLIS, MARYLAND

CH2MHILL

5505f015.dlv 04-JUN-1998



LEGEND

SWMU OR AOC

SURFACE WATER BOUNDARY

FIGURE 3
SWMU LOCATIONS AT
PERRY CENTER
(N.T.S.)
U.S. NAVAL ACADEMY
ANNAPOLIS, MARYLAND

FIGURE FROM BAKER ENVIRONMENTAL, 1997

CH2MHILL

5505f019.dlv 04-JUN-1998

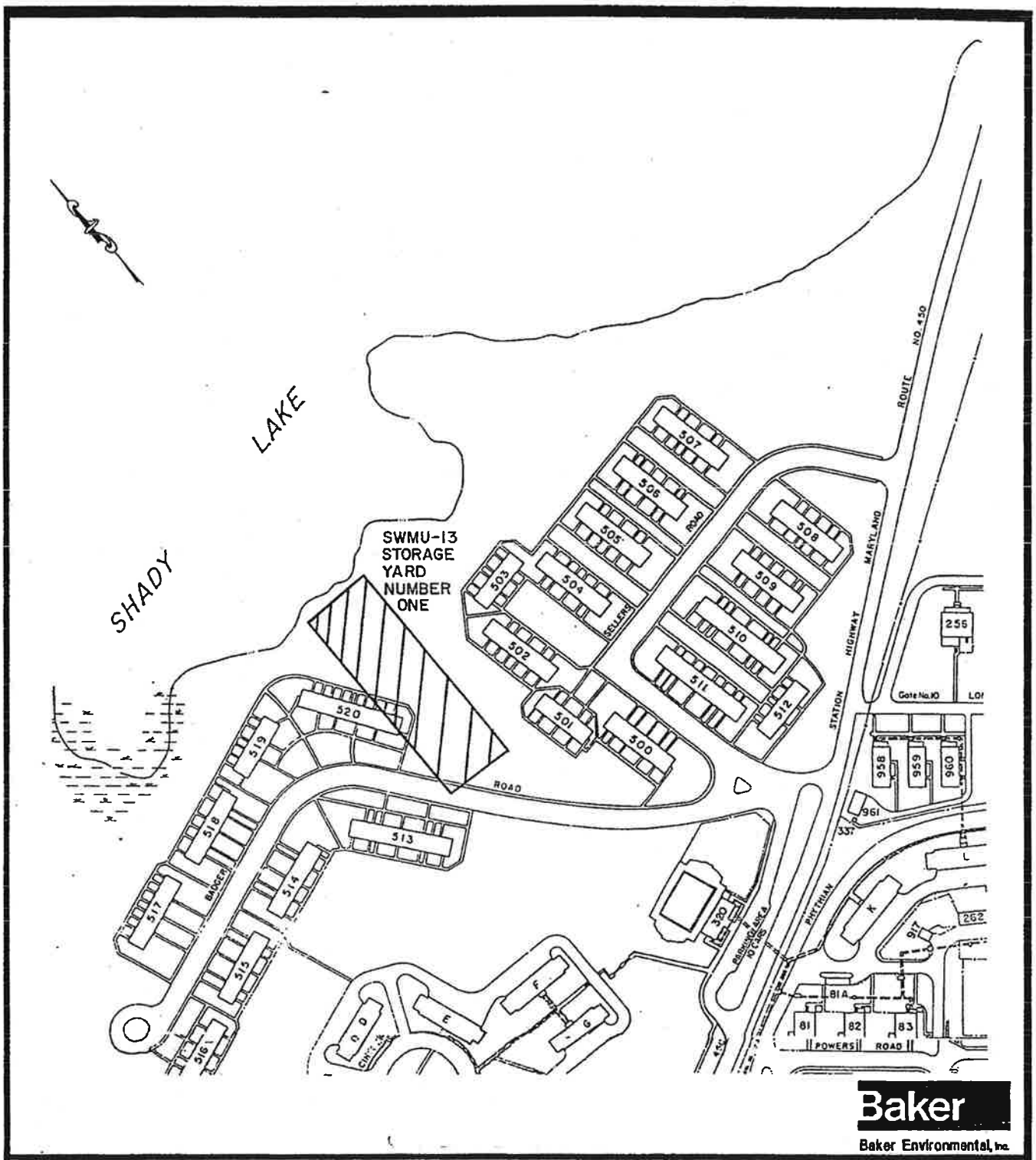


FIGURE 4
SITE LOCATION
SWMU-13
(N.T.S.)

U.S. NAVAL ACADEMY
ANNAPOLIS, MARYLAND

136-501