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U.S. DEPARTMENT OF THE NAVY

INSTALLATION RESTORATION PROGRAM

NAVAL AIR STATION, BRUNSWICK

BRUNSWICK, MAINE

PROPOSED PLAN

SITE 9

NEPTUNE DRIVE DISPOSAL SITE

JULY 1994

U.S. DEPARTMENT OF THE NAVY
INSTALLATION RESTORATION PROGRAM

PROPOSED PLAN: SITE 9
NAVAL AIR STATION, BRUNSWICK

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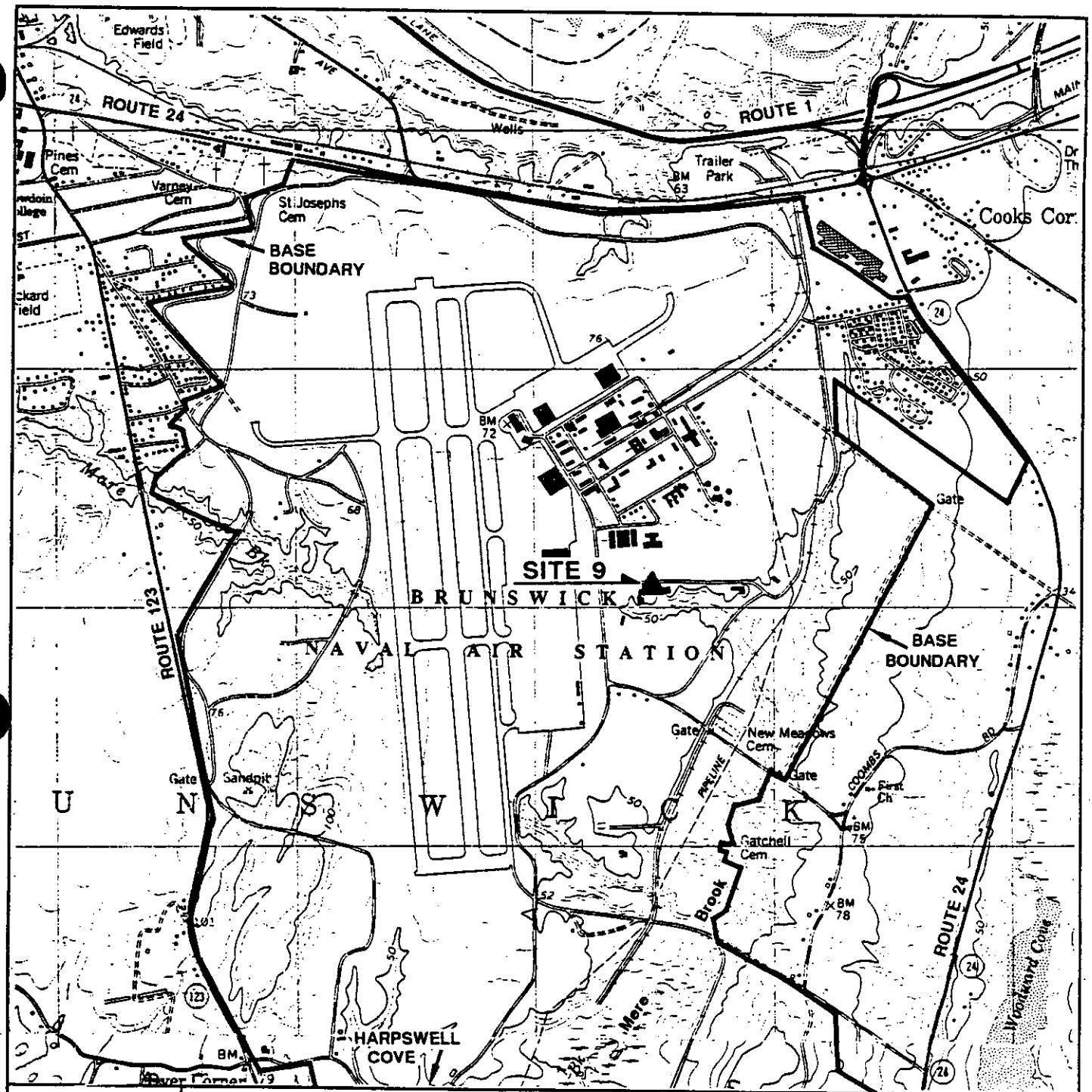
1.0 INTRODUCTION

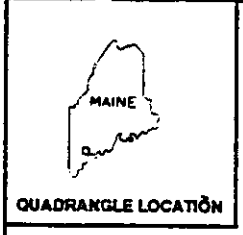
The U.S. Navy is responsible for addressing environmental contamination at the Naval Air Station (NAS) Brunswick pursuant to Section 120 of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** and a Federal Facility Agreement (FFA) entered into by the Navy, the U.S. Environmental Protection Agency (USEPA), and the Maine Department of Environmental Protection (MEDEP). Site 9 is one of 13 sites being addressed by the Navy as part of the clean-up of hazardous substances at NAS Brunswick (see Figure 1-1). In this document, the Navy is proposing a remedial plan to address, on an interim basis, an area of groundwater contamination emanating from Site 9.

This Proposed Plan recommends an **interim remedial action** for the **groundwater operable unit** at Site 9, in which groundwater contamination will be remediated by **natural attenuation**. The interim remedial action, being proposed for groundwater while additional **source** investigations are being conducted, consists of institutional controls and long-term monitoring of groundwater, surface water, sediment, and leachate. The Navy has decided to pursue an interim remedial alternative and **Record of Decision (ROD)** for Site 9 so that additional groundwater data can be collected (a minimum of quarterly sampling over the next five years) while source investigations are being conducted. The interim ROD commits the Navy to conducting long-term groundwater, surface water, sediment and leachate monitoring, maintaining institutional controls, and conducting five-year reviews during the time required to prepare a final ROD for this site. The Navy believes the data collected as part of this interim remedial alternative are necessary to help identify potential source areas of contamination and ensure proper protection of human health and the environment.

This interim remedial action is not intended to be the final remedy but is considered to be consistent with the ultimate final remedy selected for Site 9. The interim remedial action will be reevaluated when additional source information becomes available. The Navy's preferred interim remedial alternative is described in greater detail in Section 6.0 of this document.

In accordance with Section 117(a) of CERCLA, the Navy is publishing this Proposed Plan to give the public an opportunity to review and comment on the interim remedial action alternatives under consideration for Site 9 before selecting an interim remedy. The Navy, in consultation with USEPA and MEDEP, will select the interim remedy for the site after public comments have been reviewed and considered. This Proposed Plan summarizes the results and conclusions of the **Remedial Investigations (RIs)**, **Feasibility Study (FS)**, and





SOURCE: USGS QUADRANGLE, BRUNSWICK, AND ORRS ISLAND, ME, DATED 1980, 1978. 7.5 MINUTE SERIES.

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ABB ASEA BROWN BOVERI — ABB Environmental Services Inc.	SITE LOCATION MAP: SITE 9	
INSTALLATION RESTORATION PROGRAM NAVAL AIR STATION BRUNSWICK, MAINE	PROPOSED PLAN SITE 9	
	JOB NO. 7124-03	FIGURE 1-1

Technical Memorandum prepared for Site 9 (E.C. Jordan Co., 1990a and b; 1991 and 1992; ABB-ES, 1994a). Technical terms used in this document are highlighted in bold print and defined in the glossary at the end of this Proposed Plan.

This Proposed Plan:

1. explains the opportunities for the public to comment on the interim remedial alternative (Section 2.0);

2. includes a brief history of the site and the principal findings of the RI, Technical Memorandum, and **risk assessment** (Sections 3.0 and 4.0);

3. outlines the proposed remedial objectives and levels (Section 5.0);

4. briefly describes the preferred alternative (Sections 6.0 and 7.0);

5. outlines the criteria used by the Navy to propose an alternative for use at the site, and briefly analyzes whether the alternative would meet each criterion (Section 8.0); and

6. presents the Navy's rationale for its preliminary selection of the preferred interim remedial alternative for Site 9 (Section 9.0).

To help the public participate in the selection of an interim remedial alternative, this document also includes information on where interested citizens can find more detailed descriptions of the remedy selection process and the interim remedial alternative under consideration for Site 9 at NAS Brunswick.

2.0 THE PUBLIC'S ROLE IN EVALUATING REMEDIAL ALTERNATIVES

The Navy is offering the public the opportunity to review and comment on the remedial alternative described in this Proposed Plan. The following paragraphs provide information about how the public can get involved in the review process.

2.1 PUBLIC INFORMATIONAL MEETING AND PUBLIC HEARING

The Navy will hold a public informational meeting at 7 p.m., on Thursday, July 14, 1994, at the Brunswick High School Auditorium on Spring Street in Brunswick, Maine, to describe the preferred alternative. The public is encouraged to attend the meeting to hear the presentations and to ask questions. To provide the opportunity for people to formally comment on the Proposed Plan, the Navy will hold a formal public hearing immediately following the informational meeting to accept oral comments on the interim remedial alternative under consideration for Site 9. Comments made at the hearing will be recorded and transcribed, and the transcript added to the **Administrative Record** at the Public Works Office at NAS Brunswick and provided to the following location:

Curtis Memorial Library
23 Pleasant Street
Brunswick, Maine 04011
(207) 725-5242

Hours:

Monday-Wednesday: 9:30 a.m. - 8:00 p.m.
Thursday-Friday: 9:30 a.m. - 6:00 p.m.
Saturday: 9:30 a.m. - 5:00 p.m.

2.2 PUBLIC COMMENT PERIOD

The Navy is conducting a 30-day public comment period from July 12 to August 10, 1994, to provide an opportunity for citizen involvement in the remedial decision. During the comment period, the public is invited to review this Proposed Plan and the RI,

Supplemental RI, Phase I FS, FS, and Technical Memorandum reports, and to make comments to the Navy.

2.3 WRITTEN COMMENTS

If, after reviewing the information on the site, you would like to comment in writing on the Navy's preferred alternative or other issues relevant to the clean-up of Site 9, please deliver your comments to the Navy at the public hearing or mail your written comments (postmarked no later than August 10, 1994) to:

Fred Evans, Code 1823/FE
Department of the Navy, Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop 82
Lester, Pennsylvania 19113-2090

2.4 THE NAVY'S REVIEW OF PUBLIC COMMENT

The Navy will consider comments received from the public before implementing the proposed interim remedial alternative for Site 9. The Navy's final choice of an interim remedy will be documented in an Interim ROD for the site, which will be submitted to the MEDEP and the USEPA for review and approval. Public comment is an important part of the ROD process that will be considered in selecting the interim remedial alternative. A document, called a Responsiveness Summary, that summarizes the Navy's responses to public comments, will be issued with the ROD. Once the Interim ROD is signed by the USEPA Regional Administrator, and the MEDEP concurs, it will become part of the Administrative Record.

2.5 ADDITIONAL PUBLIC INFORMATION

Because this Proposed Plan provides only a summary description of the field investigations for Site 9, the public is encouraged to visit the Curtis Memorial Library, and review the RI, Supplemental RI, Phase I FS, FS, and Technical Memorandum reports for more detailed

information on the site. These documents are part of the Administrative Record and are available for review at the Curtis Memorial Library at the address listed in Subsection 2.1.

If you have any questions about the site or would like more information, you may call or write:

Public Affairs Office
Attn: Lt. David Welch
Naval Air Station, Brunswick
Brunswick, Maine 04011
(207) 921-2527

or

Robert Lim, Remedial Project Manager
U.S. Environmental Protection Agency, Region I
JFK Federal Building (HAN-CAN1)
Boston, Massachusetts 02203-2211
(617) 223-5521

or

Nancy Beardsley, Remedial Project Manager
Division of Federal Facilities Remediation
Office of the Commissioner
State House Station #17
Augusta, Maine 04333
(207) 287-2651

3.0 BASE HISTORY

NAS Brunswick is located south of the Androscoggin River between Brunswick and Bath, Maine. NAS Brunswick is an active facility supporting the U.S. Department of the Navy's antisubmarine warfare operations in the Atlantic Ocean and Mediterranean Sea. The primary mission of the base is to operate and maintain P-3 Orion aircraft. NAS Brunswick first became active in the 1940s during World War II, and underwent major expansion in the 1950s.

In 1975, with growing awareness of the long-term effects of hazardous substances on the environment, the Department of Defense developed the Installation Restoration Program (IRP) to address potential hazardous conditions created by past events and practices. This program was designed to identify, evaluate, and **remediate** former disposal and spill sites at defense facilities. Originally, the Navy IRP was called the Navy Assessment and Control of Installation Pollutants (NACIP) Program. Early reports produced for NAS Brunswick reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IRP to be consistent with the regulatory programs established by new legislation.

The IRP meets the requirements of CERCLA and the Superfund Amendments and Reauthorization Act (SARA) and is conducted in several stages:

1. Research is conducted in the Preliminary Assessment stage to identify potential hazardous waste sites. [This was called an **Initial Assessment Study (IAS)** under the NACIP program.]

2. Site Inspections then confirm which areas contain contamination, constituting actual "sites." [This was called the **Pollution Abatement Confirmation (PAC)** Study or Step 1A Verification under the NACIP program.]

3. Next, the RI and FS together characterize the type and distribution of contamination, establish criteria for remediation, and identify and evaluate remedial action alternatives and their costs. As part of the RI/FS, a risk assessment identifies potential effects on human health and/or the environment to help evaluate the need for and effectiveness of remedial alternatives.

4. An interim remedial alternative is proposed and described in the Proposed Plan.

5. A remedy is selected and documented in the ROD.

6. The selected alternative is designed and implemented in the Remedial Design and Remedial Action stages. Remedial Design and Remedial Action are implemented following ROD signature.

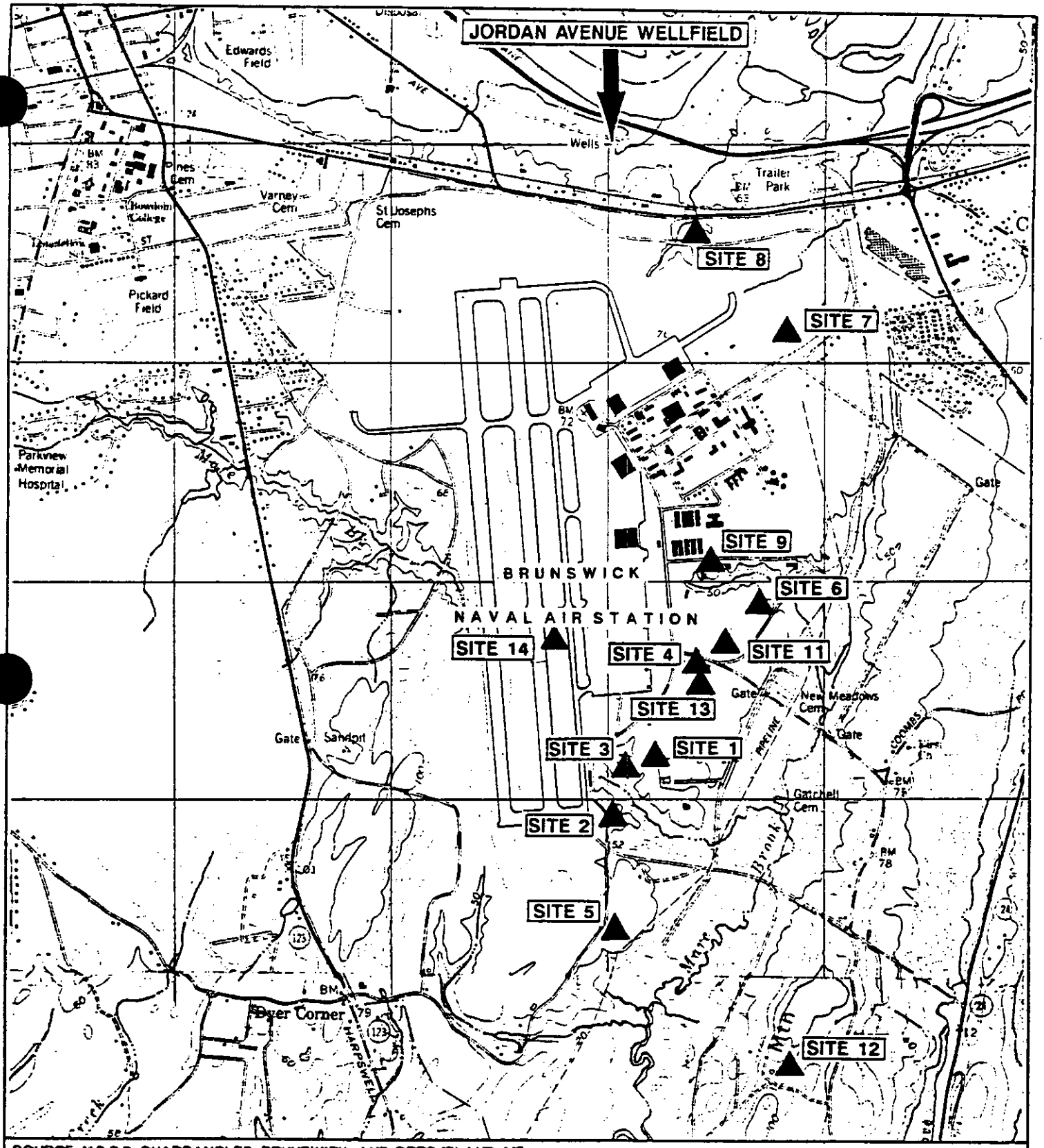
In 1983, an IAS was completed detailing historical hazardous material usage and waste disposal practices at NAS Brunswick. The IAS was followed by a PAC Study (R.F. Weston, Inc., 1983; E.C. Jordan Co., 1985). The PAC Study recommended further investigation of seven of the 10 hazardous waste sites originally identified in the IAS; the RI/FS process for those seven sites began in 1987. Based on further information, two more sites, as well as the other two sites originally identified in the IAS, were added to the RI/FS program in 1989. Two additional sites were included in the program in 1990 for a total of 13 sites that the Navy is currently studying under the IRP (Figure 3-1). One site identified in the IAS, the Harpswell Fuel Depot (Site 10), is no longer under the jurisdiction of NAS Brunswick and is not included under the IRP.

In 1987, NAS Brunswick was placed on the USEPA's **National Priorities List (NPL)**. Private-sector NPL sites are eligible for funding from the national environmental trust fund called **Superfund** and are often called Superfund sites. However, Department of Defense sites such as NAS Brunswick are funded through the Defense Environmental Restoration Account.

In 1990, the Navy entered into an FFA with the USEPA and the MEDEP regarding the clean-up of environmental contamination at NAS Brunswick. The FFA sets forth the roles and responsibilities of each agency, sets deadlines for the investigation and clean-up of hazardous waste sites, and establishes a mechanism to resolve disputes among the agencies.

3.1 SITE HISTORY

Site 9 is located in the central portion of the base. Based on historical information, including aerial photographs and grading plans, Site 9 was originally defined as three areas of potential contamination: (1) the former location of an incinerator in the northeastern corner of the current site of Building 220, and an ash disposal area in the current location



SOURCE: U.S.G.S. QUADRANGLES, BRUNSWICK, AND ORRS ISLAND, ME., 1984, 1978, 7.5 MINUTE SERIES.

QUADRANGLE LOCATION

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E.C. JORDAN CO. CONSULTING ENGINEERS	SITE LOCATION MAP
INSTALLATION RESTORATION PROGRAM NAVAL AIR STATION BRUNSWICK, MAINE	PROPOSED PLAN SITE 9
	JOB NO. 7124-03 / FIGURE 3-1

of Buildings 218 and 219 (Marine barracks north of Neptune Drive); (2) a reported **solvent** burning and dumping area behind Building 201 (the enlisted men's club south of Neptune Drive); and (3) the two streams bordering the recreational area behind Building 201 (E.C. Jordan Co., 1990b). These areas are shown in Figure 3-2 and are described in the following paragraphs.

Former Incinerator and Ash Landfill

There is no precise information concerning the location of the incinerator and ash landfill or types of wastes handled or disposed of in these areas. The incinerator was apparently operated during a period commencing on or after April 1943, when the air station was commissioned, until the fall of 1946, when the air station was demobilized. Although the station was leased to various occupants from 1947 through 1951, including the University of Maine and Bowdoin College for classrooms and student housing, and various small commercial enterprises, it is unknown if the incinerator was used during this period. The air station was recommissioned in 1951, but it is unknown if the incinerator resumed operation. The incinerator could have been used as late as 1953, when the barracks that now occupy the location of the former incinerator were built. The IAS (R.F. Weston, Inc., 1983) states that during the period the incinerator was in operation, solid wastes were burned and the ash was placed in the dump. Wastes disposed of at this location reportedly included solvents which were burned on the ground, paint sludges, and possibly wastes from the Metal Shop.

Current land use at the former incinerator and inactive ash landfill is for military residences. The grading plans for the barracks (Buildings 212 through 220) constructed at this location show an oblong "dump area," approximately 125 by 75 feet, located around existing Building 219. The grading plans also show an old, 42-inch-diameter drain adjacent to the dump area. The drain ran from north of Orion Street, past the dump area, under Neptune Drive to the stream running between Buildings 201 and 293 (see Figure 3-2). The drain was reportedly removed during construction of the barracks.

Building 201

Historical information and aerial photographs indicate an area southeast of Building 201 as a potential source of contamination (see Figure 3-2). This area, reportedly used as a solvent dumping and burning area (R.F. Weston, Inc., 1983), more recently has been used as a picnic area. A barbecue pit is located southeast of Building 201.

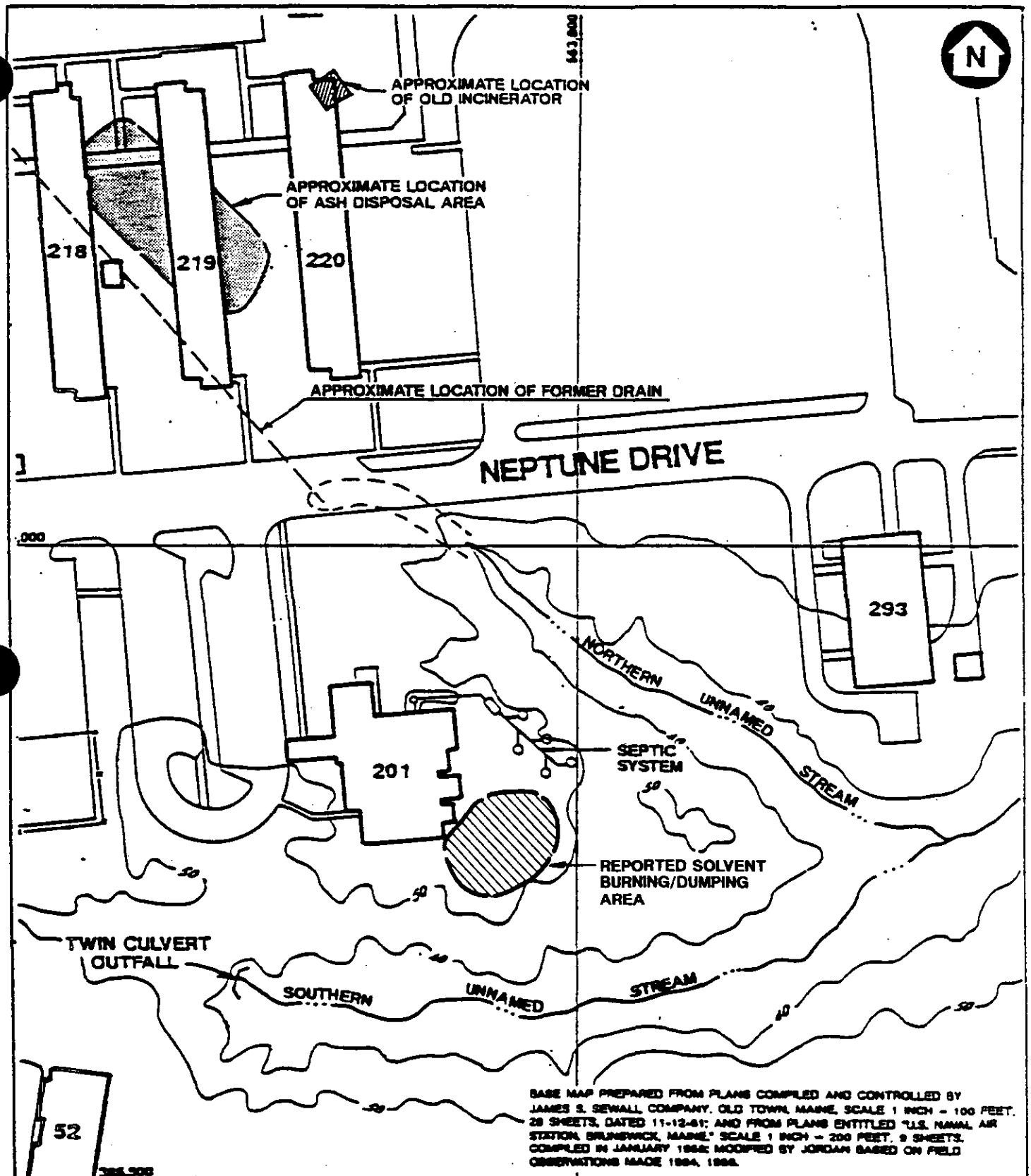


ABB Environmental Services Inc.

AREAS OF POTENTIAL CONTAMINATION: SITE 9

INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE

PROPOSED PLAN SITE 9

JOB NO. 7124-03

FIGURE 3-2

Unnamed Streams

Two unnamed streams border the area around Building 201; one to the north; one to the south (see Figure 3-2.) These streams receive runoff from the central portion of the base including the runways, parking lots, and paved roads. **Leachate** seeps have been observed flowing into the northern unnamed stream.

Summary of Investigations and Reports

The Navy conducted field activities and environmental sampling in 1988, as part of the RI for Site 9, to determine the geologic and hydrologic conditions and the distribution of contamination at this site. The focus of these investigations was on the area south of Neptune Drive including Building 201 and the two unnamed streams. The results of these investigations, including the risk assessment are presented in Section 11.0 and Appendix Q of the Draft Final RI Report (E.C. Jordan Co., 1990a). In April 1991, the Navy submitted the Draft Final Supplemental RI report that included results of additional investigations conducted in 1990 at Site 9. These investigations focused on identifying the source area(s) of groundwater contamination detected at Site 9 and included test pitting, and soil and groundwater sampling. Data from this sampling did not uncover evidence of a solvent burning or disposal area(s) near Building 201. The results of these investigations are presented in Section 7.0 of the Supplemental RI report.

In 1991, plans were discovered by the NAS identifying the presence of a septic system east of Building 201. This septic system was installed in 1952 when Building 201 was built, and was used until 1972 when Building 201 was connected to the basewide sewer system (E.C. Jordan Co., 1991). The septic system, located upgradient of the most highly contaminated **monitoring wells**, was then speculated to be the primary source of groundwater contamination at Site 9, prompting further investigation of this area. A FS report was prepared that described various source control alternatives aimed at removing, treating, or reducing suspected residual contamination in the septic system (E.C. Jordan Co., 1992).

In January through March of 1993, the Navy conducted additional investigations to evaluate the Building 201 septic system as a potential source of contamination and to address data gaps identified by the USEPA and the MEDEP concerning the northern portion of Site 9. The results of these investigations are summarized in the Technical Memorandum (ABB-ES, 1994a). Results of sampling and analysis in 1993 indicate that the septic system and subsurface soils around the septic system are not acting as a current source of groundwater contamination. As such, remedial actions developed and presented in the FS report for

removing, containing, or treating the septic system or subsurface soils were no longer considered necessary (E.C. Jordan Co., 1992).

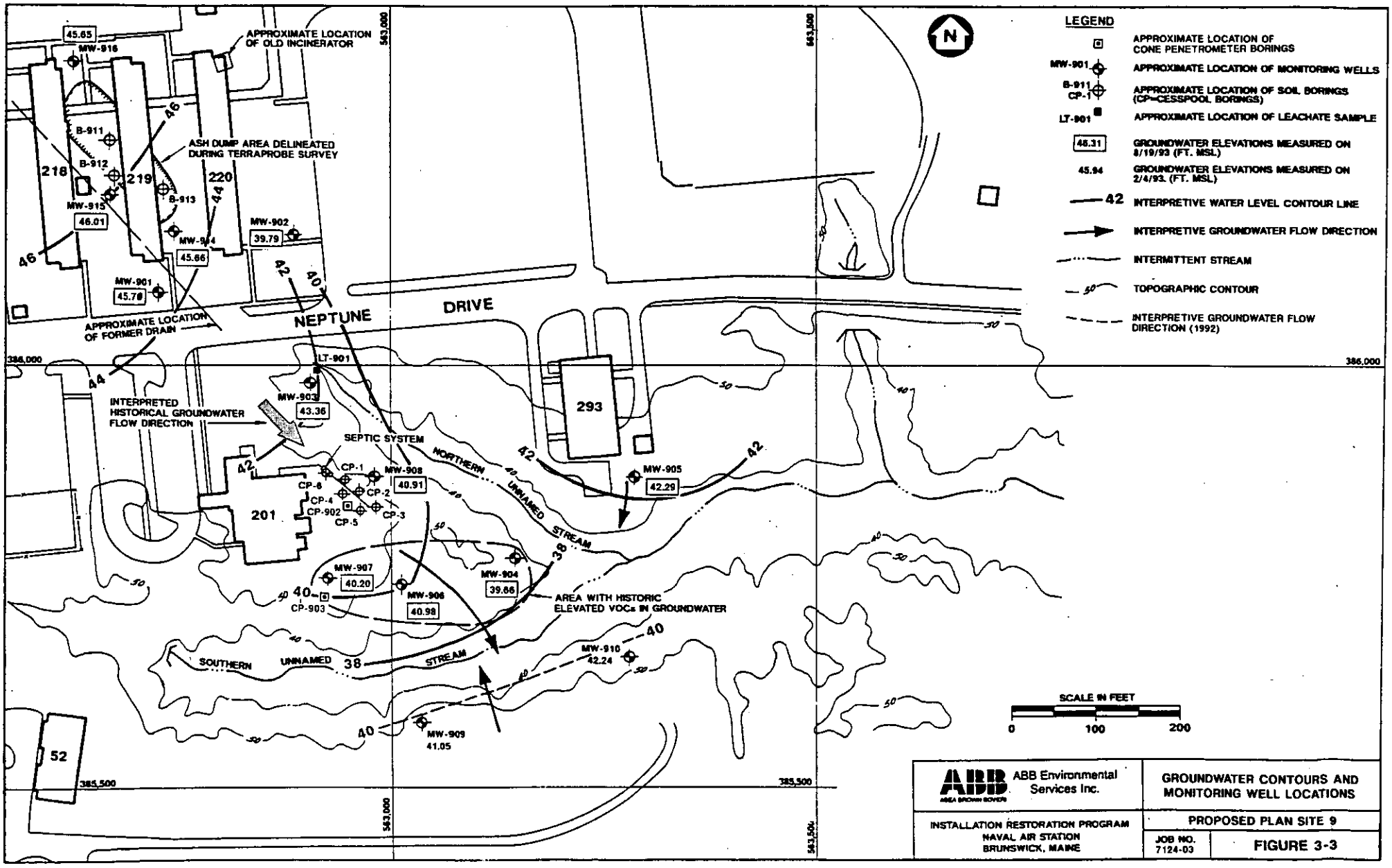
Because no source of groundwater contamination has been identified, the Navy will be conducting additional field investigations to evaluate other potential source areas. Until these field investigations are completed, the final remedial action at this site can not be developed. Therefore, this interim remedial action addresses only groundwater contamination.

The following section provides a summary of the groundwater investigations conducted at Site 9. A brief summary of the analytical results for soils (including ash and septic system soils), surface water, sediment, and leachate is included to support the proposed interim remedial action. A more detailed description and summary of these results will be presented with the results of additional source investigations in the Proposed Plan and final ROD for Site 9.

3.2 Results of Groundwater Investigations and Analytical Data

Groundwater investigations conducted in 1988 and 1990 were designed to assess the areal distribution of groundwater contamination, the potential impact of groundwater contamination on sediment and surface water quality, and the significance of chemicals detected in the groundwater at Site 9. Most of the investigation focused on the area south of Neptune Drive where six monitoring wells were installed around Building 201 (MW-903 through MW-908). Two monitoring wells also were installed north of Neptune Drive (MW-901 and 902) at locations considered to be downgradient of the former incinerator and ash disposal area. The monitoring well locations are shown in Figure 3-3. Up to five groundwater samples were collected from these wells during the RI field investigations.

Groundwater investigations conducted in 1993 were designed to evaluate groundwater quality south of the unnamed streams and north of Neptune Drive in the area of the former ash disposal area. Two monitoring wells (MW-909 and MW-910) were installed south of the southern unnamed stream to evaluate groundwater flow beneath the stream and three monitoring wells (MW-914, MW-915, and MW-916) were installed north of Neptune Drive to better characterize groundwater quality in this portion of the site. One well (MW-916) was placed in an area upgradient and two wells (MW-914 and MW-915) were placed immediately downgradient of the ash disposal area (see Figure 3-3). One round of


LEGEND
APPROXIMATE LOCATION OF CONE PENETROMETER BORINGS
MW-901 APPROXIMATE LOCATION OF MONITORING WELLS
B-911 CP-1 APPROXIMATE LOCATION OF SOIL BORINGS (CP=CESSPOOL BORINGS)
LT-901 APPROXIMATE LOCATION OF LEACHATE SAMPLE
46.31 GROUNDWATER ELEVATIONS MEASURED ON 8/19/93 (FT. MSL)
45.94 GROUNDWATER ELEVATIONS MEASURED ON 2/4/93. (FT. MSL)
42 INTERPRETIVE WATER LEVEL CONTOUR LINE
INTERPRETIVE GROUNDWATER FLOW DIRECTION
INTERMITTENT STREAM
50 TOPOGRAPHIC CONTOUR
INTERPRETIVE GROUNDWATER FLOW DIRECTION (1992)
N
APPROXIMATE LOCATION OF OLD INCINERATOR
ASH DUMP AREA DELINEATED DURING TERRAPROBE SURVEY
APPROXIMATE LOCATION OF FORMER DRAIN
INTERPRETED HISTORICAL GROUNDWATER FLOW DIRECTION
NEPTUNE DRIVE
SEPTIC SYSTEM
NORTHERN UNNAMED STREAM
SOUTHERN UNNAMED STREAM
AREA WITH HISTORIC ELEVATED VOCs IN GROUNDWATER
218
219
220
201
293
52
MW-916 45.65
B-911
B-912
B-913
MW-915 46.01
MW-914 45.66
MW-902 39.79
MW-901 45.78
LT-901
MW-903 43.36
CP-1
CP-2
CP-3
CP-4
CP-5
CP-6
CP-902
MW-908 40.91
MW-905 42.29
MW-907 40.20
CP-903
MW-906 40.98
MW-904 39.66
MW-910 42.24
MW-909 41.05
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385,500
543,000
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ABB Environmental Services Inc.
GROUNDWATER CONTOURS AND MONITORING WELL LOCATIONS
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
PROPOSED PLAN SITE 9
JOB NO. 7124-03
FIGURE 3-3

groundwater samples was collected from these wells and from four existing wells (MW-904, MW-906, MW-907, and MW-908) during the 1993 field investigation.

The groundwater results from the 1988, 1990, and 1993 investigations are presented in Table 3-1 and summarized below.

3.2.1 Subsurface Geology and Groundwater Flow

Groundwater at Site 9 occurs in the **overburden soil** and varies in depth between 10 and 14 feet below ground surface (bgs). Overburden soil at Site 9 is a **stratified** formation consisting of a sand layer, a **transition** layer, and a clay layer overlying **bedrock**. The elevation of ground surface at the site is approximately 40 to 50 feet above mean sea level. The top of clay has been interpreted from boring logs to occur at a depth of about 20 feet bgs on the southern edge of the site.

Groundwater flow at the site is to the south and southeast. The calculated **seepage velocities** range from 26 feet per year throughout most of the site to 130 feet per year in the vicinity of the streams (E.C. Jordan Co., 1991). Data collected from MW-909 and MW-910 (south of the unnamed stream) indicate that the groundwater discharges to the two streams (see Figure 3-3). Ten-foot well screens were placed in sands just above a clay zone in these wells. Groundwater levels in these wells and the adjacent stream support the assumption that the stream is a discharge area for shallow groundwater.

3.2.2 Groundwater Analytical Results

Volatile organic compounds (VOCs) were detected in three wells (MW-904, MW-906, and MW-907) south of Neptune Drive and one well (MW-915) north of Neptune Drive. These data are presented in Table 3-1. Vinyl chloride was detected twice in MW-904 (12 to 27 **micrograms per liter** [μg/L]), once in MW-906 (31 μg/L), once in MW-907 (18 μg/L), and in MW-915 and its duplicate sample (8 μg/L and 10 μg/L). The federal **Maximum Contaminant Level (MCL)** for vinyl chloride is 2 μg/L. The federal **Maximum Contaminant Level Goal (MCLG)** is zero, because this compound is classified as a carcinogen. The state **Maximum Exposure Guideline (MEG)** for vinyl chloride is 0.15 μg/L. Groundwater contaminants and their respective MCLs, MCLGs, and MEGs are presented in Table 3-2. Other VOCs detected in these wells include:

- 1,1-Dichloroethane (DCA) detected in MW-904 at concentrations ranging from 5 to 12 μg/L; in MW-906 at 36 μg/L; in MW-907 at 2

TA[illegible]3-1
GROUNDWATER DATA

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

Sampling Date Sample Location	CRQL (µg/L)	1/89 MW-903	3/89 MW-903	1/90 MW-903	1/89 MW-904	3/89 MW-904	7/89 MW-904	1/90 MW-904	4/91 MW-904	2/93 MW-904	4/91 MW-906	1/90 MW-906	2/93 MW-906
Vinyl Chloride	10	ND	ND	ND	12	27	ND	ND	NA	8J	31	ND	ND
1,1-Dichloroethane	10	ND	ND	ND	12	12	6J	5	NA	ND	ND	36	ND
1,2-Dichloroethylene	10	ND	ND	ND	6	6	ND	ND	NA	1J	79	ND	4J
2-Butanone	-	ND	ND	110	ND	ND	68J	ND	NA	ND	ND	ND	ND
Aluminum	200	ND	ND	ND	ND	ND	1130	ND	NA	ND	ND	445J	ND
Calcium	5000	9700J	7140	6650	18000	21100	16800	18400	NA	18400	10700	12000	14100
Iron	100	3600J	3430	3700	ND	ND	1950	ND	NA	ND	115	ND	314J
Magnesium	5000	ND	ND	ND	5700	5960J	5610	5730	NA	5520	ND	ND	4310J
Manganese	15	240J	207	223	160	167	123	155	NA	ND	52.5	336	56.7
Mercury	0.2	ND	ND	ND	0.22J	0.23	ND	ND	NA	ND	ND	ND	ND
Sodium	5000	17000J	14000	17800	7500	5410	8040	ND	NA	6240	35100	36700	35400
Zinc	20	ND	ND	ND	ND	ND	25.3	ND	NA	8.8J	ND	ND	6.9J
Bicarbonate	-	NA	ND	NA	NA	ND	NA	NA	43	-	74	NA	-
Chloride	-	NA	NA	NA	NA	NA	NA	NA	7.3	-	29	NA	-
Sulfate	-	NA	NA	NA	NA	NA	NA	NA	4.9	-	8.8	NA	-

Notes:

All concentrations in µg/L except bicarbonate, chloride, and sulfate which are in mg/L.

µg/L = micrograms per liter
mg/L = milligrams per liter
CP = cone penetrometer
CRQL = Contract Required Detection Limit
DUP = duplicate sample
J = estimated concentration
MW = monitoring well
ND = not detected
NA = not analyzed

TABLE 3-1
GROUNDWATER DATA

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

Sampling Date Sample Location	1/90 MW-907	4/91 MW-907	2/93 MW-907	1/90 MW-908	2/93 MW-908/ DUP	4/91 CP-902	4/91 CP-903	2/93 MW-909	2/93 MW-910	2/93 MW-914	2/93 MW-916/ DUP	2/93 MW-916	Background Concentration[1] (µg/L)
Vinyl Chloride	18	NA	9J	ND	ND/2J	NA	NA	ND	ND	ND	10J/8J	ND	-
1,1-Dichloroethane	ND	NA	2J	ND	ND	20	20	ND	ND	ND	1J/1J	ND	-
1,2-Dichloroethylene	ND	NA	1J	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
2-Butanone	ND	NA	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	-
Aluminum	ND	NA	ND	ND	ND	NA	NA	214J	ND	5510	1910/1830	ND	652
Calcium	26600	NA	40300	18200	24100/25700	NA	NA	2140J	4180J	33800	51300/51300	22000	18000
Iron	ND	NA	ND	ND	ND	NA	NA	360J	ND	30100J	12000J/12100J	220J	4430
Magnesium	5570	NA	5530	ND	3000J/2990J	NA	NA	775J	709J	3050J	4490J/4500J	2290J	8300
Manganese	2500	NA	6720	823	609/689	NA	NA	22.8	27.8	230	991/1010	14.7J	570
Mercury	ND	NA	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	0.11
Sodium	16100	NA	16200	10800	15100/16200	NA	NA	4030J	2550J	4100J	27900/27900	58800	52500
Zinc	ND	NA	13.8J	ND	ND/8.1J	NA	NA	10.4J	7.9J	ND	ND	ND	105
Bicarbonate	NA	100	-	NA	-	NA	NA	-	-	-	-	-	-
Chloride	NA	24	-	NA	-	NA	NA	-	-	-	-	-	-
Sulfate	NA	6.2	-	NA	-	NA	NA	-	-	-	-	-	-

Notes:

All concentrations in µg/L except bicarbonate, chloride, and sulfate which are in mg/L.

µg/L	=	micrograms per liter	J	=	estimated concentration
mg/L	=	milligrams per liter	MW	=	monitoring well
CP	=	cone penetrometer	ND	=	not detected
CRQL	=	Contract Required Detection Limit	NA	=	not analyzed
DUP	=	duplicate sample			

[1]the following wells were used to determine background concentrations: MW-2118, MW-301, MW-312, MW-320, MW-403, MW-702, MW-703, MW-705, MW-801

W0069452.T80/2

TABLE 3-2

GROUNDWATER CONTAMINANTS AND REGULATORY CRITERIA

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

COMPOUND	MAXIMUM DETECTED CONCENTRATION (µg/L)	FEDERAL MCL (µg/L)	FEDERAL MCLG (µg/L)	MAINE MEG (µg/L)
Vinyl Chloride	31	2	0	0.15
1,1-Dichloroethane	36	--	--	5
1,2-Dichloroethylene	79	70	70	70
2-Butanone	110	--	--	--
Aluminum	5,510	50-200(S)	50-200(S)	1,430
Cadmium	6.4	5	5	5
Manganese	1,010	50(S)	50(S)	--
Iron	12,100	300(S)	300(S)	--
Mercury	0.23	2	2	2

Notes:

MCL = Maximum Contaminant Level; (USEPA, 1992)
MCLG = Maximum Contaminant Level Goal; (USEPA, 1992)
MEG = Maximum Exposure Guideline; (MEDOH, 1990)
µg/L = microgram per liter
S = secondary MCL or MCLG; based on aesthetic quality

μg/L; in MW-915 at 1 μg/L; and in two temporary sampling locations (CP-902 and CP-903) at 20 and 7 μg/L, respectively.

- total 1,2-Dichloroethene (DCE) detected in MW-904 at concentrations ranging from 1 to 6 μg/L; in MW-906 at concentrations ranging from 4 to 79 μg/L, and in MW-907 at 1 μg/L.

The MEG for DCA is 5 μg/L, there is neither an MCL nor an MCLG for this compound. The MCL, MCLG, and MEG for DCE are all 70 μg/L (see Table 3-1). 2-Butanone was also detected in the groundwater from Site 9. However, the presence of this compound was not considered to be related to past disposal activities but to sampling or laboratory contamination (E.C. Jordan 1990a; ABB-ES 1994a).

Inorganic analytes detected in groundwater south of Neptune Drive were in the normal background range except for sodium, calcium, iron, and magnesium (E.C. Jordan Co., 1990a). Mercury was detected in MW-904 in two sampling rounds in 1989 at concentrations of 0.22 and 0.23 μg/L. The MCL, MCLG, and MEG for mercury are all 2 μg/L (see Table 3-1). Mercury has not been detected in groundwater samples from Site 9 since 1989.

Only a few inorganic analytes were detected in MW-909 and MW-910 located south of the unnamed southern stream. Of these, aluminum, iron, and manganese exceeded their respective MCLs; however, these are secondary standards based on aesthetic qualities and not on protection of human health.

Elevated inorganic concentrations were detected in MW-914 and MW-915 located downgradient of the ash disposal area and included aluminum, barium, cadmium, calcium, iron, manganese, and potassium. Of these, cadmium and manganese were detected above their respective MCLs.

Semivolatile organic compounds (SVOCs) were detected in some wells but at low and estimated concentrations (i.e., below the Contract Required Quantitation Limit [CRQL]). Total **polynuclear aromatic hydrocarbons** (PAH) concentrations ranged from non-detect to 12J μg/L in the wells sampled in 1993. The concentrations of PAHs downgradient of the ash disposal area (i.e., MW-914 and MW-915) ranged from non-detect to 4J μg/L. One SVOC [bis(2-ethylhexyl)phthalate at 12J μg/L in MW-906] was observed; however, this analyte is a common laboratory contaminant and is not considered to be site-related (ABB-ES, 1994a).

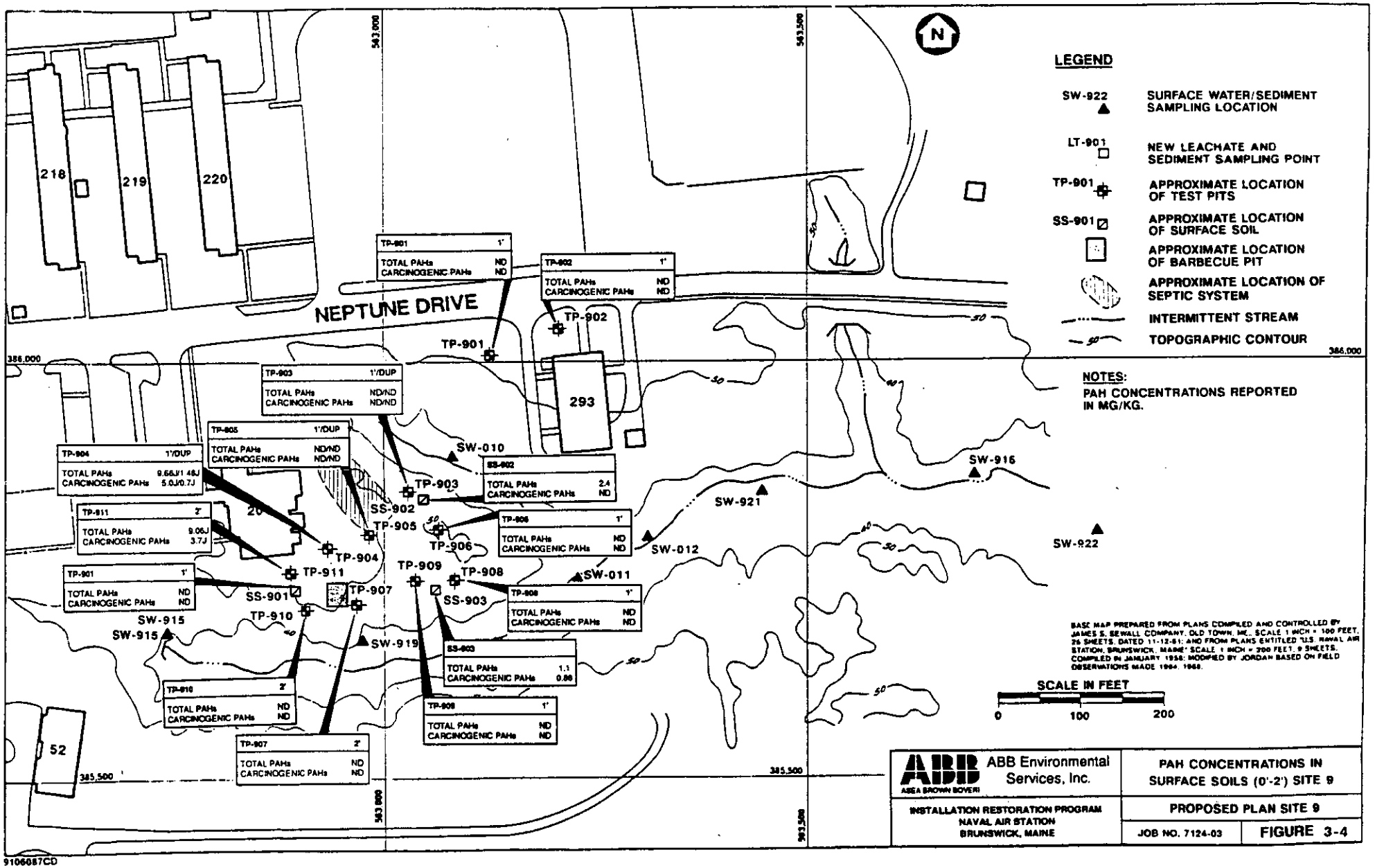
3.2.3 Surface and Subsurface Soils Analytical Results

Soil sampling was conducted at Site 9 to evaluate the source of groundwater contamination. Potential source areas identified and investigated during 1988, 1990, and 1993 included the area behind Building 201, the septic system associated with Building 201, and the former ash disposal area beneath Buildings 218 and 219.

Surface and subsurface soil samples were collected behind Building 201. The sampling locations and analytical data are presented in Figure 3-4. VOCs were not detected in these samples and inorganic analytes were detected at background concentrations. PAHs were detected in the surface soil and test pit samples. Detectable concentrations of PAHs were observed in two test pits (TP-904 and TP-911) at concentrations of 3.8 and 4.1 **milligrams per kilogram** (mg/kg), and two surface soil samples (SS-901 and SS-902) at concentrations of 13.1 and 0.81 mg/kg. The highest concentrations of PAHs (SS-901) were observed adjacent to the barbecue pit area, suggesting that these compounds are a result of residual charcoal or ash from the barbecue pit. Pesticides (**dichlorodiphenyltrichloroethene** [DDE] and **dichlorodiphenyltrichloroethane** [DDT]) were also detected in surface and shallow soil samples at concentrations consistent with the historic usage of DDT. The IAS indicated that DDT was applied basewide between 1955 and 1972. PAHs and pesticides were not detected in soils deeper than 2 feet bgs.

The septic system and ash disposal area were investigated in 1993 to evaluate these areas as potential sources of groundwater contamination. Soil borings were drilled through the septic tank and four of the five cesspools, and samples collected from the organic-rich soils associated with this area. One SVOC (i.e., chlorobenzene at 16 μg/L) was the only site-related contaminant detected in the subsurface soils around the septic system. No VOCs, **polychlorinated biphenyls** (PCBs), or pesticides were detected above the CRQL.

Three soil borings (B-911, B-912, and B-913) were placed in the ash disposal area, and samples collected for laboratory analysis (two from B-912 and one from B-913). The borings were placed to depths between 17 and 18 feet bgs. Ash material was observed between 8 and 16 feet bgs, and the water table observed at approximately 4 feet bgs. Total PAHs detected in samples from these borings ranged from 3.8 to 33 mg/kg. The presence of PAHs is typical of the burned materials observed in the borings. Two VOCs (acetone and 2-butanone) were detected in the soil. Both VOCs are considered by the USEPA to be common laboratory contaminants and their presence may not indicate site contamination. Other VOCs detected in these samples were at estimated concentrations up to 0.003 mg/kg, well below the CRQL. Low concentrations of pesticides were detected in these samples but


LEGEND
SW-922 SURFACE WATER/SEDIMENT SAMPLING LOCATION
LT-901 NEW LEACHATE AND SEDIMENT SAMPLING POINT
TP-901 APPROXIMATE LOCATION OF TEST PITS
SS-901 APPROXIMATE LOCATION OF SURFACE SOIL
APPROXIMATE LOCATION OF BARBECUE PIT
APPROXIMATE LOCATION OF SEPTIC SYSTEM
INTERMITTENT STREAM
TOPOGRAPHIC CONTOUR
NOTES:
PAH CONCENTRATIONS REPORTED IN MG/KG.
NEPTUNE DRIVE
218
219
220
293
52
TP-901 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-902 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-903 1'/DUP TOTAL PAHs ND/ND CARCINOGENIC PAHs ND/ND
TP-904 1'/DUP TOTAL PAHs 9.66J/1.46J CARCINOGENIC PAHs 5.0J/0.7J
TP-905 1'/DUP TOTAL PAHs ND/ND CARCINOGENIC PAHs ND/ND
TP-906 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-907 2' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-908 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-909 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-910 2' TOTAL PAHs ND CARCINOGENIC PAHs ND
TP-911 2' TOTAL PAHs 9.06J CARCINOGENIC PAHs 3.7J
SS-901 1' TOTAL PAHs ND CARCINOGENIC PAHs ND
SS-902 TOTAL PAHs 2.4 CARCINOGENIC PAHs ND
SS-903 TOTAL PAHs 1.1 CARCINOGENIC PAHs 0.88
SW-010
SW-011
SW-012
SW-915
SW-916
SW-919
SW-921
SW-922
TP-901
TP-902
TP-903
TP-904
TP-905
TP-906
TP-907
TP-908
TP-909
TP-910
TP-911
SS-901
SS-902
SS-903
386,000
385,500
543,000
543,500
BASE MAP PREPARED FROM PLANS COMPILED AND CONTROLLED BY JAMES S. SEWALL COMPANY, OLD TOWN, ME., SCALE 1 INCH = 100 FEET, 26 SHEETS, DATED 11-12-81; AND FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE" SCALE 1 INCH = 200 FEET, 9 SHEETS, COMPILED IN JANUARY 1958; MODIFIED BY JORDAN BASED ON FIELD OBSERVATIONS MADE 1964, 1968.
SCALE IN FEET
0
100
200
ABB ASEA BROWN BOVERI
ABB Environmental Services, Inc.
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
PAH CONCENTRATIONS IN SURFACE SOILS (0'-2') SITE 9
PROPOSED PLAN SITE 9
JOB NO. 7124-03
FIGURE 3-4
9106087CD

at concentrations representing low-level background conditions consistent with concentrations observed at NAS Brunswick. Inorganics detected in the samples above background concentrations include: barium, cadmium, chromium, copper, iron, lead, and zinc.

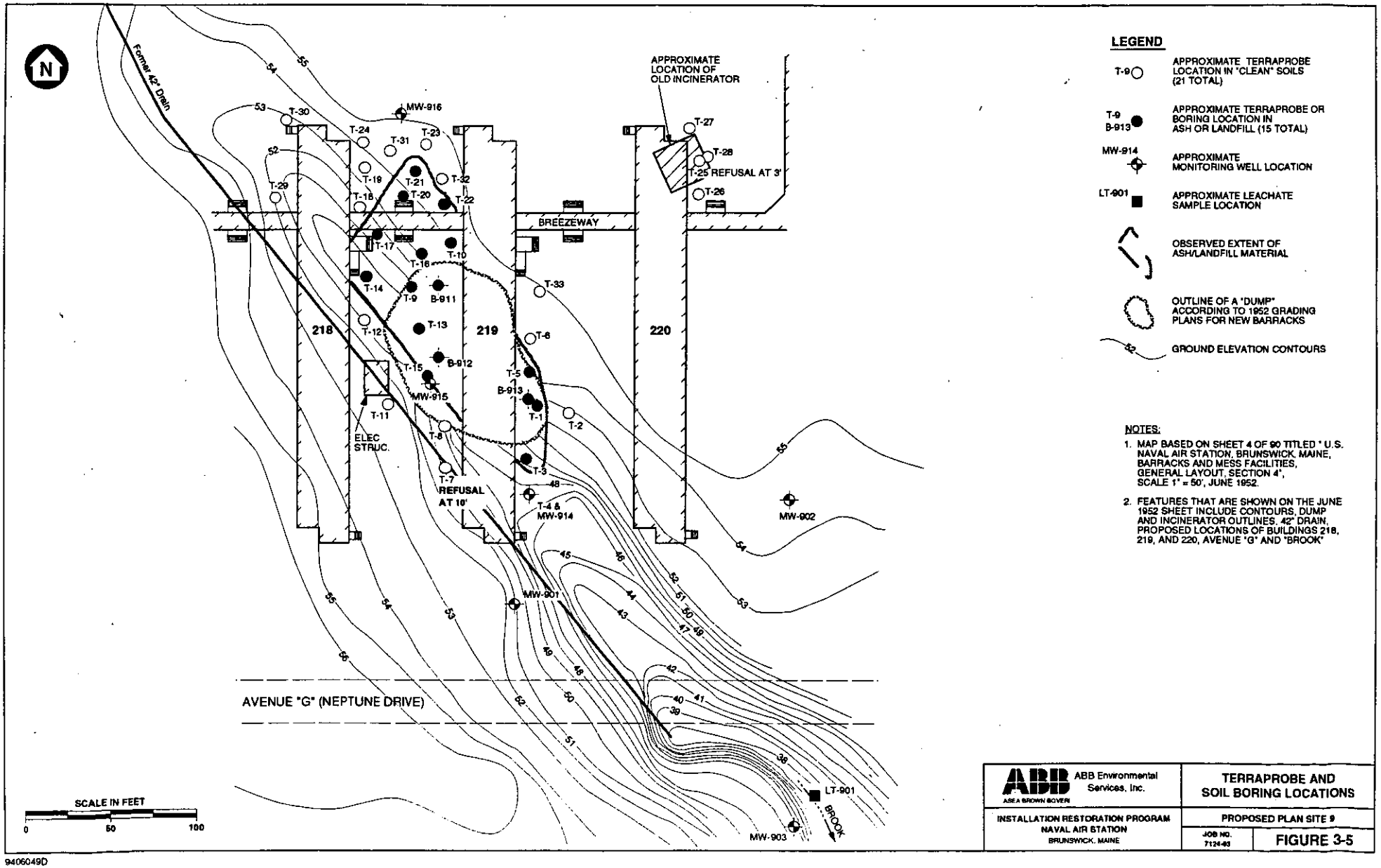
A **TerraProbe investigation**, consisting of 33 field sampling locations was conducted to identify the ash disposal area. The area of investigation is shown on Figure 3-5. The ash was discovered to extend on either side of Building 219 in an oblong trench oriented northwest to southeast. Ash was found from 6 to 16 feet bgs, with some ash below the water table (approximately 10 feet bgs).

3.2.4 Surface Water and Sediment Analytical Results

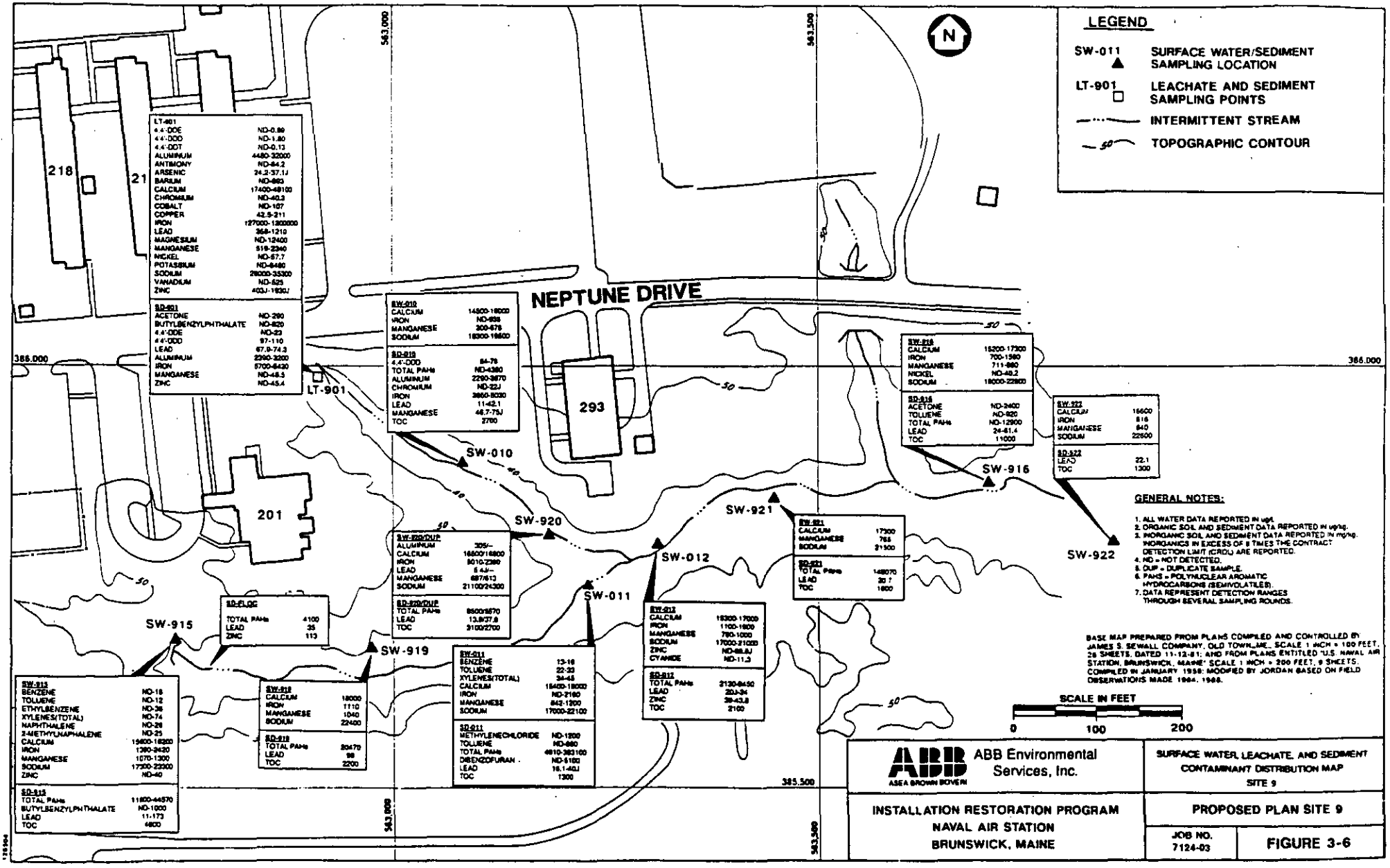
Surface water and **sediment** were sampled at 16 locations in the streams near Site 9 as well as downstream at the Picnic Area Pond (about 3,000 feet downstream of Site 9) during the RI field program. The sampling locations and analytical data are presented in Figure 3-6. The fuel-related organic compounds, benzene (6 to 18 μg/L), toluene (12 to 22 μg/L), ethylbenzene (36 μg/L), xylenes (34 to 74 μg/L), naphthalene (26 μg/L), and methylnaphthalene (25 μg/L), were detected in surface water samples in the stream bordering the southern side of Site 9 (E.C. Jordan Co., 1990a). The maximum concentration of all compounds except toluene was detected in the upstream sample (i.e., SW-915), suggesting that **non-point source** runoff from parking lots, roadways and/or the runways, located upstream of this tributary, is the source of these contaminants (see Figure 3-6). The source of toluene is not known. None of these compounds were detected above their respective **Ambient Water Quality Criteria (AWQC)**.

Calcium, iron, magnesium, and sodium were detected in the streams bordering Site 9 at concentrations exceeding background levels of surface water samples collected in Mere Brook. In addition, iron concentrations exceed the AWQC for this metal in both upstream (i.e., SW-915) and on-site sampling locations. Concentrations of inorganics in surface water at the Picnic Area Pond did not exceed federal AWQC. These concentrations are consistent with background values (E.C. Jordan Co., 1990a).

Site-related VOCs (i.e., vinyl chloride, DCE, and DCA) were not detected in sediment samples from the streams near Site 9; however, toluene was detected in two sediment samples from the Picnic Area Pond. Concentrations of inorganics in sediment samples were consistent with background concentrations in sand and clay soils (E.C. Jordan Co., 1990a).


N
Former 42" Drain
APPROXIMATE LOCATION OF OLD INCINERATOR
MW-916
T-30
T-24
T-31
T-23
T-27
T-28
T-25 REFUSAL AT 3'
T-26
T-29
T-19
T-21
T-32
T-18
T-20
T-22
BREEZEWAY
T-17
T-10
T-16
T-14
T-9
B-911
T-33
218
T-12
T-13
219
T-6
220
B-912
T-15
T-5
B-913
MW-915
T-1
T-2
T-11
ELEC STRUC.
T-8
T-7
REFUSAL AT 10'
T-3
T-4 & MW-914
MW-902
MW-901
AVENUE "G" (NEPTUNE DRIVE)
LT-901
BROOK
MW-903
SCALE IN FEET
0
50
100
LEGEND
T-9 APPROXIMATE TERRAPROBE LOCATION IN "CLEAN" SOILS (21 TOTAL)
T-9 B-913 APPROXIMATE TERRAPROBE OR BORING LOCATION IN ASH OR LANDFILL (15 TOTAL)
MW-914 APPROXIMATE MONITORING WELL LOCATION
LT-901 APPROXIMATE LEACHATE SAMPLE LOCATION
OBSERVED EXTENT OF ASH/LANDFILL MATERIAL
OUTLINE OF A "DUMP" ACCORDING TO 1952 GRADING PLANS FOR NEW BARRACKS
GROUND ELEVATION CONTOURS
NOTES:
1. MAP BASED ON SHEET 4 OF 90 TITLED " U.S. NAVAL AIR STATION, BRUNSWICK, MAINE, BARRACKS AND MESS FACILITIES, GENERAL LAYOUT, SECTION 4", SCALE 1" = 50', JUNE 1952.
2. FEATURES THAT ARE SHOWN ON THE JUNE 1952 SHEET INCLUDE CONTOURS, DUMP AND INCINERATOR OUTLINES, 42" DRAIN, PROPOSED LOCATIONS OF BUILDINGS 218, 219, AND 220, AVENUE "G" AND "BROOK"
ABB ASEA BROWN BOVERI
ABB Environmental Services, Inc.
TERRAPROBE AND SOIL BORING LOCATIONS
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
PROPOSED PLAN SITE 9
JOB NO. 7124-43
FIGURE 3-5

9406049D


LEGEND
SW-011 SURFACE WATER/SEDIMENT SAMPLING LOCATION
LT-901 LEACHATE AND SEDIMENT SAMPLING POINTS
INTERMITTENT STREAM
50 TOPOGRAPHIC CONTOUR
N
NEPTUNE DRIVE
218
21
201
293
LT-901
SW-010
SW-920
SW-921
SW-012
SW-011
SW-919
SW-915
SW-916
SW-922
386,000
385,500
563,000
563,500
LT-901
4,4'-DDE ND-0.89
4,4'-DDD ND-1.80
4,4'-DDT ND-0.13
ALUMINUM 4480-32000
ANTIMONY ND-84.2
ARSENIC 24.2-37.1J
BARIUM ND-860
CALCIUM 17400-48100
CHROMIUM ND-40.3
COBALT ND-107
COPPER 42.5-211
IRON 127000-1300000
LEAD 368-1210
MAGNESIUM ND-12400
MANGANESE 519-2340
NICKEL ND-67.7
POTASSIUM ND-6480
SODIUM 28000-35300
VANADIUM ND-525
ZINC 403J-1930J
SD-901
ACETONE ND-290
BUTYLBENZYLPHTHALATE ND-820
4,4'-DDE ND-23
4,4'-DDD 97-110
LEAD 67.9-74.3
ALUMINUM 2390-3200
IRON 5700-6420
MANGANESE ND-48.5
ZINC ND-45.4
SW-010
CALCIUM 14500-18000
IRON ND-858
MANGANESE 300-678
SODIUM 16300-18600
SD-010
4,4'-DDD 84-78
TOTAL PAHs ND-4380
ALUMINUM 2290-3670
CHROMIUM ND-22J
IRON 3860-5030
LEAD 11-43.1
MANGANESE 48.7-75J
TOC 2700
SW-916
CALCIUM 15200-17300
IRON 700-1580
MANGANESE 711-880
NICKEL ND-40.2
SODIUM 18000-22800
SD-916
ACETONE ND-2400
TOLUENE ND-820
TOTAL PAHs ND-12900
LEAD 24-61.4
TOC 11000
SW-922
CALCIUM 15600
IRON 816
MANGANESE 840
SODIUM 22600
SD-922
LEAD 22.1
TOC 1300
SW-920/DUP
ALUMINUM 305/--
CALCIUM 16600/18800
IRON 8010/2380
LEAD 6.4J/--
MANGANESE 687/613
SODIUM 21100/24300
SD-920/DUP
TOTAL PAHs 8500/8670
LEAD 13.8/37.8
TOC 9100/2700
SW-921
CALCIUM 17300
MANGANESE 768
SODIUM 21500
SD-921
TOTAL PAHs 148070
LEAD 20.7
TOC 1800
SD-FLOC
TOTAL PAHs 4100
LEAD 35
ZINC 113
SW-012
CALCIUM 15300-17000
IRON 1100-1800
MANGANESE 780-1000
SODIUM 17000-21000
ZINC ND-68.8J
CYANIDE ND-11.3
SD-012
TOTAL PAHs 2130-8450
LEAD 20J-34
ZINC 39-43.8
TOC 2100
SW-011
BENZENE 13-18
TOLUENE 22-33
XYLENES(TOTAL) 34-45
CALCIUM 15400-18000
IRON ND-2160
MANGANESE 842-1300
SODIUM 17000-22100
SD-011
METHYLENECHLORIDE ND-1200
TOLUENE ND-880
TOTAL PAHs 4810-383100
DIBENZOFURAN ND-5100
LEAD 16.1-40J
TOC 1300
SW-919
CALCIUM 18000
IRON 1710
MANGANESE 1040
SODIUM 22400
SD-919
TOTAL PAHs 30470
LEAD 98
TOC 2200
SW-915
BENZENE ND-18
TOLUENE ND-12
ETHYLBENZENE ND-36
XYLENES(TOTAL) ND-74
NAPHTHALENE ND-26
2-METHYLNAPHALENE ND-23
CALCIUM 19400-18200
IRON 1390-2420
MANGANESE 1070-1300
SODIUM 17300-22000
ZINC ND-40
SD-915
TOTAL PAHs 11800-44570
BUTYLBENZYLPHTHALATE ND-1000
LEAD 11-173
TOC 4800
GENERAL NOTES:
1. ALL WATER DATA REPORTED IN ug/l.
2. ORGANIC SOIL AND SEDIMENT DATA REPORTED IN ug/kg.
3. INORGANIC SOIL AND SEDIMENT DATA REPORTED IN mg/kg. INORGANICS IN EXCESS OF 5 TIMES THE CONTRACT DETECTION LIMIT (CRDL) ARE REPORTED.
4. ND = NOT DETECTED.
5. DUP = DUPLICATE SAMPLE.
6. PAHS = POLYNUCLEAR AROMATIC HYDROCARBONS (SEMIVOLATILES).
7. DATA REPRESENT DETECTION RANGES THROUGH SEVERAL SAMPLING ROUNDS.
BASE MAP PREPARED FROM PLANS COMPILED AND CONTROLLED BY JAMES S. SEWALL COMPANY, OLD TOWN, ME. SCALE 1 INCH = 100 FEET, 26 SHEETS, DATED 11-12-81; AND FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE" SCALE 1 INCH = 200 FEET, 9 SHEETS, COMPILED IN JANUARY 1958; MODIFIED BY JORDAN BASED ON FIELD OBSERVATIONS MADE 1984, 1988.
SCALE IN FEET
0 100 200
ABB Environmental Services, Inc.
ASEA BROWN BOVERI
SURFACE WATER, LEACHATE, AND SEDIMENT CONTAMINANT DISTRIBUTION MAP
SITE 9
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
PROPOSED PLAN SITE 9
JOB NO. 7124-03
FIGURE 3-6

PAHs were detected in the majority of sediment samples collected in most sampling rounds from the streams in the Site 9 vicinity, at concentrations up to 383 mg/kg. The highest concentration was detected in sample SD-011. Two other organic compounds, bis(2-ethylhexyl)phthalate (up to 1,900 micrograms per kilogram [μg/kg]) and butylbenzylphthalate (up to 1,000 μg/kg), were detected sporadically in sediment samples from the Site 9 streams. The highest concentrations were detected in the upstream sample at the culvert outfall (E.C. Jordan Co., 1990a).

Pesticides and PCBs were not detected in surface water or sediment samples.

3.2.5 Leachate Seeps and Sediments Analytical Results

One leachate seep was identified and sampled twice during the RI field program and once during the 1993 field investigation. The seep is located at the head of the northern stream and at the discharge of the historical drain (see Figures 3-2 and 3-6). Because the drain was located downgradient of the ash disposal area, this structure may have acted as a preferential pathway for contaminant migration. Therefore, it is possible that the ash disposal area north of Neptune Drive is the source of contaminants detected in the leachate. Pesticides and PAHs were detected at low levels in both the leachate (LT-901) and sediment (SD-901) from this location. Other organic compounds were not detected in the leachate, but one organic compound, butylbenzylphthalate, was detected in the sediment in one of the two sampling rounds at 820 μg/kg. Inorganic contaminants detected in leachate and sediment samples are shown in Figure 3-6.

3.4 SUMMARY

The results of the 1988, 1990, and 1993 field investigations at Site 9 indicate the presence of vinyl chloride and DCE in groundwater both south and north of Neptune Drive at concentrations in excess of their respective MCLs and MCLGs, MEGs, and DCA in groundwater south of Neptune Drive at concentrations in excess of its respective MEG. The septic system, originally thought to be a potential source of VOC contamination south of Neptune Drive, was sampled to evaluate residual contamination. Sampling results indicate that the septic system is not a current source of groundwater contamination. The former ash disposal area, north of Neptune Drive, was identified and samples collected for analysis. PAHs were detected in the ash material; however, these compounds were not detected in groundwater immediately downgradient from this area. Vinyl chloride was detected in one monitoring well downgradient from the disposal area but was not detected in ash or soil

samples. Elevated concentrations of inorganics were detected in groundwater downgradient of the ash disposal area and the presence of these analytes may be due to past disposal activities in this area. Inorganics and PAHs were detected in leachate and/or sediment samples. The presence of these contaminants may be due to the ash or to other non-point source runoff from the roadways or parking lots.

4.0 SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to estimate the potential risks to human health and the environment from exposure to groundwater, surface water, sediment, leachate, and soil contaminants associated with Site 9. The risk assessment can be found in Appendix Q of the Draft Final RI and is summarized in Section 15.0 of the Draft Final RI Report (E.C. Jordan Co., 1990a). Since submittal of the RI, additional risk estimates for Site 9 were developed at the request of USEPA Region I based on more recent guidance (USEPA, 1991a). The revised risk estimates can be found in Subsections 8.1.2 and 8.1.3 and Appendix H of the FS (E.C. Jordan Co., 1992). Risk estimates were also calculated as part of the Technical Memorandum and are presented in Section 4.0 of this report. These documents are part of the Administrative Record and are also available for review at the Curtis Memorial Library in Brunswick, Maine.

Because this section is to support the interim groundwater remedial alternative, only the risks associated with groundwater exposure are summarized. A summary of site risks will be presented in the Proposed Plan and final ROD for this site.

4.1 SUMMARY OF GROUNDWATER RISK ASSESSMENT

The groundwater contaminants of concern (COC) identified in the Site 9 human health risk assessment constitute a representative subset of all contaminants identified during the RI. The COCs were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. The COCs are summarized in Tables Q-7 and Q-14 in Appendix Q of the Draft Final RI Report (E.C. Jordan Co., 1990a). A summary of the health effects of each COC is presented in Appendix Q, pages Q-122 through Q-151 of the Draft Final RI Report (E.C. Jordan Co., 1990a).

The potential risks associated with exposure to groundwater contaminants south of Neptune Drive were qualitatively evaluated in the Draft Final RI report (E.C. Jordan Co., 1990a) based on a comparison of contaminant concentrations to MCLs, MCLGs, MEGs, or health-based criteria. Compounds detected in excess of these drinking water standards and criteria concentrations are considered to present a potential health risk. Quantitative risk estimates from exposure to groundwater were developed as part of the Technical Memorandum (ABB-ES, 1994a) to evaluate risks associated with potential future use of groundwater from

the portion of Site 9 north of Neptune Drive not previously evaluated. A summary of the groundwater COCs, analytical data, and regulatory standards and criteria are presented in Table 4-1.

VOCs were the contaminants detected most frequently at Site 9. VOCs were detected in three wells (MW-904, 906, and 907) and two temporary monitoring locations (CP-902 and CP-903) located south of Neptune Drive and one well (MW-915) located north of Neptune Drive. Vinyl chloride was detected at concentrations ranging from non-detect to 31 μg/L south of Neptune Drive and from non-detect to 10J μg/L north of Neptune Drive. The federal MCL for vinyl chloride is 2 μg/L. The federal MCLG is zero because this compound is classified as a carcinogen. The MEG for vinyl chloride is 0.15 μg/L. In addition to vinyl chloride, DCA and DCE were detected in groundwater at concentrations in excess of the MCL, MCLG, or MEG. The presence of these compounds in groundwater are considered to present a potential health risk.

Inorganics detected in groundwater at Site 9 were in the normal background range, except for sodium, calcium, iron, and magnesium (south of Neptune Drive) and sodium, cadmium, calcium, aluminum, iron, and manganese (north of Neptune Drive). Aluminum, iron, and manganese concentrations exceeded their respective MCLs. However, the MCLs for these inorganic analytes are based on aesthetic qualities and not on protection of human health. Cadmium was detected in only one sample, but at a concentration that exceeded its MCL.

Quantitative risk estimates for ingestion of groundwater were developed as part of the Technical Memorandum based on analytical data collected in 1993. The risk estimates were based on a residential exposure and assumed that a 70-kilogram adult drinks 2 liters of water per day for 30 years. This scenario is considered to be conservative because groundwater beneath the site is not currently or likely to be used in the future for potable purposes. The quantitative risk estimates are presented in Appendix C of the Technical Memorandum (ABB-ES, 1994a) and summarized in the following paragraphs.

Excess lifetime cancer risks were estimated for the groundwater exposure pathway by multiplying the exposure level by the chemical-specific **cancer slope factor** (CSF). CSFs have been developed by USEPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risks posed by potentially **carcinogenic** compounds. That is, the true risk is unlikely to be greater than the predicted risk. The resulting risk estimates are expressed in scientific notation as a probability (e.g., $1x10^{-6}$ for 1/1,000,000) and indicate (using this example) that an individual is not likely to have more than a one-in-a-million chance of developing cancer over 70 years as a result of site-related exposure to the

TABLE 4-1

GROUNDWATER CONTAMINANTS AND REGULATORY CRITERIA

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

COMPOUND	CONCENTRATION RANGE (µG/L)	FEDERAL MCL (µG/L)	FEDERAL MCLG (µG/L)	MAINE MEG (µG/L)
Vinyl Chloride	ND - 31	2	0	0.15
1,1-Dichloroethane	ND - 36	--	--	5
1,2-Dichloroethylene	ND - 79	70	70	70
2-Butanone	ND - 110	--	--	--
Toluene	ND - 1J	1,000	1,000	2,000
PAHs (total)	ND - 12J	--	--	--
Mercury	ND - 0.23	2	2	2

Notes:

MCL = Maximum Contaminant Level; (USEPA, 1992)
MCLG = Maximum Contaminant Level Goal; (USEPA, 1992)
MEG = Maximum Exposure Guideline; (MEDOH, 1990)
ND = Not Detected
J = Estimated Concentration

compound at the stated concentration. Current USEPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

The **Hazard Index** (HI) was also calculated for the groundwater exposure pathway as USEPA's measure of the potential for **noncarcinogenic** health effects. The HI is the sum of Hazard Quotients (HQs), which are calculated for each chemical by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for noncarcinogenic health effects. RfDs have been developed by USEPA to protect sensitive individuals during the course of a lifetime, and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help confirm that adverse health effects will not occur. The HQ is often expressed as a single value (e.g., 0.3) indicating the ratio of the stated exposure as defined to the RfD value (in this example, the exposure as characterized is approximately one-third of an acceptable exposure level for the given compound). The HQ is only considered additive for compounds that have the same or similar toxic endpoints. Risk estimates developed as part of this baseline risk assessment were evaluated using the USEPA criteria and target risk range to identify the need for remedial actions at this site.

The significance of risk estimates was evaluated by comparing risks to established target levels. USEPA has established target levels for the evaluation of carcinogenic risks and noncarcinogenic hazards at hazardous waste sites. USEPA's guidelines state that the total incremental carcinogenic risk for an individual resulting from multiple-pathway exposures at a Superfund site should not exceed a range of 10^{-6} to 10^{-4}. The State of Maine has established a guideline of $1x10^{-5}$ incremental carcinogenic risk as a target risk level for remediation at hazardous waste sites. The risk characterizations in this report refer to the USEPA's target risk range; and carcinogenic risk estimates as being "below the target range" when risks are less than 10^{-6}; "within the target range" when risks are between 10^{-6} and 10^{-4}; and "above the target range" when risks are greater than 10^{-4}. The USEPA's and State of Maine's target hazard level for noncarcinogenic effects is an HI of 1.0.

Incremental cancer risks and HIs for the groundwater scenarios evaluated at Site 9 are summarized in Table 4-2. The HI is calculated to be 6.0 and 3.0 based on exposure to the maximum and average contaminant concentrations, respectively. Both HIs exceed the USEPA target level of 1.0, but are below the USEPA Region I values of concern for an HI of 10 (USEPA, 1989). The elevated HI is due almost entirely to the presence of manganese. The incremental carcinogenic risk is estimated to be $2x10^{-4}$ for the maximum and $1x10^{-4}$ for the average exposure conditions. The cancer risk is attributable to the

TABLE 4-2
SUMMARY OF RISK ESTIMATES: INGESTION OF GROUNDWATER[1]

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

COMPOUND	MAXIMUM CONCENTRATION (µg/L)	AVERAGE CONCENTRATION (µg/L)	AVERAGE SCENARIO		MAXIMUM SCENARIO	
			HAZARD INDEX (UNITLESS)	INCREMENTAL CARCINOGENIC RISK (UNITLESS)	HAZARD INDEX (UNITLESS)	INCREMENTAL CARCINOGENIC RISK (UNITLESS)
Vinyl Chloride	10	6	0.00027	1.3×10^{-4}	0.00027	2.2×10^{-4}
1,1-Dichloroethane	1	1	0.00068	NA	0.00068	NA
Naphthalene	1	1	0.00046	NA	0.00046	NA
Acenaphthalene	1	1	0.00068	NA	0.00068	NA
Phenanthrene	1	1	0.0027	NA	0.0027	NA
Bis(2-ethylhexyl)phthalate	2	2	--	3.3×10^{-7}	--	3.3×10^{-7}
Aluminum	5,510	2,493	0.094	NA	0.17	NA
Barium	443	239	0.21	NA	0.35	NA
Cadmium	6.4	3.8	0.035	NA	0.054	NA
Chromium	9.9	6.4	2.3	NA	5.5	NA
Manganese	1,010	415	0.024	NA	0.024	NA
Vanadium	6.2	6.2	--	NA	--	NA
		Summary	4	1×10^{-4}	6	2×10^{-4}

Notes:

-- Not calculated; no quantitative toxicity information available.
NA Not applicable; compound not considered to be carcinogenic.
[1] This scenario is based on 70 kilogram adult ingesting 2 liters of water per day for 30 years. Data used to estimate risk include only those samples collected North of Neptune Drive during the 1993 sampling event.

presence of vinyl chloride. The estimated incremental cancer risks are at or slightly exceed the USEPA target risk range.

Environmental receptors are not considered to be at risk from exposure to groundwater contaminants. Groundwater at Site 9 discharges to the tributaries bordering the site. The ecological risks associated with exposure to surface water and sediments were calculated and are presented in Appendix Q to the Draft Final RI (E.C. Jordan Co., 1990a). These risk estimates will be used to determine the need for additional remedial actions at Site 9 and will be summarized in the final ROD or source operable unit ROD for this site.

5.0 PROPOSED REMEDIAL OBJECTIVES AND LEVELS

Using information gathered from site studies, the Navy developed objectives for the interim remedial action for groundwater at Site 9. The interim remedial objectives are proposed to minimize human health risks associated with future potential exposure to contaminated groundwater. The objective for groundwater remediation is to reduce VOC contamination in groundwater to concentrations considered protective of human health.

As an interim step, the Navy proposes to allow natural attenuation to achieve this objective. Long-term environmental monitoring will be conducted by the Navy to evaluate groundwater quality and to measure contaminant concentrations in the groundwater, surface water, and sediment while the Navy conducts additional investigations of possible source areas of contamination at Site 9. The additional source investigations and results of the long-term monitoring will be used by the Navy to develop the overall remediation strategy for Site 9. Groundwater remediation, through natural attenuation, is considered by the Navy to be part of this overall strategy, and therefore is being proposed as an interim remedial action. Long-term monitoring, which will be implemented as a result of this interim action, is necessary to document the attenuation of contamination over time.

Clean-up concentrations for groundwater were developed based on future potential exposure to groundwater, and were set at the drinking water standards for the contaminants of concern: vinyl chloride, DCE, and DCA. These concentrations are presented in Table 5-1. Under the natural attenuation alternative, it is expected that these levels will be attained through natural processes within a reasonable time frame (i.e., between two and 15 years).

In addition to activities being conducted as part of the IR Program, the NAS is also taking steps to mitigate non-point source contamination at the base. Activities include the placement of catch basins in the southern unnamed stream, adjacent to Site 9, to collect and trap contaminated sediments. The NAS is also conducting an investigation of groundwater contamination associated with the Naval Exchange gas station located north of Neptune Drive. Information collected as part of these activities will be provided to the IR Program, to support the development of the final remedial action(s) at Site 9.

The need for and extent of additional remedial actions and development of clean-up concentrations for soil, surface water, sediment, and leachate will be described in the source area Proposed Plan and developed to support the final ROD for Site 9.

TABLE 5-1
TARGET CLEAN-UP LEVELS

PROPOSED PLAN: SITE 9
NAS BRUNSWICK

MEDIUM/ CONTAMINANT	TARGET CLEAN-UP LEVEL	RATIONALE
Groundwater:		
Vinyl Chloride	2 μg/L	MCL
1,2-Dichloroethylene	70 μg/L	MCL
1,1-Dichloroethane	5 μg/L	MEG

Notes:

μg/L = micrograms per liter
MCL = Maximum Contaminant Level
MEG = Maximum Exposure Guideline

6.0 THE NAVY'S PREFERRED ALTERNATIVE

The Navy's selection of the preferred alternative for an interim remedial action at Site 9, as described in this Proposed Plan, is the result of a comprehensive evaluation, screening, and regulatory agency review process. The following paragraphs describe the preferred interim **remedial alternative** developed by the Navy for Site 9.

Preferred Alternative: Groundwater Remediation through Natural Attenuation, Institutional Controls and Long-Term Monitoring

The preferred alternative for the interim remedial action at Site 9 is remediation through natural attenuation, and long-term monitoring of the groundwater operable unit to measure expected decreases of contaminant concentrations over time. In addition, institutional controls will be implemented to limit exposure to groundwater during the time required to reduce contaminant concentrations in groundwater. Because the source has not been characterized, the site groundwater has been set as an operable unit, and a long-term monitoring plan is being prepared. The Navy proposes to initiate additional source investigations to develop the final remedial action at this site.

The preferred alternative is the same as the Minimal Action Alternative described in the FS, except it includes monitoring of the leachate seep at the former drain outlet location when sufficient liquid is present to collect a sample (E.C. Jordan Co., 1992). The preferred alternative also includes groundwater, surface water, and sediment monitoring to measure the decrease in contaminant concentrations by natural attenuation. The time to achieve groundwater clean-up concentrations under this alternative was estimated based on USEPA-approved groundwater models and groundwater flow velocities at the site. Groundwater at Site 9 moves at an estimated 26 feet to 130 feet per year; therefore, a water particle will move through the site (i.e., from Neptune Drive to the southern unnamed stream) in approximately 0.70 years. The groundwater models indicate that it may require three to 22 **pore volume** flushes to remediate the aquifer. Under natural flow conditions, groundwater clean-up concentrations would be achieved over a period of two to 15 years, the amount of time it would take for the groundwater to discharge to the streams (E.C. Jordan Co., 1992).

This alternative includes the following components:

- institutional controls
- environmental monitoring

- five-year reviews

The Navy will also be conducting additional source investigations concurrent with implementing this alternative.

Components of this interim remedial alternative are described in the following paragraphs.

Institutional Controls. The preferred alternative requires institutional controls (i.e., deed and land use restrictions) to prevent human consumption of contaminated groundwater until monitoring results determine that controls are no longer necessary. These controls would be implemented to restrict future use of site groundwater for drinking water. The legal implications of instituting land-use restrictions would be coordinated with appropriate Navy officials and state and local governments. If NAS Brunswick ever closes, these restrictions would be placed on future development.

Environmental Monitoring. Groundwater and surface water quality would be monitored as a measure of the long-term effectiveness of remediation by natural attenuation. Monitoring groundwater would track contaminant concentrations and groundwater movement. Surface water and sediment monitoring would also track contaminant concentration to evaluate the impact, if any, of groundwater discharge to the streams. The Navy will prepare a **Long-Term Monitoring Plan** detailing the sampling locations, frequency of sampling events, and contaminants to be analyzed. This plan would be submitted for regulatory agency review, comment, and approval. Environmental monitoring would occur until groundwater clean-up concentrations are achieved. For cost-estimating purposes, the monitoring was assumed to occur for up to 30 years, although the clean-up concentrations are expected to be achieved within 15 years. The costs for monitoring the groundwater have been included to assess the progress of natural attenuation for up to 30 years.

Five-year Site Review. Under CERCLA 121c, a five-year site review is required for any site where contaminants remain on the site at concentrations that do not allow for unlimited exposure or land use. The five-year review is expected to focus on evaluating whether the remedial alternative continues to provide adequate protection of human health and the environment, and would focus on the data collected as part of the long-term monitoring program. The five-year site review could recommend additional remedial actions at the site or that no further action is necessary. The five-year review would be conducted in cooperation with the MEDEP and USEPA.

The cost estimate for this interim remedial alternative is based on conducting quarterly groundwater sampling at 11 locations, surface water and sediment sampling at five locations, and leachate sampling at one location for a period of five years. After five years, the sampling frequency is assumed to occur bi-annually for 10 additional years and annually for up to 30 years. All samples will be analyzed for VOCs and selected samples analyzed for SVOCs and inorganics. The cost estimate also includes costs associated with conducting five-year reviews. The actual costs of this interim remedial alternative will be determined based on the final Long-Term Monitoring Plan and agency input during the five year reviews.

Estimated Time for Design and Construction: Not applicable
Estimated Time of Operation: 30 years of monitoring
Estimated Capital Costs: $0
*Estimated Operations and Maintenance Costs (**net present worth**): $434,000*
Estimated Total Cost (net present worth): $434,000

7.0 OTHER ALTERNATIVES EVALUATED IN THE FEASIBILITY STUDY

Source control and groundwater remedial alternatives for Site 9 were developed and presented in the FS report (E.C. Jordan Co., 1992). However, these alternatives were developed based on the assumption that the septic system and leachfield associated with Building 201 were the sources of groundwater contamination. Sampling results collected and analyzed in 1993 indicate that the septic system and subsurface soils around the septic system are not acting as a current source of contamination (ABB-ES, 1994a). Therefore, remedial actions for removing, containing, or treating the septic system or subsurface soils are not necessary at this time.

The Navy will be conducting additional field investigations in the vicinity of Site 9 to evaluate other potential source areas of groundwater contamination. Until these field investigations are completed, no source control alternatives will be developed. Therefore, this interim remedial action addresses only groundwater contamination. Other alternatives (i.e., a no action alternative and alternatives that include a source control component) will be developed and evaluated after the completion of the additional field investigations at Site 9. The public is invited to review and comment on the proposed interim remedial action at this time, and will have the opportunity to comment on the other alternatives when the Navy proposes an overall remediation strategy for the site.

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

In FS reports conducted for remediating hazardous waste sites under CERCLA, the USEPA requires that remedial alternatives be evaluated using nine criteria. These nine criteria are used to select a remedy that meets national Superfund program goals of protecting human health and the environment, maintaining long-term protection, and minimizing untreated waste. Definitions of the nine criteria and a summary of the Navy's evaluation of the proposed interim remedial alternative using the nine criteria are provided in the following subsections.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall Protection of Human Health and the Environment addresses how an alternative as a whole will protect human health and the environment. This includes an assessment of how human health and environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

The interim remedial action developed for Site 9 will provide protection of human health and the environment. Protection to human health is provided by reducing exposure to site contaminants through institutional controls. Protection to the environment would be provided, over time, as natural attenuation reduces contaminant concentrations discharging to the unnamed streams. Clean-up concentrations would be achieved over two to 15 years, the amount of time required for the groundwater to discharge to the streams.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)** addresses whether or not a remedy complies with all state and federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and clean-up options at a specific site. If an ARAR cannot be met, the reasons must be clearly stated and a waiver may be required. When comparing interim remedies, it is appropriate to analyze compliance with only those laws and regulations that are applicable or relevant and appropriate to the limited scope of the interim action.

The interim remedial alternative will attain ARARs that apply to the limited scope of the interim action. Because the remedy selected is an interim action that includes no remedial action, the location- and action-specific ARARs do not apply. The selected remedy would meet the following chemical-specific federal and state ARARs: Safe Drinking Water Act MCLs and non-zero MCLGs; and Maine Drinking Water Rules.

8.3 Long-term Effectiveness and Permanence

Long-term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once clean-up goals have been met.

Site 9 risks associated with the groundwater operable unit stem largely from potential exposure to groundwater as drinking water. Because there is no current use of groundwater, there is no immediate threat to human health at Site 9.

The interim remedial action depends solely on institutional controls and land use restrictions to reduce risks, while natural attenuation will provide the long-term effectiveness. Effective enforcement of institutional controls will be needed to assume proper protection of human health under this alternative.

8.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of Toxicity, Mobility, or Volume through Treatment are three principal measures of the overall performance of an alternative. The 1986 Superfund amendments emphasize that, whenever possible, USEPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at the site, the spread of contaminants away from the source of contamination (i.e., mobility), and the volume or amount of contamination at the site.

The interim remedial alternative relies on institutional controls and natural flushing of the aquifer to achieve risk reduction. There is no treatment component to this alternative. Therefore, this alternative does not meet this criterion.

8.5 SHORT-TERM EFFECTIVENESS

Short-term Effectiveness refers to the likelihood of adverse effects on human health or the environment that may result during the construction and implementation of an alternative until clean-up goals have been achieved.

There will be no impacts to the community, workers, or environment above those that currently exist at Site 9 as a result of implementing the interim remedial alternative.

Impacts to workers conducting long-term monitoring will be controlled by the use of appropriate personal protective clothing and equipment during remedial activities. All site work would be conducted in accordance with Occupational Safety and Health Administration (OSHA) regulations.

8.6 IMPLEMENTABILITY

Implementability refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

The interim remedial action is implementable. Long-term monitoring has been successfully demonstrated at other Superfund sites.

8.7 COST

Cost includes the capital (up-front) cost of implementing an alternative as well as the cost of operating and maintaining the alternative over the long term, and net present worth of both capital and operation and maintenance costs.

The capital, operation and maintenance, and total cost for the interim remedial action alternative is provided as part of the site description in the preceding sections on "The Navy's Preferred Alternative." The costs are based on sampling 11 monitoring well locations, five surface water and sediment locations and one leachate seep. Quarterly sampling is assumed for the first five years, with bi-annual sampling through 15 years and annual sampling up to 30 years. The major cost component in this alternative is long-term environmental monitoring.

8.8 STATE ACCEPTANCE

State Acceptance addresses whether, based on its review of the RI/FS and Proposed Plan, the state concurs with, opposes, or has no comment on the alternative the Navy is proposing as the interim remedy for the site.

The MEDEP, on behalf of the State of Maine, has reviewed this Proposed Plan and has provided comments and recommendations. The state may comment further after it has had an opportunity to review comments received during the public comment period.

8.9 COMMUNITY ACCEPTANCE

Community Acceptance addresses whether the public concurs with the Navy's Proposed Plan. Community Acceptance of this Proposed Plan will be evaluated based on comments received at the public meeting and during the public comment period. This criterion will be addressed in the Interim ROD.

9.0 THE NAVY'S RATIONALE FOR PROPOSING THE PREFERRED ALTERNATIVE

Based on current information and analysis of the RI, FS, and Technical Memorandum reports, the Navy believes that the proposed interim remedial alternative for Site 9 is consistent with the requirements of the Superfund law and its amendments, specifically Section 121 of CERCLA, and to the extent practicable, the **National Oil and Hazardous Substances Contingency Plan.** The interim remedial alternative presented in this Proposed Plan will provide overall protection of human health and the environment under current conditions. In the Navy's analysis, the preferred alternative is cost-effective, easily implementable, and would have minimal short-term impacts to the community. The preferred alternative would provide short- and long-term protection of human health and the environment, and would attain federal and state human health and environmental ARARs. This interim remedial action will be consistent with the future source control or groundwater remedial actions conducted at other areas or operable units of Site 9.

GLOSSARY

Administrative Record: A file established and maintained in compliance with Section 113(k) of CERCLA consisting of information upon which the lead agency bases its final decisions on the selection of clean-up method(s) for a Superfund site. The Administrative Record should be established at or near the site and made available to the public.

Ambient Water Quality Criteria (AWQC): Contaminant concentrations in surface water that are considered to be protective of aquatic receptors.

Applicable or Relevant and Appropriate Requirements (ARARs): ARARs include any state or federal statute or regulation that pertains to protection of public health and the environment in addressing certain site conditions or using a particular clean-up technology at a Superfund site. The Navy must consider whether a remedial alternative meets ARARs as part of the process for selecting a clean-up alternative for a Superfund site.

Bedrock: The layer of rock located below the glacially deposited soil and rock under the ground's surface. Bedrock can be either solid or fractured (cracked); fractured bedrock can support aquifers.

Cancer Slop Factor (CSF): Used to estimate an upper bound probability of an individual developing cancer as a result of lifetime exposure to a potential carcinogen.

Carcinogenic: Cancer-producing.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The act created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean-up abandoned or uncontrolled hazardous waste sites.

Dichlorodiphenyltrichloroethane (DDE): A metabolic and degradation product of DDT.

Dichlorodiphenyltrichloroethane (DDT): A chlorinated hydrocarbon insecticide. DDT persists in the environment and bioaccumulates. The insecticide was banned in the United States in 1972 but was widely used until that point and is found at low concentrations throughout NAS Brunswick.

Feasibility Study (FS): A report that summarizes the development and analysis of remedial alternatives.

Groundwater: Water found beneath the earth's surface that fills pores in soil and bedrock to the point of saturation. Groundwater may transport substances that have percolated downward from the ground surface as it flows toward its point of discharge.

Hazard Index: The ratio of a substance exposure level over a specified time period (e.g., chronic) to a reference dose for that substance derived from a similar exposure period.

Initial Assessment Study (IAS): Field investigations that confirm the presence of hazardous materials at a site.

Inorganic Analyte: Chemical substances of mineral origin, not of basically carbon structure.

Interim Remedial Action: An option evaluated to address the source or migration of contaminants at a Superfund site to control or prevent further migration. This action is not intended to be the final remedy for the site, but must be consistent with the ultimate remedy chosen.

Leachate: Contaminated liquid resulting from water flushing through a source area. Leachate can be produced when rain percolates through a disposal area. *Leachate seeps* are small amounts of water flowing from the sides of stream embankments.

Long-Term Monitoring Plan: A document that outlines the tasks to be performed to characterize media (e.g., soil, groundwater) quality at a site and to identify contamination, if any, associated with past disposal or spill activities.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water that is consumed as drinking water. These levels are determined by USEPA under the Safe Drinking Water Act and are enforceable standards applicable to all public water supplies.

Maximum Contaminant Level Goal (MCLG): The maximum level goal of a contaminant in drinking water at which no known or anticipated adverse effect on human health will occur. USEPA establishes MCLGs under the Safe Drinking Water Act at threshold levels with a margin of safety for noncarcinogens and a zero level for carcinogens where the threshold level is unknown.

Maximum Exposure Guideline (MEG): The maximum contaminant level or health advisory of a chemical or man-made radiological contaminant in drinking water. These levels are determined by the State of Maine and are applicable to all public water supplies in Maine. The MEG typically coincides with the federal MCL for each regulated contaminant; however, risk-based calculations have resulted in some specific MEGs that are set at more stringent levels.

Micrograms per kilogram (μg/kg): A unit of measure used to describe levels of contamination on a weight-per-weight basis in soils. One microgram per kilogram is equal to one millionth of a gram of a contaminant in one thousand grams of material (i.e., soil). This unit of measure is also known as one part per billion (ppb).

Micrograms per liter (μg/L): A unit of measurement used to describe levels of contamination in water. One microgram per liter is equal to one millionth of a gram of a contaminant in one liter of water. This unit of measure is also known as one part per billion (ppb).

Milligrams per kilogram (mg/kg): A unit of measure used to describe levels of contamination on a weight-per-weight basis in soils. One milligram per kilogram is equal to one thousandth of a gram of a contaminant in one thousand grams of material (i.e., soil). This unit of measure is also known as one part per million (ppm).

Monitoring Wells: Wells installed to collect groundwater samples for physical, chemical, or biological analysis to determine the amounts, types, and distribution of contaminants in the groundwater beneath the site.

National Oil and Hazardous Substances Contingency Plan (NCP): The federal regulation that guides determination of the sites to be corrected under the Superfund program and the program to prevent or control spills into surface waters or other portions of the environment.

National Priorities List (NPL): USEPA's list used to prioritize uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund.

Natural Attenuation: The natural process by which biodegradation, dispersion, dilution, and adsorption reduce contaminants in the groundwater to concentrations protective of human health. Natural attenuation is generally acceptable in cases where contaminant concentrations can be reduced to acceptable levels in a time frame comparable to that

which could be achieved through active restoration, the aquifer will not be used as a drinking water supply, or active restoration is not practicable.

Net Present Worth: The amount of money necessary to secure the promise of future payment, or series of payments, at an assumed interest rate.

Noncarcinogenic: A compound that produces a toxic response other than cancer.

Non-point Source: A non-discrete or widespread origin of contamination, such as uncontrolled runoff.

Operable. Unit: A discrete action of a remedial response that comprises an incremental step toward comprehensively addressing site problems by managing migration, or eliminates or mitigates a release, threat of a release, or pathway of exposure. The clean-up of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions, specific site problems, initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but are located in different parts of a site.

Overburden Soil: Soil overlying the bedrock layer.

Pollution Abatement Confirmation (PAC) Study: A study conducted to confirm the presence of hazardous constituents or hazardous waste.

Polychlorinated Biphenyls (PCBs): A group of toxic, persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Further sale or new use of PCBs was banned by law in 1979.

Polynuclear Aromatic Hydrocarbons (PAHs): A small group of chemicals typically formed during the combustion of hydrocarbon fuels, but that can also exist naturally in the environment. PAHs are found in high concentrations in urban or industrial areas or in the vicinity of airports. PAHs are relatively immobile in the environment. Some PAHs are believed to cause cancer, while others have not been observed to produce adverse health effects.

Pore Volume: The liquid water volume occupying the effective porosity in the aquifer within the area of concern.

Record of Decision (ROD): A public document that explains the clean-up alternative to be used at a National Priorities List (NPL) site. The ROD is based on information and technical analysis generated during the Remedial Investigation/Feasibility Study (RI/FS) and on consideration of the public comments and community concerns.

Remedial Alternatives: Clean-up options evaluated for a site to address contamination and contaminated media at the site.

Remedial Investigation (RI): The Remedial Investigation determines the nature and extent and composition of contamination at a hazardous waste site, and directs the types of clean-up options that are developed in the Feasibility Study.

Remediate: To clean-up.

Risk Assessment: Evaluation and estimation of the current and future potential for adverse human health or environmental effects from exposure to contaminants.

Sediments: The sand or mud found at the bottom and sides of bodies of water, such as creeks, rivers, streams, lakes, swamps, and ponds. Sediments typically consist of soil, silt, clay, plant matter, and sometimes gravel.

Seepage Velocities: The average groundwater velocities (speed) occurring at certain points of a porous medium. Seepage velocity (or Darcy velocity) is defined by the equation $VV = \frac{ki}{n}$, where K = hydraulic conductivity of the porous medium, i = hydraulic gradient, and n = fraction of voids present in the porous medium (i.e., the porosity).

Semivolatile Organic Compound: A group of chemical compounds having a molecular weight greater than 100. These compounds are heavier than and less volatile than volatile organic compounds.

Solvents: Liquids capable of dissolving other liquids or solids to form a solution. The chief uses of industrial solvents are as cleaners and degreasers. Solvents also are used in paints and pharmaceuticals. Solvents used in foundries and other industrial applications are frequently volatile organic compounds (VOCs). Many solvents are flammable and toxic to varying degrees.

Source: Area at a hazardous waste site from which contamination originates.

Stratified: Separated into layers.

Superfund: The program operated under CERCLA and SARA that funds and carries out the USEPA solid waste emergency and long-term removal activities.

TerraProbe Investigation: A field sampling event using a piece of equipment, called a TerraProbe. The TerraProbe uses hydraulic force to push hollow, metal rods into the ground. Soil and groundwater samples can be collected in the rods at different depths, depending on how deep the rods are pushed.

Transition: Soil unit consisting of varying layers of sands, silts, and clays.

Volatile Organic Compounds (VOCs): A group of chemical compounds composed primarily of carbon and hydrogen that are characterized by their tendency to evaporate (or volatilize) into the air from water or soil. VOCs include substances that are contained in common solvents and cleaning fluids. Some VOCs are believed to cause cancer.

ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminants of Concern
CRQL	Contract Required Detection Limit
CSF	cancer slope factor
DCA	dichloroethane
DCE	dichloroethylene
DDE	dichlorodiphenyltrichloroethene
DDT	dichlorodiphenyltrichloroethane
FFA	Federal Facility Agreement
FS	Feasibility Study
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guideline
mg/kg	milligrams per kilogram
NACIP	Navy Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NPL	National Priorities List
PAC	Pollution Abatement Confirmation
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

Rfd	Reference dose
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVOC	semivolatile organic compound
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

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