RECORD OF DECISION

OPERABLE UNITS 2 AND 9
RUBBLE DISPOSAL AREA

NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

December 2003

PART 1: DECLARATION FOR THE RECORD OF DECISION

1.0 SITE NAME AND LOCATION

Naval Air Station South Weymouth
1134 Main Street
Weymouth, Massachusetts 02190
MA2170022022
Operable Units 2 and 9 – Rubble Disposal Area

2.0 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Units (OUs) 2 and 9, the upland and wetland areas of the Rubble Disposal Area (RDA), at the Naval Air Station (NAS) South Weymouth, in Weymouth, Massachusetts, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The regulatory program performed under the context of these combined laws and regulations is commonly referred to as "Superfund."

This decision is based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Navy's northeastern office, Engineering Field Activity Northeast (EFANE), in Lester, Pennsylvania. Public information repositories are also kept at the Tufts Library in Weymouth, Massachusetts; the Abington Public Library in Abington, Massachusetts; the Hingham Public Library in Hingham, Massachusetts; the Rockland Memorial Library in Rockland, Massachusetts; and the Department of the Navy Caretaker Site Office (CSO) in Weymouth, Massachusetts. The Administrative Record Index (Appendix D) identifies each of the items comprising the Administrative Record upon which the selection of this decision is based.

This decision has been selected by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Navy (Navy). The Massachusetts Department of Environmental Protection (MADEP) concurs with the selected remedy as indicated in their December 23, 2003 letter (Appendix A).

3.0 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4.0 DESCRIPTION OF THE SELECTED DECISION

This ROD sets forth the selected remedy for the RDA at NAS South Weymouth, which involves the removal and offsite disposal of PCB-impacted material from the wetland area to protect ecological receptors from exposure to this material, the construction of a soil cap over the disposed material to meet state regulations for landfill closure, long-term monitoring (LTM) as required under state landfill closure regulations, and institutional controls regarding the former disposal area and the groundwater conditions at the site. Refer to Part 2 (The Decision Summary), Section 12.0 (Description of the Selected Remedy), for a detailed description of the selected remedy.

The selected remedy is a comprehensive approach for the RDA that addresses potential current and future risks identified at OUs 2 and 9, which include PCBs in hydric soil and inorganic chemicals in groundwater. The selected remedy achieves pertinent state and federal regulations, including state landfill closure requirements. The selected remedy also includes excavating approximately 54 cubic yards of PCB-impacted material (i.e., hydric soil) from the adjacent wetland area, disposing this material in an offsite landfill, constructing a soil cover over the former 4-acre disposal area, implementing institutional controls, and conducting long-term groundwater monitoring and site maintenance (collectively referred to as LTM). These remedial measures will address the potential risks to small mammals from exposure to PCBs in hydric soil, will address the potential risks to humans from consuming groundwater without standard, municipal-level treatment, and will meet all pertinent state landfill closure regulations.

Further, in the interest of minimizing disruptions to the wetlands, physical debris observed beyond the previously mapped RDA boundary will be removed for either placement on the surface of the disposal area or for offsite disposal. The areas of the wetlands affected by this removal will be restored.

The major components of this remedy are:

- Conducting, as necessary, further data evaluation or collection to support the design of the soil cover over the former 4-acre disposal area (e.g., compaction and related testing).
- Excavating approximately 54 cubic yards of PCB-impacted material (i.e., hydric soil) from the adjacent wetland area, and disposing this material in an offsite landfill;
- Conducting confirmatory PCB sampling and analysis within the excavated wetland area, as well as the immediately abutting upland soil on the disposal area, as part of the remedial action process prior to landfill capping;
- Removing physical debris from the wetland area for either placement on the upland portion of the disposal area or for offsite disposal;
- Restoring the wetland area that was disturbed during the removal of the PCB-impacted material and physical debris;
- Clearing, grubbing and grading the disposal area;
- Constructing a soil cover over the disposal area;
- Constructing a fence around the site and posting warning signs (note: this component is optional, and should only be implemented if consistent with future site use plans);
- Implementing, monitoring, reporting on, and enforcing institutional controls;
- Conducting long-term monitoring and site maintenance; and
- Conducting a review of the site every five years.

Details on the scope and duration of LTM, as well as details on the administration of LUCs will be provided in the remedial design documentation for the LTM plan and LUCs. Further, design component details, such as the use of geotextiles to minimize the potential for burrowing animals to contact disposed materials, riprap along the slopes of the RDA to protect against 100-year floods, biodegradable mats for erosion control, clean fill and soil cap thickness required for frost protection, and compaction of disposed materials to provide for cap stability, will be refined during the design and implementation process to the extent necessary to comply with engineering standards and state requirements and approvals.

The RDA, which is comprised of OUs 2 and 9, is one of several sites at NAS South Weymouth. Each of these sites progresses through the cleanup process independent of each other. The RDA has been addressed independently from the rest of NAS South Weymouth so that the Navy can proceed with closure of this site as soon as it has met the requirements of the Superfund process. Additional details on the strategy and schedule for the remediation for NAS South Weymouth are in the Site Management Plan (April 2003).

The selected response action addresses potential low-level threats at the RDA by:

- removing the PCB-impacted material from the wetland area for offsite disposal; and
- implementing institutional controls.

5.0 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions to the maximum extent practicable.

Based on site conditions, the nature and extent of contamination, and the conservative assumptions used during the risk assessment, no treatment technologies were retained for the RDA (refer to Section 4.2 of the Feasibility Study, Tetra Tech NUS/ENSR, 2002). Only containment and removal technologies were deemed potentially applicable to the RDA. Thus, the selected remedy does not satisfy the statutory preference for "treatment" as a principal element of the remedy.

Because this remedy will result in contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, and groundwater and land use restrictions are necessary, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Details on the scope and duration of the 5-year reviews will be provided in the LTM plan for the RDA.

6.0 SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Navy and EPA Region I pursuant to CERCLA and Section 404 of the Clean Water Act. Under section 404 of the Clean Water Act, the Navy and EPA Region I find that the remedial action selected for the RDA (OUs 2 and 9) at NAS South Weymouth is one of the least damaging practicable alternatives for protecting aquatic ecosystems within the wetland area at the site under the standards of 40 CFR Part 230.

7.0 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD:

- Chemicals of concern (COCs) and their respective concentrations;
- Baseline risk represented by the COCs;
- Cleanup levels established for COCs and the basis for the levels;
- Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD;
- Land and groundwater use that will be available at the site as a result of the selected remedy;
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected; and
- Decisive factors that led to selecting the remedy.

Additional information can be found in the Administrative Record file for this site.

8.0 AUTHORIZING SIGNATURES

This ROD documents the selected remedy, offsite disposal of PCB-impacted material from the wetlands, the construction of a soil cap over the former disposal area, institutional controls, and long-term monitoring at OUs 2 and 9, the RDA, at NAS South Weymouth. This remedy was selected by the Navy and EPA. MADEP concurs with the selected remedy as indicated in their December 23, 2003 letter (Appendix A).

Concur and recommended for immediate implementation:

U.S. Department of the Navy

By: ______________________ Date: 12/30/03

David A. Barney
BRAC Environmental Coordinator
Caretaker Site Office
NAS South Weymouth
U.S. Navy

By: ______________________ Date: 12/17/03

Al Haring
Director, Environmental Restoration Division
Engineering Field Activity Northeast
Naval Facilities Engineering Command
U.S. Navy

U.S. Environmental Protection Agency, Region I

By: ______________________ Date: 12-31-03

Susan Studlien
Director, Office of Site Remediation and Restoration
Region I – New England
U.S. EPA

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- Installation Restoration (IR) Program, 1983. In response to the growing awareness of the potential effects of hazardous materials on human health and the environment, the DOD developed the IR Program to investigate and cleanup potential problem areas created by historic activities at federal facilities. The IR Program was the catalyst for environmental investigations at NAS South Weymouth.

- Preliminary Assessment (PA), Argonne National Laboratory, 1988. The PA included a records search, interviews, and a site walkover. The purpose of the PA was to identify and evaluate past waste practices at NAS South Weymouth and make an assessment of the associated potential for environmental contamination.

- Site Inspection (SI), Baker Environmental, Inc., 1991. The SI included site walkovers, geophysical surveys, installation of groundwater monitoring wells, and the collection of soil, sediment, surface water, and groundwater samples at eight sites at the NAS South Weymouth property. The purpose of the SI was for "screening" purposes to assess the potential for contaminant migration, provide data for Hazard Ranking System (HRS) scoring, and to provide the information necessary to develop a comprehensive work plan for further study.

- Phase I RI Study, Brown & Root Environmental/ENSR, 1998. The Phase I RI included a literature search, geophysical survey, soil-vapor survey, immunoassay testing, ecological assessment, test pit excavation, monitoring well, well point and piezometer installation, hydraulic conductivity testing, groundwater gauging and water level measurements, stream gauging, and surface soil, subsurface soil, groundwater, sediment, and surface water. This information was used to refine the Conceptual Site Model (CSM) and identify areas warranting further study.

- Phase II RI, Tetra Tech NUS/ENSR, 2001. The Phase II RI was conducted to address and fill data gaps from the Phase I RI and previous investigations, and to further verify the absence of hazardous substances within the landfill. The Phase II RI included further ecological assessment, groundwater gauging, water level measurements, and surface soil sampling.

- Feasibility Study (FS), Tetra Tech NUS/ENSR, 2002. The Navy prepared a FS to identify the remedial action objectives for the site, and to identify and evaluate cleanup alternatives to achieve the objectives.

2.3 History of CERCLA Enforcement Activities

In May 1994, NAS South Weymouth was listed on EPA's NPL, indicating that the NAS South Weymouth property was a priority for environmental investigation and cleanup. Environmental studies and activities at NAS South Weymouth have been conducted by the Navy in accordance with CERCLA and the NCP.

Based on the designation of the NAS South Weymouth property as an NPL site, a Federal Facility Agreement (FFA) was executed by the Navy and EPA. The FFA became effective in April 2000. This agreement established the Navy as the lead agency for the investigation and cleanup of designated sites within the NAS South Weymouth property, with EPA providing oversight. The MADEP is not a part of the FFA. In accordance with CERCLA and the NCP, MADEP has participated in ongoing discussions and strategy sessions, as well as provided oversight and guidance through their review of IR Program documents.

In accordance with the FFA, a Site Management Plan (SMP) with task schedules and deliverables is updated annually each June, and is published each October. The SMP serves as a management tool for planning, reviewing, and setting priorities for environmental investigative and remedial response activities to be conducted at NAS South Weymouth. The SMP is available for review at the Navy's EFANE office in Lester, Pennsylvania; at the Tufts Library in Weymouth, Massachusetts; at the Abington Public Library in Abington, Massachusetts; at the Hingham Public Library in Hingham, Massachusetts; at the Rockland Memorial Library in Rockland, Massachusetts; and at the Department of the Navy, Caretaker Site Office, Weymouth, Massachusetts.

3.0 COMMUNITY PARTICIPATION

Throughout the site's history, community involvement has been ongoing. The Navy has kept the community and other interested parties apprised of site activities through informational meetings, fact sheets, press releases, public meetings, and regular contact with local officials. Also, the Navy meets on a regular basis to discuss the status and progress of the IR Program with the Restoration Advisory Board (RAB), which includes representatives from the neighboring community. Representatives from the Navy, EPA Region I, MADEP, and local government have attended public meetings and hearings. Below is a brief chronology of public outreach efforts regarding the RDA.

- In September 1995, the Navy initiated a series of public meetings, at which the RAB process was explained and community members were asked to join the RAB. A sufficient number of volunteers were assembled and RAB meetings began in March 1996. Since that time, RAB meetings have been held on a monthly basis (or as needed) to keep the RAB and local community informed of IR activities. These meetings have provided updates of IR activities throughout the process.

- In July 1998, the Navy released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

- The North and South Rivers Watershed Association (NSRWA) applied for and was awarded a Technical Advisory Grant (TAG) from the EPA and MADEP. This TAG allows the NSRWA to hire a Technical Advisor to review documents, attend meetings, and prepare evaluation reports. The Technical Advisor attends most RAB and technical project meetings.

- The RAB for NAS South Weymouth has applied for and been granted a Technical Assistance for Public Participation (TAPP) grant from the Department of Defense. This grant allows the RAB to obtain technical assistance from experts in the environmental field to help them understand the environmental cleanup programs at the base.

- Several fact sheets have been prepared about the NAS South Weymouth property during the course of investigation and study at the base. These fact sheets have been provided to the public mailing list for the NAS South Weymouth NPL site, and are listed in the AR index provided in Appendix D.

- The Navy published a notice of availability of the RI and FS reports and the AR for the site in the Patriot Ledger on February 10, 2003; in the Weymouth News on February 12 and 19, 2003; in the Hingham Journal on February 13, 2003; and in the Abington/Rockland Mariner on February 14, 2003.

- The Navy also published a notice and brief analysis of the RI, FS, and Proposed Plan for the RDA in the Patriot Ledger on February 10, 2003; in the Weymouth News on February 12 and 19, 2003; in the Hingham Journal on February 13, 2003; and in the Abington/Rockland Mariner on February 14, 2003. In addition, the Navy provided copies of the Proposed Plan to the community mailing list maintained for the site, and placed a copy of the plan and the RI/FS reports at the Tufts Library in Weymouth, Massachusetts; at the Abington Public Library in Abington, Massachusetts; at the Hingham Public Library in Hingham, Massachusetts; at the Rockland Memorial Library in Rockland, Massachusetts; and at the Department of the Navy, Caretaker Site Office, South Weymouth, Massachusetts.

- From February 24, 2003 to March 26, 2003, the Navy offered the RI/FS reports Proposed Plan, and AR for public comment, in accordance with the requirements of the NCP and the SMP developed for the NAS South Weymouth Superfund program. The Proposed Plan for the RDA included a notice that the proposed remedy for the site was one of the least damaging practicable alternatives under Section 404 of the Clean Water Act. Based upon verbal and written requests, the Navy granted a 15-day comment period extension which ended the comment period on April 10, 2003. Written comments received during the public comment period are included as Appendix E1.

- On February 27, 2003, the Navy held an informational meeting to present the Navy's Proposed Plan to the community. At this meeting, representatives from the Navy answered questions from the public. In addition, the Navy held a public hearing, at which oral comments on the Proposed Plan were recorded for the record. A transcript of oral comments received at the public hearing is included as Appendix E2.

- The Navy has provided responses to both oral comments received at the public hearing and written comments received during the comment period. These are provided in the Responsiveness Summary, which is included as Part 3 of this ROD.

In addition, the Navy is providing an index of the administrative record available for public review at the Navy's EFANE office in Lester, Pennsylvania (see Appendix D). Information repositories have also been established at several locations, including the Tufts Library in Weymouth, Massachusetts, the Abington Public Library in Abington, Massachusetts, the Hingham Public Library in Hingham, Massachusetts, the Rockland Memorial Library in Rockland, Massachusetts, and the U.S. Department of the Navy, Caretaker Site Office, Weymouth, Massachusetts.

4.0 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As outlined in the FFA for NAS South Weymouth, there are several operable units undergoing study and cleanup (as necessary) at the former base. OUs 2 and 9 are two of the operable units (refer to Table 1) being addressed, and are the subject of this ROD. The remaining operable units will progress through the CERCLA cleanup process independently from OUs 2 and 9, and will be the subjects of other RODs.

Regarding the other OUs, the Navy and EPA have already selected the remedy for OU 3, the Small Landfill, in a ROD signed in March 2002 and OU 8, the Abandoned Bladder Tank Fuel Site in a ROD signed in March 2003. The ROD for OU 3 stipulated No Further Action under CERCLA for OU 3, with one year of groundwater monitoring. The ROD for OU 8 stipulated No Further Action.

The operable units which are the subject of this ROD (i.e., OUs 2 and 9) address media within the upland and wetland areas of the RDA. In summary, the remedy provides for the removal and offsite disposal of PCB-impacted material from the wetland area to protect ecological receptors from exposure to this material, the construction of a soil cap over the disposed materials to meet state regulations for landfill closure, LTM as required under state landfill capping regulations, and institutional controls regarding the former disposal area and the groundwater conditions at the site. The selected remedy is a comprehensive approach for OUs 2 and 9 that addresses all potential current and future risks posed by PCBs present in hydric soil and arsenic, benzo(a)pyrene, and manganese present in groundwater, and that meets all pertinent state and federal regulations, including state landfill closure requirements. These actions address potential threats at the site and present the final response actions for the RDA. The ROD for the RDA is one component of the Superfund program at NAS South Weymouth, and, as such, has proceeded on an independent track to enable the Navy to expedite site closure and property transfer. The proposed remedy for the RDA is not expected to have an impact on the strategy or progress for the rest of the OUs at NAS South Weymouth.

Table 1
Summary of Operable Units

Site	IR Program Site Designation	Operable Unit Designation	Site Abbreviation	Site Description	Regulatory Status (as of September 2003)
West Gate Landfill	1	1	WGL	Disposal area used for a variety of C&D debris, municipal, and other waste materials.	PA, SI, Phase I and II RI, FS completed. Proposed Plan being completed.
Rubble Disposal Area (Upland)	2	2	RDA	Disposal area used for primarily building demolition debris.	PA, SI, RI, and FS completed. PRAP issued recommending excavation and offsite disposal of PCB-impacted material, construction of a soil cap for the landfill material, long-term monitoring, and institutional controls.
Rubble Disposal Area (Wetland)	2	9	RDA	Steep sloping area adjacent to RDA.	Combined with OU 2. No separate actions being performed.
Small Landfill	3	3	SL	Disposal area used primarily for concrete, metal, and wood.	PA, SI, RI completed. No FS necessary. PRAP issued recommending No Action with Groundwater Monitoring. ROD signed in March 2002, selecting No Action with Groundwater Monitoring.
Fire Fighting Training Area	4	4	FFTA	Area designated for dispensing fuels for igniting and extinguishing fires.	PA, SI, Phase I and II RI completed. Additional follow-up site investigation completed. PRAP issued recommending No Action.
Tile Leach Field	5	5	TLF	Sand bed used to receive and distribute treated industrial wastewater.	PA, SI, RI completed. PRAP distribution is pending.
Fuel Farm	6	NA (MCP)	NA (MCP)	Tank farm and fuel dispensing area.	Site transferred into the MCP program based on exhibiting only fuel-related issues.
Sewage Treatment Plant	7	7	STP	Wastewater treatment plant used primarily for domestic wastewater.	PA, SI, RI completed. FS being finalized.
Abandoned Bladder Tank Fuel Storage Area	8	8	ABTFS	Area in which temporary above-ground tanks were used for quick aircraft refueling.	PA, SI, RI completed. PRAP issued recommending No Action. ROD signed in March 2003, selecting No Action.
Building 81	9	10	Building 81	Building was formerly used for motor pool (i.e., vehicle maintenance). Only the footprint of Building 81 currently remains onsite.	RI work plan being finalized.
Building 82	10	11	Building 82	Building formerly used for aircraft maintenance and storage.	RI work plan being finalized.

Notes:
NA (MCP) = Site transferred to the state Massachusetts Contingency Plan (MCP) program.
IR = Installation Restoration (U.S. Department Of Defense [DOD] Superfund compliance program)
OU = Operable Unit
PA = Preliminary Assessment
SI = Site Inspection
RI = Remedial Investigation (Phase I and II)
FS = Feasibility Study
PRAP = Proposed Remedial Action Plan
C&D = Construction and demolition debris

In summary, the potential threats that this ROD addresses are summarized below:

Table 2
Potential (i.e., Low-level) Threats

Contaminants	Medium	Receptor	Action to be Taken
PCBs	Hydric Soil	Small Mammals	Excavation and offsite disposal of PCB-impacted material from the wetland area.
Arsenic Benzo(a)pyrene Manganese	Groundwater	Humans	Based upon minimal potential risks posed, and conservative assumptions used during the risk assessment, groundwater treatment is not necessary for the RDA. However, an institutional control to prevent exposure to groundwater is included as part of the selected remedy.

5.0 SITE CHARACTERISTICS

A conceptual site model (CSM) for the RDA was presented in Section 2.0 of the FS report (Tetra Tech NUS/ENSR, 2002). The CSM specific for the RDA is shown in Figure 3, and presents a three-dimensional image of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response actions are based on this CSM.

The RDA is located in the northeastern portion of the NAS South Weymouth property. To the north of the site are roads and trails, and forested land is located south of the site. The RDA is bound to the east by palustrine vegetated wetlands that border Old Swamp River. A small intermittent stream, known as the Feeder Stream, forms the western boundary of the RDA. This stream discharges into Old Swamp River adjacent to the RDA. The distance from the former disposal area at the RDA to Old Swamp River ranges from approximately 300 feet (southern portion of disposal area) to approximately 50 feet (northern portion of disposal area).

Topographically, the RDA is relatively flat (Figure 2). The majority of the debris is located in the flatter upland area of the RDA. Some debris has been observed along the eastern, downslope edges of the former disposal area, which was likely deposited there through erosion from the upland area. Much of the RDA uplands are open and grassy (Figure 4). Palustrine wetlands are located at the toe of the slope of the upland area, between the filled uplands and Old Swamp River, and surrounding Feeder Stream. The area of the former disposal area, designated by the approximate extent of waste material, is approximately 3.83 acres (167,000 square feet). Based upon the investigations performed, the average depth of the disposal area is 8 feet below ground surface (bgs). This depth varies, with the deeper portions generally in the center of the upland area (OU 2), and the shallow portions near the edges of the wetland area (OU 9). Based on these measurements and observations, the approximate volume of waste material within the disposal area (OUs 2 and 9) is 50,000 cubic yards.

Historically, the RDA was used for 4 years, between 1959 and 1962, and again for a short period in 1978. Between 1959 and 1962, the RDA was used for the disposal of natural debris that was unsuitable as base-material during construction of the Old Swamp River bridge. In 1978, building debris from Building 21, which was destroyed by fire, were placed in the RDA. Other materials that may have been disposed at the RDA include unofficial reports of transformers, transformer components, or transformer fluids.

Materials observed within the RDA during historical investigations include glass, insulation material, concrete, scrap metal, wire, asphalt, rubber, fabric, boulders, and wood. In addition, arresting gear strapping and metal drum fragments have been observed at the RDA. No tanks, transformers, or other large metallic objects have been noted or detected at the RDA. Although there have been unofficial reports that transformers, transformer components, or transformer fluids have been disposed of at the RDA, it is not clear whether this may have been a separate event, or whether it was associated with the Building 21 disposal in 1978.

Site geology is relatively consistent throughout the site, with fill material overlying glacial and post-glacial deposits to a depth of 5 to 10 feet bgs. The fill material is underlain by varying quantities of shallow sediments, organic peat, fluvial sand and gravel, lacustrine delta/beach deposits, and glacial till. Dedham granite bedrock is encountered at a relatively consistent depth of 20 feet bgs.

The RDA is located within the Weymouth River Drainage Basin. Regional groundwater flow direction is mapped as flowing north and northeast, in the direction of Old Swamp River. The RDA is also located on top of a state-designated potentially productive aquifer (PPA), and Old Swamp River is part of the public drinking water supply watershed associated with Whitman's Pond.

In 1990, 1996, and 1999, samples of several media were collected and analysis programs were implemented to characterize the site (Figure 5). Media sampled during the historic environmental studies performed at the RDA included surface soil, subsurface soil, groundwater, surface water, and sediment (hydric soil and river sediment). In addition, terrestrial (upland) and aquatic (wetland and river) tissue samples were also collected from a variety of animals and organisms. Chemical parameters analyzed included all of the organic compounds on EPA's target compound list (TCL), as well as all of the inorganic compounds on EPA's target analyte list (TAL). In addition, samples collected in 1996 were analyzed for potential hazardous waste properties (to aid in understanding the regulatory context of the site), and samples collected in 1999 were analyzed for dioxins.

For the most part, chemicals detected at the RDA were very close to sample quantitation limits reported by the laboratories. With the exception of only a few constituents, chemicals at concentrations above the sample quantitation limits were generally either (1) consistent with background conditions (such as the occurrence of metals), or (2) consistent with expected residual from site activities (such as the base-wide application of pesticides). A limited area (54 cubic yards) of PCB impacts (11 to 23 mg/kg total PCBs) exists in hydric soils within the wetland area of the RDA, near the toe of the slope at the northeastern edge of the former disposal area. In addition, four chemicals, arsenic, lead, manganese and benzo(a)pyrene, were detected in groundwater at concentrations greater than background conditions. Based upon the samples analyzed from the RDA for potential hazardous waste properties, materials from the RDA would not be classified as a hazardous waste under RCRA. Refer to Tables 3 and 4 of Section 7.0, Summary of Potential Site Risks, for the characteristics and concentrations of these chemicals in the various media sampled.

Based on the human health risk assessment for the RDA, risks in exceedence of regulatory thresholds were not identified for humans being exposed to soil, surface water, or sediment. However, potential carcinogenic and noncarcinogenic risks in excess of regulatory thresholds were identified for a hypothetical future resident ingesting groundwater based on the presence of arsenic, manganese, and benzo(a)pyrene in selected groundwater monitoring wells. The risk assessment did not identify any unacceptable risks to humans based on exposure to lead. The ecological risk assessment indicated potential risks to small mammals based on the presence of PCBs in hydric soil. However, no adverse effects on the food chain or to higher trophic level mammalian and avian receptors were identified. The results of the human health and ecological risk assessments are presented in Section 7.0.

Principal threat wastes are those source materials considered to be highly toxic or highly mobile, and which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether or not the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile, and/or highly toxic source material. By definition, and based upon site characteristics and the site-specific risk assessment performed, there are no principal threat wastes at the RDA.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants or low toxicity source material. By definition, and based upon the site characteristics and the site-specific risk assessment performed, PCBs in hydric soil and arsenic, benzo(a)pyrene, and manganese in groundwater may be considered as low-level threat wastes at the RDA.

6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

NAS South Weymouth was operationally closed on September 30, 1996, and administratively closed on September 30, 1997. As such, historical operations conducted at the base are no longer occurring. The base is located within a residential/light commercial area.

Regarding the RDA, it has not been used since 1978. In addition, the area adjacent to the RDA has not been used for any operational purposes since closure of the base. The surface of the RDA is grassy with some exposed debris. The RDA is generally an upland, open area, in a terrestrial portion of NAS South Weymouth. Roads and trails are located to the north of the site, and forested land is located to the south. To the east are wetlands and Old Swamp River, and to the west is Feeder Stream.

Although discussions regarding future reuse plans are ongoing, proposed future use of the RDA has been identified as open space. A small portion of the RDA to the north has been proposed for commercial business or industrial use.

Other reuse possibilities include a desire to explore the potential use of a nearby aquifer as a potential drinking water source. Old Swamp River is one of several sources of surface water to Whitman's Pond. Whitman's Pond is an important drinking water supply for the City of Weymouth. Old Swamp River is classified as an EPA Class A water body under the Clean Water Act. The aquifer underlying Old Swamp River is classified as a Potentially Productive Aquifer (PPA) under the state's Geographic Information System (MassGIS) designation, as well classified as a Potential Drinking Water Source Area (PDWSA) under the Local Reuse Authority's (LRA's) Aquifer Protection Zoning By-law, adopted in March 1998. A draft Groundwater Use and Value Determination (GUVD) was submitted by the state to EPA in January 1999, which recommended that the aquifer be considered "high use and value" for the purposes of site cleanup. EPA has yet not approved that recommendation, and in December 1999, EPA requested further site-specific aquifer yield and related information be collected by the LRA prior to EPA's GUVD approval. However, the Navy has developed risk assessments to reflect use of the underlying aquifer as a potential drinking water source.

Although land reuse plans are currently being discussed, all potential reuse scenarios were assessed during the RI risk assessment and FS evaluations (refer to Section 7.0) as required under CERCLA. This included the potential for groundwater ingestion as a drinking water source.

7.0 SUMMARY OF POTENTIAL SITE RISKS

Baseline human health and ecological (environmental) risk assessments were conducted for the RDA. Initial assessments were performed in 1999/2000 as part of the Phase I RI program, and expanded assessments were performed in 2000/2001 as part of the Phase II RI program (Tetra Tech NUS/ENSR, 2001). The baseline risk assessments evaluated many exposure pathways, including both current and reasonably expected future exposure scenarios for the RDA. Specifically, the baseline risk assessments were performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to compounds associated with the site if no remedial actions were taken. The assessments provide the basis for taking action, and identify the compounds and exposure pathways that need to be addressed by the remedial action, if necessary. A summary the human health risk assessment, followed by a summary of the ecological risk assessment is discussed below.

7.1 Human Health Risk Assessment

The human health risk assessment followed EPA's required four-step process: 1) hazard identification, which identified those hazardous substances that, given the specifics of the site, were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances; and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential risks posed by hazardous substances at the site, including potential carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates.

Twenty of the chemicals detected at the RDA were selected for evaluation in the human health risk assessment as chemicals of potential concern. The chemicals of potential concern were selected to represent potential site hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment, and can be found in Tables 6-1 of the Phase II RI report (Tetra Tech NUS/ENSR, 2001). Table 3 contains the exposure point concentrations used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment for these chemicals of potential concern. Estimates of average or central tendency case (CTC) exposure concentrations for the chemicals of potential concern are presented in Tables 6-26, 6-27, 6-30, 6-31, 6-34, 6-35, 6-38, 6-39, 6-42, and 6-43 of the Phase II RI report (Tetra Tech NUS/ENSR, 2001).

Table 3
Summary of Chemicals of Potential Concern Used in Human Health Risk Assessment

Exposure Point	Chemical of Concern	Maximum Concentration Detected	Units	Frequency of Detection	Exposure Point Concentration	Units	Statistical Measure
Surface Soil	Benzo(a)anthracene	1.2E+00	mg/kg	8/9	1.2E+00	mg/kg	Max
	Benzo(a)pyrene	1.2E+00	mg/kg	9/9	1.2E+00	mg/kg	Max
	Benzo(b)fluoranthene	1.8E+00	mg/kg	9/9	1.3E+00	mg/kg	95% UCL
	Dibenz(a,h)anthracene	1.5E-01	mg/kg	3/9	1.4E-01	mg/kg	95% UCL
	Heptachlor Epoxide	1.2E-01	mg/kg	3/9	1.1E-01	mg/kg	95% UCL
	Manganese	3.0E+02	mg/kg	9/9	2.4E+02	mg/kg	95% UCL
	Thallium	1.8E+00	mg/kg	1/9	1.2E+00	mg/kg	95% UCL
	Total 2,3,7,8-TCDD TEQ	3.0E-05	mg/kg	3/3	3.0E-05	mg/kg	Max
	Total PCB	6.1E-01	mg/kg	4/9	5.0E-01	mg/kg	95% UCL
Subsurface Soil	Aluminum	8.4E+03	mg/kg	11/11	7.1E+03	mg/kg	95% UCL
	Arsenic	4.6E+00	mg/kg	8/12	3.0E+00	mg/kg	95% UCL
	Benzo(a)anthracene	4.2E+00	mg/kg	7/13	2.1E+00	mg/kg	95% UCL
	Benzo(a)pyrene	4.4E+00	mg/kg	9/13	1.9E+00	mg/kg	95% UCL
	Benzo(b)fluoranthene	5.3E+00	mg/kg	8/12	4.4E+00	mg/kg	95% UCL
	Dibenz(a,h)anthracene	3.8E-01	mg/kg	2/13	2.3E-01	mg/kg	95% UCL
	Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg	7/12	4.7E-01	mg/kg	95% UCL
	Thallium	1.0E+00	mg/kg	1/10	6.6E-01	mg/kg	95% UCL
	Total 2,3,7,8-TCDD TEQ	2.8E-06	mg/kg	6/6	2.3E-06	mg/kg	95% UCL
	Total PCB	5.0E-01	mg/kg	3/12	3.3E-01	mg/kg	95% UCL
	Vanadium	2.0E+02	mg/kg	11/11	5.9E+01	mg/kg	95% UCL
Sediment	Arsenic	6.5E+00	mg/kg	14/14	4.3E+00	mg/kg	95% UCL
	Benzo(a)anthracene	1.5E+00	mg/kg	9/11	1.5E+00	mg/kg	Max
	Benzo(a)pyrene	1.6E+00	mg/kg	10/12	1.4E+00	mg/kg	95% UCL
	Benzo(b)fluoranthene	2.4E+00	mg/kg	11/11	2.4E+00	mg/kg	Max
	Cadmium	9.8E+00	mg/kg	8/13	9.8E+00	mg/kg	Max
	Chromium VI	7.7E+01	mg/kg	14/14	2.4E+01	mg/kg	95% UCL
	Dibenz(a,h)anthracene	3.1E-01	mg/kg	4/10	3.1E-01	mg/kg	Max
	Dieldrin	5.5E-02	mg/kg	3/10	5.5E-02	mg/kg	Max
	Manganese	1.3E+03	mg/kg	14/14	1.2E+03	mg/kg	95% UCL
	Total 2,3,7,8-TCDD TEQ	3.3E-05	mg/kg	13/13	3.3E-05	mg/kg	Max
	Total PCB	2.3E+01	mg/kg	7/16	5.5E+00	mg/kg	95% UCL
Groundwater	Ammonia	3.3E+00	mg/L	5/5	3.3E+00	mg/L	Max
	Arsenic	1.1E-02	mg/L	2/8	1.1E-02	mg/L	Max
	Benzo(a)pyrene	3.0E-05	mg/L	1/4	3.0E-05	mg/L	Max
	Lead*	4.3E-02	mg/L	6/8	NA	mg/L	NA
	Manganese	1.3E+01	mg/L	8/8	1.3E+01	mg/L	Max
	Mercury	6.4E-04	mg/L	1/1	6.4E-04	mg/L	Max
	Naphthalene	1.0E-03	mg/L	1/4	1.0E-03	mg/L	Max
Surface Water	Arsenic	1.8E-03	mg/L	1/10	1.8E-03	mg/L	Max
	Manganese	3.6E+00	mg/L	10/10	3.6E+00	mg/L	Max
	Thallium	5.2-03	mg/L	1/10	3.0E-03	mg/L	95% UCL

Notes:
NA – Not applicable
Max – Maximum Concentration
95% UCL – 95% Upper Confidence Limit of the mean
* Lead was assessed using the IEUBK model

Potential human health effects associated with exposure to the chemicals of potential concem were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to the chemicals of potential concern based on present uses, potential future uses, and location of the site. The risk evaluation for both current site use (onsite worker, trespassing child, and utility/construction worker), and hypothetical future site use (onsite resident and recreational child) assumed that potential human receptors would be exposed to chemicals of concern at the RDA via incidental ingestion, dermal contact, or inhalation of fugitive dusts from soil. It also assumed that the hypothetical future resident would be exposed to groundwater via ingestion.

Average daily doses of chemicals of potential concem were estimated using conservative assumptions relative to the rates of potential contact with soil, sediment, groundwater, or surface water, the frequency and duration of contact, and other parameters. Exposure assumptions are presented in Tables 6-12 through 6-17 of the Phase II RI report (Tetra Tech NUS/ENSR, 2001).

Excess lifetime cancer risks were determined for each receptor by multiplying a daily dose with the chemical-specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} for 1/1,000,000, which indicates that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure to the compound at the stated concentration). All risks estimated represent an "excess lifetime cancer risk," or the additional cancer risk above the background level from other causes. EPA's generally acceptable risk range for site-related exposure is $1x10^{-4}$ to $1x10^{-6}$. EPA protocol at the time of risk characterization considered carcinogenic risks to be additive when assessing exposure to a variety of substances. A summary of the potential carcinogenic toxicity data relevant to the chemicals of potential concem for the RDA is presented in Table 4. This table provides the carcinogenic risk information that is relevant to the contaminants of concern in soil, sediment, groundwater, and surface water at the RDA. At the time of risk characterization, there were no slope factors available for the dermal route of exposure. Therefore, in accordance with EPA guidance, the oral slope factors for these chemicals were used to evaluate dermal exposure. Different absorption adjustment factors were used for the oral and dermal exposure routes.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily dose by the reference dose (RfD) or other suitable benchmark. RfDs have been developed by EPA and represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. An HQ less than or equal to 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that adverse non-carcinogenic effects from that chemical are unlikely. The HQs for each chemical of potential concern, for which the receptor is potentially exposed to via a specific pathway, are summed to yield the Hazard Index (HI) for that pathway. A total HI is then calculated for each receptor by summing the pathway-specific HIs. A HI less than or equal to 1 indicates that adverse non-carcinogenic effects are unlikely. A summary of the potential non-carcinogenic toxicity data relevant to the chemicals of potential concern at the RDA is presented in Tables 5 through 7. These tables provide the non-carcinogenic risk information that is relevant to contaminants of concern in soil, sediment, groundwater, and surface water. Similar to the carcinogenic risk data, the dermal dose-response values applied during risk characterization were the same as the oral dose-response values for these chemicals.

Because of the uncertainties in the dose-response relationship between exposures to lead and biological effects, there is no EPA-derived RfD for lead. Therefore, the Integrated Exposure Uptake Biokenetic or IEUBK model was used to evaluate future residential exposure to lead in groundwater. The percent population predicted to exceed blood levels of 10 ug/dL was 0.14%. This percentage is less than the exceedance probability of 5% that has been used by EPA in evaluating the potential need for cleanup actions.

Table 4
Potential Carcinogenic Toxicity Data Summary from Human Health Risk Assessment

Chemical of Concern	Oral Cancer Slope Factor (c) $(mg/kg\text{-}day)^{-1}$	Reference (Last Verified)	Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Reference (Last Verified)	Weight of Evidence/ Cancer Guideline Description
Aluminum	NA	NA	NA	NA	NA
Ammonia	NA	NA	NA	NA	NA
Arsenic	1.50E+00	IRIS (6/00)	1.50E+01	IRIS (6/00) (b)	A
Benzo(a)anthracene	7.30E-01	(a)	3.10E-01	(a)	B2
Benzo(a) pyrene	7.30E+00	IRIS (6/00)	3.10E+00	RBC (4/00)	B2
Benzo(b)fluoranthene	7.30E-01	(a)	3.10E-01	(a)	B2
Cadmium	NA	NA	6.3E+00	IRIS (6/00) (b)	B1
Chromium VI	NA	NA	4.1E+01	HEAST (97)	A
Dibenz(a,h)anthracene	7.30E+00	(a)	3.10E+00	(a)	B2
Dieldrin	1.6E+01	IRIS (6/00)	1.6E+01	IRIS (6/00) (b)	B2
Heptachlor Epoxide	9.1E+00	IRIS (6/00)	9.1E+00	IRIS (6/00) (b)	B2
Indeno(1,2,3-cd)pyrene	7.3E-01	(a)	3.1E-01	(a)	B2
Manganese	NA	NA	NA	NA	D
Mercury	NA	NA	NA	NA	D
Naphthalene	NA	NA	NA	NA	C
Thallium	NA	NA	ND	NA	NA
Total 2,3,7,8-TCDD TEQ	1.5E+05	HEAST (97)	1.5E+05	HEAST (97)	B2
Total PCB	2.0E+00	IRIS (6/00)	2.0E+00	IRIS (6/00) (b)	B2
Vanadium	NA	NA	NA	NA	NA

Notes:
HEAST: Health Effects Assessment Summary Tables, published annually by the EPA (1997)
IRIS: Integrated Risk Information System, an online computer database of toxicological information (EPA, 2000)
NA: Not available
RBC: Region III Risk based concentration table
(a): CSF for Benzo(a)pyrene multiplied by appropriate Toxicity Equivalence Factor
(b): Converted from unit risk of $1/ug/m^3$ to an inhalation CSF of 1/mg/kg-day
(c): In accordance with EPA guidance, dermal slope factors were based on the oral slope factors for these chemicals. Different absorption adjustment factors were used for the oral and dermal exposure routes.
A: Human carcinogen
B1:Probable human carcinogen – Indicates limited evidence of carcinogenicity in humans
B2: Probable human carcinogen – Indicates sufficient evidence in animals or no evidence in humans
C: Possible human carcinogen
D: Not classifiable as a human carcinogen

Table 5
Potential Non-Carcinogenic Toxicity Data Summary from Human Health Risk Assessment
Chronic Exposure Through Ingestion

Chemical of Concern	Oral Dose-Response Value* (mg/kg-day)	Target Organ/ Critical Effect at LOAEL	EPA Confidence Level	Reference (Last Verified)
Aluminum	1.0E+00	Neurotoxicity of off-spring	Low	NCEA (6/20/94)
Ammonia	NA	NA	NA	NA
Arsenic	3.0E-04	Hyperpigmentation, keratosis & possible vascular complications	Medium	IRIS (6/00)
Benzo(a)anthracene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Benzo(a) pyrene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Benzo(b)fluoranthene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Cadmium	1.0E-03	Proteinurea	High	IRIS (6/00)(b)
Chromium VI	3.0E-03	No adverse effects	Low	IRIS (6/00)(c)
Dibenz(a,h)anthracene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Dieldrin	5.0E-05	Liver lesions	Medium	IRIS (6/00)
Heptachlor Epoxide	1.3E-05	Increased liver to body weight ratios	Low	IRIS (6/00)
Indeno(1,2,3-cd)pyrene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Manganese	2.0E-02	CNS effects	Medium	IRIS (6/00)(d)
Mercury	3.0E-04	Autoimmune effects	High	IRIS (6/00)
Naphthalene	2.0E-02	Decreased birth weight in males	Low	IRIS (6/00)
Thallium	8.0E-05	No adverse effects	Low	IRIS (6/00)(e)
Total 2,3,7,8-TCDD TEQ	NA	NA	NA	NA
Total PCB	2.0E-05	Reduced birth weights	Medium	IRIS (6/00)(f)
Vanadium	7.0E-03	No effects reported	NA	HEAST (97)

Notes:
CNS: Central nervous system
HEAST: Health Effects Assessment Summary Tables, published annually by the EPA (1997)
IRIS: Integrated Risk Information System, an online computer database of toxicological information (EPA, 2000)
LOAEL: Lowest observed adverse effects level
NA: Not available
NCEA: National Center for Environmental Assessment
(a): Dose response value for pyrene, based on structural similarity
(b): RfD for cadmium-food. Used to estimate risks from all pathways except water ingestion. For water ingestion, used RfD for cadmium-water (5.00E-04 mg/kg-day)
(c): RfD for chromium VI
(d): RfD for manganese – non food
(e): RfD for thallium carbamate
(f): RfD for Aroclor 1254
*In accordance with EPA guidance, dermal slope factors were based on the oral slope factors for these chemicals. Different absorption adjustment factors were used for the oral and dermal exposure routes.

Table 6
Potential Non-Carcinogenic Toxicity Data Summary from Human Health Risk Assessment
Subchronic Exposure Through Ingestion

Chemical of Concern	Oral Dose-Response Value* (mg/kg-day)	Target Organ/ Critical Effect at LOAEL	EPA Confidence Level	Reference (Last Verified)
Aluminum	1.0E+00	Neurotoxicity of off-spring	Low	NCEA (6/20/94)
Ammonia	NA	NA	NA	NA
Arsenic	3.0E-04	Hyperpigmentation, keratosis	NA	HEAST 97(e)
Benzo(a)anthracene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Benzo(a)pyrene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Benzo(b)fluoranthene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Cadmium	1.0E-03	Proteinurea	High	IRIS (6/00)(b)
Chromium VI	2.0E-02	No adverse effects	NA	HEAST (97)(c,e)
Dibenz(a,h)anthracene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Dieldrin	5.0E-05	Liver lesions	NA	HEAST 97(e)
Heptachlor Epoxide	1.3E-05	Increased liver to body weight ratios	NA	HEAST 97(e)
Indeno(1,2,3-cd)pyrene	3.0E-02	Kidney effects	Low	IRIS (6/00)(a)
Manganese	1.4E-01	CNS effects	NA	HEAST 97(e)
Mercury	3.0E-03	Autoimmune effects	NA	HEAST 97(e)
Naphthalene	2.0E-02	Decreased birth weights in males	Low	IRIS (6/00)
Thallium	8.0E-04	Altered liver function, increase serum lactate dehydrogenase, alopecia	NA	HEAST 97(e)
Total 2,3,7,8-TCDD TEQ	NA	NA	NA	NA
Total PCB	5.0E-05	Reduced birth weights	NA	HEAST 97(d,e)
Vanadium	7.0E-03	No effects reported	NA	HEAST 97(e)

Notes:
CNS: Central nervous system
HEAST: Health Effects Assessment Summary Tables, published annually by the EPA (1997)
IRIS: Integrated Risk Information System, an online computer database of toxicological information (EPA, 2000)
LOAEL: Lowest observed adverse effects level
NA: Not available
NCEA: National Center for Environmental Assessment
(a): Dose response value for pyrene, based on structural similarity
(b): RfD for cadmium-food. Used to estimate risks from all pathways except water ingestion. For water ingestion, used RfD for cadmium-water (5.00E-04 mg/kg-day)
(c): RfD for chromium VI
(d): RfD for Aroclor 1254
(e): Subchronic RfD

*In accordance with EPA guidance, dermal slope factors were based on the oral slope factors for these chemicals. Different absorption adjustment factors were used for the oral and dermal exposure routes.

Table 7
Potential Non-Carcinogenic Toxicity Data Summary from Human Health Risk Assessment
Chronic and Subchronic Exposure Through Inhalation

Chemical of Concern	Oral Dose-Response Value (mg/kg-day)	Target Organ/ Critical Effect at LOAEL	EPA Confidence Level	Reference (Last Verified)
Aluminum	1.00E-03	Psychomotor and cognitive impairment	NA	NCEA (6/20/97)
Ammonia	2.86E-02	Respiratory effects	Medium	IRIS (6/00)(a)
Arsenic	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA
Cadmium	5.70E-05	Lung, trachea and bronchus cancer deaths	NA	NCEA (7/30/93)
Chromium VI	3.00E-05	Lactate dehydrogenase in bronchioaveolar lavage fluid	Low	IRIS (6/00)(a)
Dibenz(a,h)anthracene	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA
Manganese	1.43E-05	Increased respiratory symptoms and psychomotor disturbances	Medium	IRIS (6/00)(a)
Mercury	8.60E-05	Nervous system neurotoxicity	Medium	IRIS (6/00)(a)
Naphthalene	9.00E-04	Histopathology in nasal epithelium	Medium	IRIS (6/00)(a)
Thallium	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ	NA	NA	NA	NA
Total PCB	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA

Notes:
CNS: Central nervous system
HEAST: Health Effects Assessment Summary Tables, published annually by the EPA (1997)
IRIS: Integrated Risk Information System, an online computer database of toxicological information (EPA, 2000)
LOAEL: Lowest observed adverse effects level
NA: Not available
NCEA: National Center for Environmental Assessment
(a): Converted from RfC (RfC*20 cubic meters^3/70 kilogram = inhalation RfD)

The results of the risk assessment showed that potential carcinogenic and non-carcinogenic risks under the current use scenarios were within or below the acceptable risk benchmarks at the RDA. However, potential risks under the future scenario were above acceptable carcinogenic and non-carcinogenic risk benchmarks for the residential receptor. These theoretical excedeences were based on the presence of arsenic, benzo(a)pyrene, and manganese in drinking water. Table 8 depicts the human health risk summary for the chemicals of potential concern in soil, sediment, groundwater, and surface water evaluated to reflect current and potential future site use corresponding to the RME scenario. Refer to Section 6.0 of the Phase II RI report (Tetra Tech NUS/ENSR, 2001) for a more comprehensive risk summary.

The risk assessment uses assumptions that have uncertainties associated with them. Some of the assumptions have a firm scientific basis, while others do not. Some level of uncertainty is introduced into the risk characterization process every time an assumption is made. In regulatory risk assessment, the methodology dictates that assumptions err on the side of overestimating potential exposure and toxicity. Such estimates may be useful for regulatory decision-making, but do not provide a realistic estimate of potential health impacts. The effect of using numerous assumptions that each overestimate potential exposure and toxicity is to exaggerate estimates of potential human risk.

Table 8 Summary of Human Health Risk Assessment			
Scenario Evaluated	**Media**	**Total Carcinogenic Risk (statistical chance)**	**Total Non-Carcinogenic Risk (hazard index)**
Onsite Worker			
Ingestion/Dermal Contact	Surface Soil	1.4E-06	0.02
	Sediment	1.9E-07	0.007
	Surface Water	3.3E-09	0.002
Onsite Worker Total		***1.5E-06***	***0.03***
Construction Worker			
Ingestion/Dermal Contact	Surface Soil	9.0E-08	0.013
	Subsurface Soil	1.2E-07	0.02
Inhalation	Surface Soil	8.2E-10	0.1
	Subsurface Soil	4.8E-09	0.2
Construction Worker Total		***2.1E-07***	***0.3***
Trespasser			
Ingestion/Dermal Contact	Surface Soil	7.7E-07	0.03
	Sediment	1.5E-06	0.1
	Surface Water	2.2E-08	0.03
Trespasser Total		***2.3E-06***	***0.2***
Future Resident			
Ingestion/Dermal Contact	Surface Soil	6.9E-06	0.3
	Sediment	3.9E-06	0.6
	Surface Water	6.9E-08	0.1
	Groundwater	2.4E-04	45.5
Future Resident Total		***2.5E-04***(1)	***46.5***(2)
Future Recreational Child (1-6)			
Ingestion/Dermal Contact	Surface Soil	4.2E-06	0.3
	Sediment	3.6E-06	0.6
	Surface Water	6.2E-08	0.1
Future Recreational Child Total		***7.8E-06***	***1.0***

Notes:
(1) Arsenic (2.3×10^{-4}), and to a lesser extent benzo(a)pyrene (3.3×10^{-6}), in groundwater were contributors to this cancer risk estimate.
(2) Manganese (43), and to a lesser extent arsenic (2.2), in groundwater were the main contributors to this noncancer risk estimate.

7.2 Ecological Risk Assessment

In addition to the human health risk assessment described above, an ecological risk assessment was also performed. The ecological risk assessment evaluated potential risks to ecological receptors that may occur in the presence of chemical stressors in environmental media. The ecological risk assessment was completed in three steps (1) problem formulation, (2) risk analysis, and (3) risk characterization. The chemicals of potential concern used in the ecological risk assessment are presented in Tables 9 through 15.

Table 9
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Surface Soil

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Surface Soil	***Inorganics***							
	Antimony	1:3:9	0.36	0.36	mg/kg	0.36	mg/kg	Max
	Barium	9:9:9	16	144	mg/kg	75	mg/kg	95% UC
	Beryllium	9:9:9	0.20	0.51	mg/kg	0.35	mg/kg	95% UCL
	Chromium	9:9:9	7.70	15.05	mg/kg	11.86	mg/kg	95% UCL
	Cobalt	9:9:9	3.10	5.20	mg/kg	4.38	mg/kg	95% UCI
	Iron	9:9:9	8,010	15,400	mg/kg	12,456	mg/kg	95% UC
	Lead	9:9:9	26	91	mg/kg	63	mg/kg	95% UC
	Manganese	9:9:9	135	296	mg/kg	239	mg/kg	95% UCL
	Mercury	3:6:9	0.03	0.06	mg/kg	0.06	mg/kg	95% UCI
	Silver	1:9:9	0.76	0.76	mg/kg	0.50	mg/kg	95% UC
	Thallium	1:9:9	1.80	1.81	mg/kg	1.18	mg/kg	95% UC
	Zinc	9:9:9	35	154	mg/kg	96	mg/kg	95% UCL
	Pesticides/PCBs							
	4,4'-DDD	2:4:9	1.70	1.90	µg/kg	1.90	µg/kg	Max
	4,4'-DDE	3:9:9	5.50	64.0	µg/kg	39.0	µg/kg	95% UC
	4,4'-DDT	7:9:9	3.85	40.0	µg/kg	40.0	µg/kg	Max
	Aldrin	1:9:9	6.50	6.5	µg/kg	4.30	µg/kg	95% UCL
	Alpha-chlordane	4:9:9	5.10	950.0	µg/kg	950.0	µg/kg	Max
	Aroclor-1254	2:9:9	46.0	590.0	µg/kg	590.0	µg/kg	Max
	Aroclor-1260	3:9:9	65.0	170.0	µg/kg	170.0	µg/kg	Max
	Delta-BHC	1:8:9	2.50	2.5	µg/kg	1.64	µg/kg	95% UCL
	Dieldrin	2:9:9	5.15	27.0	µg/kg	16.60	µg/kg	95% UCL
	Endosulfan I	1:8:9	2.30	2.3	µg/kg	1.53	µg/kg	95% UC
	Endosulfan II	1:9:9	8.45	8.5	µg/kg	6.66	µg/kg	95% UCI
	Endrin	2:9:9	8.20	31.0	µg/kg	15.61	µg/kg	95% UCL
	Endrin aldehyde	3:8:9	1.20	6.0	µg/kg	4.02	µg/kg	95% UCL
	Endrin Ketone	1:9:9	23.0	23.0	µg/kg	12.76	µg/kg	95% UCL
	Gamma-chlordane	4:9:9	4.90	720.0	µg/kg	720.0	µg/kg	Max
	Heptachlor	3:9:9	3.6	94.0	µg/kg	94.0	µg/kg	Max
	Heptachlor Epoxide	3:9:9	0.8	120.0	µg/kg	107.6	µg/kg	95% UCL
	Methoxychlor	2:9:9	18.0	31.0	µg/kg	18.5	µg/kg	95% UCL
	Total PCBs	4:9:9	111	613	µg/kg	499	µg/kg	95% UC
	Semivolatiles							
	Acenaphthylene	2:3:9	68	99	µg/kg	99	µg/kg	Max
	Anthracene	4:8:9	89	230	µg/kg	221	µg/kg	95% UCL
	Benzo(A)anthracene	8:9:9	99	1,200	µg/kg	1,200	µg/kg	Max
	Benzo(a)pyrene	9:9:9	26	1,200	µg/kg	1,200	µg/kg	Max
	Benzo(b)fluoranthene	9:9:9	89	1,800	µg/kg	1,330	µg/kg	95% UC
	Benzo(g,h,i)perylene	7:9:9	53	540	µg/kg	396	µg/kg	95% UCL
	Benzo(k)fluoranthene	9:9:9	65	1,900	µg/kg	1,290	µg/kg	95% UCL
	Bis(2-ethylhexyl)phthalate	8:8:9	56	280	µg/kg	199	µg/kg	95% UC
	Butylbenzylphthalate	1:4:9	210	210	µg/kg	210	µg/kg	Max
	Carbazole	3:5:9	56	120	µg/kg	120	µg/kg	Max
	Chrysene	9:9:9	64	1,400	µg/kg	1,400	µg/kg	Max
	Dibenz(a,h)anthracene	3:4:9	28	150	µg/kg	143	µg/kg	95% UCL
	Di-n-butylphthalate	1:1:9	41	41	µg/kg	41	µg/kg	Max
	Di-n-octylphthalate	1:7:9	290	290	µg/kg	246	µg/kg	95% UC
	Fluoranthene	9:9:9	99	3,000	µg/kg	1,909	µg/kg	95% UCL
	Indeno(1,2,3-cd)pyrene	7:9:9	63	570	µg/kg	436	µg/kg	95% UCI
	Phenanthrene	7:9:9	76	1,200	µg/kg	1,200	µg/kg	Max
	Phenol	1:1:9	74	74	µg/kg	74	µg/kg	Max
	Pyrene	9:9:9	71	2,600	µg/kg	2,600	µg/kg	Max
	Total PAHs	9:9:9	1,124	14,510	µg/kg	14,510	µg/kg	Max

Table 9 (continued)
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Surface Soil

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistica Measure
Surface Soil	*Dioxins (2,3,7,8 – TCDD TEF)*							
	Mammal	3:3:3	7.16	31.21	pg/g	31.21	pg/g	Max
	Bird	3:3:3	8.37	40.85	pg/g	40.85	pg/g	Max
	Fish	3:3:3	6.37	28.15	pg/g	28.15	pg/g	Max

Notes:
mg/kg – milligram per kilogram
µg/kg – microgram per kilogram
pg/g – picogram per gram
95% UCL – 95% upper concentration limit on the arithmetic mean
TEF – toxic equivalency factor
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected not including duplicates

Table 10
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Sediment

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Sediment	***Inorganics***							
	Arsenic	14:14:14	0.95	6.50	mg/kg	4.35	mg/kg	95% UCL
	Cadmium	8:13:13	0.07	9.80	mg/kg	9.80	mg/kg	Max
	Chromium	14:14:14	5.20	77.00	mg/kg	23.6	mg/kg	95% UCL
	Cobalt	14:14:14	1.80	11.00	mg/kg	8.08	mg/kg	95% UCL
	Iron	14:14:14	6,000	45,500	mg/kg	20,70	mg/kg	95% UCL
	Lead	14:14:14	7.80	105	mg/kg	69.8	mg/kg	95% UCL
	Manganese	14:14:14	105	1,350	mg/kg	1,230	mg/kg	95% UCL
	Mercury	6:13:13	0.09	0.39	mg/kg	0.194	mg/kg	95% UCL
	Thallium	1:3:10	0.43	0.43	mg/kg	0.43	mg/kg	Max
	Vanadium	14:14:14	12.8	46.2	mg/kg	31.8	mg/kg	95% UCL
	Zinc	14:14:14	20	371	mg/kg	336	mg/kg	95% UCL
	Organics							
	Pesticides/PCBs							
	4,4'-DDD	9:13:13	0.0078	0.650	mg/kg	0.65	mg/kg	Max
	4,4'-DDE	10:12:12	0.0065	0.140	mg/kg	0.14	mg/kg	Max
	4,4'-DDT	6:10:10	0.0035	0.240	mg/kg	0.24	mg/kg	Max
	Aldrin	1:9:9	0.018	0.018	mg/kg	0.018	mg/kg	Max
	Alpha-chlordane	7:12:12	0.00094	0.054	mg/kg	0.054	mg/kg	Max
	Aroclor-1260	7:16:16	0.039	23	mg/kg	5.54	mg/kg	95% UCL
	Endosulfan II	2:10:10	0.120	0.710	mg/kg	0.71	mg/kg	Max
	Gamma-BHC (Lindane)	1:9:9	0.017	0.017	mg/kg	0.017	mg/kg	Max
	Gamma-chlordane	5:11:11	0.004	0.044	mg/kg	0.044	mg/kg	Max
	Heptachlor	1:9:9	0.028	0.028	mg/kg	0.0251	mg/kg	95% UCL
	Total PCBs	7:16:16	0.039	23	mg/kg	5.54	mg/kg	95% UCL
	Semivolatiles							
	2-Methylnaphthalene*	1:4:8	0.20	0.20	mg/kg	NA	mg/kg	NA
	4-Methylphenol	1:2:5	0.26	0.26	mg/kg	0.26	mg/kg	Max
	Anthracene	4:7:9	0.068	0.39	mg/kg	NA	mg/kg	NA
	Benzo(a)anthracene	9:11:11	0.078	1.50	mg/kg	NA	mg/kg	NA
	Benzo(a)pyrene	10:12:12	0.095	1.60	mg/kg	NA	mg/kg	NA
	Benzo(b)fluoranthene	11:11:11	0.031	2.40	mg/kg	NA	mg/kg	NA
	Benzo(g,h,i)perylene	4:10:10	0.260	0.61	mg/kg	NA	mg/kg	NA
	Benzo(k)fluoranthene	10:11:11	0.035	1.80	mg/kg	NA	mg/kg	NA
	Carbazole	4:6:10	0.11	0.27	mg/kg	0.27	mg/kg	Max
	Chrysene	11:11:11	0.033	2.90	mg/kg	NA	mg/kg	NA
	Dibenz(a,h)anthracene	4:9:10	0.160	0.308	mg/kg	NA	mg/kg	NA
	Fluoranthene	13:13:13	0.057	5.40	mg/kg	NA	mg/kg	NA
	Fluorene	2:4:9	0.15	0.22	mg/kg	NA	mg/kg	NA
	Indeno(1,2,3-c,d)pyrene	5:10:10	0.084	0.695	mg/kg	NA	mg/kg	NA
	Phenanthrene	9:11:11	0.084	2.10	mg/kg	NA	mg/kg	NA
	Pyrene	13:13:13	0.065	4.40	mg/kg	NA	mg/kg	NA
	Total PAHs	14:14:14	0.159	23.35	mg/kg	23.4	mg/kg	Max

Table 10 (continued)
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Sediment

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Sediment	**Dioxins** (2,3,7,8 – TCDD TEF)							
	Mammal	8:8:8	0.000001917	0.000046463	mg/kg	0.0000463	mg/kg	95% UCL
	Bird	8:8:8	0.000002530	0.000052752	mg/kg	0.0000516	mg/kg	95% UCL

Notes:
mg/kg – milligram per kilogram
95% UCL – 95% upper concentration limit on the arithmetic mean
TEF – toxic equivalency factor
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected not including duplicates
NA – Not Applicable, PAHs were evaluated as total PAHs rather than as individual PAHs

Table 11
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Surface Water

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Surface Water	***Inorganics (Total)***							
	Barium	9:10:10	0.0223	0.0842	mg/L	0.00592	mg/L	95% UCL
	Manganese	10:10:10	0.041	3.570	mg/L	3.570	mg/L	Max
	Volatiles							
	Carbon Disulfide	1:6:6	0.0050	0.005	mg/L	0.005	mg/L	Max

Notes:
mg/L – milligram per liter
95% UCL – 95% upper concentration limit on the arithmetic mean
TEF – toxic equivalency factor
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected not including duplicates

Table 12
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Earthworm Tissue

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Earthworm Tissue	***Inorganics***							
	Antimony	4:4:4	0.08	0.14	mg/kg	0.14	mg/kg	Max
	Barium	4:4:4	1.50	3.70	mg/kg	3.70	mg/kg	Max
	Beryllium	2:4:4	0.03	0.04	mg/kg	0.04	mg/kg	Max
	Chromium	4:4:4	3.10	7.40	mg/kg	7.40	mg/kg	Max
	Cobalt	4:4:4	0.40	0.73	mg/kg	0.73	mg/kg	Max
	Iron	4:4:4	238	973	mg/kg	973	mg/kg	Max
	Lead	4:4:4	3.20	11.40	mg/kg	11.40	mg/kg	Max
	Manganese	4:4:4	6.40	19.70	mg/kg	19.18	mg/kg	95% UCL
	Inorganic Mercury	4:4:4	0.18	0.32	mg/kg	0.32	mg/kg	Max
	Methyl Mercury	4:4:4	0.01	0.01	mg/kg	0.01	mg/kg	Max
	Silver	1:4:4	0.03	0.03	mg/kg	0.03	mg/kg	Max
	Zinc	4:4:4	91	118	mg/kg	118	mg/kg	Max
	Pesticides/PCBs							
	Aldrin	1:4:4	7.3	7.3	µg/kg	7.3	µg/kg	Max
	Alpha-chlordane	3:4:4	13.0	52	µg/kg	52	µg/kg	Max
	Aroclor-1260	3:4:4	130	250	µg/kg	250	µg/kg	Max
	Dieldrin	1:4:4	16	16	µg/kg	16	µg/kg	Max
	Gamma-chlordane	1:4:4	13	13	µg/kg	13	µg/kg	Max
	Total PCBs	3:4:4	130	250	µg/kg	250	µg/kg	Max

Table 12 (continued)
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Earthworm Tissue

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Earthworm Tissue	*Dioxins (2,3,7,8-TCDD TEF)*							
	Mammal	1:1:1	7.83	7.83	ρg/g	7.83	ρg/g	Max
	Bird	1:1:1	6.69	6.69	ρg/g	6.69	ρg/g	Max
	Fish	1:1:1	5.59	5.59	ρg/g	5.59	ρg/g	Max

Notes:
mg/kg – milligram per kilogram
µg/kg – microgram per kilogram
ρg/g – picogram per gram
Max – maximum
95% UCL – 95% upper concentration limit on the arithmetic mean
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected not including duplicates

Table 13
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Small Mammal Tissue

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Small Mammal Tissue	***Inorganics***							
	Antimony	4:4:4	0.04	0.11	mg/kg	0.11	mg/kg	Max
	Barium	4:4:4	1.80	2.80	mg/kg	2.80	mg/kg	Max
	Chromium	3:4:4	0.48	0.80	mg/kg	0.78	mg/kg	95% UCL
	Cobalt	1:4:4	0.03	0.03	mg/kg	0.03	mg/kg	Max
	Iron	4:4:4	59	74	mg/kg	74	mg/kg	Max
	Lead	4:4:4	0.32	1.60	mg/kg	1.60	mg/kg	Max
	Manganese	4:4:4	3.10	4.70	mg/kg	4.70	mg/kg	Max
	Inorganic Mercury	3:3:3	0.0008	0.0022	mg/kg	0.0022	mg/kg	Max
	Methyl Mercury	3:3:3	0.0041	0.0109	mg/kg	0.0109	mg/kg	Max
	Zinc	4:4:4	25	75	mg/kg	75	mg/kg	Max
	Organics							
	Pesticides/PCBs							
	Aroclor-1260	3:4:4	600	5,000	µg/g	5,000	µg/g	Max
	Dieldrin	3:4:4	8.9	57	µg/g	57	µg/g	Max
	Total PCBs	3:4:4	600	5,000	µg/g	5,000	µg/g	Max
	Dioxins (2,3,7,8 – TCDD TEF)							
	Mammal	1:1:1	2.10	2.10	ρg/g	2.10	ρg/g	Max
	Fish	1:1:1	3.17	3.17	ρg/g	3.17	ρg/g	Max
	Bird	1:1:1	2.02	2.02	ρg/g	2.02	ρg/g	Max

Notes:
mg/kg – milligram per kilogram
µg/kg – microgram per kilogram
ρg/g – picogram per gram
Max – maximum
95% UCL – 95% upper concentration limit on the arithmetic mean
TEF – toxic equivalency factor
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected not including duplicates

Table 14
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Fish Tissue

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Fish Tissue	*Pesticides/PCBs*							
	4,4'-DDD	3:3:3	45	150	µg/kg	150	µg/kg	Max
	4,4'-DDE	3:3:3	53	82	µg/kg	82	µg/kg	Max
	4,4'-DDT	1:3:3	12	12	µg/kg	12	µg/kg	Max
	Alpha-chlordane	3:3:3	6.9	13	µg/kg	13	µg/kg	Max
	Gamma-chlordane	1:3:3	4.4	4.4	µg/kg	4.4	µg/kg	Max

Notes:
µg/kg – microgram per kilogram
Max – maximum
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected n including duplicates

Table 15
Summary of Chemicals of Concern Used in Ecological Risk Assessment – Amphibian Tissue

Exposure Medium	Chemical of Concern	Frequency of Detection	Minimum Concentration	Maximum Concentration	Units	Exposure Point Concentration	Units	Statistical Measure
Amphibian Tissue	*Inorganics*							
	Arsenic	1:1:1	0.04	0.04	mg/kg	0.04	mg/kg	Max
	Cadmium	1:1:1	0.14	0.14	mg/kg	0.14	mg/kg	Max
	Chromium	1:1:1	0.4	0.4	mg/kg	0.4	mg/kg	Max
	Cobalt	1:1:1	0.03	0.03	mg/kg	0.03	mg/kg	Max
	Iron	1:1:1	43	43	mg/kg	43	mg/kg	Max
	Lead	1:1:1	0.21	0.21	mg/kg	0.21	mg/kg	Max
	Manganese	1:1:1	12.8	12.8	mg/kg	12.8	mg/kg	Max
	Methyl Mercury	1:1:1	0.035	0.035	mg/kg	0.035	mg/kg	Max
	Zinc	1:1:1	16.8	16.8	mg/kg	16.8	mg/kg	Max
	Dioxins (2,3,7,8-TCDD TEF)							
	Mammal	1:1:1	0.0280	0.0280	pg/g	0.0280	pg/g	Max
	Bird	1:1:1	0.0028	0.0028	pg/g	0.0028	pg/g	Max
	Fish	1:1:1	0.0028	0.0028	pg/g	0.0028	pg/g	Max

Notes:
mg/kg – milligram per kilogram
pg/g – picogram per gram
Max – maximum
TEF – toxic equivalency factor
Frequency of Detection displayed as: number of detected values: number of samples used to calculate statistics: total number of samples collected n including duplicates

The ecological receptor groups evaluated included vertebrate wildlife, aquatic invertebrates, aquatic and wetland vertebrates, terrestrial invertebrates, and terrestrial plants. The ecological exposure pathways evaluated included:

- Direct contact with surface soils by terrestrial invertebrates;
- Direct contact with surface soils by terrestrial plant species;
- Incidental ingestion of sediment, surface water, and surface soils by vertebrate wildlife;
- Direct contact with surface water and sediment by aquatic invertebrates;
- Direct contact with surface water and sediment by aquatic and wetland vertebrates (i.e., amphibians, fish); and
- Vertebrate wildlife ingestion of prey items that have bioaccumulated chemicals of potential concern from surface water, soils, and sediment.

The exposure pathways used in the ecological risk assessment are presented in Table 16.

Table 16
Summary of Potential Exposure Pathways Used in the Ecological Risk Assessment – Surface Soil

Potential Receptor	Sensitive Environment (Y/N)	Sensitive Species (Y/N)[1]	Exposure Routes Evaluated	Assessment Endpoints	Measurement Endpoints	Findings
Terrestrial Invertebrates and Plants (e.g., earthworms, ruderal growth vegetation)	N	N	Direct contact	Sustainability of an invertebrate and plant community which reflects the available habitat at the RDA and can serve as a forage base for higher trophic level receptors.	• Laboratory toxicity testing of earthworms and plants using RDA soils, earthworm and plant species. • Comparison of RDA surface soil COPC concentrations to soil quality benchmarks for plants and invertebrates. • Evaluation of earthworm tissue burden data relative to literature-derived Critical Body Ratios (CBRs)	Little to no significant potential risks were identified.
Terrestrial Vertebrates (e.g., small mammals, birds, predatory wildlife)	N	N	Ingestion	Sustainability of terrestrial small mammal and avian populations that reflect the available habitat at the RDA and can serve as a forage base for higher trophic level receptors.	• Food chain analysis using conservative assumptions and concentrations of COPCs in surface soil from the RDA. • Evaluation of small mammal tissue burden data relative to literature-derived CBRs. • Qualitative field assessment of the small mammal and avian communities at the RDA.	With the exception of small mammals, little to no significant risks to wildlife were predicted.
Aquatic/benthic Invertebrates (e.g., benthic macroinvertebrates)	N	N	Direct contact	Sustainability of a healthy and well-balanced benthic invertebrate community that reflects the available habitat at the RDA.	• Evaluation of simultaneously extracted metals (SEM) and acid volatile sulfides (AVS) data. • Comparison of bulk sediment data to literature-derived low effect and severe effect sediment quality guidelines. • Comparison of total recoverable and dissolved metal concentrations in surface water to acute and chronic water quality criteria and guidelines. • Bulk sediment screening level invertebrate toxicity testing. • Field assessment of the benthic community using RBP III analysis.	Little to no significant potential risks were identified.
Aquatic Vertebrates (e.g., fish)	N	N	Direct contact	Sustainability of a healthy and well-balanced warmwater fish community that reflects the available habitat at the RDA.	• Comparison of total recoverable and dissolved metal concentrations in surface water to acute and chronic water quality criteria and guidelines. • Evaluation of fish tissue burden data relative to literature-derived CBRs. • Qualitative field assessment of the fish communities at the RDA.	Little to no significant potential risks were identified.
Wetland Vertebrates (e.g., amphibians, small mammals, birds)	N	N	Direct contact	Sustainability of a healthy and well-balanced amphibian community that reflects the available habitat at the RDA.	• Comparison of bulk sediment data to literature-derived low effect and severe effect sediment quality guidelines. • Bulk sediment screening level amphibian toxicity testing. • Evaluation of amphibian tissue burden relative to literature-derived CBRs. • Qualitative field assessment of the amphibian communities at the RDA.	Little to no significant potential risks were identified.

Notes:
[1] Although state-listed species of special of concern may occur in the vicinity of the site, these receptors were not extensively evaluated due to the lack of available ecotoxicological data.
Y = Yes; N = No

The ecological risk assessment did not identify adverse effects to receptors based on exposure to surface soil, sediment, surface water, or wetland plants and aquatic animal tissue. However, the presence of PCBs in hydric soil and small mammal tissue suggested potential risks to small mammals. This finding also resulted in the need to assess potential risks posed by PCB exposure to wildlife, including selected higher trophic-level birds and mammals (fox, mink, and hawk). The results concluded that, although the presence of PCBs in hydric soil and lower trophic-level animals (mice, fish, amphibians, and earthworms) presents potential risks to small mammals, it does not impact the food chain, and does not exceed regulatory risk thresholds for higher trophic-level birds and mammals. Refer to Section 7.0 of the Phase II RI report (Tetra Tech NUS/ENSR, 2001) for a comprehensive ecological risk assessment presentation.

Similar to the human health risk assessment, the ecological risk assessment uses assumptions that have uncertainties associated with them, which influence the results and conclusions of the risk assessment. Some of the assumptions may underestimate potential risk, some have an unknown effect on potential risk, while some assumptions tend to overestimate potential risk. Uncertainties in the ecological risk assessment process for the RDA are summarized in Table 7-54 of the Phase II RI (Tetra Tech NUS/ENSR, 2001). While these uncertainties generally tend to overestimate the potential ecological risks at the RDA, the use of limited site-specific toxicity testing data results in fewer uncertainties than are often contained in ecological risk assessments.

7.3 Basis for Response Action

In summary, the human health risk assessment indicated potential risks that would exceed regulatory risk thresholds if, in the future, groundwater beneath the site were to be used as drinking water. This potential risk was based on the presence of arsenic, benzo(a)pyrene, and manganese in groundwater. Further, the ecological risk assessment concluded that potential adverse effects to small mammals could potentially exist based on the presence of PCBs in hydric soil. No other human health or ecological risks were identified for the current and future use scenarios evaluated.

8.0 REMEDIATION OBJECTIVES

Remedial objectives, or Remedial Action Objectives (RAOs), are media-specific goals that are established to protect human health and the environment. RAOs are typically based on chemicals of concern, exposure pathways, and receptors present or available at the site. Additionally, RAOs are developed to ensure compliance with federal and state Applicable or Relevant and Appropriate Requirements (ARARs). Based on the gathered information relating to types of contaminants, environmental media of concern, and potential exposure pathways, RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment, and comply with ARARs. The RAOs for the RDA that were established during the FS, and expanded upon during the development of the Proposed Plan (based on discussions with EPA and MADEP) are:

- Minimize erosion and deposition of waste materials into the adjacent wetlands.
- Eliminate or minimize the potential for small mammals to be exposed to PCBs present in hydric soil in the adjacent wetlands.
- If capping is being considered, comply with Massachusetts solid waste landfill closure and post-closure requirements.
- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.

The first RAO was established in the FS based on site characteristics described in the RI. The Navy has determined that preventing physical hazards associated with direct contact with exposed debris, controlling erosion and surface water runoffs, and preventing deposition of sediments from the upland portion of the site into the adjacent wetlands would be an appropriate action for the RDA.

The second RAO was established in the FS, but was expanded upon based on discussions with MADEP and EPA regarding a cleanup value. The RAO was established to reduce the potential exposure of small mammals to PCBs in hydric soil via ingestion that may present a potential ecological risk in excess of risk benchmarks. To achieve this exposure reduction, approximately 54 cubic yards of PCB-impacted material should be addressed via a remedial action. The Navy will achieve the site-specific, ecological risk-based cleanup goal for the PCB-impacted hydric soils, which is a maximum concentration of 8 mg/kg total dry weight PCBs. Further, the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs in hydric soils will be achieved as an arithmetic mean concentration.

The third RAO was established during the FS such that, if a capping alternative is selected, state regulations regarding closure of a landfill are achieved through the selected remedial action.

Based upon discussions with EPA and the MADEP during the preparation of the Proposed Plan, a fourth RAO was established to prevent the potential exposure of a hypothetical future resident from consuming groundwater as a drinking water source. The estimated total carcinogenic risk level for this exposure scenario was 2.4×10^{-4}, which is slightly greater than EPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Arsenic (2.3×10^{-4}), and to a lesser extent benzo(a)pyrene (3.3×10^{-6}), were contributors to this cancer risk estimate. The noncancer hazard index for groundwater at the RDA is 46.5, which is above EPA's acceptable level of 1. Manganese (43), and to a lesser extent arsenic (2.2), were the main contributors to this noncancer risk estimate. However, the following observations can be made regarding groundwater at the site:

- Only one groundwater sample (10.8 µg/L from MW-22D) slightly exceeded the current Maximum Contaminant Level (MCL) for arsenic (10 µg/L). Based upon the potential list of materials disposed in the RDA, it is unlikely that the RDA materials would provide a source of arsenic in groundwater. Arsenic is naturally occurring, sorbed on solids (e.g., ferric oxyhydroxides) and appears in the form of suspended solids in unfiltered groundwater samples.
- For manganese, there is no current or proposed primary drinking water standard. When municipalities consider manganese removal in water supplies, it is generally categorized with iron as a source of staining (e.g., sinks, laundry), not as a potential source of toxicity.
- Benzo(a)pyrene was detected at very low concentrations in only a few groundwater samples. The maximum concentration detected was less than the state and federal MCL.
- If, in the future, the groundwater beneath the site were to be used as a drinking water supply, routine groundwater treatment using standard municipal treatment technologies (e.g., precipitation and filtration) would be recommended to achieve federal and state drinking water standards, including secondary standards that improve aesthetics (e.g., taste and odor).

Overall, existing groundwater data for the RDA indicate that active remediation (e.g., a pump and treat system) is not necessary to address site groundwater. EPA and MADEP have agreed with the Navy that evaluation of active groundwater treatment in the FS was not necessary.

9.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

Statutory Requirements/Response Objectives

The Navy's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that the response action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that the response action is cost-effective and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for response actions in which treatment significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the RDA. However, the level of response (e.g., degree of cleanup, regulatory basis, etc.) varies in order to provide a broad range of alternatives to consider. In addition, a No Action alternative is included, per the NCP and regulatory guidance, as a baseline for comparison.

As presented in the FS for the RDA (Tetra Tech NUS/ENSR, 2002), remedial technologies and process options were identified, assessed, and screened based on implementability, effectiveness, and cost. These technologies were then combined into remedial alternatives. Section 4.0 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 5.0 of the FS. In summary, seven remedial alternatives were selected for detailed analysis. Further detail is provided in Section 10.0 of this ROD.

10.0 DESCRIPTION OF ALTERNATIVES

This section provides a narrative summary of each alternative evaluated. The alternatives evaluated and presented in the FS for the RDA include:

- RDA-1: No Action
- RDA-2: Limited Action
- RDA-3: Permeable Soil Cap for PCBs and Landfill Material
- RDA-4: Low-permeability Membrane Cap for PCB and Landfill Material
- RDA-5: Excavation and Offsite Disposal of PCB Material, and Permeable Soil Cap for Landfill Material
- RDA-6: Excavation and Offsite Disposal of PCB and Landfill Material
- RDA-7: Excavation of PCB and Landfill Material, and Containment at a New Onsite Location

Each of the alternatives and their major components, as evaluated and presented in the FS, are summarized below and in Table 17. A more complete, detailed presentation of each alternative is found in Section 5.0 of the FS (Tetra Tech NUS/ENSR, 2002). Since the completion of the FS, modifications have been made to the selected remedy to address the concerns and interests of EPA and MADEP. These modifications have been incorporated into the selected remedy, which is presented and described in Section 12.0, Description of the Selected Remedy.

Table 17
Summary of Each Remedial Alternative and their Major Components as Evaluated in the FS

	RDA-1	RDA-2	RDA-3	RDA-4	RDA-5	RDA-6	RDA-7
Remedy Components							
• Clearing, grubbing, grading		x	x	x	x	x	x
• Wetland Restoration		x	x	x	x	x	x
• Institutional Controls (on land and aquifer use)		x	x	x	x		x*
• Physical Controls (fencing and signage)		x	x	x	x		x*
• 5-Year Reviews	x	x	x	x	x		
• Post Closure Monitoring/Maintenance			x	x	x		x*
• In-place Capping of Landfill Material			x	x	x		
• Onsite Relocation and Capping of Landfill Material							x
• Removal of Landfill Contents for Offsite Disposal						x	
• Excavation and Consolidation of PCBs within the RDA			x	x			
• Onsite Relocation and Capping of PCBs							x
• Removal of PCBs for Offsite Disposal					x	x	
Estimated Timeframes(years)							
• Designing and Constructing the alternative	NA	<1	1	1-2	1	2	4
• Achieving the cleanup objectives	NA	NA	1	1-2	1	2	4
Costs ($)							
• Capital Costs	0	360K	770K	870K	800K	11.3M	13.3M
• O&M Costs	0	0	600K	600K	600K	0	4.0M
• Periodic Costs	50K	160K	160K	160K	160K	0	0
• Present Worth Costs	50K	520K	1.5M	1.6M	1.6M	11.3M	17.3M

Notes:
RDA-1: No Action
RDA-2: Limited Action
RDA-3: Permeable Soil Cap for PCBs and Landfill Material
RDA-4: Low-permeability Membrane Cap for PCBs and Landfill Material
RDA-5: Excavation and Offsite Disposal of PCB Material, and Permeable Soil Cap for Landfill Material
RDA-6: Excavation and Offsite Disposal of PCB and Landfill Material
RDA-7: Excavation of PCB and Landfill Material, and Containment at a New Onsite Location
K – Thousand
M – Million
- Included as a component for the new landfill
- x* included as a component for the new landfill

RDA-1: No Action

The "No Action" alternative does not include the implementation of any remedial action for the site. It also does not include any long-term monitoring (LTM) or institutional controls. The only component of this alternative is the implementation of one 5-year review.

In general, when hazardous substances, pollutants, or contaminants are left in-place, 5-year site reviews are required pursuant to CERCLA Section 121. As such, leaving the disposed material in-place, or leaving PCB-impacted material in-place, could be considered a condition that warrants 5-year site reviews for the RDA. For No Action alternatives, there is a minimum obligation under CERCLA to perform one 5-year review after signing the ROD. This 5-year review would entail assessing that there is no unacceptable erosion of materials into the wetlands, and that general site conditions (upon visual observation) have not changed, since the ROD was signed, necessitating more aggressive action.

Since this alternative does not include any remedial action, the RAOs established for erosion control, landfill closure, and reducing the concentrations of PCBs at the RDA would not be achieved. This alternative would not achieve ARARs and TBCs, and is retained solely to satisfy EPA guidance which requires its use as a baseline for comparison to other remedial alternatives (EPA, 1988).

RDA-2: Limited Action

The limited action alternative would combine limited surface restoration, wetland restoration, institutional and physical (engineering) controls, and 5-year reviews. The performance objective for the institutional controls that are a component of this alternative is to prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.

Overall, this alternative would provide some level of erosion control, as well as some level of PCB exposure reduction, as the surface of the disposal area would be graded and smoothed. Thus, the likelihood of further erosion of debris into the wetland would be minimized. It would also include restrictions on land and groundwater use. It is noted that the RAO pertaining to landfill closure is not applicable to this alternative. According to EPA, state and federal landfill closure regulations would only apply to an alternative if capping were considered as a component of the remedy. For RDA-2, capping is not a part of this alternative; therefore, compliance with landfill closure regulations, and thus compliance with the RAO for landfill capping, is not necessary for this alternative.

Surface Restoration (Clearing, Grubbing, and Grading)

Limited surface restoration would include clearing, grubbing, grading, and revegetating of the upland portion of RDA, where the bulk of the waste material is contained. It would also include surface restoration of the slope on the eastern edge of the disposal area and the adjacent wetlands.

Wetland Restoration

Delineated wetland areas adjacent to where earthwork (clearing, grubbing, and grading) is performed would require mitigation. Mitigation efforts would include, at a minimum, backfilling to a suitable grade with organic soils, and replanting with native species as specified by a wetland scientist. Monitoring of mitigation efforts would continue until such a time that it is certain that transplantation or planting efforts is successful.

Physical (engineering) Controls

A fence with posted signs would be constructed to restrict access to the RDA, and protect the public from contacting or disrupting the surface of the RDA.

Institutional Controls

The Navy will implement institutional controls to achieve the land use control performance objective. Refer to Section 10.1 and 12.0 for details.

Five-year Reviews

The 5-year reviews would include a record review and a site inspection to confirm that the institutional/engineering controls are in place and effective, as well as monitoring to ensure that the wetland restoration efforts are successful.

RDA-3: Permeable Soil Cap for PCB and Landfill Material

This alternative would include the Limited Action (Alternative RDA-2) components, and would add a soil cap to contain the disposed material and eliminate exposure. Alternative RDA-3 focuses on the removal of PCB-impacted material from the wetlands, consolidation of that material within the RDA, and the construction of a permeable soil landfill cover. In addition, this alternative includes the installation of perimeter fencing and signage, a restrictive covenant, LTM, and 5-year reviews.

This alternative would achieve the erosion-control RAO established for the RDA, as well as comply with state landfill closure requirements (necessary only in the event of capping). In addition, although this alternative would not provide a reduction in PCB concentrations, it does include the excavation and placement of the PCB-impacted material on the upland portion of the RDA with subsequent covering by a soil cap; thus, potential exposure of ecological receptors to this impacted material is limited. In addition, this alternative would include restrictions on land and/or aquifer use.

Surface Restoration (clearing, grubbing, grading)

Surface restoration would include clearing, grubbing, and grading of the upland portion of RDA, where the bulk of the waste material is contained within the former disposal area. It would also include surface restoration of the slope on the eastern edge of the disposal area and the adjacent wetlands.

Such work would be accomplished to prepare the surface of the RDA for capping. As such, the surface would be cleared of vegetation, and the grading would be modified to provide a consistent slope to promote surface water drainage and minimize erosion. In order to construct a cap over the area, irregular fill areas extending into the wetlands would need to be excavated and consolidated on the upland portion of the site. The soils used for grading must be free of debris and have a moderate organic content. Soils must be able to be compacted to form a stable, dense, graded fill. If excavated materials do not provide a suitable volume of soil to provide a base for construction of a soil cap, there may be a need to import soils from elsewhere onsite.

To prevent the erosion of cap construction materials into the adjacent wetlands, all clearing, grubbing, and grading activities would take place after a perimeter ring of hay bales and a silt fence are installed.

Excavation and Consolidation of PCB-impacted Material

Areas where total PCB concentrations are greater than 8 mg/kg (dry weight) within the palustrine wetland hydric soils will be excavated and placed on top of the former disposal area. The total volume of PCB-impacted material is assumed to be approximately 54 cubic yards. Sampling and analysis of wetland hydric soils in the immediate vicinity of the excavated materials will be conducted.

Construction of Soil Cap

Based on the known site conditions at the RDA and according to the EPA CERCLA Municipal Landfill Site guidance document, a native soil cap is appropriate for the RDA. Federal requirements allow the use of "hybrid" landfill closures, which include permeable or soil caps. State closure requirements allow the use of a soil cap at disposal closing facilities that were inactive as of October 1993 (which applies to the RDA). This containment alternative, therefore, includes use of a soil cap as an appropriate and cost-effective option.

State requirements specify that a soil cap should consist of an 18-inch thick layer of low-permeability soils, with a maximum permeability of $1x10^{-7}$ centimeters per second (cm/sec). However, landfills ceasing to accept material as of October 1993 can be closed with an alternative cap consisting of a minimum 18-inch infiltration layer and a minimum 6-inch erosion layer, and having a maximum permeability of $1x10^{-5}$ cm/sec. Given the age of the RDA, and the potential applicability of state requirements, it is appropriate to propose use of an alternative cover with a maximum permeability of $1x10^{-5}$ cm/sec for this alternative. Per state municipal landfill guidance, the soil cap thickness would be a minimum of 18 inches with a 6 inch erosion layer, to ensure long-term integrity.

Once compacted, the suggested maximum permeability of $1x10^{-5}$ cm/sec may also be met. Because the soil cap is relatively permeable, it is not necessary to provide a drainage layer on top of it to control surface water. To maintain overall site aesthetics and to prevent erosion of the soil cap, a 6-inch layer of topsoil should be constructed and seeded to produce a thick and dense vegetative mat. Soil required must meet relevant specifications including fertilization and liming requirements. During germination, seeded areas would be protected with a mulch or straw mat.

Because of the gentle top slopes and moderate side-slopes that a soil cap over the RDA would exhibit, and because the soil cap would be relatively permeable, storm water would be managed by sheet-flow off of the side-slopes, with channelized flow and discharge from several exit points at the toe of the landfill. Preliminary calculations show that the post-construction increase in flow can be discharged to the wetland area east of the disposal area at a maximum rate of 4 feet per second (ft/sec). This value is the recommended maximum discharge velocity for storm water flow discharged into wetlands.

In the event that the current land reuse plans necessitate the consideration of paving on top of the closed disposal area (e.g., if a future road or parking area were to be considered for portions of the RDA), the soil cap described in this section could be replaced with a crushed-stone base cap. Crushed stone may be better suited for future compaction to support highway construction, whereas soil may be better suited for future landscaping or open-space-type uses. The alternative evaluation presented in this document would not be substantially different if crushed stone were used instead of soil. A similar level of exposure elimination to disposed materials would be achieved with either soil or crushed stone.

<u>Wetland Restoration</u>

Delineated wetland areas adjacent to where earthwork (clearing, grubbing, and grading) is performed and from which material would be removed would require restoration. Refer to Atlernative RDA-2 for details.

<u>Physical (engineering) Controls</u>

This alternative also includes fencing and signage to limit access to the site. Refer to Alternative RDA-2 for details.

<u>Institutional Controls</u>

The Navy will implement institutional controls to achieve the following land use control performance objectives:

- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.
- Prohibit activities or uses of the site that would disturb or otherwise interfere with the integrity or function of the permeable soil cap. These prohibited activities include construction on, excavation of, or breaching of the permeable soil cap.

Refer to Section 10.1 and 12.0 for details.

<u>Post-Closure Monitoring/Maintenance</u>

To supplement the cap construction, this alternative would include a long-term monitoring (LTM) program to provide post-closure care, and to assess the permanence and performance of the soil cap. Post-closure monitoring/maintenance activities associated with the soil cap closure would consist of groundwater and surface water monitoring; inspection of cap and storm water management components; and maintenance of the vegetative cover onsite, including mowing, fertilizing and liming (as needed). The LTM program would also include measures to assess and if necessary, maintain the wetlands that were restored.

<u>Five-year Reviews</u>

This alternative would include an inspection and a review of the site every five years. These reviews would include a record review and a site inspection to confirm that the institutional/engineering controls are in place and effective, as well as monitoring to ensure that the wetland restoration efforts are successful. In addition, LTM data would be reviewed every five years throughout the LTM program duration.

RDA-4: Low-permeability Membrane Cap for PCB and Landfill Material

This alternative is similar to Alternative RDA-3, except that a low-permeability FML cover would be constructed over the former disposal area instead of a soil cover. Overall, this alternative includes the removal of PCB-impacted material from the wetlands, consolidation of that material within the RDA, the construction of a low-permeability FML landfill cover, wetland restoration, the installation of perimeter fencing and signage, institutional controls, LTM, and 5-year reviews.

Similar to RDA-3, this alternative would achieve the erosion-control RAO established for the RDA, as well as comply with state landfill closure requirements (necessary only in the event of capping). In addition, although this alternative would not provide a reduction in PCB concentrations, it does include the excavation and placement of the PCB-impacted material on the disposal area with subsequent covering by a low-permeability FML cap; thus, potential exposure of ecological receptors to this impacted material is limited. Further, this alternative would include restrictions on land and groundwater use.

Surface Restoration (clearing, grubbing, grading)

To prepare the surface of the site for capping, the surface needs to be cleared of vegetation, and the grades need to be modified to provide a consistent slope to promote surface water drainage and minimize the potential for erosion. Refer to Alternative RDA-3 for details.

Excavation and Consolidation of PCB-impacted Material

Similar to Alternative RDA-3, PCB-impacted material from the wetland area would be excavated and placed on the upland portion of the RDA prior to capping. Refer to Alternative RDA-3 for details.

Construction of FML Cap

An alternate capping material to soil is the use of FMLs. An FML cap would minimize surface water infiltration to the subsurface of the RDA. FMLs are subject to puncture damage by both foot and vehicular traffic. As a result, the FML must be covered with protective soils. Massachusetts closure requirements allow the use of an FML cap in closing landfill facilities.

State requirements specify that a final FML cap over a solid waste landfill should have a low-permeability layer, composed of 60 mil (0.06-inch) thick material. To maintain the low permeability characteristics of the material both during installation and over time, it is recommended that the FML be installed on a compacted soil base composed of 6 inches of screened material, having no individual objects of greater than 2 inches. State closure requirements suggest that a total of 24 inches of material be used to form the protective barrier; however, conventional closures within the state have typically specified 20 inches of material composed of 12 inches of drainage sand and 8 inches of topsoil. The drainage sand component is technically required with an FML closure because the FML is essentially impermeable to percolating surface water.

A topsoil layer is typically used as a component of the barrier-protection layer, and supports a vegetative mat on the surface of the final cover. The state requires a minimum of 6 inches of topsoil to support a vegetative mat. An 8-inch layer is typically used to support vegetative growth because some of the topsoil fines are washed into the drainage sand layer and there needs to be adequate water-retaining capacity of the soil for sustaining root growth and propagation.

Storm water must be managed such that sedimentation of the adjacent wetlands is limited, and the discharge velocity to the wetlands is low enough to prevent scour. Because of the gentle top slopes and moderate side-slopes that an FML cap over the RDA would exhibit, storm water would be managed by sheet-flow off of the side-slopes, with channelized flow and discharge from several exit points at the toe of the disposal area. Surface water that percolates to the drainage layer would also be discharged at the toe of slope through a riprap-lined channel. Preliminary calculations show that the post-construction increase in flow can be discharged to the wetland area east of the disposal area at a maximum rate of 4 ft/sec, which is the recommended maximum discharge velocity for storm water flow discharged into wetlands.

Contrary to the permeable capping option (Alternative RDA-3), the FML cap described in this section can not be covered with crushed-stone in the event that the current land reuse plans change such that the highway bypass alignment encompasses a significant portion of the RDA. That would impair the integrity of the FML capping system. An alternate capping technique (e.g., Alternative RDA-3) would be necessary to achieve the desired compaction to support highway construction, if desired.

Wetland Restoration

Similar to Alternative RDA-3, delineated areas adjacent to where earthwork (clearing, grubbing, and grading) is performed, and wetland areas from which material would be removed would require restoration. Refer to Alternative RDA-2 for details.

Physical (engineering)Controls

This alternative also includes fencing and signage to limit access to the site. Refer to Alternative RDA-2 for details.

Institutional Controls

The Navy will implement institutional controls to achieve the following land use control performance objectives:

- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.
- Prohibit activities or uses of the site that would disturb or otherwise interfere with the integrity or function of the cap. These prohibited activities include construction on, excavation of, or breaching of the cap.

Refer to Section 10.1 and 12.0 for details.

Post-Closure Monitoring/Maintenance

Similar to Alternative RDA-3, post-closure monitoring/maintenance activities associated with the FML cap consist of groundwater and surface water monitoring; inspection of cap and storm water management components; and maintenance. These inspections would be performed by a Massachusetts-licensed Professional Engineer. Recommendations on any required repairs or maintenance would be forwarded to the Navy. The Navy would be responsible for contracting for those repairs and for contracting the monitoring/maintenance activities. The LTM would also include measures to assess, and if necessary, maintain the wetlands that were restored.

Five-year Reviews

Similar to Alternative RDA-3, this alternative would include inspection and review every five years. Refer to Alternative RDA-3 for details.

RDA-5: Excavation and Offsite Disposal of PCB-impacted Material, and Permeable Soil Cap for Landfill Material

This alternative is very similar to the permeable soil capping option (Alternative RDA-3). However, it differs in that PCB-impacted material would be excavated and transported offsite for subsequent disposal, rather than placed on top of the RDA for inclusion within the soil cap. Management of PCB-impacted material would include excavation of the material, transportation to an offsite disposal facility, backfilling the excavation, and wetland restoration. In addition, this alternative includes the installation of perimeter fencing and signage, institutional controls, LTM, and 5-year reviews.

This alternative would achieve the RAO established for erosion-control, as well as comply with state landfill closure requirements (necessary only in the events of capping). By removing areas that exhibit PCB concentrations in excess of 8 mg/kg from the site, this alternative would also be protective of ecological receptors. Further, this alternative includes restrictions on land and groundwater use.

Clearing, Grubbing, and Grading

Refer to Alternative RDA-3 for details.

Excavation and Removal of PCB-Impacted Material

Refer to Alternative RDA-3 for details.

Disposal of PCB-Impacted Material

Since the concentrations of PCBs are less than 50 mg/kg, the excavated PCB-impacted material would not be considered as a TSCA-regulated or "special" waste. As such, there are several facilities in the Greater Boston area that would accept the PCB-impacted material for disposal.

Backfill to Grade

Because only 54 cubic yards of material are projected for excavation and offsite disposal, it is presumed that subsequent grading for placement of the soil cap would be sufficient to restore site conditions. As such, no backfill (specifically to fill the excavated area) is included in this alternative. Wetland restoration and mitigation efforts, implemented after construction of the landfill cap, would be intended to restore site conditions (refer to the wetland restoration discussion below).

Construction of Soil Cap

Refer to Alternative RDA-3 for details.

Wetland Restoration

Delineated wetland areas from which material would be excavated would require restoration. Refer to Alternative RDA-2 for detail.

Physical (engineering)Controls

This alternative also includes fencing and signage to limit access to the site. Refer to Alternative RDA-2 for details.

Institutional Controls

The Navy will implement institutional controls to achieve the following land use control performance objectives:

- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.
- Prohibit activities or uses of the site that would disturb or otherwise interfere with the integrity or

function of the permeable soil cap. These prohibited activities include construction on, excavation of, or breaching of the permeable soil cap.

Refer to Section 10.1 and 12.0 for details.

Post-Closure Monitoring/Maintenance

Refer to Alternative RDA-3 for details.

Five-year Reviews

Refer to Alternative RDA-3 for details.

RDA-6: Excavation and Offsite Disposal of PCB and Landfill Material

This alternative consists of excavating the entire contents of the RDA, including the adjacent PCB-impacted material, using conventional earth-moving equipment. Further, this alternative is based on the premise that all of the excavated material would be disposed offsite. Since all materials would be removed from the site, fencing and signage, LTM, institutional controls, and 5-year reviews would not be required for this alternative.

This alternative would achieve the erosion-control RAO established for the RDA, as well as the RAO established to minimize and/or eliminate ecological exposure to PCBs. As the landfill would be completely removed, landfill closure regulations would not apply to this alternative.

Clearing, Grubbing, and Grading

To prepare the area for excavation, the surface area would need to be cleared of vegetation. Vegetative and woody material cleared and grubbed would be chipped and used as fill onsite.

To prevent erosion of excavated materials into the adjacent wetlands, all clearing, grubbing, and grading activities would take place after a perimeter ring of hay bales and a silt fence are installed. Following final cover stabilization, but no less than one year after construction, the controls would be removed and seed would be sown to provide a continuous vegetative mat across the site.

Excavation and Removal of PCB and Landfill Material

Excavation would consist of both wet and dry material (referred to as "in the wet" and "in the dry"). The RDA is, on average, 8 feet deep and groundwater is encountered between 2 and 7 feet bgs. Depth to groundwater also varies seasonally. As such, it is advantageous to conduct the excavation work during low water-table conditions (e.g., August).

It is anticipated that a 6-inch screen would be used to separate daily cover from general debris. A grapple attachment on an excavator could be used to "hand-pick" large concrete and steel for segregation from the other materials. Disposal characterization would be performed on every 500 cubic yards of segregated material. The total volume of material within the RDA is assumed to be approximately 50,000 cubic yards. There is no cleanup objective (i.e., field screening number) to determine when to stop excavating as there are no defined areas within the RDA that warrant removal. Therefore, the decision of when to stop excavating would be based upon visual inspection (i.e., when native material or underlying topographic fill is encountered).

The excavation and follow-up sampling and analysis for the PCB-impacted material from the adjacent wetlands would proceed as described for Alternative RDA-3.

Offsite Disposal of PCB and Landfill Material

Based on the data collected to date, the majority of material excavated from the RDA site would require disposal offsite as construction and demolition (C&D) debris. Because the concentrations of PCB are less than 50 mg/kg, the excavated PCB-impacted material would not be considered a TSCA-regulated or "special" waste. As such, there are several facilities in the Greater Boston area that would accept construction and demolition debris from the RDA.

Backfill to Grade

This alternative assumes that the entire RDA contents would be excavated and transported offsite. As such, approximately 50,000 cubic yards of clean backfill would be required.

Final slopes created by backfilling must be no more than 20% from the top of the excavation to the toe of the wetlands. A 20% slope minimizes the amount of on or offsite sill required and is generally considered stable. Conventional earth moving equipment would be used to place and compact the fill material. Lifts of no more than 2 feet would be allowed.

A topsoil layer, consisting of a minimum of 6 inches of organic material, would be placed on top of the compacted fill area. Soil used for the topsoil layer must meet relevant specifications, including fertilization and liming requirements. During germination, seeded areas would be protected with a mulch or straw mat. If hydroseeding is used, a tackifier may be used as a substitute erosion control protection measure.

Because of the gentle top slopes and moderate side-slopes that the excavation would create, and because the vegetated surface would be relatively permeable, storm water would be managed by sheet-flow off of the side slopes, with channelized flow and discharge from several exit points at the toe of the filled area. Preliminary calculations show that the post construction increase in flow can be discharged to the wetland area east of the filled area at a maximum of 4 ft/sec, which is the recommended maximum discharge velocity for storm water flow discharged into wetlands.

Wetland Restoration

Delineated wetland areas from which material would be excavated would require restoration. With the current configuration of the RDA, it is anticipated that only a small adjacent strip of wetlands would be impacted. However, with the aggressive removal of the entire RDA contents, it is likely that more of the wetlands would be impacted during the operations. Refer to Alternative RDA-2 for details.

RDA-7: Excavation of PCB and Landfill Material, and Containment at a New Onsite Location

In contrast to in-place capping or offsite disposal, an alternate option could consist of relocating the RDA to a new location within the NAS South Weymouth property. As this alternative would consist of removing the "CERCLA" site, installation of perimeter fencing and signage, institutional controls, LTM, and 5-year reviews would not be required for the current location of the RDA.

State municipal landfill closure regulations would be applicable to the newly constructed landfill. These regulations would stipulate the establishment of an institutional control restricting invasive activities at the new landfill site, as well as an LTM program. State regulations, however, would not necessitate 5-year reviews for the new landfill site, as this new site would not be considered regulated under CERCLA.

This alternative would achieve the erosion-control RAO established for the RDA, as well as the RAOs established to minimize and/or eliminate ecological exposure to PCBs. As the landfill would be completely removed, landfill closure would not apply to the RDA. However, as previously discussed, a new set of rules and regulations would then apply to the newly constructed landfill. The new landfill requirements are relatively stringent; however, it is inherent within this alternative that all of the requirements would be achieved.

Clearing, Grubbing, and Grading

Similar to Alternative RDA-6, to prepare the area for excavation, the surface of the RDA would need to be cleared of vegetation. Vegetative and woody material cleared and grubbed would be chipped and used as fill onsite.

Excavation of PCB and Landfill Material

Similar to Alternative RDA-6, excavation would consist of both wet and dry material (referred to as "in the wet" and "in the dry"). Because the RDA could have significant portions below the water table, it is advantageous to conduct the excavation work during low water-table conditions, (e.g., August). This alternative assumes that no dewatering would be required.

To avoid placing regulated wastes into the new landfill, characterization of the waste materials excavated from the RDA would be performed. Samples would be collected for every 500 cubic yards of excavated material. The total volume of material contained in the RDA is estimated to be 50,000 cubic yards. As described in Alternative RDA-6, there is no cleanup objective (i.e., field screening number) to determine when to stop excavating since there are no defined areas within the RDA that warrant removal. Therefore, the decision of when to stop excavating would be based upon visual inspection (i.e., when native material or underlying topographic fill is encountered).

The excavation and follow-up sampling and analysis for the PCB-impacted material from the adjacent wetlands would proceed as described for Alternative RDA-3.

Onsite Transport of PCB and Landfill Material

Upon siting a new landfill location, the disposed materials, as well as PCB-impacted material adjacent to the upland portion of the RDA, would be transported from their present location at the RDA to the new onsite landfill location. This procedure would require some level of staging and segregation for handling purposes, as well as the coordination of observations and analytical characterization in order to appropriately dispose of the material.

Although the intent of this alternative is to transport the entire RDA contents (including the adjacent PCB-impacted material) to the new landfill location, some of the material may require offsite disposal. This could be based upon restrictions established during the siting of the new landfill, limiting the ability to place "other" types of materials on site.

Backfilling of Previous RDA Location

Because the wetland area could be regraded without backfilling, only the previous upland portion of the RDA would require backfill. As such, approximately 50,000 cubic yards of clean backfill would be required for the previous location. Refer to Alternative RDA-6 for further detail.

It is possible that after excavating the disposal area, surface water could reclaim the unfilled cavity. If that is the case, the backfill could be comprised of an appropriate wetland soil to expand the size of wetlands in that area. This alternative, however, projects a dryer post-excavation condition and subsequent upland-type backfilling.

Wetland Restoration at Previous RDA Location

Similar to Alternative RDA-6, wetlands adjacent to the RDA would require restoration after excavation and backfilling of the disposal area. Refer to Alternative RDA-2 for restoration details.

Siting and Permitting of New Landfill

In contrast to other landfill capping and consolidation alternatives, this alternative requires formal siting and permitting. This administrative step is necessary to ensure that the landfill is constructed in an appropriate location. Criteria used for siting include proximity to 100-year floodplains, depth to groundwater, proximity to rivers, proximity to wetlands, proximity to potentially productive aquifers and Zone II designated areas, and other geologic and hydrogeologic factors. Based on the siting evaluation conducted by the Navy (ENSR, 2001), there appears to be sufficient space for a new landfill within the NAS South Weymouth property.

Engineering Design, Plans, and Specifications for New Landfill

Per state regulations, a collection of plans is required during the landfill siting and permitting process. Plans include a Landfill Site Plan, Hydrogeologic Report, Landfill Design Plan, Landfill O&M Plan, Conceptual Closure Plan, and Conceptual Post-Closure Plan. A presentation of the studies performed (e.g., hydrogeologic study) are required to accompany landfill design plans and construction specifications. Although some level of design is required for the closure of an existing landfill in-place (refer to the other capping and consolidation alternatives), the level of study and design for a newly sited landfill is much more extensive.

Construction of Multi-Layer Liner for New Landfill

A groundwater protection system is required for newly constructed landfills. The protection system includes a subgrade layer, composite liner, drainage layer, leachate collection system, and leachate storage system. State regulations dictate minimum performance requirements for each of these components. These components would not be required for the other capping and consolidation alternatives, only for this new landfill alternative.

Placement of PCB and Landfill Material on New Landfill Liner

It is estimated that approximately 50,000 cubic yards of material would be transported onsite for placement in the new landfill. A 20% swell factor would then be applied to account for post-excavation expansion, resulting in a volume estimate of approximately 60,000 cubic yards for the new landfill.

Multi-Layer Capping System for New Landfill

In contrast to a simple soil or FML cap design, a new landfill would require a multi-layer cap to satisfy state regulations. Minimum requirements for new landfill caps include a subgrade layer, landfill gas venting layer, low-permeability (e.g., FML) layer, drainage layer, filter material layer, vegetation support layer, and vegetative cover. Other components may also be required based on site-specific conditions.

Physical Controls for New Landfill

This alternative would require fencing and signage (physical controls) to limit site access. Refer to Alternative RDA-2 for detail.

Institutional Controls for New Landfill

This alternative would require a deed restriction to comply with state landfill closure regulations. The restriction would prohibit activities or uses of the new landfill site that would disturb or otherwise interfere with the integrity or function of the landfill cap. These prohibited activities would include construction on, excavation of, or breaching of the landfill cap.

Post-Closure Monitoring/Maintenance of New Landfill

Similar to the other landfill capping alternatives, LTM would be required by the state for a newly sited landfill. In addition to groundwater monitoring, surface water, leachate, and gas monitoring would also be required for a new landfill. The additional monitoring requirements for this alternative would include O&M of the leachate and gas recovery systems, as well as periodic sampling and reporting of waste streams.

10.1 Institutional Controls

The Navy shall implement institutional controls to achieve the land use control performance objectives. Within 90 days following the execution of a ROD for the RDA, the Navy, with concurrence of EPA Region I and in consultation with the MADEP, would develop a remedial design that would contain land use control implementation and maintenance actions (the "LUC Remedial Design"). The Navy shall be responsible for implementing, inspecting, reporting, and enforcing the institutional controls described in the ROD in accordance with the approved LUC Remedial Design. Should any institutional control component of the selected remedy fail, the Navy would ensure that appropriate actions are taken to reestablish the selected remedy's protectiveness. The Navy may transfer various operational responsibilities for these actions to other parties through contracts, agreements and/or deed restrictions. However, the Navy acknowledges its ultimate liability under CERCLA for remedy integrity, including for the performance of any transferred operational responsibilities.

The purpose of these institutional controls would be to control or restrict certain types of property uses. The IC objectives are contained in each alternative. The institutional controls are necessary because hazardous substances could otherwise pose potential risks if property use was not controlled or restricted. The institutional controls would be maintained within the boundaries of the RDA shown in Figure 6. The institutional controls would be maintained until the concentrations of hazardous substances have been reduced to levels that allow for unlimited exposure and unrestricted use, as determined by long-term monitoring at the RDA. The following specific land use controls are included as part of the selected remedy:

- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.
- Prohibit activities or uses of the site that would disturb or otherwise interfere with the integrity or function of the permeable soil cap. These prohibited activities include construction on, excavation of, or breaching of the permeable soil cap.

The Navy's remedial design shall ensure that the Navy, in implementing the land use controls, provides that a regulatory agency satisfactory to EPA, with the concurrence of MADEP, may acquire an irrevocable right to enforce the land use controls directly against all current and future owners of any interest in the property, for as long as the land use controls are required, and an associated access easement, both of which may be assignable. This enforcement right would supplement, not replace, the Navy's right and responsibility to enforce the institutional controls, described above. If the remedial design provides for this enforcement right and access easement to be granted or assigned to MADEP, (i) acceptance of any grant shall be subject to approval of the Commissioner of MADEP or other designated State official and (ii) the form of the land use controls and the process of implementation shall be satisfactory to MADEP and, to the extent applicable, such form shall be substantially the same as Form 1072A ("Grant of Environmental Restriction") of the Massachusetts Contingency Plan, 310 Code of Massachusetts Regulations 40.1099 and such implementation shall comply with the survey plan, subordination and title requirements set forth in 310 Code of Massachusetts Regulations 40.1071 and 40.1072(2).

11.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum the Navy is required to consider in its assessment of the alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. **State/Support agency acceptance** addresses the state's position and key concerns related to the preferred alternative and other alternatives, and the state's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Section 6.0 of the FS (Tetra Tech NUS/ENSR, 2002), and a summary table is included as Table 18 in this ROD.

Table 18
Detailed Comparison of Remedial Alternatives as Presented in the FS

Comparative Criteria	RDA-1	RDA-2	RDA-3	RDA-4	RDA-5	RDA-6	RDA-7
Detailed Description							
Includes clearing, grubbing, and grading and wetland restoration		x	x	x	x	x	x
Includes physical/institutional controls (i.e., fencing and signage; deed restriction)		x	x	x	x		
Includes post-closure monitoring/maintenance			x	x	x		x
Includes 5-year reviews	x	x	x	x	x		x
Does not generate wastes that require subsequent management/disposal	x	x	x	x			
Does not require specialized expertise of workers to implement	x	x	x				
Does not require significant design, planning, and implementation logistics	x	x	x		x		
Estimated Timeframes (years)							
Designing and Constructing the alternative	NA	<1	1	1-2	1	2	4
Achieving the RAOs	NA	NA	1	1-2	1	2	4
Criteria Analysis							
Achieves RAOs :							
• If capping is being considered, complies with state landfill closure requirements	NA	NA	x	x	x	(x)	x
• Eliminates/minimizes the potential for small mammals to be exposed to PCBs in hydric soil			x	x	x	x	x
• Minimizes erosion and deposition of waste materials into the wetlands		x	x	x	x	x	x
Achieves overall protection of human health and the environment:							
• Eliminates, reduces and/or controls risks		x	x	x	x	x	x
• Minimal potential for short-term and cross-media impacts	x	x	x	x	x		
Achieves ARARs			x	x	x	(x)	x
Achieves TBCs			x	x	x	x	x
Achieves long-term effectiveness		x	x	x	x	x	x
Reduces the toxicity, mobility and volume of waste through treatment	NA	NA	NA	NA	NA	NA	NA
Achieves short-term effectiveness		x	x	x	x		
Easily implemented	x	x	x		x		
Cost ($)							
▪ Capital	0	360K	770K	870K	800K	11.3M	13.3M
▪ Operation and Maintenance	0	0	600K	600K	600K	0	4.0M
▪ Periodic Costs	50K	160K	160K	160K	160K	0	0
Total Cost	50K	520K	1.5M	1.6M	1.6M	11.3M	17.3M
Additional Regulatory Considerations							
Achieves intent of *Presumptive Remedy for CERCLA Municipal Landfill Sites*			x	x	x		
Would comply TSCA requirements presented in the *PCB Megarule*			x	x	x	x	x

Notes:
RDA-1 – No Action
RDA-2 – Limited Action
RDA-3 – Permeable Soil Cap for PCB and Landfill Material
RDA-4 – Low-Permeability Membrane Cap for PCB and Landfill Material
RDA-5 – Excavation, Offsite Disposal of PCB material, Permeable Soil Cap for Landfill Material
RDA-6 – Excavation and Offsite Disposal of PCB and Landfill Material
RDA-7 - Excavation of PCB and Landfill Material, and Containment at New Onsite Location

x – Includes component or achieves criterion (positive attribute)
(x) – Not applicable or inherently achieved
NA - Not applicable
K – thousand
M - million

The section below presents the nine criteria and a brief narrative summary of the alternatives, and the strengths and weaknesses according to the detailed and comparative analysis presented in the FS (Tetra Tech NUS/ENSR 2002).

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Alternative RDA-1, No Action, is not protective of small mammals and would not achieve the RAOs established for the RDA. The limited action that would be performed under Alternative RDA-2 would provide limited protection through grading, slope stabilization and wetland mitigation. The degree of protection is highly dependent upon maintaining existing ground cover and slope stability.

Alternatives RDA-3 through RDA-7 would provide a satisfactory level of overall protection to the environment. Alternatives RDA-3, RDA-4, and RDA-5 would achieve ecological protection primarily through the construction of an in-place cap, in order to achieve the RAOs established for the RDA. Conversely, Alternatives RDA-6 and RDA-7 would remove the contents of the landfill, thereby eliminating the current human and ecological exposure potential at the RDA. However, contrary to Alternative RDA-6 (offsite disposal), Alternative RDA-7 (new onsite landfill) would not fully eliminate the exposure potential from the NAS South Weymouth property.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA required that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal and state law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes or provides a basis for invoking a waiver.

As presented in the FS, Alternatives RDA-1 and RDA-2 would not achieve the site-specific, ecological risk-based PRG (8 mg/kg) for PCBs in hydric soils. For Alternative RDA-2, the ARARs and TBCs related to the protection of wetlands would be moderately achieved for this alternative.

Only Alternatives RDA-3 through RDA-7 would fully comply with ARARs and TBCs. Alternatives RDA-3, RDA-4, and RDA-5 (capping) would comply with state landfill closure requirements, whereas RDA-6 (offsite disposal) would result in complete elimination of the landfill as it exists, negating the applicability of state landfill closure requirements. Alternative RDA-7 would result in the development of a new landfill on the NAS South Weymouth property.

All of those alternatives (Alternatives RDA-3 through RDA-7) would excavate wetland areas that exhibit PCB concentrations greater than 8 mg/kg. In addition, ARARs and TBCs related to the protection of wetlands and the management of solid waste would be achieved for each of the alternatives upon implementation.

Long Term Effectiveness and Permanence

Long term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Alternative RDA-1, which does not involve any remedial action, would not be considered to have long-term effectiveness or permanence.

Alternative RDA-2 would be considered to have a minimal level of long-term effectiveness and permanence as long as site conditions remain unchanged and maintained.

Alternatives RDA-3 through RDA-7 would be considered to have long-term effectiveness and permanence. However, Alternative RDA-6 (offsite disposal) would be considered to have the greatest degree of permanence, given that the disposed and PCB-impacted materials would be permanently removed from the NAS South Weymouth property.

After the FS was finalized, the Navy prepared a landfill cover evaluation matrix relative to groundwater issues to identify whether there were any benefits to implementing one capping technique over another (i.e., permeable soil landfill cover versus a low-permeability FML landfill cover). According to the evaluation performed, the permeable soil cover alternatives (RDA-3 and RDA-5) were determined to be more effective than the low-permeability FML cover alternative (RDA-4) since the continued aeration of the landfill (promoted by the use of a soil cover material) would decrease the potential for metals and other inorganic chemicals to impact groundwater in the future. Refer to Appendix G.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

None of the alternatives developed for the RDA include a component of "treatment." However, it should be noted that, under Alternatives RDA-3, RDA-4, RDA-5, RDA-6, and RDA-7, the PCB-impacted material would be removed from the RDA. Although this material would not be treated, its toxicity, mobility, and volume, as currently present within the wetland area, would be addressed. Further, this material would no longer be present at the RDA, thus it would not longer pose potential risks to small mammals.

Alternatives RDA-2, RDA-3, RDA-4, RDA-5, and RDA-7 would provide a reduction in the physical mobility of disposed materials, thereby reducing the potential for erosion. Alternative RDA-6 (offsite disposal) would provide a reduction in mobility and volume through complete removal of the landfill and PCB-impacted material.

Short Term Effectiveness

Short term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

Alternative RDA-1 would not be considered to have any short-term effectiveness. Alternative RDA-2 would be considered have some level of short-term effectiveness by deterring trespassers with fencing. However, Alternative RDA-2 would not achieve the cleanup goal established for the protection of lower-order ecological receptors.

Alternatives RDA-3, RDA-4, and RDA-5 (in-place capping) would be effective in achieving site RAOs and reducing potential risks within a relatively short timeframe (1 to 2 years). In-place landfill capping would create minimal disruption to current site conditions, and would be completed relatively quickly.

Alternatives RDA-6 and RDA-7 would not be effective in the short-term, given the substantial amount of site disruption that would occur during excavation activities. Both alternatives would require a high-level of preventive wetland mitigation efforts, as well as a high-level of noise and dust control during implementation. Subsurface disposed materials, that are currently not posing an exposure concern, would be brought to the surface and potentially expose receptors to new hazards.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives RDA-1 and RDA-2 would require minimal implementation efforts, and thus are considered to be very easily implemented. Alternatives RDA-3 and RDA-5 (in-place soil cap) are also considered to be relatively easy to implement. Soil capping is a common practice in landfill closure.

Alternative RDA-4 (in-place FML cap) is slightly more involved than Alternatives RDA-3 and RDA-5, in that it requires specialized labor and techniques to construct.

Alternative RDA-6 (offsite disposal) is not a difficult concept and does not necessarily require specialized labor and techniques. However, the logistics involved with mobilization, excavation, dewatering, water treatment (if required), waste characterization, waste segregation, stockpiling, staging, and all of the other tasks associated with excavation and offsite disposal, are cumbersome.

Alternative RDA-7 (new landfill) is much more cumbersome and logistically difficult than the other alternatives being considered. This alternative has the added task of siting, permitting, and constructing a new landfill. The new landfill would be constructed based on engineering design, plans, and specifications. Upon approval, the new landfill would include a multi-layer liner, multi-layer cap, and leachate and gas collection systems. Further, in contrast to the other alternatives that would require LTM (Alternatives RDA-3, RDA-4, and RDA-5), Alternative RDA-7 would require the installation of new monitoring wells, as well as the sampling of groundwater, landfill leachate, and landfill gas, as part of its perpetual care.

Cost

The cost estimates for the seven alternatives being considered range from $50,000 (Alternative RDA-1) to $17.3M (Alternative RDA-7) (see Table 18). In general, the alternatives span a range of possible options with a range of associated costs.

State/Support Agency Acceptance

MADEP has stated that additional data needs to be collected during the design and implementation phases of the selected remedy, prior to the state issuing its formal concurrence. Specifically, the state does not believe they have adequate information to concur that the selected remedy is protective of human health and the environment. MADEP concerns are listed below, followed by the Navy's modifications of the selected remedy to alleviate those concerns. The Navy's modifications were described in the Proposed Plan, and are further described in Section 12.0 of this ROD:

- State Concern Regarding PCB Cleanup Goal: The MADEP does not believe that the 8 mg/kg cleanup goal (established by the EPA and Navy to protect ecological receptors) is adequately protective of human health. The MADEP would prefer a 1 or 2 mg/kg cleanup goal in order to be protective of both human health and the environment. Navy Modification: The Navy further clarified in the Proposed

Plan that there are no risks posed to human health from PCBs at the RDA. However to alleviate state concerns, the Navy modified the selected remedy to ensure that no post-excavation hydric soil samples exceed the site-specific, ecological risk-based cleanup goal of 8 mg/kg total PCBs (dry weight), and that the arithmetic mean for the post-excavation hydric soil samples will not exceed the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs.

- State Concern Regarding Land Reuse: The MADEP does not believe that the components of the selected remedy (e.g., fencing and signage) are consistent with reuse plans for the area. Navy Modification: Because the fencing and signage are not required to mitigate potential risks, the Navy specified that these particular components are optional, only to be implemented if they are not an impediment to site reuse. Further, although discussions regarding future reuse plans are ongoing, proposed future use of the RDA vicinity has been identified as open space. Therefore, the soil cover for the RDA will be designed to allow for active and passive recreation. Design component details will be provided in the design documents for the RDA.
- State Concern Regarding Floodplain: The MADEP is concerned that the landfill will extend into the 100-year floodplain of Old Swamp River. Navy Modification: The eastern edge of the former disposal area is located immediately adjacent to the wetland area, which is also the boundary of the 100-year floodplain of Old Swamp River. The Navy clarified that it would construct the cap such that it did not extend into the wetlands. To accomplish this, some material from the former disposal area in the vicinity of the eastern edge of the footprint would be excavated and placed on top of the landfill, which will also be covered by the soil cap. Further, the Navy discussed with MADEP and EPA the use of riprap along the slopes of the RDA to protect against 100-year floods. Design component details, such as the use of geotextiles to minimize the potential for burrowing animals to contact disposed materials, riprap along the slopes of the RDA to protect against 100-year floods, biodegradable mats for erosion control, clean fill and soil cap thickness required for frost protection, and compaction of disposed materials to provide for cap stability, will be refined during the remedial design and implementation process to the extent necessary to comply with engineering standards and state requirements and approvals.
- State Concern Regarding Groundwater: The MADEP stated that although treatment is not required, based on potential risks posed to human health from ingestion of groundwater, MADEP (and EPA) requested the development of a groundwater RAO for the RDA. Navy Modification: The Navy developed an additional RAO for groundwater, using precise language provided by EPA. Further, the selected remedy includes institutional controls to achieve the land use control performance objectives.
- State Concern Regarding Landfill Soil Cover: Since the use of an alternate cover system is subject to MADEP approval, the MADEP is deferring approval of the final cover system until remedial design stage. Navy Modification: The Navy clarified that design details would be deferred to the remedial design stage, and finalized subject to the approval of MADEP.

It is important to note that the modifications identified above apply equally to all of the remedial alternatives developed for the RDA. Therefore, the addition of these components would not change the outcome of the comparative analysis performed during the development of the FS.

Community Acceptance

During the public comment period, the community did not express its support for the selected remedy. The majority of community participants in attendance at the February 27, 2003 public hearing requested that the Navy implement an alternate approach, consisting of Alternative RDA-6: Excavation and Offsite Disposal of PCB and Landfill Material. Refer to Appendix E for a copy of the verbal and written comments received during the public comment period on the Proposed Plan for the RDA.

Although the Navy is fully committed to serving the community, EPA requires that the Navy consider all nine NCP criteria in rendering a final remedial decision. Therefore, the Navy is unable to exclude the first eight criteria from its decision process. As presented in the Proposed Plan and summarized in this Section of the ROD, an evaluation of the first eight criteria reveals that the in-place capping alternatives (Alternatives RDA-3, RDA-4, and RDA-5) are the most appropriate remedies for the RDA. The capping alternatives are protective of human health and the environment, are compliant with ARARs, achieve long-term effectiveness and permanence, reduce toxicity/mobility/volume (through removal), achieve short-term effectiveness, can be implemented, are cost effective, and are supported by EPA. Refer to Section 13.0 of this ROD for more precise detail relative to these criteria. Of the capping alternatives developed for the RDA during the Feasibility Study, both EPA and MADEP expressed their preferences for the alternative that included the removal and offsite disposal of PCB-impacted material.

After reviewing the input from the community and giving all of the alternatives careful consideration (including Alternatives RDA-5 and RDA-6 in particular), the Navy has decided that the most appropriate remedy for the site, when considering all nine NCP criteria required by EPA, is Alternative RDA-5: Excavation and Offsite Disposal of PCB Material, Permeable Soil Cap for Landfill Material, LTM, and Institutional Controls.

12.0 THE SELECTED REMEDY

Summary of the Rationale for the Selected Remedy

The selected remedy is Alternative RDA-5, Excavation and Offsite Disposal of PCB Material, Permeable Soil Cap for Disposed Material, LTM, and Institutional Controls. This remedy is a comprehensive remedy, which addresses the principal site risks and the overall goals established for the site. As mentioned above, this remedy has been modified to incorporate and address the concerns and interests of EPA and MADEP, which have arisen since completion of the FS.

Overall this alternative will include the following components:

- Conducting, as necessary, further data evaluation or collection to support the design of the soil cover (e.g., compaction and related testing). Collection of this data will be considered during the design process and will ultimately be determined by the design team, consisting of the Navy, the design contractor, and the regulatory agencies.
- Excavating PCB-impacted material from the adjacent wetland area, and disposing the material in an offsite landfill;
- Conducting confirmatory PCB sampling and analysis within the excavated wetland area, as well as the immediately abutting upland soil, as part of the remedial action process prior to landfill capping.
- Removing physical debris from the wetland area for either placement on the upland portion of the disposal area or for offsite disposal;
- Restoring the wetland area that was disturbed during the removal of the PCB-impacted material and debris;
- Clearing, grubbing, and grading the site;
- Constructing a soil cover on the site in accordance with Massachusetts Solid Waste Landfill Closure requirements;
- Constructing a fence around the site and posting warning signs (note: this component is optional, and should only be implemented if consistent with future site use plans);
- Institutional controls to achieve the land use control performance objectives;
- Conducting long-term monitoring and site maintenance; and
- Conducting a review of the site every five years.

This alternative is recommended because it offers the best balance among the criteria used to evaluate the alternatives. The selected remedy will accomplish the following: (1) it will be protective of human health and the environment; (2) it will comply with all pertinent state and federal regulations; (3) it will be cost-effective; and (4) it will use permanent solutions to the maximum extent practicable.

The selected remedy may change slightly as a result of the remedial design and implementation process. Design component details may be modified slightly during the remedial design and implementation process to the extent necessary to comply with engineering standards and state requirements and approvals. Changes to the remedial components described in this ROD that alter the intent of the selected remedy must be documented in a technical memorandum in the Administrative Record for the site, an Explanation of Significant Differences or a Record of Decision Amendment, as appropriate. The final design plans and specifications, state approval documentation, and as-built engineering drawings will be sufficient to describe the final remedy.

Description of the Remedial Components

Alternative RDA-5 focuses on the removal of PCB-impacted material from the wetlands for offsite disposal, and the construction of a permeable soil landfill cover. In addition, this alternative includes the installation of perimeter fencing and signage (if deemed necessary), institutional controls, LTM, and 5-year reviews.

This alternative would achieve the RAO established for erosion-control, as well as comply with state landfill closure requirements (necessary only in the event of capping). By removing the PCBs in excess of 8 mg/kg from the site, this alternative would also be protective of ecological receptors. The Navy will ensure that no post-excavation hydric soil samples exceed the site-specific, ecological risk-based cleanup goal of 8 mg/kg total PCBs (dry weight), and that the arithmetic mean for the post-excavation hydric soil samples will not exceed the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs.

The maximum concentration of PCBs detected in the wetlands adjacent to the RDA is 23 mg/kg. Because this value is less than 50 mg/kg, the PCB-impacted material may be disposed offsite, in a permitted solid waste municipal landfill, without pre-treatment. As such, this alternative includes the excavation and offsite transport of approximately 54 cubic yards of PCB-impacted material for direct disposal.

Federal requirements allow the use of "hybrid" landfill closures. Massachusetts closure requirements also allow the use of an alternative cap in closing facilities that ceased to accept material as of October 1993. Given the age of the RDA and the potential applicability of state requirements, it is appropriate to propose the use of an alternative cover with a maximum permeability of 1×10^{-5} cm/sec, in accordance with 310 CMR 19.113, Alternative Landfill Cover Design. The use of an alternate soil cover system or waiver (in accordance with 310 CMR 19.114, Groundwater Protection System and Final Cover Waivers) is subject to approval by the state in the remedial design stage.

Overall, this alternative includes site preparation, clearing and grubbing, surface water drainage, and post-closure care, all of which are necessary to support the permanence and performance of the soil cap. Other components include the excavation and offsite disposal of PCB-impacted material, long-term monitoring, and institutional controls. The following paragraphs describe the components of this alternative, which may be varied slightly during remedial design and implementation, to the extent necessary to comply with engineering standards and State requirements and approvals.

<u>Clearing, Grubbing, and Grading</u>

The surface of the RDA is unpaved, and covered with a mixture of gravel and vegetation. Wetlands form an irregular border to the east of the RDA. The site is sloped to the east at an average top slope of 3% and side-slope (i.e., steeper slope down to the wetland boundary) of 15%. While the surface contains some oversized cobbles and concrete, there is not an extensive amount of surface debris requiring sizing and processing. Physical debris observed beyond the previously mapped RDA boundary will be removed for either placement on the surface of the disposal area or for offsite disposal. The areas of the wetlands affected by this removal will be restored.

To prepare the wetland area for excavation, the surface area would need to be cleared of vegetation. Vegetative and woody material cleared and grubbed would be disposed of appropriately. To prevent erosion of excavated materials into the adjacent wetlands, all clearing, grubbing, and grading activities would take place after a perimeter ring of hay bales and a silt fence are installed. These controls would be inspected to ensure that silt depositing behind the bales does not exceed 1/2 of the bale height. If sediment accumulates behind the bales, it would be removed periodically. Following final cover stabilization, but no less than one year after construction, the controls would be removed and seed would be sown to provide a continuous vegetative mat across the site.

To prepare the surface of the RDA for capping, the surface needs to be cleared of vegetation, and the grades need to be modified to provide a consistent slope to promote surface water drainage and minimize erosion. Vegetative and woody material cleared and grubbed would be disposed of appropriately. As was conducted for the wetlands area, all clearing, grubbing, and grading activities would take place after a perimeter ring of hay bales and a silt fence are installed such that the erosion of cap construction materials into the adjacent wetlands is prevented. These controls would be inspected to ensure that silt depositing behind the bales does not exceed 1/2 of the bale height. If sediment accumulates behind the bales, it would be removed periodically. Following final cover stabilization, but no less than one year after construction, the controls would be removed and seed would be sown to provide a continuous vegetative mat across the site.

It is noted that state and federal regulations specify the minimum slope for capping to be 5%, and the maximum side-slope for capping to be 33%. The side-slopes would be maintained at approximately 15%. Top slopes would be established at approximately 5%. The soils used for grading must be free of debris and have a moderate organic content. Soils must be able to be compacted to form a stable, dense, graded fill. If excavated materials do not provide a suitable volume of soil to provide a base for construction of a soil cap, there may be a need to import soils from elsewhere onsite. In order to construct a regular cap over the former disposal area to achieve these grades, irregular fill areas extending into the wetlands would need to be excavated and consolidated on the upland portion of the site (which will then eventually be covered by the soil cap). By performing this additional excavation, impacts to the wetlands will be minimized, and the potential for the soil cover to be vulnerable to the 100-year flood will be reduced. Design component details, such as the use of riprap along the slopes of the RDA to protect against 100-year floods, will be refined during the remedial design and implementation process to the extent necessary to comply with engineering standards and state requirements and approvals.

<u>Excavation and Removal of PCB-Impacted Material</u>

PCB-impacted material exists at the toe of the slope, located at the northeastern edge of the RDA. The approximate area of PCB-impacted material is an estimated 490 square feet and extends approximately 3 feet deep. As such, it is estimated to encompass a volume of 1,470 cubic feet (approximately 54 cubic yards). The precise shape of the excavation will be field-determined based on the iterative excavation and post-excavation sampling process.

PCB-impacted hydric soils in the palustrine wetland adjacent to the landfill, where total PCB concentrations are greater than 8 mg/kg total PCBs, will be excavated and disposed of offsite. The site-specific, ecological risk-based cleanup goal of 8 mg/kg total PCBs as a maximum concentration will be met in the area of excavation following the excavation of the PCB-impacted hydric soils. The non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs will also be used as a cleanup goal for the palustrine wetland adjacent to the landfill. The non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs as a cleanup value will be implemented as an arithmetic mean concentration to be met in the area of excavation following excavation and in hydric soils throughout the entire wetland area.

Upon removal, hydric soil samples will be collected from the excavation for analysis of total PCBs. The dry weight concentration of total PCBs in hydric soils will be used to ensure that no post-excavation hydric soil samples exceed the site-specific, ecological risk-based cleanup goal of 8 mg/kg, and that the arithmetic mean for the post-excavation hydric soil samples will not exceed the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs. The arithmetic mean total PCB concentration for the area of excavation will be defined by calculating the arithmetic mean of the post-excavation confirmatory samples taken from the area of excavation (i.e., this calculation will not include Phase I and Phase II hydric soil data).

The arithmetic mean for the entire wetland area will be calculated by using previous Phase I and II hydric soil data with the two values in the area of excavation (11 mg/kg and 23 mg/kg) replaced by the arithmetic mean concentration of the post-excavation confirmatory samples taken from the area of excavation.

The final selection of the 8 mg/kg value in the FS is a conservative, site-specific, ecological risk-based cleanup goal for the protection of potential ecological receptors, including small mammals and birds, that may be exposed to hydric soils within the palustrine wetlands adjacent to the landfill at the RDA. This value was developed based on the site-specific biological data collected during the Phase I and Phase II RI program at the RDA.

In addition, prior to capping the RDA, upland soil at the former disposal area in the immediate vicinity of the excavated materials will be sampled and analyzed for total PCBs as well, to ensure that there are no elevated PCB concentrations (i.e., concentrations in excess of the TSCA threshold of 50 mg/kg) prior to construction of the landfill cap. Details on the number of samples, analytical methods, and sampling and excavation sequence will be provided in the Verification Sampling and Analysis Plan (VSAP), included in the design documents for the RDA.

If during the remedial activities the Navy detects PCB concentrations greater than or equal to 50 mg/kg, and EPA determines that there is an unreasonable risk of injury to human health or the environment from those PCBs, then the Navy will clean up the RDA site in accordance with 40 CFR Part 761.61.

If the Navy detects additional (i.e., previously undetected) PCB concentrations less than 50 mg/kg, and there is a CERCLA risk from those PCBs, then the Navy must clean up the site to remove both this newly identified CERCLA risk and the already identified CERCLA risk to ecological receptors from PCBs. This could involve the development of a risk-based PRG or modification of the proposed risk-based PRG (8 mg/kg), or use of cleanup levels from 40 CFR 761.61, as appropriate.

If the Navy detects additional (i.e., previously undetected) PCB concentrations less than 50 mg/kg, and there is no CERCLA risk from those PCBs, then no further action would be required to address PCBs at the site other than the action planned to address the already identified CERCLA risk to ecological receptors from PCBs.

In addition, if the Navy detects PCB concentrations greater than or equal to 50 mg/kg, but EPA determines that there is no unreasonable risk of injury to health or the environment at the RDA from those PCBs, then the Navy is not required to clean up the site in accordance with 40 CFR 761.61; however, the Navy must remove the PCB-impacted materials and dispose of them in accordance with 40 CFR 761.50(b)(3).

Disposal of PCB-Impacted Material

Because the concentrations of PCBs are less than 50 mg/kg, the excavated PCB-impacted material would not be considered as a TSCA-regulated or "special" waste. As such, there are several facilities in the Greater Boston area that would accept the PCB-impacted material for disposal.

Backfill to Grade

Because only 54 cubic yards of material are projected for excavation and offsite disposal, it is presumed that subsequent grading for placement of the soil cap would be sufficient to restore site conditions. As such, no backfill (specifically to fill the excavated area) is included in this alternative. Wetland restoration and mitigation efforts, implemented after construction of the landfill cap, would be intended to restore site conditions (refer to the wetland restoration discussion below).

Construction of Soil Cap

State requirements specify that a soil cap should consist of an 18-inch thick layer of low-permeability soils, with a maximum permeability of 1×10^{-7} centimeters per second (cm/sec). However, landfills ceasing to accept material as of October 1993 may be closed with an alternative cap, having a maximum permeability of 1×10^{-5} cm/sec. Given the age of the RDA and the potential applicability of state requirements, it is appropriate to propose the use of an alternative cover with a maximum permeability of 1×10^{-5} cm/sec in accordance with 310 CMR 19.113, Alternative Landfill Cover Design. The soil cap thickness should be a minimum of 18 inches, with a 6-inch erosion layer to ensure long-term integrity. The use of an alternate soil cover system or waiver (in accordance with 310 CMR 19.114, *Groundwater Protection System and Final Cover Waivers*) is subject to approval by the state in the remedial design stage.

Once compacted, the suggested maximum permeability of 1×10^{-5} cm/sec should also be achieved. Because the soil cap is relatively permeable, it is not necessary to provide a drainage layer on top of it to control surface water. To maintain overall site aesthetics and to prevent erosion of the soil cap, a 6-inch layer of topsoil should be constructed and seeded to produce a thick and dense vegetative mat. Soil required must meet relevant specifications including fertilization and liming requirements. During germination, seeded areas would be protected with a mulch or straw mat. If hydroseeding is used, a tackifier may be substituted as an erosion control protection measure.

Because of the gentle top slopes and moderate side-slopes that a soil cap over the RDA would exhibit, and because the soil cap would be relatively permeable, storm water would be managed by sheet-flow off of the side-slopes, with channelized flow and discharge from several exit points at the toe of the disposal area. Preliminary calculations show that the post-construction increase in flow can be discharged to the wetland area east of the landfill at a maximum rate of 4 feet per second (ft/sec). This value is the recommended maximum discharge velocity for storm water flow discharged into wetlands.

In the event that the current land reuse plans change (e.g., a future road encompasses a significant portion of the RDA), the soil cap described in this section could be replaced with a crushed-stone base cap. Crushed stone may be better suited for future compaction to support highway construction, whereas soil may be better suited for future landscaping or open-space-type uses. The alternative evaluation presented in this document would not be substantially different if crushed stone were used instead of soil. A similar level of exposure elimination to disposed materials would be achieved with either soil or crushed stone.

Design component details, such as the use of geotextiles to minimize the potential for burrowing animals to contact disposed materials, riprap along the slopes of the RDA to protect against 100-year floods, biodegradable mats for erosion control, clean fill and soil cap thickness required for frost protection, and compaction of disposed materials to provide for cap stability, will be refined during the remedial design and implementation process to the extent necessary to comply with engineering standards and state requirements and approvals. Changes to the remedial components described in this ROD that alter the intent of the selected remedy must be documented in a technical memorandum in the Administrative Record for the site, an Explanation of Significant Differences or a Record of Decision Amendment, as appropriate. The final design plans and specifications, state approval documentation, and as-built engineering drawings will be sufficient to describe the final remedy.

Wetland Restoration

This alternative includes removal of PCB-impacted soils from the wetland area, which is an unavoidable impact to the wetlands. In addition, delineated wetland areas adjacent to where earthwork (clearing, grubbing, and grading) is performed may be impacted, which, again, is an unavoidable impact to the wetlands. The Navy will minimize these impacts to the wetlands through removal of impacted soils and restoration of the wetlands, which would ultimately increase the beneficial use of the wetlands in the environment.

Restoration efforts would include, at a minimum:

- Coordination with the local (i.e., Rockland) Conservation Commission, the MADEP and the USACE-NAE;
- Replacement of soils removed with a mixture of loam and organic materials;
- Stabilization of the restored wetlands through the introduction of a seed mixture including native wetland herbaceous species;
- Development of a planting plan which includes the planting of woody species similar to what exists in adjacent undisturbed wetlands; and
- Monitoring of the site for 3 to 5 years to ensure that the area would be restored to wetlands.

With the mapped configuration of the RDA, it is anticipated that an estimated adjacent 1,528 linear feet of wetlands would be impacted.

Further, the eastern edge of the former disposal area is located immediately adjacent to the wetland area, which is also the boundary of the 100-year floodplain of Old Swamp River. Therefore, the selected remedy may affect a potential floodplain because it will involve the construction of a soil cover over the former disposal area. The Navy will minimize these impacts by constructing the cap such that it did not extend into the wetlands. To accomplish this, some material from the former disposal area in the vicinity of the eastern edge of the footprint would be excavated and placed on top of the landfill, which will also be covered by the soil cap. Further, the Navy discussed with MADEP and EPA the use of riprap along the slopes of the RDA to protect against 100-year floods.

The Navy has determined that no practicable alternative to the selected remedy exists that will not be located in or affect the wetlands and potential floodplain at the site. The Navy will act to minimize potential harm and avoid adverse effects to the wetland and potential floodplain, and to restore and preserve the natural and beneficial values of the wetland as is feasible.

Fencing and Signage

Construction of an 8-foot high, chain-link, perimeter fence with warning signs posted approximately every 200 feet, are included as options for this alternative. These optional physical controls could provide an added level of protection that would be designed to provide site security by limiting trespassers from entering the RDA. The use of these components would be determined during the remedial design phase and would be consistent with reuse plans for the RDA.

Institutional Controls

The Navy will implement institutional controls to achieve the following land use control performance objectives, which are consistent with the Feasibility Study prepared for the site, the Proposed Plan presented to the community, and further discussions among the Navy, EPA, and MADEP:

- Prevent human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans.
- Prohibit activities or uses of the site that would disturb or otherwise interfere with the integrity or function of the permeable soil cap. These prohibited activities include construction on, excavation of, or breaching of the permeable soil cap.

The Navy shall implement institutional controls to achieve the land use control performance objectives. Within 90 days following the execution of a ROD for the RDA, the Navy, with concurrence of EPA Region I and in consultation with the MADEP, would develop a remedial design that would contain land use control implementation and maintenance actions (the "LUC Remedial Design"). The Navy shall be responsible for implementing, inspecting, reporting, and enforcing the institutional controls described in the ROD in accordance with the approved LUC Remedial Design. Should any institutional control component of the selected remedy fail, the Navy would ensure that appropriate actions are taken to reestablish the selected remedy's protectiveness. The Navy may transfer various operational responsibilities for these actions to other parties through contracts, agreements and/or deed restrictions. However, the Navy acknowledges its ultimate liability under CERCLA for remedy integrity, including for the performance of any transferred operational responsibilities.

The purpose of these institutional controls would be to control or restrict certain types of property uses. The IC objectives are contained in each alternative. The institutional controls are necessary because hazardous substances could otherwise pose potential risks if property use was not controlled or restricted. The institutional controls would be maintained within the boundaries of the RDA shown in Figure 6. The institutional controls would be maintained until the concentrations of hazardous substances have been reduced to levels that allow for unlimited exposure and unrestricted use, as determined by long-term monitoring at the RDA.

The Navy's remedial design shall ensure that the Navy, in implementing the land use controls, provides that a regulatory agency satisfactory to EPA, with the concurrence of MADEP, may acquire an irrevocable right to enforce the land use controls directly against all current and future owners of any interest in the property, for as long as the land use controls are required, and an associated access easement, both of which may be assignable. This enforcement right would supplement, not replace, the Navy's right and responsibility to enforce the institutional controls, described above. If the remedial design provides for this enforcement right and access easement to be granted or assigned to MADEP, (i) acceptance of any grant shall be subject to approval of the Commissioner of MADEP or other designated State official and (ii) the form of the land use controls and the process of implementation shall be satisfactory to MADEP and, to the extent applicable, such form shall be substantially the same as Form 1072A ("Grant of Environmental Restriction") of the Massachusetts Contingency Plan, 310 Code of Massachusetts Regulations 40.1099 and such implementation shall comply with the survey plan, subordination and title requirements set forth in 310 Code of Massachusetts Regulations 40.1071 and 40.1072(2).

Post-Closure Monitoring/Maintenance (LTM)

Post-closure monitoring/maintenance activities (LTM) associated with the soil cap closure would likely consist of groundwater and surface water monitoring; monitoring of sediment and hydric soil, inspection of cap and storm water management components; and maintenance of the vegetative cover onsite, including mowing, fertilizing and liming (as needed). However, if the fencing is not installed, to ensure cap integrity there may be an increase in the frequency of inspections for at least some period of time until it can be demonstrated that the inspection frequency can be reduced. The details of this program would be provided in an LTM workplan. However, at a minimum, this plan would detail the Navy's commitment to conduct groundwater monitoring for parameters appearing in the Massachusetts post-closure monitoring regulations (310 CMR 19.142); inspect the site using by a Massachusetts-licensed Professional Engineer; and repair or maintain (as required) the soil cap.

Details on the scope, including all pertinent media and monitoring parameters, and the duration of LTM will be provided in the LTM plan for the site.

Five-year Reviews

This alternative would include an inspection and a review every five years. These reviews would include a record review and a site inspection to confirm that the alternative was implemented and achieves the established objectives.

The primary objective of the 5-year reviews would be to assess the continued applicability of the alternative selected, and to consider modifications to that alternative or the implementation of a different alternative, in the event that site conditions change. The 5-year reviews could vary from a visual inspection of changes in site conditions (e.g., erosion, wetland growth, drainage), to recalculating risks, collecting samples for analysis, and preparing substantial reports to model cleanup trends. It is presumed to include visual observation, a minor level of sampling and analysis, risk-threshold screening comparisons, and preparation of a brief report.

Details on the duration of the 5-year review period will be considered during the development of the LTM plan for the RDA.

Summary of the Estimated Remedy Costs

Table 19 presents a summary of the capital costs, annual operation and maintenance costs, and periodic costs associated with the selected remedy. The estimated total cost for this remedy is $1.6 million.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative as detailed in the FS. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. The estimate provided on the table is an order-of-magnitude engineering cost estimate that is expected to be within +50 to −30 percent of the actual project cost.

In calculating LTM costs, a net present value was used to put all estimated expenditures in today's dollars. Pursuant to the references in EPA Guidance, A guide to Developing and Documenting Cost Estimates During the Feasibility Study, EPA 540-R-00-002 (EPA, 2000), a 4% discount rate was used for analyzing on-going costs. This rate was the average of all of the "real discount rates" options in the U.S. Office of Management and Budget (OMB) circular A-94 (January 2000 edition) at the time of initial cost estimation (fall 2000) for the FS. Further, in calculating present value costs, it was assumed that there would be no inflation of the annual dollar amounts. In addition, according to EPA guidance (EPA, 2000) there is no limit on the term for analyzing on-going costs; therefore, a 30-year operation and maintenance period was assumed for the LTM program for cost comparison purposes. This assumption is consistent with previous EPA costing guidance (EPA, 1988) and is consistent with common liability insurance caps.

Table 19
Costs Associated with the Selected Remedy

DESCRIPTION	QTY	UNIT	UNIT TOTAL	TOTAL	Notes
CAPITAL COSTS					
Site Preparation					
Mobilization and Demobilization	1	Each	$ 20,000	$ 20,000	Contractor
Clearing and Grubbing	3.83	Acre	$ 3,000	$ 11,490	Means
Site Survey	2	LS	$ 2,000	$ 4,000	ENSR
Subtotal				**$ 35,490**	
Excavation and Sorting of impacted adjacent wetland					
Excavation of PCB contaminated soil	54	CY	$ 6	$ 324	Foster Wheeler
Loading of material for offsite disposal	54	CY	$ 5	$ 270	ENSR
Pre-excavation (PCB material only) sample collection	15	Each	$ 600	$ 9,200	EPA Method 8082
Post-excavation (PCB material) sample collection	31	Each	$ 600	$ 18,400	EPA Method 8082
Subtotal				**$ 28,194**	
Filling/Grading/Fencing					
Vegetation of impacted adjacent wetland area (includes permitting, engineering & construction)	490	SF	$ 2.85	$1,397	ENSR
Soil Cap (18" thick) Offsite Source includes: material, hauling	9278	CY	$ 18	$ 167,000	Contractor
Spreading with low pressure equipment	9278	CY	$ 6	$ 55,667	Foster Wheeler
Odor and Dust Control	1	LS	$ 40,000	$ 40,000	Foster Wheeler
Vegetative Layer (6" thick loam, hauling and spreading material)	4123	CY	$ 20	$ 82,469	Contractor
Revegetation (hydroseed)	167,000	SF	$ 0.15	$ 25,050	Contractor
Cap construction oversight, QA/QC (5% of soil cost) & CQA Report	1	Each	na	$ 8,350	ENSR
Fencing (silt) of RDA and adjacent wetland	1528	LF	$ 3.50	$ 5,348	ENSR
Fencing around the perimeter (8' high chain link) of RDA and adjacent wetland	1528	LF	$ 28	$ 42,784	Means
Signs (every 200 feet)	8	one/200'	$ 50	$ 400	Means
Deed Restriction	1	Each	$ 4,150	$ 4,150	ENSR
Drainage Improvements	1	LS	$ 10,000	$ 10,000	ENSR
Fertilization/Lime	167	MSF	$ 3	$ 501	ENSR
Reseeding (assume 10% of cover will require reseeding)	16,700	SF	$ 0.80	$ 2,505	ENSR
Subtotal				**$ 445,620**	
Materials Handling					
Hauling material offsite	54	CY	$ 12	$ 648	Contractor
Disposal of material offsite	54	CY	$ 165	$ 8,910	Contractor
Subtotal				**$ 9,558**	
Cumulative Subtotal				**$ 528,420**	
Contingency	20%			$ 105,684	ENSR
Cumulative Subtotal				**$ 634,104**	

Table 19 (Continued)
Costs Associated with the Selected Remedy

DESCRIPTION	QTY	UNIT	UNIT TOTAL	TOTAL	Notes
Project Management and Design					
Project Management	6%			$ 38,046	EPA
Remedial Design	12%			$ 76,093	EPA
Construction Management	8%			$ 50,728	EPA
Subtotal				**$ 164,867**	
TOTAL CAPITAL COSTS				**$ 798,971**	
ANNUAL OPERATION AND MAINTENANCE COSTS					
Site Monitoring/Maintenance					
Mowing/High Density	1	LS per year	$ 3,000	$ 3,000	ENSR
Groundwater Monitoring – varies annually	1	round	$ 10,000	na	ENSR
Annual Inspection (one day inspection per year)	8	Hour	$ 125	$ 1,000	ENSR
Maintenance (including stormwater management structure maintenance)	1	LS per year	$ 5,000	$ 5,000	ENSR
Subtotal				**$ 9,000**	
Annual O&M Costs (years 1-2 - includes quarterly groundwater sampling + annual maintenance listed above)				$ 49,000	ENSR
Annual O&M Costs (years 3-5 - includes semi-annual groundwater sampling + annual maintenance listed above)				$ 29,000	ENSR
Annual O&M Costs (years 6-30 - includes annual groundwater sampling + annual maintenance listed above)				$ 19,000	ENSR
Calculated 30 Year O&M Net Present Value				**$ 410,789**	ENSR
Contingency	30%			$ 123,237	ENSR
Project Management and Design					
Project Management	5%			$ 20,539	EPA
Technical Support	10%			$ 41,079	ENSR
Subtotal				**$ 61,618**	
TOTAL 30 YEAR O&M NET PRESENT VALUE				**$ 595,644**	
PERIODIC COSTS					
5-year Reviews		Event	$ 50,000	$ 50,000	ENSR
Calculated 30 Year Periodic Cost Net Present Value				**$ 159,629**	
TOTAL COST (CAPITAL COST PLUS O&M AND PERIODIC COSTS)				**$1,554,224**	

NOTES:
LS = lump sum
CY = cubic yards
SF = square feet
LF = linear feet
SY = square yards
MSF = thousand square feet

Expected Outcomes of the Selected Remedy

The expected outcomes of the selected remedy are to (1) minimize erosion and deposition of waste materials into the adjacent wetlands; (2) eliminate the potential for small mammals to be exposed to PCBs present in hydric soil in the wetlands adjacent to the landfill; (3) close the RDA in accordance with Massachusetts solid waste landfill closure requirements; and (4) prevent or reduce human exposure to groundwater containing contaminant concentrations in excess of federal or more stringent state drinking water standards or posing potential risks to humans. Approximately one to two years are estimated as the time necessary to achieve these goals. The selected remedy will also provide environmental and ecological benefits such as wetland restoration and the protection of wildlife.

Land reuse plans are currently being discussed as of this writing (2003). Current discussions reveal the proposed future use of the RDA as open space. Further, a small portion of the RDA to the north has been proposed for commercial business or industrial use. Other reuse possibilities include a desire to explore the potential use of a nearby aquifer as a potential drinking water source. Refer to Section 6.0, Current and Potential Future Site Use and Resources.

Cleanup Levels for Groundwater

As described in Section 7.0, a baseline human health and ecological risk assessment was conducted during the RI. The human health portion of the baseline risk assessment concluded that potential risks for humans being exposed to sediment, soil, or surface water at the RDA were not anticipated. However, the risk assessment concluded potential risks to the hypothetical future resident consuming groundwater containing arsenic, benzo(a)pyrene, and manganese. Remedial goals have been established for these chemicals as the federal MCLs or non-zero MCLGs established under the Safe Drinking Water Act, or, if lower, the state MCL established by the Massachusetts Office of Research and Standards. In the absence of such standards, a remedial goal was established based on a level that represents an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime. If a remedial goal was established, the calculation included an adequate margin of safety (i.e., a hazard quotient equal to 1) and considered the future ingestion of groundwater from domestic water usage. Table 20 summarizes the remedial goals for the chemicals of concern identified in groundwater.

Table 20
Groundwater Remedial Goals

Carcinogenic Chemical of Concern	Cancer Classification	Remedial Goal(1) (ug/l)	Basis	RME Risk (from RI risk assessment)
Arsenic	A, Human carcinogen	10	Proposed MCL (effective Jan 2006)	2.3×10^{-4}
Benzo(a)pyrene	B2, Probable human carcinogen	0.2	MCL	3.3×10^{-6}
			Sum of Carcinogenic risks	2.4×10^{-4}
Non-carcinogenic Chemicals of Concern	**Target Endpoint**	**Remedial Goal(1) (ug/l)**	**Basis**	**RME Hazard Quotient (from RI risk assessment)**
Manganese	Increased respiratory symptoms and psychomotor disturbances	313(2)	HQ	43
Arsenic	NA	10	Proposed MCL (effective Jan 2006)	2.2
			Sum of Non-carcinogenic risks	~45.2

Note:
(1) If a value described by any of the above methods is not capable of being detected with good precision and accuracy or is below what was deemed to be the background value, then the practical quantitation limit or background value will used as appropriate.
(2) Based upon the calculated manganese HQ of 43 for the resident child associated with an exposure point concentration of 13.45 mg/L, a conservative risk-based remedial goal would be 0.313 mg/L. However, in accordance with EPA guidance (EPA, 1991), which provides equations and exposure assumptions for an adult residential receptor, a risk-based remedial goal of 0.713 mg/L would be appropriate for an adult residential receptor.

Subsequent to identifying remedial goals, the Navy conducted an evaluation to assess whether remedial action was warranted for these chemicals (refer to Section 3.5.4 of the FS (Tetra Tech NUS/ENSR, 2002)). Based upon the evaluation performed, the Navy and EPA agreed that groundwater treatment was not necessary for the following reasons:

- Only one groundwater sample (10.8 μg/L from MW-22D) slightly exceeded the current Maximum Contaminant Level (MCL) for arsenic (10 μg/L). Based upon the potential list of materials disposed in the RDA, it is unlikely that the RDA materials would provide a source of arsenic in groundwater. The arsenic is naturally occurring, sorbed on solids (e.g., ferric oxyhydroxides) and appears in the form of suspended solids in unfiltered groundwater samples.

- For manganese, there is no current or proposed primary drinking water standard. When municipalities consider manganese removal in water supplies, it is generally categorized with iron as a source of staining (e.g., sinks, laundry), not as a potential source of toxicity.
- Benzo(a)pyrene was detected at very low concentrations in only a few groundwater samples. The maximum concentration detected was less than the state and federal MCL.
- If, in the future, the groundwater beneath the site were to be used as a drinking water supply, routine groundwater treatment using standard municipal treatment technologies (e.g., precipitation and filtration) would be required to meet other federal and state drinking water and aesthetic (e.g., taste and odor) standards.
- The alternative selected for the RDA includes long-term monitoring of groundwater and surface water as a component of landfill closure to allow for continued assessment of the adequacy, reliability, and long-term effectiveness of this alternative.

Overall, existing groundwater data for the RDA indicates that active remediation (e.g., a pump and treat system) is not necessary to address site groundwater. This decision has been confirmed by EPA and MADEP.

Cleanup Levels for Hydric Soil

The results of the ecological risk assessment indicated potential adverse effects to small mammals based on exposure (ingestion) of PCBs in hydric soil. Therefore, an RAO was established to reduce this exposure. To achieve this goal, approximately 54 cubic yards of PCB-impacted hydric soil will be addressed via implementation of the selected remedy. Upon removal, hydric soil samples will be collected from the excavation for analysis of total PCBs. The dry weight concentration of total PCBs in hydric soils will be used to ensure that no post-excavation hydric soil samples exceed the site-specific, ecological risk-based cleanup goal of 8 mg/kg, and that the arithmetic mean for the post-excavation hydric soil samples will not exceed the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs.

13.0 STATUTORY DETERMINATIONS

The remedial action selected for implementation at the RDA is consistent with CERCLA, and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions to the maximum extent practicable.

The Selected Remedy is Protective of Human Health and the Environment

The remedy at this site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through the excavation of PCB-impacted material from the wetland area, construction of a landfill cover, engineering controls, and institutional controls.

Removal of PCB-impacted hydric soil from the wetland area for offsite disposal would improve environmental conditions. It would also achieve the site-specific, ecological risk-based cleanup level of 8 mg/kg total PCBs (dry weight), and the non site-specific, literature-based risk screening value of 1 mg/kg total dry weight PCBs. The construction of a soil cap would protect human and ecological receptors by creating a physical barrier to the disposed material. Long-term monitoring, an essential landfill capping component, would provide water quality data and allow an ongoing assessment of the impact of this alternative. Further, this alternative includes institutional controls to achieve the land use control performance objectives.

The selected remedy will reduce ecological risk levels such that they do not exceed EPA's acceptable risk range. It will also address the potential risks posed to humans consuming groundwater as a drinking water source without prior sampling and analysis, and, if necessary, standard, municipal level treatment. It will also be protective of ARARs and To Be Considered (TBC) criteria. Implementation of the selected remedy will not pose any unacceptable short-term risks or cross-media impacts.

The Selected Remedy Complies with ARARs

The selected remedy will comply with all federal and state ARARs that pertain to the site. In addition, TBCs will also be considered during the implementation of the remedial action. In particular, this remedy will comply with the federal and state ARARs and TBCs listed and described in Appendix F. A discussion of why these requirements are applicable or relevant and appropriate may be found in Section 3.2 of the FS report (Tetra Tech NUS/ENSR, 2002).

Specifically, the selected remedy includes the removal of PCB-impacted soils from the wetland area, which is an unavoidable impact to the wetlands. Under section 404 of the Clean Water Act, the Navy and EPA Region I find that the selected remedy is one of the least damaging practicable alternatives for protecting aquatic ecosystems within the wetland area at the site under the standards of 40 CFR Part 230. The Navy will minimize the impacts to the wetlands through removal of impacted soils and restoration of the wetlands, which would ultimately increase the beneficial use of the wetlands in the environment.

The Selected Remedy Is Cost Effective

In the Lead Agency's judgment, the selected remedy is cost effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria – long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent. Refer to Table 17 for the cost of each remedial alternative considered.

The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Based upon conditions at the RDA, no alternative treatment or resource recovery technologies were evaluated for the site. Only containment and removal technologies were deemed potentially applicable to the RDA.

The Selected Remedy does not Satisfy the Preference for Treatment as a Principal Element

Treatment technologies that "reduce the toxicity, mobility, and volume of contaminants" are typically given considerable thought in an FS. However, based on the conditions at the RDA, no treatment technologies were retained for the RDA (refer to Section 4.2 of the FS (Tetra Tech NUS/ENSR, 2002)). Only containment and removal technologies were deemed potentially applicable to the RDA.

Five-Year Reviews of the Selected Remedy are Required

Because this remedy will result in substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Details on the scope and duration of the 5-year review period will be considered during the development of the LTM plan for the RDA.

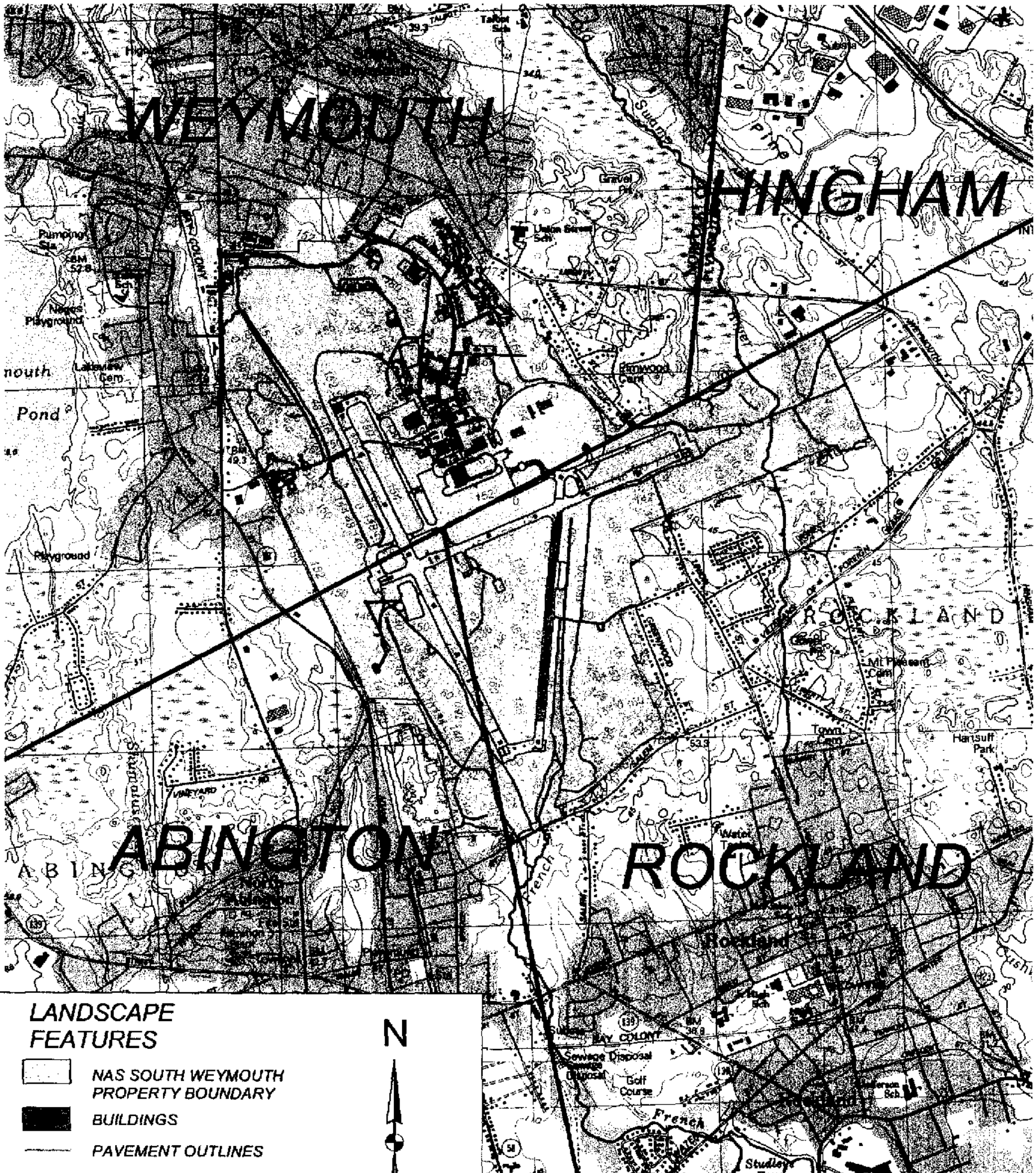
14.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Navy presented a Proposed Plan for the removal and offsite disposal of PCB-impacted material from the wetland area, construction of a soil cap over the landfill material, long-term monitoring and institutional controls on February 27, 2003. After the public comment period (which concluded on April 10, 2003), the Navy reviewed all written and verbal comments submitted during the public comment period.

During the public comment period, the community did not express its support for the selected remedy. The majority of community participants in attendance at the February 27, 2003 public hearing requested that the Navy implement an alternate approach, consisting of Alternative RDA-6: Excavation and Offsite Disposal of PCB and Landfill Material. Although the Navy is fully committed to serving the community, EPA requires that the Navy consider all nine NCP criteria in rendering a final remedial decision. An evaluation of the first eight criteria reveals that the in-place capping alternatives (Alternatives RDA-3, RDA-4, and RDA-5) are the most appropriate remedies for the RDA. The capping alternatives are protective of human health and the environment, are compliant with ARARs, achieve long-term effectiveness and permanence, reduce toxicity/mobility/volume (through removal), achieve short-term effectiveness, can be implemented, are cost effective, and are supported by both EPA and MADEP. Refer to Section 13.0 of this ROD for more precise detail relative to these criteria. Of the capping alternatives developed for the RDA during the FS, both EPA and MADEP expressed preference for the alternative that included the removal and offsite disposal of PCB-impacted material. Therefore, it was determined that no significant changes to the decision, as originally identified in the proposed plan, were necessary.

15.0 STATE ROLE

The MADEP has reviewed the various alternatives. The MADEP has also reviewed the RI and FS to determine if the selected remedy is in compliance with applicable or relevant and appropriate state environmental and facility siting laws and regulations. MADEP concurs with the selected remedy as indicated in their December 23, 2003 letter (Appendix A). Refer to Section 11.0 of this ROD (State/Support Agency Acceptance) for more detail on MADEP expectations associated with the selected remedy.



LANDSCAPE FEATURES

- NAS SOUTH WEYMOUTH PROPERTY BOUNDARY
- BUILDINGS
- PAVEMENT OUTLINES
- SURFACE WATER
- MUNICIPLE BOUNDARIES

N

0 0.25 0.5 1 1.5 2 Kilometers

0 0.15 0.3 0.6 0.9 1.2 Miles

DRAWN BY	DATE		ENSR INTERNATIONAL
RSE	01/03	SITE LOCUS	FIGURE NUMBER
CHECKED BY	DATE	RECORD OF DECISION	1
MDK	01/03		
APPROVED BY	DATE		
MDK	01/03	NAS SOUTH WEYMOUTH, MA	
SCALE			
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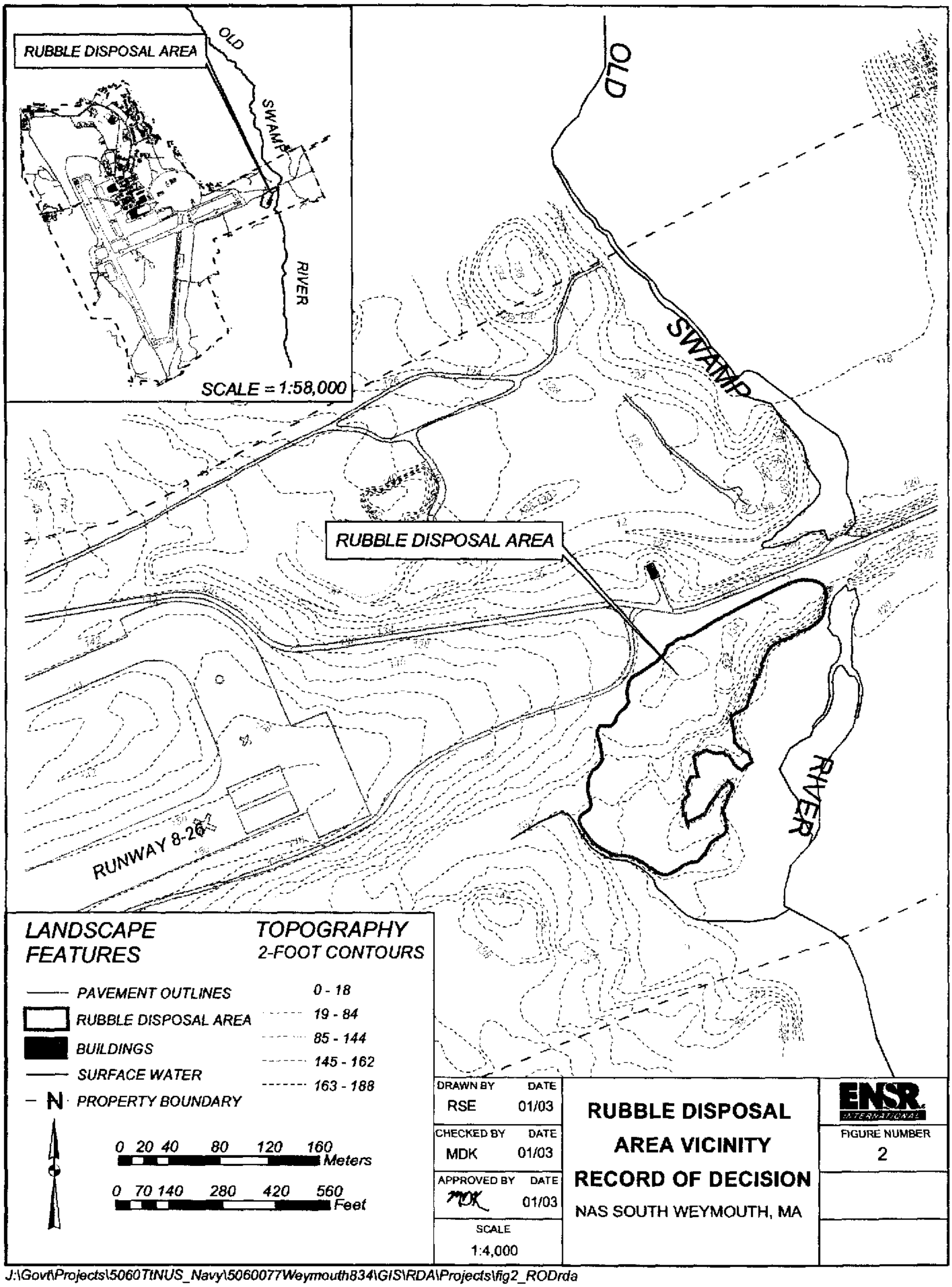

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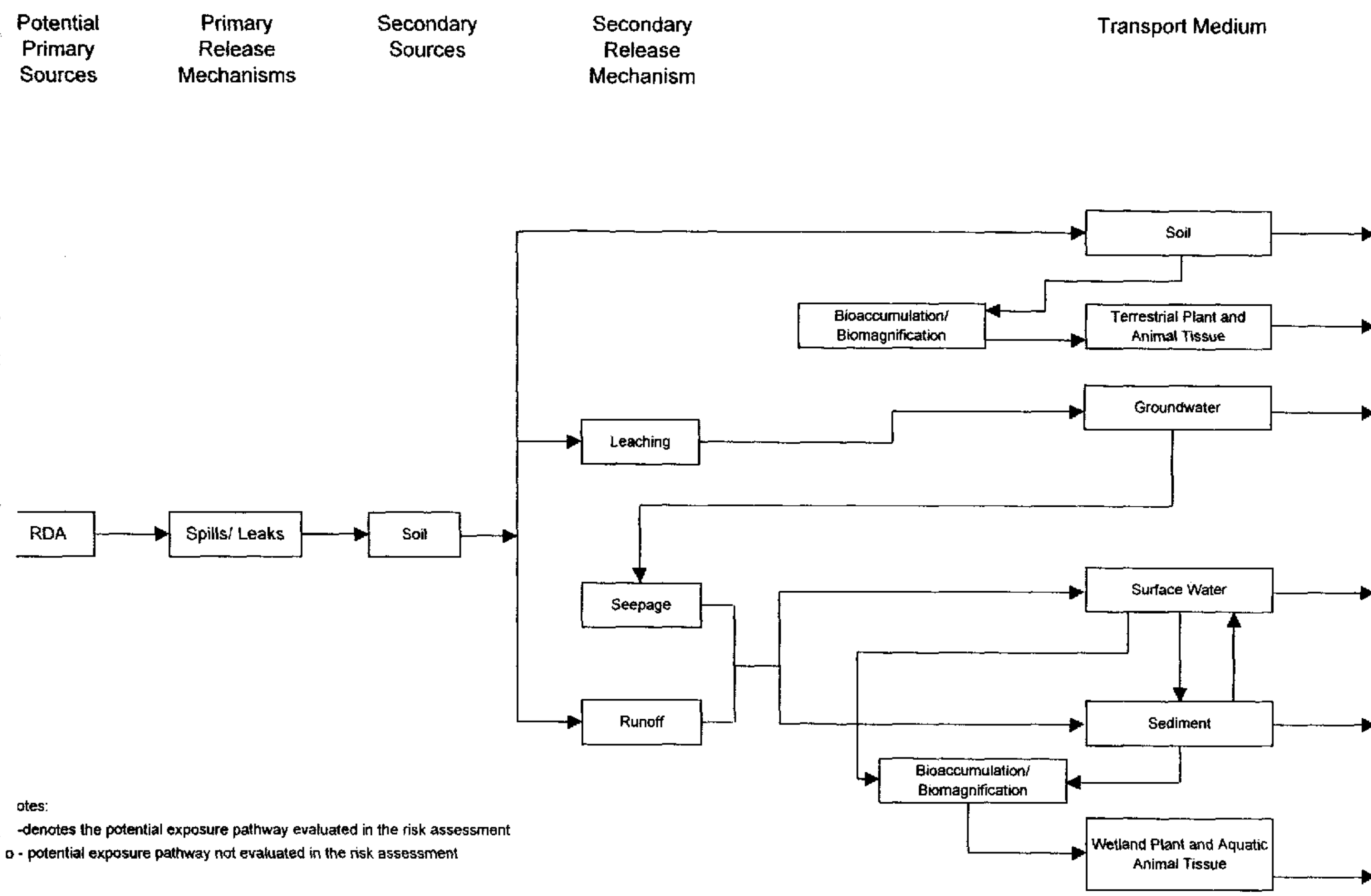
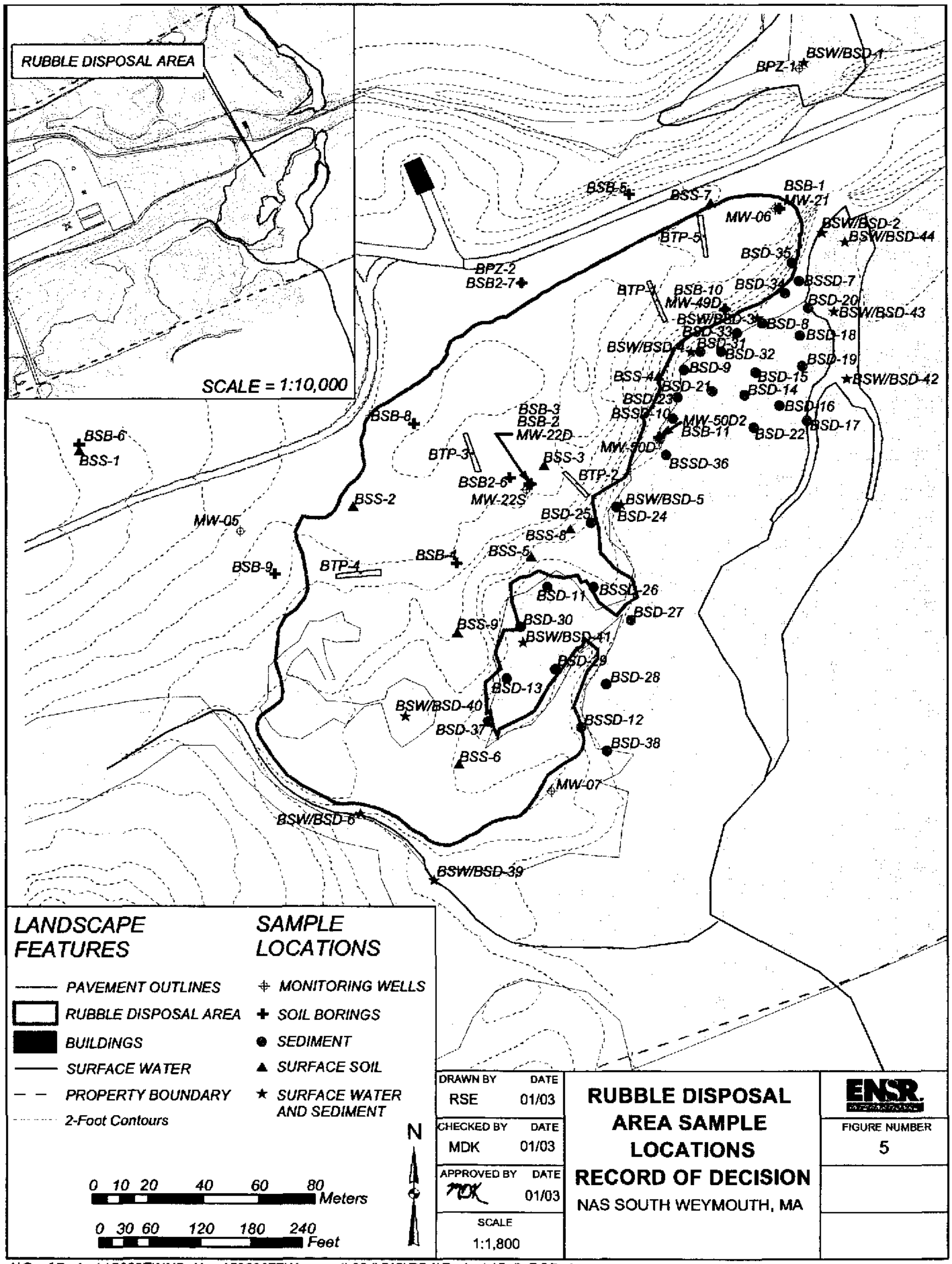
Figure 3: Rubble Disposal Area Conceptual Site Model



Transport Medium	Exposure Route	Human: Onsite Workers	Human: Construction Workers	Human: Trespassers	Human: Residents	Human: Recreational Child	Ecological: Plants	Ecological: Invertebrates	Ecological: Vertebrate Wildlife	Ecological: Fish/ Amphibians	Ecological: Wetland Plants
Soil	Direct Contact	x	x	x	x	x	x	x	o		
	Ingestion	x	x	x	x	x		o	x		
	Inhalation		x								
Terrestrial Plant and Animal Tissue	Ingestion								x		
Groundwater	Inhalation				x						
	Ingestion				x						
Surface Water	Direct Contact	x		x	x	x		x	o	x	
	Ingestion	x		x	x	x		x	x	x	
Sediment	Direct Contact	x		x	x	x		x	o	x	o
	Ingestion	x		x	x	x		o	x	o	
Wetland Plant and Aquatic Animal Tissue	Ingestion							o	x	o	

otes:
-denotes the potential exposure pathway evaluated in the risk assessment
o - potential exposure pathway not evaluated in the risk assessment

Figure 4: Site Photograph



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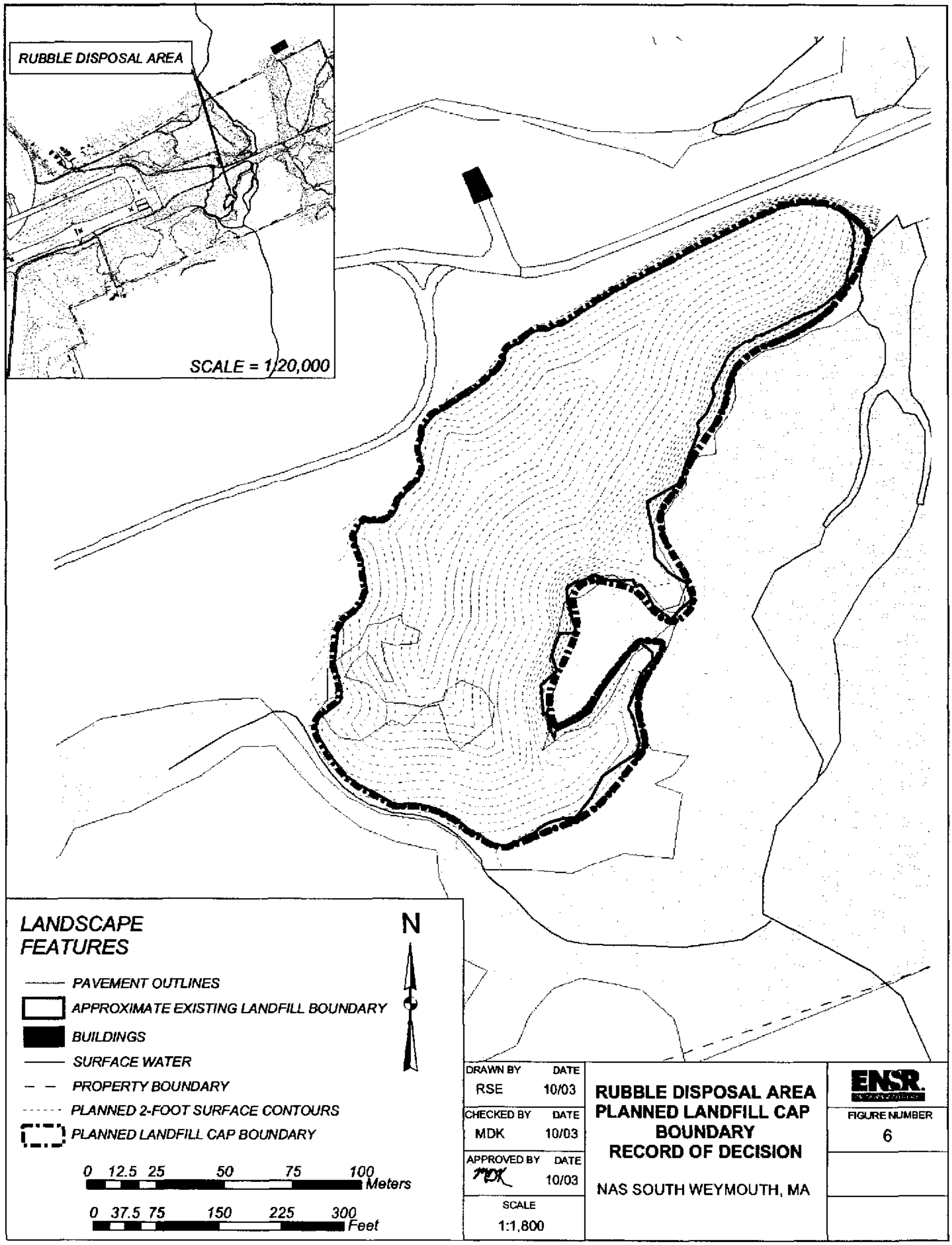

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