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MCRD PARRIS ISLAND
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RECORD OF DECISION FOR SITE 12 SOLID WASTE MANAGEMENT UNIT 10 JERICHO ISLAND DISPOSAL AREA MCRD PARRIS ISLAND SC

9/1/2006

TETRA TECH NUS, INC

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

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Record of Decision
for
Site 12/SWMU10 - Jericho Island Disposal Area

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0334

September 2006

NAVFAC
Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
B&R Environmental	Brown & Root Environmental
bgs	below ground surface
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CMS	Corrective Measures Study
cm/s	centimeter per second
COC	chemical of concern
COPC	chemical of potential concern
CWA	Clean Water Act
DOD	United States Department of Defense
DON	United States Department of the Navy
ERA	ecological risk assessment
ER-L	effects range – low
ER-M	effects range - median
ESVs	ecological screening values
FS	Feasibility Study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
LDRs	land disposal restrictions
LOAEL	lowest-observed-adverse-effect level
LUC	land use control
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MCRD	Marine Corps Recruit Depot
MHSPE	(Dutch) Ministry of Housing, Spatial Planning, and Environment
mg/kg	milligrams per kilogram
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policies Act
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effect level
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	probable effects level
PRG	preliminary remediation goal
PPE	personal protection equipment
PRG	preliminary remediation goal
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facilities Investigation
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TBC	to be considered (criteria)
TEL	threshold effects level
TSD	treatment, storage, and disposal
TtNUS	Tetra Tech NUS, Inc.
U.S.C	United States Code
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound

1.0 DECLARATION FOR THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Site 12/Solid Waste Management Unit (SWMU) 10, Jericho Island Disposal Area, is located northwest of Horse Island, as shown on Figure 1-1. The site was reportedly used by local residents from 1955 to 1968 as a solid waste disposal area; however, no organized landfill operations were reported to have occurred at the site. Jericho Island is approximately 25 acres in size and was acquired by the Navy in 1968 to satisfy limited distance arc requirements for Marine Corps Recruit Depot (MCRD) Parris Island's rifle range.

Disposed waste/surface debris consisted of routine domestic refuse including small metal cans, beer and soda bottles, hubcaps, tires, buckets, cinderblocks, rusted metal 5-gallon cans, sheet metal, paper, plastic, and wood. The site had an irregular, undulating surface due to the random scattering of surface debris piles that ranged up to approximately 30 feet in diameter and 5 feet in height. After MCRD Parris Island acquired Site 12, the area was no longer used for waste disposal purposes. As shown on Figure 1-2, three surface debris piles were present on Jericho Island when the land was acquired. Two of the surface debris piles were located in the upland portion of the island (one in the west-central and one in the southern portion of the island). The third surface debris pile was located at the southern edge of the island and extended into the adjacent sediment. A causeway (a raised way across wet ground or water) was constructed by unknown persons from the mainland to the northern end of Jericho Island for access purposes prior to Navy acquisition of the property. This causeway was constructed with soil commingled with waste material. The date of construction of the causeway is unknown.

The Superfund site identification number for MCRD Parris Island is 04NY. The United States Environmental Protection Agency (U.S. EPA) identification number is SC6170022762.

For ease of reading and clarity, Site 12/SWMU 10 will be referred to as Site 12, for the remainder of this Record of Decision (ROD).

1.2 STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedy for Site 12 at the MCRD Parris Island, South Carolina. The remedial action was selected by the Navy and EPA in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource and Conservation Recovery Act (RCRA), as amended, and, to the extent practicable, the National Oil and Hazardous Substance Pollution

Contingency Plan (NCP). The Navy and EPA select the remedy, with concurrence by the South Carolina Department of Health and Environmental Control (SCDHEC). The decision is based on information contained within the MCRD Administrative Record, which is located at the Beaufort County Public Library's Headquarters Location, 311 Scott Street, Beaufort, South Carolina, 29902. The State of South Carolina concurs with the selected remedy for Site 12.

After the Proposed Plan was published and public comments received, negotiations between U.S. EPA and the Navy on post remedial action activities, in particular Land Use Controls, delayed the agencies' ability to finalize this Record of Decision (ROD). The agencies agreed, however, on the field activity component of the Site 12 remedy and decided that the Navy should proceed to implement those components of the remedy as were so proposed. Therefore, although some language in the ROD may be in the present or future tenses, many of the required actions, have in fact, been implemented.

1.3 ASSESSMENT OF THE SITE

A Remedial Investigation (RI)/Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was conducted at Site 12. RI/RFI field activities were primarily conducted from July to September 1998. As part of the RI/RFI, three additional sampling events occurred in December 1998, December 1999, and April 2001. As further discussed in Section 2.6 (Summary of Site Risks), a human health risk assessment (HHRA) was conducted as part of the RI/RFI. It examined risks associated with exposure to the waste debris itself and to contaminated media by construction workers, adolescent trespassers, adolescent and adult recreational users, and risks to hypothetical on-site residents. These situations represented the most conservative of potential human receptor exposure scenarios and associated risk assumptions for this site.

As also discussed in Section 2.6, an ecological risk assessment (ERA) completed for Site 12 considered potential impacts for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors, and aquatic receptors.

In addition to the risks posed to human health and the environment from the presence of exposed waste debris, the migration of contamination from those materials to surrounding surface and subsurface soils, shallow groundwater, sediments and surface waters also posed unacceptable risks at the site. As a result, the response action selected in this ROD was necessary to protect the public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from the site that could present an imminent and substantial endangerment to public health or welfare.

1.4 DESCRIPTION OF THE SELECTED REMEDY

Approximately 46 sites at MCRD Parris Island are being investigated under the Installation restoration (IR) Program. This Record of Decision addresses the remedy selected for Site 12 only. The remaining 44 hazardous substance sites on the facility will be addressed separately.

Based upon the risk assessments undertaken during the study of Site 12, three (3) solid waste debris piles, underlying soils and sediment, and certain separate PAH contaminated soil and inorganic contaminated sediment areas at Site 12 were determined to pose unacceptable risks to human health and the environment (see Table 2-9 and the Tables in Section 2.6.2). Additionally, shallow groundwater containing thallium, arsenic and cadmium above current drinking water standards [Maximum Contaminant Levels (MCLs) established under the federal Safe Drinking Water Act regulations at 40 CFR Part 141] also posed potential direct exposure (consumption) risks to human health. A determination has been made that the groundwater beneath Site 12 is unsuitable for human consumption due to high salinity and Total Dissolved Solids(TDS) in excess of 13,000 mg/l. Therefore, since the ground water is naturally unusable because of the characteristics mentioned above, drinking water standards are not considered ARARs for this action and the ground water will not be actively remediated.

As a result, a remedial action is required for Site 12 to eliminate or to at least reduce these risks to acceptable levels, as well as prevent exposure to any remaining residual contamination in groundwater until the concentrations of the hazardous substances are at such levels to allow for unrestricted use and unlimited exposure. The following specific actions were undertaken or will be undertaken as part of the selected remedy (Modified Alternative 4) for Site 12:

- Excavation of Surface Debris, Soil, and Sediment: The three surface debris piles located on Jericho Island and their underlying soil and sediment (approximately 2,300 cubic yards of material) were excavated. Additionally, approximately 1,700 cubic yards of PAH-contaminated soil in the vicinity of sample locations PAI-10-SS-08 and PAI-012-03 (37) and inorganic-contaminated sediments (approximately 370 cubic yards) in the vicinity of sediment sample PAI-10-SD-08 were removed. See Figure 2-4 for these sample locations. Lastly, the causeway connecting Jericho Island to the mainland was removed. Approximately 800 cubic yards of soil, sediment, and waste was removed as part of the causeway excavation. To minimize impacts to surrounding marshlands and contaminant migration and to allow for more effective excavation measures, a temporary cofferdam system was installed along the southern portion of the island and along the causeway to prevent flooding due to daily tidal cycles. The cofferdam system was removed after all excavation activities were complete.

- Verification Sampling and Analysis: Follow-on sampling activities were performed to ensure that completed excavation activities achieved remedial goals for the protection of human and ecological

receptors. A post-removal assessment was also performed looking at both individual sampling results and an overall evaluation of remaining soils and sediment.

- Excavated Material Disposal at an Approved Off-Site Disposal Facility: All excavated solid waste debris, contaminated soils and sediment was transported to an approved off-site disposal facility. Prior to loading and transport, excavated sediment and wet surface debris was dewatered. Additionally, all excavated material was characterized to determine the appropriate disposal facility. Approximately 650 truckloads (8 cubic yards each) of materials were transported and disposed of off site.

- Site Restoration: The three surface debris piles and individual PAH-contaminated soil excavation areas were restored to original surface levels and were then re-vegetated. Areas where sediment was removed from the marsh were restored by filling in with clean sand material and were re-vegetated. These areas were stabilized as best as possible to minimize future soil erosion. The causeway area was re-established as a salt marsh. Monitoring and establishment of success criteria for these efforts were developed as part of the remedial action workplan.

- Land Use Controls: Land Use Controls (LUCs) consisting of certain Institutional Controls (ICs) to prohibit access to and use of shallow groundwater beneath Site 12 will be implemented to preclude unacceptable future human health risk(s) from the consumption of groundwater containing thallium, arsenic and cadmium above their respective MCLs. The location and area of Site 12 requiring LUCs (i.e., the LUC boundaries) is depicted in Figure 2.5. These LUCs will be maintained until the concentration of hazardous substances in the groundwater are at such levels to allow for unrestricted use and unlimited exposure. Consistent with the RAOs developed during the RI/RFI, the specific performance objective for the LUCs to be implemented at Site 12 is as follows:

  - To prohibit the extraction or any use of the groundwater beneath the Site.

The following generally describes the LUCs which will be implemented at Site 12 in order to achieve the aforementioned LUC performance objective:

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's Master Plan.

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's geographical information system, (GIS).

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's Environmental Management System. The environmental management system is a centralized tool for the dissemination of information critical to making appropriate decisions regarding the management of resources, compliance with environmental regulations and ensuring that site-specific use limitations are complied with.

- Site 12 LUCs will be included in a Depot Order currently under development governing ground disturbing activities across the facility.

- If Site 12 property is transferred or leased, then the deed and/or lease will contain conditions, restrictions or terms that prohibit the extraction or any use of the groundwater beneath Site 12.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. A LUC remedial design, as part of the Final Remedial Design or document memorializing Remedial Action Completion, (primary documents under the FFA), that addresses how this LUC will be implemented, maintained, monitored (including periodic inspections), enforced and reported on, will be prepared and submitted by the Navy per the approved Site Management Plan (SMP) schedule to EPA and SC DHEC for review and approval. Once the Final Remedial Design or document memorializing Remedial Action Completion, (including the LUC remedial design) is approved by EPA and SCDHEC, it shall supersede any Land Use Control Implementation Plan already developed for Site 12, as well as any conditions related to Site 12 LUCs in the LUC Memorandum of Agreement (also termed the Land Use Control Assurance Plan) executed between the Navy, U.S. EPA and SCDHEC.

As noted above, the majority of the components of the selected remedy for Site 12 were implemented prior to finalization of this ROD. Based upon EPA and SCDHEC review of a draft of this ROD, the fact that no adverse public comments were received during the Proposed Plan public comment period, and certain funding availability and timing issues related to the planting season for marsh re-vegetation efforts, the MCRD Partnering Team decided to proceed with remedy implementation pending finalization of this document.

1.5 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, and is cost effective. This action does not satisfy the statutory preference for remedies that employ treatment technologies that reduce toxicity, mobility, or volume as a principal element because treatment of the wastes found at the site was deemed to be impracticable and potentially harmful to surrounding marsh environs. Instead, it was determined that U.S.EPA's presumptive remedy approach for small landfills (waste excavation and

off-site disposal) was more appropriate and adequately protective. Because the remedy will result in hazardous substances, pollutants, or contaminants remaining above levels allowing for unrestricted use and unlimited exposure, in accordance with Section 121(c) of CERCLA and 40 CFR 300.430(f)(4)(ii), a statutory review will be conducted every five years after initiation of the selected remedial action and continuing every five years thereafter unless and until use and exposure may be allowed and to ensure that the remedy remains protective of human health and the environment. The first CERCLA Five Year Review for this site was conducted in September 2005.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Section 2.0, Decision Summary, of this ROD. Additional information can be found in the Administrative Record file for Site 12.

- Detected chemicals and their respective concentrations (Tables 2-1 through 2-7).
- Chemicals retained as human health COPCs (Table 2-8) and ecological COPCs (Table 2-10).
- Clean-up levels established for selected COCs and the basis for these levels (Table 2-11 and 2-12).
- Baseline human health risk represented by the COCs (Section 2.6 and Table 2-9).
- The manner in which source materials constituting principal threats are addressed (Section 2.8).
- Current and reasonably anticipated future land-use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.5.4).
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 2.5.4, Section 2.9).
- Estimated capital, annual 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 (Section 2.7.3, Section 2.9. and Appendix B).
- Key factors that led to selecting the remedy (Sections 2.9 and 2.10).

1.7 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF THE REMEDY

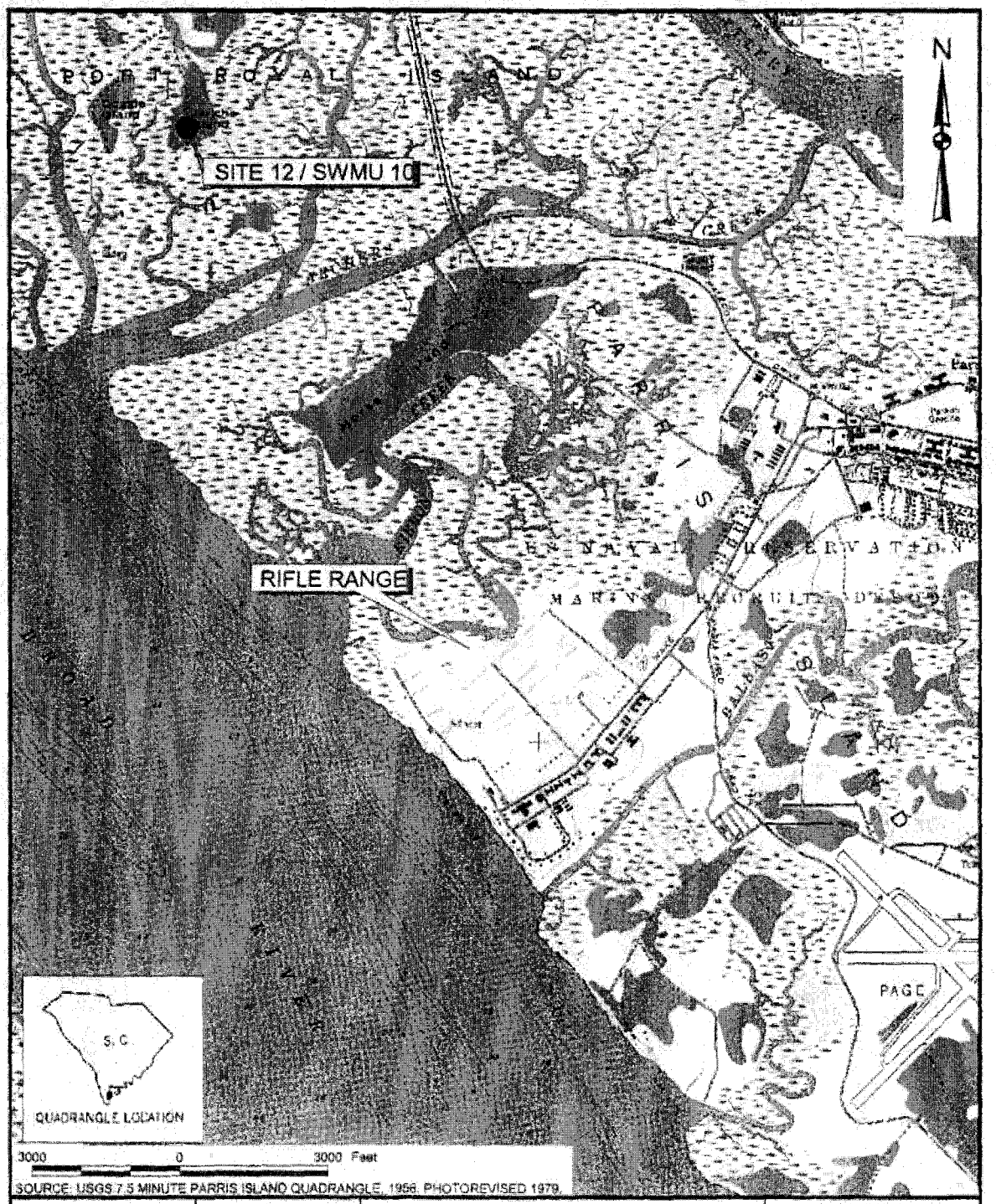
Paul E. Lefebvre
Brigadier General
Commanding General
MCRD Parris Island

Date

Beverly H. Banister
Acting Division Director
Waste Management Division
U.S. EPA Region 4

10/2/2006
Date

By separate letter, the State of South Carolina will concur with this decision.



SOURCE: USGS 7.5 MINUTE PARRIS ISLAND QUADRANGLE, 1956, PHOTOREVISED 1979.

DRAWN BY: MJJ	DATE: 06Oct09	DEPOT LOCATION MAP MCRD, PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER: 4445
CHECKED BY:	DATE:		OWNER NO:
COST/SCHEDULE-AREA:			APPROVED BY: DATE:
SCALE: AS NOTED			DRAWING NO: FIGURE 1-1 REV: 1

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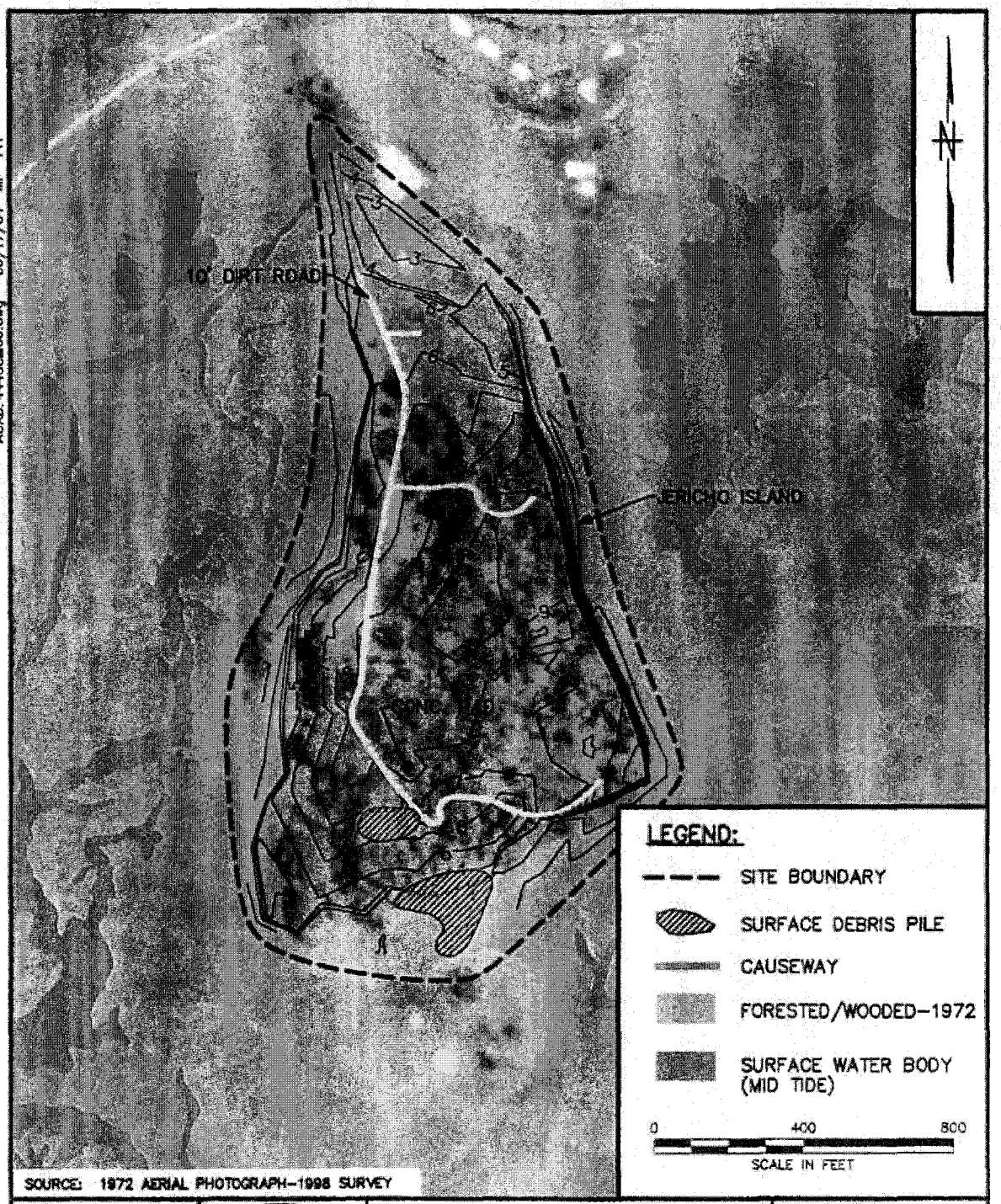

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COST/SCHED-AREA			APPROVED BY DATE
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FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

MCRD Parris Island is located along the southern coast of South Carolina, approximately 1 mile south of the City of Port Royal and 3 miles south of the City of Beaufort within Beaufort County. MCRD Parris Island covers approximately 8,047 acres that consist of dry land, salt marshes, saltwater creeks, and ponds, as shown in Figure 1-1. MCRD Parris Island is the reception and recruit training facility for the Marine Corps for enlisted men for all states east of the Mississippi River and for enlisted women nationwide. Jericho Island is approximately 25 acres in size and is located northwest of Horse Island, as shown on Figure 1-1.

The Superfund site identification number for MCRD Parris Island is 04NY. The U.S. EPA identification number is SC6170022762.

The United States Navy (Navy) is the lead agency for this ROD. The U.S. EPA Region 4 is the lead support agency and SCHDEC also serves as a support agency as contemplated under the NCP in connection with all CERCLA remedial activities at MCRD Parris Island. Representatives of National Oceanic and Atmospheric Administration (NOAA), South Carolina Department of Natural Resources (SCDNR), and U.S. Fish and Wildlife Service (USFWS) also serve as natural resource trustees.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Having been operated as a recruit training facility for the U.S. Marine Corps since 1915, MCRD Parris Island consists mainly of administrative office buildings, training facilities, recruit and family housing, building and vehicle maintenance shops, and community facilities. It is anticipated that future land uses at the facility will be substantially the same as historical land uses although Site 12 which is the subject of this ROD, will no longer be in private hands or used as a solid waste dumping site. The following paragraphs provide more specific historical use information for Site 12.

2.2.1 Site History

Jericho Island was acquired by the Navy in 1968 to comply with the limited distance arc required for MCRD Parris Island's rifle range. Site 12 was reportedly used by local residents from 1955 to 1968 as a waste disposal area. However, no organized landfill operations were reported to have occurred at the site. Disposed waste consisted of routine domestic refuse including small metal cans, beer and soda bottles, hubcaps, tires, buckets, cinderblocks, rusted metal 5-gallon cans, sheet metal, paper, plastic, and wood. Prior to implementation of the selected remedy, the site had an irregular, undulating surface due to

the random scattering of waste piles that range up to approximately 30 feet in diameter and 5 feet in height (Kearney, A.T., Inc., 1990). After MCRD Parris Island acquired Site 12, the area was no longer used for waste disposal purposes. Site 12 is not and has never been a RCRA Subtitle C or D permitted landfill site.

As shown on Figure 1-2, three areas containing surface debris were previously located on Jericho Island. Two of these areas were located in the upland portion of the island (one in the west-central and one in the southern portion of the island). The third area was located at the southern edge of the island and had extended into the adjacent wetlands. .A causeway (a raised way across wet ground or water) was constructed by unknown person(s) from the mainland to the northern end of Jericho Island for access purposes prior to MCRD's acquisition of the island. This causeway was constructed with soil commingled with waste material. The date of construction of the causeway is also unknown.

A concrete pad on the southern end of the island was reportedly used by the Marine Corps as the location of a landing light for the base's former runway. This reported use is supported by the fact that the runway is aligned on one end with Jericho Island.

Environmental investigations at Site 12 began in 1986. The following reports describe the results of investigations to date at the site and are available in the MCRD Parris Island information repository:

- Initial Assessment Study of MCRD Parris Island, South Carolina [Naval and Energy Environmental Support Activity (NEESA), 1986].

- RI/RFI Work Plan for Site 12/SWMU 10 [Brown and Root Environmental (B&R Environmental), 1998a].

- RI/RFI Report for Site12/SWMU 10 – Jericho Island Disposal Area (TtNUS, 2001).

- Feasibility Study (FS)/Corrective Measures Study (CMS) Report for Site12/SWMU 10 – Jericho Island Disposal Area (TtNUS, 2004).

- Proposed Plan for Waste, Soil and Sediment Remedial Action at Site12/SWMU 10 – Jericho Island Disposal Area (TtNUS, 2005).

2.2.2 Enforcement Activities

Although there is no history of cited violations under federal or State environmental laws or regulations in connection with MCRD's historical activities at Site 12, EPA has undertaken certain RCRA and CERCLA related compliance oversight activities at MCRD Parris Island. These include the following:

- An Interim RCRA Facility Assessment (RFA) of MCRD Parris Island in 1990 (A.T. Kearney, Inc.);
- A Hazard Ranking System (HRS II) scoring of MCRD Parris Island in May 1992. That effort yielded an initial score of 71.59. The installation was rescored by EPA in August 1994 yielding a score of 50.00.Ha
- Proposed inclusion of MCRD Parris Island on the National Priorities List in July 1994.
- Listing of MCRD Parris Island on the NPL in December 1994 with appropriate Federal Register Notice on January 17, 1995.
- Joint execution with the Navy, EPA, and SCDHEC of a Federal Facilities Agreement for MCRD Parris Island in January 2005. That agreement was made effective by EPA on March 31st, 2006.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

MCRD Parris Island has performed public participation activities in accordance with CERCLA, RCRA and to the extent practicable, the NCP, throughout the site clean-up process. On 4 August 2005, the Proposed Plan for Waste, Soil, and Sediment Remedial Action at Site 12 was made available to the public in the Information Repository at the Beaufort County Public Library's Headquarters Location at 311 Scott Street, Beaufort, South Carolina, 29902. This Proposed Plan recommended the following remedy:

- Excavation and removal of the three surface debris piles which were present on Jericho Island.
- Excavation and removal of two areas of soil containing concentrations of PAHs greater than remedial goals for protection of human and ecological receptors.
- Excavation and removal of one area of sediment containing concentrations of inorganics greater than remedial goals for protection of human and ecological receptors.
- Excavation and removal of those soils, sediments and waste debris which comprised the causeway that connected the northern end of Jericho Island to the mainland.

- Transportation of all excavated soils, sediments, and surface debris to an approved off-site disposal facility.

- Verification sampling and laboratory analysis of excavated areas and performance of a post-removal study to ensure that any residual contamination in site soils or sediments with concentrations greater than the remedial goals have been removed.

- Proper abandonment of all groundwater monitoring wells installed on Jericho Island.

- Regrading of excavated areas and restoration of disturbed wetlands.

The public notice for the Proposed Plan was published in the *Beaufort Gazette* on 6 August 2005, 10 August 2005, and 16 August 2005. Those notices solicited public comments on the PP. No adverse comments were received in response. Additionally, a public information session was held on 17 August 2005 to present the results of the RI/RFI and the FS/CMS, to explain the preferred remedy, and to solicit comments from the community. At this information session, representatives from Naval Facilities Engineering Field Division South, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 12 and the response actions under consideration. A Community Relations Responsiveness Summary is included in Appendix A of this ROD.

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION AT SITE 12

Site 12 is one of approximately 55 sites being evaluated for potential contamination at MCRD Parris Island. In 1996, the MCRD Parris Island Partnering Team was developed to facilitate the development, review, and approval of work plans, reports (RIs and FSs), and decision documents (Proposed Plans and RODs). The original members of the team consisted of the Southern Division of the Navy, Marine Corps - MCRD Parris Island, U.S. EPA, and SCDHEC. In 1997, representatives of NOAA, SCDNR, and USFWS joined the team as natural resource trustees.

As part of the overall site cleanup strategy for MCRD Parris Island, contaminated areas have been and continue to be assessed, organized into Operable Units (OUs), and addressed in relative risk order, starting with those sites with generally higher risk, followed by those of generally lower risk. The relative risk for Site 12 was high. EPA has designated Site 12 as OU 5 for purposes of tracking within EPA's CERCLIS database. The FFA details MCRD Parris Island's overall site remedial process including RCRA/CERCLA Integration. This CERCLA action will satisfy state RCRA corrective action requirements consistent with Section VI (RCRA/CERCLA Integration) of the FFA.

This ROD presents the remedy selected by the MCRD partnering team for Site 12. Based on the HHRA and ERA undertaken during the study of Site 12, wastes, soils, sediments, and groundwater at Site 12 were shown to pose a risk to human health and the environment (TtNUS, 2001). As a result, a remedial action was planned at Site 12 to eliminate or least reduce these risks to acceptable levels over time.

As part of completed remedial activities to address contamination in soils and sediments , source materials (three surface debris piles and their underlying soil and sediment) were excavated and transported to an approved off-site disposal facility. Similarly, other soils found to contain concentrations of PAHs and sediments containing concentrations of inorganics greater than their respective remedial goals were excavated and transported to an off-site disposal facility. And finally, the causeway connecting the northern portion of Jericho Island to the mainland was removed and disposed of off-site. These activities effectively eliminated future human and/or ecological exposure(s) to those waste materials and contaminated soil and sediment that were once present at Site 12.

The extensive waste debris, soil and sediment excavations and removals which were undertaken at Site 12 were also intended to preclude the continued transport of contamination to site groundwater. Groundwater sampling at Site 12 showed isolated exceedances of preliminary remedial goals for iron, manganese, cadmium, arsenic and thallium. However, the RI/RFI concluded that the elevated levels of iron and manganese were likely attributable to natural sources. While thallium exceeded the MCL in only one sample during the RI/RFI, it was detected in levels exceeding the MCL in almost all samples taken after completion of the excavation of waste materials. Thallium is one of the first contaminants to show in elevated levels if monitoring wells are not properly purged and stabilized prior to sampling, which could explain the post excavation elevated levels. The Team has concluded that acetone and chloroform exceedances were likely from lab sample processing and not Site 12 groundwater. Cadmium, arsenic, and thallium remain as COCs which exceed MCLs. Based on the RI/RFI, Site 12 groundwater was also found not to pose unacceptable risks to potential ecological receptors.

As further described in other Sections of the ROD, a determination has been made that the groundwater beneath Site 12 is unsuitable for human consumption due to high salinity and TDS in excess of 13,000 mg/l. Also, the groundwater has a low degree of interconnection with drinkable or environmentally significant waters due to its very shallow location beneath a barrier island where it is tidally influenced and flows outwardly from the island towards tidal channel surface waters. Therefore, since the ground water is naturally unusable because of the characteristics mentioned above, drinking water standards are not considered ARARs for this action and the ground water will not be actively remediated. However, after removal of waste materials, as well as contaminated soils and sediments, migration of contaminants to groundwater will be effectively eliminated. LUCs, (specifically institutional controls) prohibiting any use of

groundwater will be implemented as a part of the selected remedy to ensure protection of human health and the environment.

Although human and ecological risks from exposure to surface water within acceptable limits, the selected remedy will also effectively eliminate any future transport of residual contaminants from soil or sediment to surface water.

2.5 SUMMARY OF SITE CHARACTERISTICS

This section summarizes the regional and site-specific geology, hydrogeology, and ecology in the vicinity of MCRD Parris Island. A more detailed presentation of this information is available in the RI/RFI Report for Site 12 (TtNUS, 2001).

2.5.1 Geology

Jericho Island is a small, relatively flat, sandy island with minimal topographic relief. The highest elevation on site is approximately 9 feet above mean sea level (msl). The soil in the Site 12 area consists of the Seabrook, Capers, and Bohicket series (Soil Conservation Service, 1980). The soil at Site 12 itself is the Seabrook series, which typically consists of fine sands that are moderately well drained and nearly level. The water table is typically 2 to 4 feet below ground surface (bgs) with gradients generally less than 1 percent but reaching 2 percent along drainageways. The soil along the northern tidal flat adjacent to Site 12 consists of the Capers series. Capers soil generally consists of silty and clayey marine sediment that is nearly level and found along tidal flats. The remainder of the tidal flat soil adjacent to the site consists of the Bohicket series. Bohicket soil consists of deep, poorly drained, low-permeability soil that forms in silty and clayey marine sediment on broad tidal flats.

Surface soil collected from Site 12 during the RI/RFI field event consisted of fine to medium sands with varying silt content, as indicated in the lithologic descriptions for the sampling event. Sediment samples collected from the tidal flat area consisted of fine to coarse sand with a varying silt and clay content and clay with a varying sand and silt content. Surface debris was observed primarily on the northern and southern ends of the islands; most of the debris was located on the southern end. Debris, consisting of glass and rusted metal, was observed over a distance of approximately 200 feet along the tidal flat at the southern end of the island. Based on grain-size analyses conducted during the RI/RFI, the deeper sediments within the surficial aquifer (fine to medium sands with silt) are slightly coarser grained overall than the shallow sediments, which are predominantly fine silty sands.

Subsurface materials at Site 12 were classified based on samples collected during the drilling of seven soil test borings during the RI/RFI field investigation. The soil borings were sampled continuously to the

termination of each boring using split-spoon sampling techniques. The subsurface geology at the site does not appear to have been affected by human activities. Solid waste debris was observed on the surface but was not encountered at depth, with the exception of borings PAI-10-SB-06 and PAI-10-SB-07. At these borings, surface debris was encountered at depths of 4 feet and 2 feet, respectively. These borings were located on the southern end of the island within a large area of surface debris.

Figure 2-1 identifies the locations of cross-sections A-A' and A-B in a plan view. Figures 2-2 and 2-3 present the cross-sectional transects of A-A' and A-B, respectively. The soil encountered typically consisted of fine to medium sand with a varying silt and clay content. Sandy clay was encountered in soil borings PAI-10-SB-05, PAI-10-SB-06, and PAI-10-SB-07 at depths of 8 to 17 feet bgs. These units were predominantly clay but also contained sand. The sandy clays were wet and did not appear to be associated with the Hawthorn Formation; they were only encountered at the southern end of Jericho Island. Due to the limited areal extent, the clay units most likely do not act as local confining units within the surficial aquifer beneath the site. The borings were terminated when auger refusal was encountered at depths ranging from 26 to 39.5 feet bgs, which was interpreted to be the top of the Hawthorne Formation.

2.5.2 Hydrology

2.5.2.1 Groundwater Hydrology

The following hydrogeologic conditions at Site 12 were interpreted from soil boring and slug test data and groundwater-level measurements obtained during the RI/RFI (TtNUS, 2001).

The uppermost aquifer at the site consists of primarily sandy Pleistocene age sediments. Sandy clay lenses were encountered in some borings; however, they do not appear to be laterally extensive and therefore do not isolate lower sands from upper sands within the surficial aquifer. In general, a shallow groundwater table exists at Site 12. The depths to groundwater measured at the beginning of the tidal study ranged from 0.78 to 7.82 feet bgs. Groundwater was encountered during installation of the wells at depths ranging from less than 1 foot to approximately 4 feet bgs. Based on the results of the tidal study, all wells are tidally influenced, with fluctuations varying from 0.28 to 1.9 feet.

Groundwater primarily moves through the coarser, sandy sediments of the surficial aquifer. Sandy clays encountered in borings PAI-10-SB-05, PAI-10-SB-06, and PAI-10-SB-07 are limited to the southern end of the island. Due to the limited extent of the sandy clays, they are not likely to act as confining units. The upper surficial aquifer is approximately 21 to 30 feet thick across the site, based on the depths of the top of rock encountered in the soil borings. Recharge of the shallow aquifer beneath the site is likely to occur primarily through infiltration of precipitation across the island. The highest measured groundwater

elevations in shallow surficial aquifer wells were along the southern and southeastern edges of the island (PAI-10-MW-11 and PAI-10-MW-09). In the deep surficial aquifer, the highest groundwater elevations were in wells PAI-10-MW-12 and PAI-10-MW-06, located along the southern and northwestern edges of the island. In general, the water-level data suggest an overall groundwater flow pattern from the interior and southern end of the island towards the marshes and open water located east and west of the island.

Based on groundwater elevation data, the vertical gradient within the surficial aquifer is downward at well clusters PAI-10-MW-01(S)/PAI-10-MW-02(D), PAI-10-MW-07(S)/PAI-10-MW-08(D), PAI-10-MW-09(S)/PAI-10-MW-10(D), PAI-10-MW-11(S)/PAI-10-MW-12(D), and PAI-10-MW-13(S)/PAI-10-MW-14(D). The vertical gradient at well clusters PAI-10-MW-03(S)/PAI-10-MW-04(D) and PAI-10-MW-05(S)/PAI-10-MW-06(D) appears to be slightly upward. Four of the five well clusters with downward gradients are in the southern half of the island, and both well clusters with upward gradients are located in the northern half of the island. This suggests that the southern portion of the site is a local recharge area for groundwater.

Slug tests were performed in the newly installed wells to estimate the hydraulic conductivity of the shallow aquifer sediments. Rising head slug tests were performed in wells PAI-10-MW-03(S), PAI-10-MW-05(S), PAI-10-MW-07(S), and PAI-10-MW-09(S). Rising and falling head slug tests were performed at the remainder of the monitoring wells. For wells in which both rising and falling head tests were performed, the data were averaged prior to the calculation of the overall geometric mean. The geometric mean hydraulic conductivity for the seven shallow surficial aquifer wells was calculated to be 3.39 feet per day [1.20×10^{-3} centimeter per second (cm/sec)]. The geometric mean hydraulic conductivity for the seven deep surficial aquifer wells was calculated to be 3.30 feet per day (1.17×10^{-3} cm/sec). The values for the shallow and deep wells are within the typical range of hydraulic conductivity for silty sands, well-sorted sands, and fine sands (Fetter, 1980).

Tidal study results indicate that both shallow groundwater and deeper groundwater within the surficial aquifer are tidally influenced. At each well cluster location, the deep well had a greater tidal range than the shallow well, indicating that the hydraulic influence of the tides is greater in the deeper portion of the surficial aquifer. Overall, tidal effects were most prominent in the deep wells located along the eastern and northern edges of the island, with tidal fluctuations of over 1 foot observed in wells PAI-10-MW-02, PAI-10-MW-04, and PAI-10-MW-10. Well PAI-10-MW-10 had the greatest overall response to the tides, with a maximum fluctuation of about 1.8 feet.

The RI/RFI groundwater sampling results showed that salinity ranged from 0.05 percent to 3.03 percent. The salinity readings indicated that all the groundwater samples were considered to be salt water (greater

than 0.048 percent, as identified by SCDHEC). Total dissolved solids (TDS) averaged 13,900 mg/l (1.3 percent).

Site 12 is located within a 100-year flood plain as determined by reviewing Federal Emergency Management Agency Flood Insurance Rate Maps.

2.5.2.2 Surface Water Hydrology

High tides in the area of Jericho Island range from approximately 4 to 5 feet above msl. Except for minor erosion near the edge of the island, surface water and surface water flow channels are not present on the island. During storm events, precipitation either infiltrates the sandy soils or migrates radially as sheet flow toward the surrounding marsh.

In the marsh surrounding the island, surface water flow patterns were observed during sampling events in 1998, 1999, and 2000. Just after high tide, surface water was noted to flow primarily to the east on the eastern side of the island and to the west on the western side of the island toward the tidal channels. From the tidal channels, the surface water flows to the south and into Archers Creek.

2.5.3 Human Health Conceptual Site Model

The potential sources of contamination at Site 12 were the solid wastes disposed of at the site. As a general rule, contaminants may be released into the environment by mechanisms such as stormwater runoff and subsequent erosion of surface soil, leaching from soil via infiltrating water to subsurface soil and subsequent migration through the subsurface soil to the groundwater table, wind erosion of surface soil (fugitive dust), and the volatilization of chemicals from soil (volatile emissions). Once released, contaminants may be transported in media such as soil, groundwater, surface water, sediment, or air. Potential receptors may be exposed either directly or indirectly to contaminants in these media by a variety of exposure mechanisms. Inhalation of air, direct contact with soil, groundwater, surface water, and sediment, and ingestion of fish were exposure routes evaluated in the RI/RFI.

Two exposure pathways (inhalation of air and ingestion of fish) were not quantitatively evaluated in the RI/RFI for Site 12. For the inhalation of air pathway, maximum detections of all chemicals in surface soil were less than the soil screening levels; therefore, exposure via the inhalation pathway was considered to be minimal and was not considered for further evaluation. Similarly, ingestion of fish caught at Site 12 was not retained for quantitative evaluation in the risk assessment. The surface water bodies adjacent to Site 12 are tidally influenced and are dry at low tide. Consequently, any fish in surface water adjacent to Site 12 likely originated from outside these areas.

Potential human receptors were identified for Site 12 by analyzing the interaction of current and hypothetical future land-use practices and the identified sources of contamination. The receptors evaluated in the RI/RFI consisted of construction workers, adolescent trespassers, adolescent and adult recreational users, and hypothetical future on-site residents.

2.5.4 Current and Potential Future Land and Resource Uses

Site 12 is currently situated on vacant land covered with naturally established native vegetation (trees, shrubs, and grasses). The reasonably anticipated land use is to leave this land vacant as a safety buffer zone for MCRD Parris Island's rifle range. The surface water adjacent to Site 12 is not currently used as a potable water supply and is too shallow for recreational usage.

The EPA "Guidelines for Ground-Water Classification" (Final Draft, December 1986) is used by EPA's Superfund Program to help make decisions on the level of cleanup necessary for groundwater at Superfund sites in view of its expectation to return usable ground-waters to their beneficial use wherever practicable [Reference NCP 40 CFR 300.430(a)(1)(iii)(F) and 55 Fed. Reg. 8732-8733 (Mar. 8, 1990)]. Cleanup standards for restoration of contaminated groundwater that is currently or potentially used for drinking water purposes generally include chemical-specific ARARs such as the maximum contaminant levels (MCLs),or non-zero MCL Goals (MCLGs) established under the Federal Safe Drinking Water Act regulations at 40 CFR Part 141 *et seq.,* or risk-based levels for contaminants not covered by a specific ARAR [Reference 40 CFR 300.430(e)(2)(i)(B)-(D)and 55 Fed. Reg. 8750-8752]. These drinking water standards usually are not appropriate for groundwater that is classified as "groundwater not a potential source of drinking water and of limited beneficial use", because it has high salinity and its Total Dissolved Solids concentration is equal to or exceeds 10,000 mg/L [Reference 55 Fed. Reg. 8732].

In accordance with these guidelines, a determination has been made that the groundwater beneath Site 12 is unsuitable for human consumption due to high salinity and TDS in excess of 13,000 mg/l. Also, the groundwater has a low degree of interconnection with drinkable or environmentally significant waters due to its very shallow location beneath a barrier island where it is tidally influenced and flows outwardly from the island towards tidal channel surface waters. Therefore, since the ground water is naturally unusable because of the characteristics mentioned above, drinking water standards are not considered ARARs for this action and the ground water will not be actively remediated. However, after removal of waste materials, as well as contaminated soils and sediments, migration of contaminants to groundwater will be effectively eliminated. As described in Section 2.9, LUCs (namely Institutional controls) prohibiting future extraction or any use of groundwater beneath Site 12 will be implemented as a part of the selected remedy to ensure protection of human health and the environment.

2.5.5 Ecology

The entire upland portion of Jericho Island is forested. The overstory is dominated by slash pine (*Pinus elliottii*), loblolly pine (*Pinus taeda*), live oak (*Quercus virginiana*), and laurel oak (*Quercus laurifolia*). Common midstory species include wax myrtle (*Myrica cerifera*) and cabbage palm (*Sabal palmetto*). Common understory plants include Eastern baccharis (*Baccharis halimfolia*), saw palmetto (*Serenoa repens*), yaupon holly (*Ilex vomitoria*), poison ivy (*Rhus radicans*), Virginia creeper (*Parthenocissus quinquefolia*), muscadine grape (*Vitis rotundifolia*), greenbriar (*Smilax rotundifolia*), and *Vaccinium*. The island is surrounded by an extensive saltwater marsh dominated by cordgrass (*Spartina alterniflora*). Seashore saltgrass (*Distichlis spicata*) and rush (*Juncus effusus*) are present at the marsh/upland interface.

A variety of wildlife species occurs on Jericho Island. White-tailed deer (*Odocoileus virginianus*) and raccoons *(Procyon lotor*) are known to forage in the area, and gray squirrels (*Sciurus carolinensis*) are common. Other mammalian herbivores expected to occur in the upland portion of the island include the cotton rat (*Sigmodon hispidus*) and the cotton mouse (*Peromyscus gossypinus*). The opossum (*Didelphis virginiana*), short-tailed shrew (*Blarina carolinensis*), and eastern mole (*Scalopus aquaticus*) also probably occur there. The marsh rabbit (*Sylvilagus palustris*) and rice rat (*Oryzomys palustris*) probably forage along the edge of the marsh. Mink (*Mustela vison*) and river otters (*Lutra canadensis*) are expected to forage along the marsh edge. Other mammalian carnivores expected to occur at least occasionally at the site include the red fox (*Vulpes vulpes*) and striped skunk (*Mephitus mephitus*). A variety of birds, reptiles, and amphibians utilize the site.

The saltwater marsh provides habitat for a variety of fauna, particularly fish and crustaceans. Several species of animals probably prey upon these fish and crustaceans. These predators include mammals such as the raccoon, mink, and river otter and wading birds such as the tricolored heron (*Egretta tricolor*), great blue heron (*Ardea herodias*), green heron (*Butorides striatus),* and snowy egret (*Egretta thula*). Various shorebirds and wintering waterfowl forage in the marsh.

The shallow marsh is alternately flooded and drained by changing tides and so fish near Jericho Island are largely limited to small schooling species such as mud minnows (*Umbra pygmaea*) and mummichogs (*Fundulus heteroclitus*). However, fish such as red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), whiting (*Menticirrhus americanus*), and striped mullet (*Mugil cephalus)* are known to occur in Archer's Creek south of Jericho Island. These and other fish species probably occur at least occasionally in portions of the marsh during high tides.

Threatened and endangered species that could occur at or near the site consist of the bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), and least tern (*Sterna antillarum*). An

active bald eagle nest is located approximately 2.3 miles southeast of the site, and bald eagles (State- and federally listed as threatened) could forage on fish near Jericho Island. Wood storks (State- and federally listed as endangered) forage in various areas throughout the Depot, and they could forage in the marsh surrounding the sites. Least terns (*Sterna antillarum*) have been observed at MCRD Parris Island and might occasionally forage in the marsh near the site, but observations of this species have not been recorded in the vicinity. The least tern, State listed as threatened, occurs in coastal South Carolina only during the breeding season or briefly during migration. Preferred nesting habitat for the least tern does not exist at Jericho Island, and this species is not known to nest at MCRD Parris Island.

Although other endangered and threatened species occur in Beaufort County (Table 2-2 of Volume I, Master Work Plan), the site provides poor habitats for these species (B&R Environmental, 1998b). For example, the manatee (*Trichechus manatus*), shortnose sturgeon (*Acipenser brevirostrum*), and various sea turtles are occasionally observed in the Broad River, Beaufort River, and Port Royal Sound, and the Atlantic bottlenosed dolphin (*Tursiops truncatus*) is a year-round resident of these areas. (Although not threatened or endangered, dolphins are afforded protection under the Federal Marine Mammal Act.) However, these species usually are not associated with shallow marshes like those near Jericho Island. With the exception of the bald eagle and wood stork, the likelihood of endangered and threatened species in the vicinity of the site is probably remote.

2.6 SUMMARY OF SITE RISKS

The Site 12 RI/RFI analytical data were evaluated to determine baseline risks to human health and the environment. The baseline risk assessment estimates the risks the site would pose if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. Sections 2.6.1 and 2.6.2 summarize the results of the baseline risk assessment for this site. Summary statistics for surface soil, groundwater, surface water, and sediment analytical results from RI/RFI field activities in 1998, 1999 and 2001 are presented in Tables 2-1 through 2-7.

Surface soil samples collected in 1995 and 1998 revealed concentrations of benzo(a)pyrene and arsenic, iron, and lead exceeded human health screening criteria. In addition, concentrations of chloroform, 13 SVOCs, 4,4'-DDE, and ten inorganics exceeded U.S. EPA Region 4 ecological screening values (ESVs). Analytical results from follow-on shallow soil sampling conducted in 2001 at location PAI-10-SS-08 confirmed the results of the 1998 sampling and indicated that potential risks to human health and the environment existed at that location within Site 12. However, 2001 analytical results at location PAI-10-SS-12 did not confirm the 1998 results and indicated that risks to human health and the environment were not present at that specific location within the site.

In groundwater samples, acetone and chloroform exceeded human health screening criteria. No other organic compounds detected in groundwater exceeded a human health screening criterion, and no organics exceeded an ESV. In terms of inorganics, Site 12 sampling evidenced detections of arsenic, cadmium, iron, manganese, and thallium exceeding human health criteria or MCLs. The Partnering Team later concluded that the iron and manganese were likely attributable to naturally occurring sources and both acetone and chloroform were from lab sample processing, not Site 12 groundwater. While thallium exceeded the MCL in only one sample during the RI/RFI, it was detected in levels exceeding the MCL in almost all samples taken after completion of the excavation of waste materials. Thallium is one of the first contaminants to show in elevated levels if monitoring wells are not properly purged and stabilized prior to sampling, which could explain the post excavation elevated levels. Cadmium, arsenic, and thallium, remain as COCs which exceed MCLs. Based on the RI/RFI, Site 12 groundwater was also found not to pose unacceptable risks to potential ecological receptors.

In surface water samples, bis(2-ethylhexyl) phthalate exceeded a human health screening criterion. No other organic compounds detected in surface water exceeded a human health screening criterion, and no organics exceeded an ESV. In a comparison of unfiltered inorganic surface water results to human health criteria, detections of arsenic, iron, and manganese exceeded such criteria.

In the sediment samples collected in 1995 (sediment waste samples), one PCB (Aroclor-1254) and arsenic and iron exceeded human health screening criteria. Lead concentrations exceeded the Office of Solid Waste and Emergency Response (OSWER) human health screening value for lead. Two SVOCs, four pesticides, one PCB, and 10 inorganics exceeded U.S. EPA Region 4 ESVs. In subsequent sediment samples collected in 1998 and 1999, arsenic and iron exceeded a human health screening criterion. Three SVOCs and three pesticides exceeded U.S. EPA Region 4 ESVs. Nine inorganics exceeded their ESV.

After evaluation of all site sampling data by the Partnering Team some of the above identified contaminants were designated as media specific contaminants of concern (COCs). That selection process and the contaminants so designated are discussed further in Sections 2.6.1 and 2.6.2 of this ROD. As a result of these findings, the response action selected in this ROD was deemed necessary by the MCRD Partnering Team for the protection of the public health or welfare and the environment from actual and threatened future releases of pollutants or contaminants from the site which could present an imminent and substantial endangerment to public health or welfare. Future uncontrolled exposure(s) to the solid waste debris, contaminated soils and sediments and contaminated groundwater beneath Site 12 was deemed by the Partnering Team to present an unacceptable risk(s) to human health. Consequently, in addition to the extensive waste, soil and sediment removal components which were undertaken, the selected site remedy includes LUCs in the form of certain institutional controls (ICs) that will prohibit

future extraction or any use of the groundwater beneath Site 12 in order to preclude unacceptable human exposures to that particular media.

2.6.1 Human Health Risk Assessment

A baseline HHRA for Site 12 was conducted using the most recent guidance from the U.S. EPA (U.S. EPA, 1989, 1993a, 1998a, 1998b), including Region 4 supplemental guidance (U.S. EPA Region 4, 1995a). To maintain consistency among risk assessments performed at various sites at the Depot, methodologies presented in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998b) were also used to develop the baseline risk assessment for this site.

Maximum detected concentrations at Site 12 were compared to risk-based and health-based screening criteria. If the maximum concentration exceeded any one of the screening criteria, that chemical was retained as a human health COPC. COPCs are chemicals that need further evaluation to determine if the concentrations found at the site pose a potential risk to human health and the environment. COPCs identified for Site 12 are presented in Table 2-8.

The HHRA then qualitatively evaluated potential exposure pathways including direct contact and ingestion of soil, sediment, groundwater, surface water, and sediment and inhalation of groundwater vapors. Potential receptors consisted of construction workers, adolescent trespassers, adolescent or adult recreational users, and hypothetical future on-site residents.

Risk estimates developed in the HHRA were divided into carcinogenic (cancer) and noncarcinogenic (noncancer) concerns. For carcinogenic risks, EPA considers risks lower than 1 in 1,000,000 to require no further remedial action, while a range of 1 in 10,000 (1.0E-04) to 1 in 1,000,000 (1.0E-06) incremental lifetime cancer risk (ILCR) is considered by the U.S. EPA to be able to be managed. For non-carcinogenic concerns, the U.S. EPA threshold HI value is 1.0. A summary of the ILCRs and HIs for human receptors evaluated in the HHRA is provided in Table 2-9.

As shown in Table 2-9, ingestion of soil and groundwater by hypothetical future residents was shown to result in estimated ILCRs that exceed U.S. EPA's acceptable range of 1.0E-04 to 1.0E-06. Potential ingestion of sediment waste, soil, and groundwater by hypothetical future residents also resulted in HIs greater than 1.0. Concentrations of inorganics and Aroclor-1254, a PCB, were the main contributors to this noncarcinogenic risk.

Under other exposure scenarios, cancer and non-cancer risks were within or better than acceptable ranges.

The baseline HHRA reflects certain uncertainties regarding the true risks associated with Site 12. Conservative assumptions were used through the entire risk assessment; consequently, the final estimated risks may have been overestimated. A major uncertainty involved the estimation of exposure point concentrations. For some chemicals in surface soil, surface water, and sediment, the distribution of the chemical was not defined, and the maximum detected concentration was used as the exposure point concentration. As a result, the risk estimated with maximum concentrations used as exposure point concentrations is most likely to be overstated because it is unlikely that potential receptors would be exposed to the maximum concentration over the entire exposure period.

To a lesser extent, there is uncertainty associated with the selection of COPCs. In particular, there are several chemicals [acenaphthylene, benzo(g,h,i)perylene, and phenanthrene] for which there are no available health criteria and for which no risk-based COPC screening criterion could be developed. Per U.S. EPA guidance, the screening criterion for pyrene was used as a surrogate for these chemicals. However, the maximum detected concentrations of these chemicals in soil/sediment are approximately one or more orders of magnitude less than the screening criteria for pyrene. Consequently, the use of pyrene as a surrogate for these chemicals do not affect the conclusions of the risk assessment.

Chemicals that resulted in an estimated ILCR greater than 1.0E-06 or HI greater than 1.0 were retained as human health COCs in the FS/CMS. These chemicals are listed as follows:

Surface Soil: carcinogenic PAHs, arsenic, and iron
Sediment/Sediment Waste: Aroclor-1254 and arsenic

In the HHRA, acetone, arsenic, cadmium, iron, manganese, and thallium were all identified as groundwater COCs. However, subsequently, the MCRD Partnering Team agreed that only arsenic, cadmium and thallium (which exceeded MCLs) should be carried forward as human health related COCs for remedy selection evaluation purposes in connection with site groundwater. As stated above, the Partnering Team also later concluded that the iron and manganese were likely naturally occurring contaminants and both acetone and chloroform were from lab sample processing, not Site 12 groundwater. COCs for groundwater are listed as follows:

Groundwater: Cadmium, arsenic, and thallium

2.6.2 Ecological Risk Assessment

An ERA was performed to characterize the potential risks from site-related contaminants to ecological receptors. The ERA was performed using the general approach recommended in U.S. EPA guidance for performing ERAs (U.S. EPA, 1997 and 2000a). Furthermore, the ERA was conducted in accordance with

Navy policy (Department of the Navy, 1999) and other available guidance documents (Suter, 1993; Calabrese and Baldwin, 1993; Wentsel et al., 1996; Ingersoll et al., 1997; U.S. EPA, 1999b). The methods used in this ecological risk assessment and discussed below were summarized in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998b).

Initially, COPCs were determined by comparing the maximum concentrations of detected chemicals in Site 12 surface soil, groundwater, surface water, and sediment to U.S. EPA Region 4 ESVs. When the HQ (i.e., the ratio of the maximum concentration to its respective screening level) exceeded 1.0, adverse impacts were considered possible, and the chemical was retained as an ecological COPC. An HQ greater than 1.0 is an indication that ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially because most guidelines are conservatively derived.

The initial ecological risk screening determined that the maximum detected concentrations of SVOCs, pesticides, PAHs, PCBs, pesticides, and several inorganics exceed U.S. EPA Region 4 ESVs. Chemical concentrations greater than these screening values indicate that risks may be present to lower-level ecological receptors (e.g., plants and worms) via direct contact and ingestion of site media or uptake of site chemicals by plants. These chemicals were subsequently retained as ecological COPCs. In addition, several other chemicals were identified as ecological COPCs because of the lack of screening criteria. Table 2-10 presents the chemicals selected as ecological COPCs during this initial screening. The results of the initial ecological COPC screening process are summarized as follows and indicate that risks are present to terrestrial and aquatic plants, soil invertebrates, and benthic receptors.

Receptor	Risk Estimates	Exposure Route
Terrestrial and Aquatic Plants, Soil Invertebrates, Benthic Receptors	U.S. EPA Region 4 Screening Levels; HQs for surface soil (max = 498), sediment (max = 66.7), sediment waste (max = 60,000), groundwater (max = 2.8), and surface water (max = 1.4)	Direct contact with sediment, prey, surface water, and soil; ingestion of sediment, prey, surface water, soil, and food; and uptake by plants.

Actions taken to this point constitute those performed as part Steps 1 and 2 of the ERA process. In Steps 1 and 2, conservative assumptions are used to evaluate site data to determine whether additional assessment or accelerated cleanup may be warranted or to conclude that the site poses negligible ecological risks. Because maximum concentrations of several analytes at Site 12 exceeded conservative ESVs, Step 3a of the risk assessment process was performed.

In Step 3a, modeling of contaminant exposure via the food chain was performed to investigate potential risks to representative receptors. All ecological COPCs identified in surface water, sediment, and surface soil were used in the food-chain modeling. Contaminant intake from the ingestion of food and water and from incidental ingestion of soil or sediment was estimated, and the resulting intake values were divided by NOAELs and lowest-observed-adverse-effects levels (LOAELs) to obtain food-chain HQs. The food-chain modeling evaluated 11 upper-food-chain representative receptors. Terrestrial receptors consisted of the short-tailed shrew, cotton mouse, American robin, red-tailed hawk, red fox, and American woodcock. Aquatic receptors consisted of the mink, green heron, mummichog, red drum, and osprey. Using maximum concentrations, modeling determined that concentrations of the following chemicals posed potential risks (i.e., NOAEL HQs greater than 1.0) to the receptors listed below. Bolded receptors have NOAEL HQs greater than 1.0 when average concentrations are used.

Chemical	Receptor
bis(2-ethylhexyl)phthalate	**heron**, osprey
4,4'-DDE	robin, hawk, **woodcock, mink, heron, osprey**
4,4'-DDT	**heron, osprey**
endrin	**mink, heron, osprey**
Aroclor-1254	**mink, heron, osprey**
aluminum	**shrew, mouse, robin, fox, woodcock**, **mink, heron, osprey**
antimony	**shrew**, mouse, **mink**
arsenic	**shrew**, mouse, robin, fox, woodcock, **mink, heron, mummichog, red drum, osprey**
barium	**shrew**, woodcock, robin, **mink**
cadmium	**shrew**, robin, hawk, fox, **woodcock**, mink
chromium	robin, woodcock, **mink, heron, mummichog, red drum, osprey**
cobalt	shrew, robin, woodcock, **mink, heron, osprey**
copper	shrew, robin, woodcock, **mink, heron, osprey**
iron	**shrew, mouse, robin, hawk, fox, woodcock**, **mink, heron, osprey**
lead	**shrew**, mouse, **robin**, fox, **woodcock**, **mink, heron, osprey**
mercury	**shrew, mouse, robin, woodcock**, **mink, heron**, mummichog, **osprey**
nickel	mink, heron, osprey
selenium	**mink**, heron, osprey
thallium	**mink,** heron, osprey
vanadium	**shrew**, **mink**, heron, osprey
zinc	shrew, **robin**, **hawk**, fox, **woodcock**, **mink, heron, osprey**

These results indicated that risks were present to terrestrial (land-based) animals via direct contact with sediment, surface water, and soil and via ingestion of soil, sediment, surface water, and prey. Additionally, risks were present for aquatic (water-based) animals via direct contact with sediment and

surface water and via ingestion of sediment, surface water, and prey. A summary of the maximum HQs for each receptor is as follows:

Receptor	Risk Estimates	Exposure Route
Aquatic Food-Chain Receptors – Maximum Concentrations	Food-Chain Modeling Maximum HQs:	Direct contact with sediment and surface water; ingestion of sediment, prey, and surface water
- Mink	6,008 (aluminum)	
- Heron	91 (aluminum)	
- Mummichog	225 (total chromium)	
- Red Drum	75 (total chromium)	
- Osprey	101 (total chromium)	
Terrestrial Food-Chain Receptors – Maximum Concentrations	Food Chain Modeling Maximum HQs:	Direct contact with sediment, surface water, and soil; ingestion of sediment, prey, surface water, soil, and food
- Shrew	303 (aluminum)	
- Mouse	553 (iron)	
- Robin	593 (iron)	
- Hawk	52 (zinc)	
- Fox	65 (zinc)	
- Woodcock	256 (lead)	

Also in Step 3a, chemicals identified as COPCs in Step 2 underwent a refinement process that involved the consideration of factors such as the following:

- Toxicological evaluation of COPCs
- Frequency of detection of COPCs
- Spatial analysis of COPCs
- Comparisons of COPCs to alternative guidelines
- Background data (for inorganics)
- Magnitude of screening-level HQs and food-chain modeling HQs

Based on consideration of these factors, each COPC was either retained or dropped from consideration. As a result of this Step 3a assessment, the following chemicals were identified as ecological COCs for soil, sediment, and sediment waste:

Surface Soil – total PAHs, 4,4'-DDE, antimony, arsenic, cadmium, chromium, copper, lead, iron, manganese, mercury, nickel, and zinc

Sediment – bis(2-ethylhexyl) phthalate, 4,4'-DDT, gamma chlordane, antimony, arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc

Sediment Waste – bis(2-ethylhexyl)phthalate, 4,4'-DDE, 4,4'-DDT, dieldrin, endrin, antimony, arsenic, cadmium, copper, chromium, lead, silver, nickel, and zinc

2.7 RESPONSE ACTION

The response action selected in this ROD is necessary to protect the public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from this site that may present an imminent and substantial endangerment to public health or welfare. In the development of the response action, remedial action objectives (RAOs) were initially generated. Next, remedial alternatives were derived for the purposes of determining how best to achieve those RAOs as well as comply with all federal and state Applicable or Relevant and Appropriate Requirements (ARARs). Lastly, those remedial alternatives were evaluated and compared so that the most appropriate alternative could be selected. This process is discussed in the following sections.

2.7.1 Remedial Action Objectives

Based on the results of the RI/RFI as well as additional analysis of groundwater data, the following RAOs were developed for protection of human health and the environment at Site 12:

- Eliminate contact with debris and impacted surface soils by human and ecological receptors.

- Eliminate the migration of COCs from the source material (debris and impacted soils) to downgradient media (i.e., sediment, surface water, and groundwater).

- Eliminate human exposure (i.e., direct exposure to construction workers, adolescent trespassers, adolescent recreational users, adult recreational users, child residents, adult residents, and lifelong residents) to COCs in sediment and sediment waste at concentrations in excess of remedial goals. Remedial goals take into consideration an ILCR of 1.0E-06 for individual COCs. Additionally, remedial goals take into consideration an HQ of 1.0 where noncarcinogenic effects would be expected. Elimination of COCs in sediment will also address human health concerns identified from chemicals detected in surface water.

- Eliminate exposure of ecological receptors to COCs in sediment/sediment waste at concentrations greater than remedial goals. The sediment remedial goals take into account direct contact with COCs by macroinvertebrates and are expected to be protective of upper-food-chain receptors. Remedial goals address risks where "low effects" may be anticipated by ecological receptors and consider site background concentrations.

- Eliminate human exposure to COCs in groundwater.

Media-specific remediation goals (i.e., cleanup or remediation levels) as required by 40 CFR 300.435(f)(5)(iii)(A) and described in 40 CFR 300.430(e)(2)(i) were established and monitored. These remediation levels are provided in Tables 2-11 and 2-12. The remediation levels initially identified during the FS are considered final clean up levels for this action. Remediation goals were developed to account for background concentrations. Sediment and soil remediation goals for the protection of ecological receptors were selected from Region 4 ESVs and background concentrations. This approach was taken in lieu of doing a more detailed ecological risk assessment. Even though the selected remedial goals are based primarily on effects screening values, the selected values are also protective of potential higher-level consumers.

2.7.2 Description of Remedial Alternatives

Due to the potential for exposed waste and contaminated soil to migrate to the surface waters and sediment adjacent to the landfill, and based on the RAOs, remedial alternatives were developed and evaluated in the FS/CMS. These remedial alternatives are as follows.

Alternative 1 – No Action. Evaluation of the no-action alternative is required by law as a basis for comparison with other alternatives. No remedial action would be taken to eliminate risks to human health and the environment. Concentrations of contaminants may eventually be reduced to clean-up levels through natural attenuation processes, but no monitoring would be performed to quantify this reduction. As existing soil erosion continues, contaminant levels might have actually increased in surrounding surface water and sediment. Transport of contaminants to groundwater would also continue. Mechanisms would not be in place to determine whether the alternative would comply with ARARs or achieve RAOs.

Alternative 2a – Monitored Natural Recovery of PAH-Contaminated Soil and Excavation/ Consolidation/Capping of Contaminated Sediment and Waste Materials/Land Use Controls and Monitoring. Alternative 2a consists of the following components:

- Monitored natural biodegradation of soil at sample locations PAI-10-SS-08 and PAI-012-03 (37), which had concentrations of PAHs greater than the remedial goals for the protection of human and ecological receptors.

- Excavation of sediment at sample location PAI-10-SD-08, which had concentrations of inorganic chemicals greater than the remedial goals for human and ecological receptors and consolidation of the excavated sediment within the limits of a proposed cap system.

- Excavation of waste materials, soil, and sediment from the debris piles and consolidation of the material within the limits of the cap system.

- Installation and maintenance of a low-permeability cap system over the consolidated and regraded waste materials, soil, and sediment.

- Use of slope stabilization and erosion controls.

- Excavation and off-site disposal of oversized materials from the three waste debris piles.

- Restoration of debris pile areas and sample locations where excavation was performed according to the restoration plan developed during the remedial design.

- Implementation of land use controls within the limits of the cap and the areas of soil contaminated with PAHs.

- Long-term monitoring of the groundwater and the PAH-contaminated soil.

Alternative 2b – Enhanced Biodegradation of PAH-Contaminated Soil and Excavation/ Consolidation/Capping of Contaminated Sediment and Waste Materials/Land Use Controls and Monitoring. Alternative 2b consists of the following components:

- Enhanced biodegradation of the soil at sample locations PAI-10-SS-08 and PAI-012-03 (37), which had concentrations of PAHs greater than the remedial goals for the protection of human and ecological receptors.

- Excavation of sediment at sample location PAI-10-SD-08, which had concentrations of inorganic chemicals greater than the remedial goals for human and ecological receptors and consolidation of the excavated sediment within the limits of a proposed cap system.

- Excavation of waste materials, soil, and sediment from the debris piles and consolidation of the material within the limits of the cap system.

- Installation and maintenance of a low-permeability cap system over the consolidated and regraded waste materials, soil, and sediment.

- Use of slope stabilization and erosion controls.

- Excavation and off-site disposal of oversized materials from the three waste debris piles.

- Restoration of debris pile areas and sample locations where excavation was performed according to the restoration plan developed during the remedial design.

- Implementation of land use controls within the limits of the cap and the areas of soil contaminated with PAHs.

- Long-term monitoring of the groundwater and the PAH-contaminated soil.

Alternative 3 – Excavation/Consolidation/Capping of All Contaminated Sediment, Soil, and Waste Materials/Land Use Controls and Monitoring. Alternative 3 consists of the following components:

- Excavation of waste materials in all areas and impacted soil and sediment, which had concentrations of inorganic compounds, pesticides, and PAHs greater than the remedial goals for the protection of human and ecological receptors, excavation of soil contaminated with PAHs greater than remedial goals for protection of human and ecological receptors, and consolidation within the limits of a proposed cap system.

- Installation and maintenance of a low-permeability cover system over the consolidated and regraded soil, waste materials, and sediments.

- Use of slope stabilization and erosion controls.

- Removal and off-site disposal of oversized materials from the waste debris piles.

- Regrading of waste pile removal areas and wetlands restoration per the plan developed during the remedial design.

- Implementation of LUCs within the limits of the cover.

- Long-term monitoring of the groundwater.

Alternative 4 – Excavation and Off-Site Disposal of Waste Materials, Soil, and Sediment (follows unrestricted land use evaluation). Alternative 4 consists of the following components:

- Excavation of sediments with concentrations of inorganics compounds greater than the remedial goals for human and ecological receptors.

- Excavation of soil with concentrations of PAHs greater than the remedial goals for human and ecological receptors.

- Excavation of waste materials and impacted soil/sediment in the debris pile areas with concentrations greater than remedial goals for human and ecological receptors.

- Transportation and disposal of soil, sediment, and waste materials to approved off-site disposal facilities.

- Regrading of the waste pile areas and restoration of wetlands according to the restoration plan developed during the remedial design.

The Site 12 FS/CMS provides further detail regarding these alternatives (TtNUS, 2004).

Modified Alternative 4 - Excavation and Removal of All Waste Materials, Contaminated Soils, Sediments and Jericho Island Causeway and Land Use Controls for Groundwater

After the completion of the Site 12 FS, the MCRD Parris Island Partnering Team developed a new alternative, Modified Alternative 4 which was detailed in the Site 12 Proposed Plan. Building on the components of Alternative 4 (as listed above), Modified Alternative 4 added complete excavation and removal of the causeway that connected the northern end of Jericho Island to the mainland (as shown on Figure 1-2). That causeway, approximately 350 feet long, 15 feet wide, and 3 feet high, was believed to have been constructed from soils commingled with solid waste materials similar to those found on Jericho Island. Approximately 800 cubic yards of soil, sediment, and waste was proposed for removal.

As stated above in Section 1.2, after the Proposed Plan was published and public comments received, negotiations between U.S. EPA and the Navy on post-remedial action activities, in particular LUCs, delayed the agencies ability to finalize this ROD. Modified Alternative 4 was later revised further by the Team to include the determination that groundwater is unusable and therefore MCLs are not ARAR, and to include a LUC component in the form of institutional controls (ICs) to prohibit the future extraction or

use of contaminated groundwater from beneath Site 12. The comparative analysis of alternatives in the FS/CMS did not address these modifications. However, as further described in Section 2.11, the changes to the preferred alternative could be reasonably anticipated by the public since the Proposed Plan indicated that the Site 12 groundwater is not currently used as a potable water supply and is not expected to be used as such due to the groundwater's high salt content and high TDS. Also, the actual COCs in groundwater for Site 12 were determined later by the Team through additional analysis of the concentrations of chemicals originally screened during the RI/RFI.

All other activities described as part of Alternative 4 would be performed as part of Modified Alternative 4.

2.7.3 Summary of Comparative Analysis of Remedial Alternatives

The remedial alternatives under consideration for Site 12 were evaluated against the following criteria, in accordance with the NCP and U.S. EPA RI/FS guidance (1988):

1. Overall protection of human health and the environment. The purpose of this evaluation criterion is to assess whether each alternative provides adequate protection of human health and the environment. Evaluation of the overall protectiveness of an alternative focuses on whether a specific alternative achieves adequate protection and describes how site risks posed through each pathway being addressed by the FS/CMS are eliminated, reduced, or controlled.

2. Compliance with ARARs. The purpose of this criterion is to assess whether each alternative will meet any identified 'applicable' or 'relevant and appropriate' Federal or more stringent state environmental laws or regulations (i.e., ARARs) as required by CERCLA Section 121(d) or provides a basis for invoking a waiver under CERCLA Section 121(d)(4).

   Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than

Federal requirements may be relevant and appropriate. In addition, per 40 *CFR* 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (so-called To-Be-Considered [TBC] guidance category). The potential ARARs and TBCs considered by the MCRD Partnering Team in comparing the remedial alternatives are presented in the approved FS/CMS (May 2004). The actual ARARs and TBCs for the selected remedy are listed in Tables 2-13 and 2-14.

3. Long-term effectiveness and permanence. The purpose of this criterion is to ensure protection of human health and the environment in the future, as well as in the near term. In evaluating alternatives for long-term effectiveness and degree of permanence, the analysis considers the degree of threat posed by treatment residuals, adequacy and reliability of any controls used to manage wastes remaining at the site, potential impacts on human health and the environment should the remedy fail, and whether the alternative would have the flexibility to address uncontrollable changes at the site.

4. Reductions in toxicity, mobility, or volume through treatment. This criterion addresses the statutory preference for remedies that employ treatment as a principal element by ensuring that the relative performance of the various treatment alternatives in reducing toxicity, mobility, or volume will be assessed. There may be some situations (e.g., large, municipal-type landfills) where achieving substantial reductions in toxicity, mobility, or volume may not be practical or desirable.

5. Short-term effectiveness. This purpose of this criterion is to examine the short-term impacts of the alternatives on the neighboring community, the on-site workers, or the surrounding environment, including the potential threat to human health and the environment associated with excavation, treatment, and transportation of hazardous substances. The time to achieve protection of human health and the environment is also evaluated.

6. Implementability. Implementability considerations include the technical and administrative feasibility of the alternatives, as well as the availability of the goods and services on which the viability of the alternative depends.

7. Cost. Cost encompasses all capital and O&M costs incurred over the life of the project. The focus during the detailed analysis is on the net present value of these costs.

8. State acceptance. This criterion, which is an ongoing concern throughout the remediation process, reflects the statutory requirement to provide for substantial and meaningful state involvement.

9. Community acceptance. This criterion refers to the community's comments on the remedial alternatives under consideration, where "community" is broadly defined to include all interested parties.

Overall Protection of Human Health and the Environment

Modified Alternative 4 would provide the most overall protection compared to the other alternatives. Under Alternative 4 and Modified Alternative 4 waste and contaminated soil and sediment would be removed from all identified areas of concern and disposed at an appropriate off-site facility. Modified Alternative 4 and Alternative 4 do not allow for unrestricted use of the site because it was not verified that these resulted in permanent abatement of contaminants remaining on-site in shallow groundwater above levels that allow for unrestricted use and unlimited exposure. Modified Alternative 4 would be more protective than Alternative 4 because an additional 800 cubic yards of waste, soil, and sediment would be removed. In addition, LUCs (namely institutional controls) to prohibit future extraction or any use of the contaminated groundwater from beneath Site 12 would eliminate potential human exposure.

Alternative 3 would be more protective than Alternatives 2a and 2b because all surface debris and contaminated soil and sediment would be contained under a cap system.

Alternative 2a is less protective in the short term than Alternative 2b because PAHs in soil would undergo monitored natural recovery (10 to 30 years to achieve clean-up goals) which is a less aggressive approach than enhanced biodegradation (up to 5 years to achieve clean-up goals).

Alternative 1 is not protective of human health and the environment. In addition, site risks may increase as waste materials continue to erode.

Compliance with ARARs

Alternative 1 would not comply with chemical-specific ARARs.

Alternatives 2a and 2b would comply with chemical-specific ARARs in the long term; however, it may take up to 30 years to achieve PAH clean-up goals under Alternative 2a and up to 5 years to achieve PAH clean-up goals under Alternative 2b.

Alternative 3 is expected to comply with chemical-specific ARARs upon completion of remedial activities. The consolidation of all contaminated materials under a low-permeability cap system is expected to control the source of the contamination and eliminate the transport of impacted media to groundwater and surface water.

The excavation and off-site disposal of contaminated materials under Alternative 4 and Modified Alternative 4 are also expected to comply with chemical-specific ARARs upon completion of remedial activities. Under these alternatives, the transport of contaminants from soil, sediment, and waste to groundwater and surface water would be effectively eliminated.

Alternatives 2a, 2b, and 3 would attain all action-specific ARARs and waste management standards including Federal and South Carolina regulations concerning final covers for landfills; however, Alternative 1 would not meet these landfill requirements.

Alternative 4 and Modified Alternative 4 would also attain all action-specific ARARs and comply with waste management standards because the remedial design must be developed to comply with all federal and State ARARs.

Alternative 1 would not meet location-specific ARARs. Alternatives 2a, 2b, 3, and Modified Alternative 4 would attain all location-specific ARARs (generally pertaining to conservation and coastal resource protection issues).

Long-Term Effectiveness/Source Control

Alternative 1 would not be effective in the long term. Residual risks would remain attributable to potential exposure to surface debris and contaminated soil and sediment. Impacts to groundwater from contaminant source areas would continue. Alternative 1 would not include source control measures.

Alternatives 2a, 2b, and 3 would be equally effective in the long term. Under all of these containment alternatives, source control would be provided by excavating the more highly contaminated material and consolidating the material under a low-permeability cap system. The containment of the waste material would limit the infiltration of precipitation and would minimize the impact of contaminants on groundwater quality. Containment would also prevent the transport of contaminants to surface water via erosion. Although degradation of PAH concentrations in soil would be left to natural processes under Alternative 2a and promoted through active measures under Alternative 2b, attainment of the PAH remedial goals would be expected in the long term. Under Alternatives 2a, 2b, and 3, there may be some uncertainty in ensuring consistent implementation of long-term monitoring and maintenance of land use controls over the long term.

Modified Alternative 4 provides the most effective long-term remediation option and is the most effective remedy for source control. Impacted soil, sediment, and waste would be removed from all identified areas of concern including the Jericho Island causeway. Alternative 4 would be less effective than Modified Alternative 4 because waste commingled with the soil and sediment of the causeway would remain. Issues related to cap system integrity (such as cap erosion during a severe storm) would not be applicable to Alternative 4 and Modified Alternative 4.

Reduction in the Toxicity, Mobility, or Volume through Treatment

Alternatives 1, 3, and 4 would not include treatment technologies.

For the reduction of PAHs in soils, Alternative 2a would rely on monitored natural recovery and Alternative 2b would use enhanced biodegradation.

Approximately 2,700 cubic yards of waste material and sediment would be contained within the cap systems in Alternatives 2a and 2b. Approximately 4,300 cubic yards of soil, sediment, and waste materials would be contained within the cap system in Alternative 3. These alternatives would not reduce the toxicity or volume of the surface debris or soil and sediment contaminant concentrations other than that which would result from natural dispersion, dilution, or other attenuating factors.

Alternative 4 and Modified Alternative 4 would also not include treatment except as required to comply with land disposal restrictions. Under Alternative 4, approximately 4,300 cubic yards of surface debris, soil, and sediment would have been excavated and disposed at an appropriate off-site disposal facility. Similarly, 5,100 cubic yards of contaminated media would be (has now been) excavated, transported, and properly disposed of under Modified Alternative 4.

Short-Term Effectiveness

Alternative 1 would not pose environmentally significant short-term effects to the neighboring off-base community.

Under Alternatives 2a, 2b, and 3, there would be short-term effects to traffic conditions because approximately 400 truck loads of cap material would be transported on site.

Under Alternative 4, there would be short-term impacts to traffic conditions because of the 600 truckloads of waste material that would be transported from the site to an appropriate disposal facility. Similarly, 650 truckloads of material were anticipated for transport under Modified Alternative 4.

Under Alternatives 2a, 2b, 3, and 4, vegetation within the excavation areas would be removed. Also as part of these alternatives, 1.5 acres of wetlands would be affected but then restored to natural conditions. Under Modified Alternative 4, 1.6 acres of wetlands would be affected and then restored. Measures would be conducted to minimize the impact of excavation on the salt marsh. No endangered species are known to live within the boundaries of Site 12.

The RAOs may take approximately 10 to 30 years to be achieved under Alternative 2a and up to 5 years under Alternative 2b. The RAOs would be achieved in approximately 1 year under Alternatives 3 and Modified Alternative 4.

Health and safety training and proper personal protection equipment usage would minimize any potential adverse health effects to site workers during the implementation of Alternatives 2a, 2b, 3, 4, and Modified Alternative 4.

Implementability

The implementation of Alternatives 2a, 2b, 3, and 4 and Modified Alternative 4 is technically and administratively feasible. MCRD Parris Island is an active military installation; therefore, land use controls at Site 12 are readily implementable and enforceable. This evaluation criterion is not applicable to Alternative 1.

Cost

The costs of the alternatives evaluated in the FS (Alternatives 1, 2a, 2b, 3, and 4) are shown in the following table. For Alternatives 2a, 2b, and 3, costs are shown for both RCRA Subtitle C and D cover systems. The RCRA Subtitle D cover system would consist of a bottom 6-inch layer of crushed gravel, an 18-inch layer of native soil, and an upper 6-inch topsoil layer. In addition to these elements, a RCRA Subtitle C Cover system would also include a gas collection layer, a geosynthetic clay layer, and a drainage layer. A comparison of these costs indicates that Alternative 4 is the most cost-effective alternative.

	Capital Costs ($)	Operation and Maintenance Costs		30-Year Present Worth($)
		Min ($)	Max ($)	
Alternative 1	-	-	-	-
Alternative 2a				
RCRA C Cap	1,261,000	45,500	92,900	1,913,000
RCRA D Cap	1,075,000	45,500	92,900	1,728,000

	Capital Costs ($)	Operation and Maintenance Costs		30-Year Present Worth($)
		Min ($)	Max ($)	
Alternative 2b				
RCRA C Cap	1,434,000	45,500	192,900	2,180,000
RCRA D Cap	1,248,000	45,500	192,900	1,994,000
Alternative 3				
RCRA C Cap	1,580,000	45,500	91,500	2,227,000
RCRA D Cap	1,313,000	45,500	91,500	1,960,000
Alternative 4	1,450,000	-	-	1,450,000

These alternatives do not address waste material commingled within the soil and sediment of the causeway. Therefore, after completion of the Site 12 FS/CMS, Modified Alternative 4 was developed to include activities associated with the excavation of the causeway. The resulting cost for Modified Alternative 4 is as follows:

Alternative	Capital Costs ($)	O&M Costs	30-Year Present Worth($)
Modified Alternative 4	1,776,000	25,000	2,086,000

If Alternatives 2a, 2b, and 3 were modified to include excavation of the causeway and incorporation of the causeway material within a cap system, their costs would be expected to increase proportionately to the increase observed by modifying Alternative 4. As a result, Modified Alternative 4 is expected to be the most cost-effective alternative. A detailed breakdown of costs of the selected remedy is provided in Appendix B.

State Acceptance

The State of South Carolina concurs with this proposed remedy.

Community Acceptance

The NCP and U.S. EPA guidance also require that the remedial alternatives be evaluated for regulatory and public acceptance. These evaluations were addressed through the issuance of the Site 12 Proposed Plan on 4 August 2005 and the 60-day public comment period, which ended on 5 October 2005. A summary of the comments received is included in the Responsiveness Summary, Appendix A.

2.8 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that the treatment will be used to address the principal threats posed by a site wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. The source materials constituting principal threats at the site are the debris piles disposed at the site. However, the selected remedy does not satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element because treatment of wastes found at the site was deemed to be impractical and potentially more harmful to the surrounding ecology. Instead, it was determined that the removal and off-site disposal of all contaminated soils and sediments found to have exceeded site remedial goals was more appropriate and adequately protective.

2.9 SELECTED REMEDY

Summary of the Rationale for the Selected Remedy

The selected remedy is Modified Alternative 4. The components of the remedial action are illustrated in Figure 2-4. This alternative was selected because it satisfies the CERCLA and NCP's threshold criteria for overall protection of human health and the environment and for compliance with all ARARs. It satisfies four of the five NCP's primary balancing criteria including those for short and long term effectiveness, implementability and cost reasonableness. Although it will not satisfy the NCP's primary balancing criteria for the reduction of toxicity, mobility or volume through treatment, it will nonetheless be adequately protective of human health and the environment. It also satisfies the NCP's modifying criteria for State and community acceptance of the remedy. The physical construction of the remedy is complete, however the LUC remedial design must still be developed. The following paragraphs further describe the specific components of the selected remedy:

Description of the Selected Remedy

Excavate Surface Debris, Soil, and Sediment: The three surface debris piles located on Jericho Island and their underlying soil and sediment (approximately 2,300 cubic yards of material) were excavated. Additionally, approximately 1,700 cubic yards of PAH-contaminated soil in the vicinity of sample locations PAI-10-SS-08 and PAI-012-03 (37) and inorganic-contaminated sediments (approximately 370 cubic yards) in the vicinity of sediment sample PAI-10-SD-08 were removed. Lastly, the causeway connecting Jericho Island to the mainland was removed. Approximately 800 cubic yards of soil, sediment, and waste was removed as part of the causeway excavation.

Verification sampling and laboratory analysis was performed to determine whether excavation activities achieved the Clean-up Goals (CG) which are set at the Remedial Goals levels identified in Tables 2-11 and 2-12. A post-removal assessment was also performed. The ecological and human health remedial

goals were used to confirm that remaining materials did not pose a risk to receptors. The evaluation was based on both individual sample results and an overall evaluation of the remaining soil and sediment.

To allow for easier excavation, a temporary cofferdam system was installed along the southern portion of the island and along the causeway to eliminate daily flooding due to the tidal cycle. The cofferdam system was removed after all excavation activities were completed. Moreover, approximately 1.6 acres of wetlands were restored upon completion of excavation activities. All existing monitoring wells located on Jericho Island were also properly abandoned.

Transport Excavated Material to an Approved Disposal Facility: All excavated surface debris, soil, and sediment was loaded and transported to an approved off-site disposal facility. Prior to loading and transport, excavated sediment and wet surface debris was dewatered. Additionally, all excavated material was characterized to determine the appropriate disposal facility. Approximately 650 truckloads (8 cubic yards each) were required to transport this material.

Land Use Controls: Land Use Control (LUCs) consisting of certain Institutional Controls (ICs) to prohibit access to and use of shallow groundwater beneath Site 12 will be implemented to preclude unacceptable future human health risks from consumption of groundwater containing thallium, arsenic and cadmium above their respective MCLs. The location and area of Site 12 requiring LUCs (i.e., the LUC boundaries) is depicted in Figure 2-5. These LUCs will be maintained until the concentration of hazardous substances in groundwater are at such levels to allow for unrestricted use and unlimited exposure. Consistent with the RAOs developed during the RI/RFI, the specific performance objective for the LUCs to be implemented at Site 12 is as follows:

- To prohibit the extraction or any use of the groundwater beneath the Site.

The following generally describes the LUCs which will be implemented at Site 12 in order to achieve the aforementioned LUC performance objective:

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's Master Plan.

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's geographical information system, (GIS).

- The Site 12 location and LUC boundaries and prohibition against groundwater extraction or use will be annotated in the installation's Environmental Management System. The environmental

management system is a centralized tool for the dissemination of information critical to making appropriate decisions regarding the management of resources, compliance with environmental regulations and ensuring that site-specific use limitations are complied with.

- The Site 12 LUCs will be included in a Depot Order currently under development governing ground disturbing activities across the facility.

- If Site 12 property is transferred or leased, then the deed and/or lease will contain conditions, restrictions or terms that prohibit the extraction or any use of the groundwater beneath Site 12.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. A LUC remedial design, as part of the Final Remedial Design or document memorializing Remedial Action Completion, (primary documents under the FFA), that addresses how this LUC will be implemented, maintained, monitored (including periodic inspections), enforced and reported on, will be prepared and submitted by the Navy per the approved Site Management Plan (SMP) schedule to EPA and SC DHEC for review and approval. Once the Final Remedial Design or document memorializing Remedial Action Completion, (including the LUC remedial design) is approved by EPA and SCDHEC, it shall supersede any Land Use Control Implementation Plan already developed for Site 12, as well as any conditions related to Site 1 LUCs in the LUC Memorandum of Agreement (also termed the Land Use Control Assurance Plan) executed between the Navy, U.S. EPA and SCDHEC.

Restoration: The surface debris piles and PAH-contaminated soil excavation areas were restored to original surface levels and were then vegetated. Areas where sediment was removed from the marsh were restored by filling with a clean sand material and re-vegetated. The area was temporarily stabilized to minimize erosion. The causeway area was reestablished as a salt marsh. Monitoring and establishment of success criteria were developed and approved as part of the remedial action workplan.

As noted above, the majority of the components of the selected remedy for Site 12 were implemented prior to finalization of this ROD. Based on EPA and SCDHEC review of a draft of this ROD, the fact that no adverse comments were received during the proposed public comment period, and certain funding availability and timing issues related to the planting season for marsh revegetation efforts, the MCRD Partnering Team decided to proceed with remedy implementation pending finalization of this document.

Summary of Estimated Remedy Costs

The capital cost for the selected remedy is One Million Seven Hundred and Seventy Six Thousand Dollars ($1.776M). The annual O&M cost is anticipated to be $25,000 for LUC implementation and

maintenance activities. Total 30-year net present worth is Two Million Eighty Six Thousand Dollars ($2.086M), assuming a discount rate of seven percent. Changes in this cost estimate occurred as a result of data collected during the engineering and construction of the remedial alternative. A detailed breakdown of estimated costs is provided in Appendix B. The cost estimate is expected to be within +50% to -30% of the actual project cost.

Expected Outcomes of the Selected Remedy

The expected outcome of the selected remedial action is that remedial action objectives will be achieved because:

- Future contact with debris piles and impacted surface soils and sediments by human and ecological receptors has been effectively eliminated.

- Future migration of COCs from removed source material to downgradient media has been effectively eliminated

- Human exposure to COCs in soil and sediment concentrations in excess of remediation goals has been effectively eliminated.

- Exposure of ecological receptors to COCs in soil and sediment concentrations in excess of remediation goals has been effectively eliminated.

- Human exposure to COCs in groundwater will be eliminated with implementation of LUCs that prohibit the extraction or any use of the groundwater.

The final cleanup levels for sediment and soil are identified in Table 2-11 and Table 2-12. Although full wetlands restoration remains to be confirmed,, the quality of the coastal marsh adjacent to the Site 12 has already been significantly improved by both causeway removal and the removal of surrounding visible trash and debris. This environment will continue to improve upon revegetation of the former causeway area.

Expected Outcomes for the Selected Remedy	
Site Scenario	Exposure controlled through excavation and offsite disposal, and institutional controls for groundwater to ensure long-term protectiveness.
Expected Outcomes	**Land:** Contact with debris piles and impacted surface soils and sediment by human and ecological receptors is effectively eliminated. Land will be unavailable for reuse because of the MCRD rifle range unrelated to contamination. **Marsh:** Human exposure to COCs in sediment concentrations in excess of remediation goals is effectively eliminated. Exposure of ecological receptors to COCs in sediment concentrations in excess of remediation goals is effectively eliminated. The marsh is available for reuse (as a marsh) following the excavation of contaminated sediments and revegetation. **Groundwater:** Groundwater will remain unsuitable for use because of elevated salinity and dissolved solids levels unrelated to contamination. **Anticipated Socio-economic and Community Revitalization Impacts:** No socio-economic or community revitalization impacts are anticipated. The site will remain as it was, undeveloped land on an otherwise active military facility. **Anticipated Environmental and Ecological Benefits:** 1.6 acres of marshland is restored.

2.10 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the lead agency (Navy) and EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment: This remedial action is protective of human health and the environment because

- Human and ecological contact with debris and contaminated soil is effectively eliminated through excavation and offsite disposal.

- The migration of COCs contained in debris and contaminated soil is effectively reduced if not eliminated.

- Human exposure to COCs in sediment is effectively eliminated via excavation and offsite disposal.

- Exposure of ecological receptors to sediment with concentrations of contaminants above remediation levels is effectively eliminated via the excavation and offsite disposal of this material.

Compliance with ARARS CERCLA Section 121(d), specifies in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site or obtain a waiver [see also 40 *Code of Federal Regulations (CFR)* 300.430(f)(1)(ii)(B)]. Applicable or relevant and appropriate requirement (ARARs) include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or worker protection requirements. In addition, per 40 *CFR* 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (so-called To-Be-Considered [TBC] guidance category.

In accordance with 40 *CFR* 300.400(g), the Navy, SCDHEC, and EPA have identified the specific ARARs and TBCs for the selected remedy. The selected remedy complies with all ARARs related to implementing the selected action. Tables 2-13 and 2-14 list the Chemical-specific, Location-specific, and Action-specific ARARs, as well as the TBCs which were considered in the implementation of the selected remedy.

The EPA "Guidelines for Ground-Water Classification" (Final Draft, December 1986) is used by EPA's Superfund Program to help make decisions on the level of cleanup necessary for groundwater at Superfund sites in view of its expectation to return usable ground-waters to their beneficial use wherever practicable [Reference NCP 40 CFR 300.430(a)(1)(iii)(F) and 55 Fed. Reg. 8732-8733 (Mar. 8, 1990)]. Cleanup standards for restoration of contaminated groundwater that is currently or potentially used for drinking water purposes generally include chemical-specific ARARs such as the maximum contaminant levels (MCLs),or non-zero MCL Goals (MCLGs) established under the Federal Safe Drinking Water Act regulations at 40 CFR Part 141 *et seq.,* or risk-based levels for contaminants not covered by a specific ARAR [Reference 40 CFR 300.430(e)(2)(i)(B)-(D)and 55 Fed. Reg. 8750-8752]. These drinking water standards usually are not appropriate for groundwater that is classified as "groundwater not a potential source of drinking water and of limited beneficial use", because it has high salinity and its Total Dissolved Solids concentration is equal to or exceeds 10,000 mg/L [Reference 55 Fed. Reg. 8732].

In accordance with these guidelines, a determination has been made that the groundwater beneath Site 12 is unsuitable for human consumption due to high salinity and TDS in excess of 13,000 mg/l. Also, the groundwater has a low degree of interconnection with drinkable or environmentally significant waters due to its very shallow location beneath a barrier island where it is tidally influenced and flows outwardly from the island towards tidal channel surface waters. Therefore, since the ground water is naturally unusable because of the characteristics mentioned above, drinking water standards are not considered ARARs for this action and the ground water will not be actively remediated. However, after removal of waste materials, as well as contaminated soils and sediments, migration of contaminants to groundwater will be effectively eliminated. As described in Section 2.9, LUCs (namely Institutional controls) prohibiting future extraction or any use of groundwater beneath Site 12 will be implemented as a part of the selected remedy to ensure protection of human health and the environment.

Cost Effectiveness: In the lead agency's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: 'A remedy shall be cost-effective if its costs are proportional to its overall effectiveness.' (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant).

Utilization of Permanent Solutions and Alternative Treatment Technologies: This action does not satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element because treatment of wastes found at the site was deemed to be impractical and potentially harmful to the surrounding marsh ecology. However, excavation and off-site disposal of contaminated wastes, soils, and sediments provides permanent risk reduction.

Preference for Treatment as a Principal Element: This action does not satisfy the statutory preference for remedies that employ treatment as a principal element because treatment of wastes found at the site was deemed to be impractical. Instead, it was determined that EPA's presumptive remedy approach calling for waste excavation and offsite disposal at smaller solid waste disposal sites was more appropriate and adequately protective.

Five-Year Review: This remedy will result in groundwater contamination remaining on site above levels that allow for unrestricted use and unlimited exposure. Therefore as required by CERCLA Section 121(c) and 40 CFR 300.430(f)(4)(iii)(C) a statutory review (CERCLA Five-Year Review) was conducted in September 2005, and will be repeated every five years to ensure that the remedy will be protective of human health and the environment. Statutory Five-Year Reviews may be discontinued when no

hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited exposure and unrestricted use.

2.11 DOCUMENTATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) and 40 CFR 300.430(f)(3)(ii)(A) requires an explanation or discussion in the ROD of significant changes and the reasons for such changes from the basic features of the remedy (with respect to scope, performance or cost) presented in the Proposed Plan. As the lead agency, the Navy, in concurrence with EPA, prepared and issued the Proposed Plan for Waste, Soil, and Sediment Remedial Action at Site 12/SWMU 10 – Jericho Island Disposal Area on 4 August 2005 (TtNUS, 2005). This Proposed Plan summarized the rationale for a final response action at Site 12 and identified Modified Alternative 4 as the preferred alternative (i.e., recommended remedy). The components of the recommended remedy are listed Section 2.3 of this ROD. As described in the Proposed Plan, the implementation of the excavation activities to remove wastes, contaminated soils and sediments (i.e., source material) was expected to also indirectly address the groundwater contamination through elimination of the migration of COCs from the source material to downgradient media (e.g. surface water and groundwater).

As stated above in Section 1.2 and 2.7.2, after the Proposed Plan was published and public comments received, negotiations between U.S. EPA and the Navy on post-remedial action activities, in particular LUCs, delayed the agencies ability to finalize this ROD. Modified Alternative 4 was later revised further by the Team to include the determination that groundwater is unusable and therefore MCLs are not ARAR, and to include a LUC component in the form of institutional controls (ICs) to prohibit the future extraction or use of contaminated groundwater from beneath Site 12. The comparative analysis of alternatives in the FS/CMS did not address these modifications. However, the changes to the recommended remedy could be reasonably anticipated by the public since the Proposed Plan indicated that the Site 12 groundwater is not currently used as a potable water supply and is not expected to be used as such due to the groundwater's high salt content and high TDS. Also, the actual COCs in groundwater for Site 12 were determined later by the Team through additional analysis of the concentrations of chemicals originally screened during the RI/RFI. The Site 12 groundwater COCs include arsenic, cadmium and thallium. Accordingly, the selected remedy as described in this ROD is different from the Modified Alternative 4 presented in the Proposed Plan because a LUC component has been deemed necessary to prevent human exposure to COCs in groundwater beneath Site 12 and because MCLs are not considered ARAR since the groundwater has been determined to be unusable. This response action may be reevaluated in the future if conditions at Site 12 indicate that an unacceptable risk to public health or the environment may exist at this site.

TABLE 2-1

SUMMARY STATISTICS - SURFACE SOIL RESULTS (1998)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Dection	Range of Positive Detects	Location of Maximum Positive Detections	Average All	Background Level	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum Detection > Background?
VOCs (mg/kg)								
2-Hexanone	1/16	0.0085	PAI-10-SS-09-01	0.0612	NA	3,100	NA	NA
4-Methyl-2-pentanone	6/16	0.0038 - 0.026	PAI-10-SS-09-01	0.0631	NA	6,300	NA	NA
Acetone	4/15	0.023 - 0.35	PAI-10-SS-11-01	0.1233	NA	7,800	NA	NA
Carbon Disulfide	1/16	0.006	PI-012-03(37)	0.0365	NA	7,800	NA	NA
Carbon Tetrachloride	1/16	0.006	PI-012-03(37)	0.0365	NA	4.9	1,000	NA
Chloroform	2/16	0.0018 - 0.0075	PAI-10-SS-11-01	0.0368	NA	100	**0.001**	NA
Chloromethane	2/16	0.0036 - 0.017	PAI-10-SS-11-01	0.0375	NA	49	NA	NA
Tetrachloroethene	1/16	0.001	PI-012-03(37)	0.0362	NA	12	0.01	NA
Toluene	9/16	0.0013 - 0.0039	PAI-10-SS-15-01A	0.0367	NA	16,000	0.05	NA
SEMIVOLATILES (mg/kg)								
2-Methylnaphthalene	1/16	0.6	PAI-10-SS-12-01-D	0.203	NA	1,600	**0.1** [a]	NA
Acenaphthene	1/16	0.44	PAI-10-SS-12-01-D	0.198	NA	4,700	20	NA
Acenaphthylene	1/16	0.58	PAI-10-SS-12-01-D	0.203	NA	2,300 [d]	**0.1** [b]	NA
Anthracene	1/16	0.024	PAI-10-SS-08-01	0.180	NA	23,000	0.1	NA
Benzo(a)anthracene	3/16	0.041 - 0.14	PAI-10-SS-08-01	0.168	NA	0.87	**0.1** [a]	NA
Benzo(a)pyrene	3/16	0.032 - 0.12	PAI-10-SS-08-01	0.167	NA	**0.087**	**0.1**	NA
Benzo(b)fluoranthene	3/16	0.033 - 0.13	PI-012-03(37)	0.172	NA	0.87	**0.1** [a]	NA
Benzo(g,h,i)perylene	2/16	0.05 - 0.055	PI-012-03(37)	0.172	NA	2,300 [d]	0.1 [a]	NA
Benzo(k)fluoranthene	2/16	0.034 - 0.11	PAI-10-SS-08-01	0.177	NA	8.7	**0.1** [a]	NA
Bis(2-Ethylhexyl)phthalate	9/16	0.03 - 0.48	PAI-10-SS-07-01	0.141	NA	46	NA	NA
Chrysene	3/16	0.047 - 0.16	PAI-10-SS-08-01	0.171	NA	87	**0.1** [a]	NA
Dibenzo(a,h)anthracene	1/16	0.034	PI-012-03(37)	0.178	NA	0.087	0.1 [a]	NA
Dimethyl Phthalate	1/16	0.18	PI-012-03(37)	0.188	NA	780,000	200	NA
Fluoranthene	3/16	0.041 - 0.28	PAI-10-SS-08-01	0.180	NA	3,100	**0.1**	NA
Fluorene	1/16	0.22	PAI-10-SS-12-01-D	0.192	NA	3,100	**0.1** [b]	NA
Indeno(1,2,3-cd)pyrene	2/11	0.064 - 0.069	PAI-10-SS-08-01	0.169	NA	0.87	0.1 [a]	NA
Naphthalene	1/16	2.7	PAI-10-SS-12-01-D	0.269	NA	1,600	**0.1**	NA
Pentachlorophenol	1/16	0.24	PAI-10-SS-12-01-D	0.381	NA	5.3	**0.002**	NA
Phenanthrene	2/16	0.069 - 0.14	PAI-10-SS-08-01	0.181	NA	2,300 [d]	**0.1**	NA
Pyrene	4/16	0.024 - 0.23	PAI-10-SS-08-01	0.166	NA	2,300	**0.1**	NA
PESTICIDES/PCBs (mg/kg)								
4,4'-DDE	1/16	0.043	PAI-10-SS-14-01	0.004	NA	1.9	**0.0025**	NA
Methoxychlor	1/16	0.07	PAI-10-SS-13-01	0.013	NA	390	0.1	NA
INORGANICS (mg/kg)								
Aluminum	16/16	822 - 5370	PAI-10-SS-14-01	3399	7270	78,000	50	No
Antimony	1/16	8	PAI-10-SS-14-01	1.376	NA	31	**3.5**	Yes
Arsenic	16/16	0.24 - 50.8	PAI-10-SS-14-01	3.87	**1.44**	**0.43**	**10**	Yes
Barium	12/16	7 - 76.4	PAI-10-SS-14-01	13.2	23.6	5,500	165	Yes
Beryllium	5/16	0.08 - 0.18	PAI-10-SS-12-01	0.078	0.095	160	1.1	Yes
Cadmium	2/16	0.06 - 3.2	PAI-10-SS-14-01	0.294	NA	39	**1.6**	Yes

TABLE 2-1

SUMMARY STATISTICS - SURFACE SOIL RESULTS (1998)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Dection	Range of Positive Detects	Location of Maximum Positive Detections	Average All	Background Level	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum Detection > Background?
Calcium	16/16	33.9 - 2780	PAI-10-SS-14-01	308	766	NA	NA	Yes
Chromium	16/16	1.8 - 18.1	PAI-10-SS-14-01	4.16	6.23	120,000 [e]	**10** [c]	Yes
Cobalt	6/16	0.47 - 6.6	PAI-10-SS-14-01	0.722	0.363	4,700	20	Yes
Copper	8/16	0.55 - 189	PAI-10-SS-14-01	13.2	1.52	3,100	**40**	Yes
Iron	16/16	485 - 99700	PAI-10-SS-14-01	8124	**3920**	**23,000**	**200**	Yes
Lead	16/16	4.4 - 1100	PAI-10-SS-14-01	78.6	12.5	**400** [f]	**50**	Yes
Magnesium	16/16	123 - 3240	PAI-10-SS-14-01	432	515	NA	NA	Yes
Manganese	10/16	10.6 - 522	PAI-10-SS-14-01	66.2	**129**	1,600	**100**	Yes
Mercury	11/16	0.02 - 0.89	PAI-10-SS-14-01	0.089	**0.110**	23 [g]	**0.1**	Yes
Nickel	16/16	0.61 - 26.5	PAI-10-SS-14-01	2.68	1.80	1,600	30	Yes
Potassium	16/16	57.8 - 640	PAI-10-SS-14-01	153	313	NA	NA	Yes
Selenium	5/16	0.09 - 0.12	PAI-10-SS-08-01	0.093	0.285	390	0.81	No
Sodium	7/16	27.1 - 10700	PAI-10-SS-14-01	1133	241	NA	NA	Yes
Vanadium	16/16	1.7 - 9.3	PAI-10-SS-14-01	4.52	9.50	550	2.0	No
Zinc	9/16	4.1 - 1020	PAI-10-SS-14-01	72.4	9.70	23,000	**50**	Yes
MISCELLANEOUS PARAMETERS								
Ph	10/10	4.3 - 7.7	PAI-10-SS-02-01	5.43	NA	NA	NA	NA
Total Organic Carbon	10/10	0.41 - 0.96	PAI-10-SS-07-01	0.7	NA	NA	NA	NA

Associated Samples:

PAI-10-SS-01-01	PAI-10-SS-05-01	PAI-10-SS-09-01	PAI-10-SS-13-01
PAI-10-SS-02-01	PAI-10-SS-06-01	PAI-10-SS-10-01	PAI-10-SS-14-01
PAI-10-SS-03-01	PAI-10-SS-07-01	PAI-10-SS-11-01	PAI-10-SS-15-01A
PAI-10-SS-04-01	PAI-10-SS-08-01	PAI-10-SS-12-01	PI-012-03(37)

1. U.S. EPA Region 3 Soil Residential RBCs (April 13, 2000).
2. U.S. EPA Region 4 Ecological Screening Values.

a Benzo(a)pyrene was used as a surrogate for high molecular weight PAH compounds when an ecological screening value was not available.
b Naphthalene was used as a surrogate for low molecular weight PAH compounds when an ecological screening value was not available.
c ESV for total chromium. Hexavalent chromium not detected.
d Value for pyrene.
e Value for trivalent chromium, hexavalent chromium was not detected in surface soil.
f Office of Solid Waste and Emergency Response (OSWER) screening level.
g Value for mercuric chloride.

NA = Not Applicable.
PAH = polynuclear aromatic hydrocarbon
Bold values indicate that the screening level has been exceeded. If a background value is greater than a screening level that has been exceeded, the background value is also bolded.

TABLE 2-2

SURFACE SOIL RESULTS (2001)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	PAI-10-SS-08-02 2001	PAI-10-SS-12-02 2001	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]
2-METHYLNAPHTHALENE	9 J	ND	1,600,000	100[a]
ACENAPHTHENE	30	ND	4,700,000	20,000
ACENAPHTHYLENE	32	ND	2,300,000[b]	100[c]
ANTHRACENE	350 J	ND	23,000,000	100
BENZO(A)ANTHRACENE	3,100	33	870	100[a]
BENZO(A)PYRENE	1,700	33	87	100
BENZO(B)FLUORANTHENE	2,900	53	870	100[a]
BENZO(G,H,I)PERYLENE	1,200	16 J	2,300,000[b]	100[a]
BENZO(K)FLUORANTHENE	1,400	15 J	8,700	100[a]
CHRYSENE	1,800	27	87,000	100[a]
DIBENZO(A,H)ANTHRACENE	840 J	ND	87	100[a]
FLUORANTHENE	4,000	39	3,100,000	100
FLUORENE	17 J	ND	3,100,000	100[c]
INDENO(1,2,3-CD)PYRENE	1,300	22	870	100[a]
NAPHTHALENE	10 J	ND	1,600,000	100
PHENANTHRENE	1,600	16 J	2,300,000[b]	100
PYRENE	3,400	40	2,300,000	100
B(a)P EQUIVALENTS [d]	3,286	47	434[d]	NA
TOTAL PAH CONC. [d]	16,888	203	NA	1,000

1. U.S. EPA Region 3 Soil Residential RBCs (April 13, 2000).
2. U.S. EPA Region 4 Ecological Screening Levels.

a Benzo(a)pyrene was used as a surrogate for high molecular weight PAH compounds when an ecological screening value was not available.

b Naphthalene was used as a surrogate for low molecular weight PAH compounds when an ecological screening value was not available.

c Value for pyrene.

d Seven times the Region 9 PRG for benzo(a)pyrene.

TABLE 2-3

SUMMARY STATISTICS - GROUNDWATER (FILTERED RESULTS)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average All	Back-ground	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]
Inorganics (ug/L)								
Aluminum	2/13	299 - 391	22 - 113	PAI-10-GW-06-01-F	67.4	NA	NA	NA
Arsenic	14/14	0.775 - 35.9	NA	PAI-10-GW-02-01-F	10.6	NA	NA	36
Barium	14/14	55.3 - 366	NA	PAI-10-GW-14-01-F	147	NA	NA	NA
Calcium	13/13	22650 - 520000	NA	PAI-10-GW-10-01-F	258088	NA	NA	NA
Cadmium	4/14	3 - 9.2	2	PAI-10-GW-12-01-F	2.52	NA	NA	9.3
Chromium	6/14	4.95 - 17.3	6.4 - 64	PAI-10-GW-10-01-F	9.13	NA	NA	103
Cobalt	2/14	13.7 - 15.5	3.3	PAI-10-GW-08-01-F	3.50	NA	NA	NA
Copper	1/14	2.8	2.6	PAI-10-GW-06-01-F	1.41	NA	NA	2.9
Iron	13/13	2700 - 124000	NA	PAI-10-GW-05-01-F	47562	NA	NA	NA
Magnesium	13/13	18850 - 1100000	NA	PAI-10-GW-14-01-F	527012	NA	NA	NA
Manganese	13/13	44.4 - 1530	NA	PAI-10-GW-06-01-F	615	NA	NA	NA
Nickel	3/14	4.05 - 9.8	4.4	PAI-10-GW-08-01-F	3.40	NA	NA	**8.3**
Potassium	13/13	4360 - 371000	NA	PAI-10-GW-13-01-F	148768	NA	NA	NA
Selenium	1/14	25.8	0.7 - 17.5	PAI-10-GW-12-01-F	4.15	NA	NA	71
Sodium	13/13	146000 - 8640000	NA	PAI-10-GW-14-01-F	3944154	NA	NA	NA
Vanadium	12/14	2.7 - 11.7	2.6	PAI-10-GW-14-01-F	6.52	NA	NA	NA
Zinc	7/14	5.9 - 81.6	5.3 - 20.2	PAI-10-GW-06-01-F	20.6	NA	NA	86

Associated Samples:

PAI-10-GW-01-01-F	PAI-10-GW-05-01-F	PAI-10-GW-09-01-F	PAI-10-GW-13-01-F
PAI-10-GW-02-01-F	PAI-10-GW-06-01-F	PAI-10-GW-10-01-F	PAI-10-GW-14-01-F
PAI-10-GW-03-01-F	PAI-10-GW-07-01-F	PAI-10-GW-11-01-F	
PAI-10-GW-04-01-F	PAI-10-GW-08-01-F	PAI-10-GW-12-01-F	

1. U.S. EPA Region 3 Tapwater RBCs (April 13, 2000). Total inorganic results are screened against human health criteria.
2. U.S. EPA Region 4 Ecological Screening Values (saltwater).

NA = Not applicable.
Bold values indicate the screening level has been exceeded.

TABLE 2-3

SUMMARY STATISTICS - GROUNDWATER (FILTERED RESULTS)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average All	Back-ground	Human Health Screening Criteria (1)	Ecological Screening Criteria (2)
Inorganics (ug/L)								
Aluminum	2/13	299 - 391	22 - 113	PAI-10-GW-06-01-F	67.4	NA	NA	NA
Arsenic	14/14	0.775 - 35.9	NA	PAI-10-GW-02-01-F	10.6	NA	NA	36
Barium	14/14	55.3 - 366	NA	PAI-10-GW-14-01-F	147	NA	NA	NA
Calcium	13/13	22650 - 520000	NA	PAI-10-GW-10-01-F	258088	NA	NA	NA
Cadmium	4/14	3 - 9.2	2	PAI-10-GW-12-01-F	2.52	NA	NA	9.3
Chromium	6/14	4.95 - 17.3	6.4 - 64	PAI-10-GW-10-01-F	9.13	NA	NA	103
Cobalt	2/14	13.7 - 15.5	3.3	PAI-10-GW-08-01-F	3.50	NA	NA	NA
Copper	1/14	2.8	2.6	PAI-10-GW-06-01-F	1.41	NA	NA	2.9
Iron	13/13	2700 - 124000	NA	PAI-10-GW-05-01-F	47562	NA	NA	NA
Magnesium	13/13	18850 - 1100000	NA	PAI-10-GW-14-01-F	527012	NA	NA	NA
Manganese	13/13	44.4 - 1530	NA	PAI-10-GW-06-01-F	615	NA	NA	NA
Nickel	3/14	4.05 - 9.8	4.4	PAI-10-GW-08-01-F	3.40	NA	NA	**8.3**
Potassium	13/13	4360 - 371000	NA	PAI-10-GW-13-01-F	148768	NA	NA	NA
Selenium	1/14	25.8	0.7 - 17.5	PAI-10-GW-12-01-F	4.15	NA	NA	71
Sodium	13/13	146000 - 8640000	NA	PAI-10-GW-14-01-F	3944154	NA	NA	NA
Vanadium	12/14	2.7 - 11.7	2.6	PAI-10-GW-14-01-F	6.52	NA	NA	NA
Zinc	7/14	5.9 - 81.6	5.3 - 20.2	PAI-10-GW-06-01-F	20.6	NA	NA	86

Associated Samples:

PAI-10-GW-01-01-F	PAI-10-GW-05-01-F	PAI-10-GW-09-01-F	PAI-10-GW-13-01-F
PAI-10-GW-02-01-F	PAI-10-GW-06-01-F	PAI-10-GW-10-01-F	PAI-10-GW-14-01-F
PAI-10-GW-03-01-F	PAI-10-GW-07-01-F	PAI-10-GW-11-01-F	
PAI-10-GW-04-01-F	PAI-10-GW-08-01-F	PAI-10-GW-12-01-F	

1. U.S. EPA Region 3 Tapwater RBCs (April 13, 2000). Total inorganic results are screened against human health criteria.
2. U.S. EPA Region 4 Ecological Screening Values (saltwater).

NA = Not applicable.
Bold values indicate the screening level has been exceeded.

TABLE 2-4

SUMMARY STATISTICS - GROUNDWATER (TOTAL RESULTS)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average All	Back-ground	Human Health Screening Criteria [1]	Ecological Screening Criteria[2]
Volatiles (ug/L)								
Acetone	4/10	9.3 - 650	5 - 50	PAI-10-GW-08-01	159	NA	**610**	NA
Carbon Disulfide	7/14	0.2 - 24	1 - 10	PAI-10-GW-10-01	2.95	NA	1,000	NA
Chloroform	4/14	0.4 - 4.5	1 - 10	PAI-10-GW-04-01	1.49	NA	**0.15**	815
Chloromethane	2/14	0.2 - 0.3	1 - 10	PAI-10-GW-10-01	1.11	NA	2.1	2700
Toluene	1/14	0.2	1 - 10	PAI-10-GW-04-01	1.12	NA	750	37
Trichloroethene	1/14	0.4	1 - 10	PAI-10-GW-04-01	1.14	NA	1.6	NA
Semivolatiles (ug/L)								
Benzoic Acid	1/12	1	25 - 26	PAI-10-GW-01-01	11.6	NA	150,000	NA
Di-n-butyl phthalate	1/14	1	5	PAI-10-GW-10-01	2.39	NA	3,700	3.4
Inorganics (ug/L)								
Aluminum	6/13	532 - 5140	22 - 168	PAI-10-GW-03-01	1030	NA	37,000	NA
Arsenic	12/14	1.075 - 35.4	0.9	PAI-10-GW-02-01	10.6	NA	**0.045**	NA
Barium	14/14	36.4 - 216	NA	PAI-10-GW-12-01	121	NA	2,600	NA
Cadmium	7/14	1.9 - 8.1	2 - 200	PAI-10-GW-12-01	9.56	NA	18	NA
Calcium	13/13	21800 - 501000	NA	PAI-10-GW-10-01	255092	NA	NA	NA
Chromium	6/14	8.1 - 23.2	6.4 - 32	PAI-10-GW-10-01	10.2	NA	55,000 [a]	NA
Cobalt	3/14	3.9 - 11.7	3.3	PAI-10-GW-08-01/ PAI-10-GW-06-01	3.25	NA	2,200	NA
Copper	2/14	2.7 - 8.1	2.6	PAI-10-GW-06-01	1.89	NA	1,500	NA
Iron	13/13	4150 - 122000	NA	PAI-10-GW-05-01	46916	NA	**11,000**	NA
Magnesium	13/13	18600 - 1100000	NA	PAI-10-GW-14-01	517877	NA	NA	NA
Manganese	13/13	44.7 - 1530	NA	PAI-10-GW-06-01	609	NA	**730**	NA
Nickel	3/14	5.3 - 10.5	4.4	PAI-10-GW-08-01	3.37	NA	730	NA
Potassium	13/13	4370 - 371000	NA	PAI-10-GW-13-01	147198	NA	NA	NA
Selenium	1/14	7.1	0.7 - 17.5	PAI-10-GW-09-01	2.62	NA	180	NA
Sodium	13/13	146000 - 8670000	NA	PAI-10-GW-13-01	3894846	NA	NA	NA
Thallium	1/14	10	9 - 18	PAI-10-GW-06-01	5.21	NA	**2.6**	NA
Vanadium	12/14	3.7 - 14.2	2.6	PAI-10-GW-09-01	7.88	NA	260	NA
Zinc	5/14	7.5 - 82.8	7.9 - 19.5	PAI-10-GW-06-01	13.9	NA	11,000	NA

Associated Samples:

PAI-10-GW-01-01	PAI-10-GW-05-01	PAI-10-GW-09-01	PAI-10-GW-13-01
PAI-10-GW-02-01	PAI-10-GW-06-01	PAI-10-GW-10-01	PAI-10-GW-14-01
PAI-10-GW-03-01	PAI-10-GW-07-01	PAI-10-GW-11-01	
PAI-10-GW-04-01	PAI-10-GW-08-01	PAI-10-GW-12-01	

1. U.S. EPA Region 3 Tapwater RBCs (April 13, 2000).
2. U.S. EPA Region 4 Ecological Screening Values (saltwater). Filtered inorganic results are screened against ecological criteria.

a Value for trivalent chromium. Hexavalent chromium was not detected in groundwater.

NA = Not applicable.
Bold values indicate that the screening level has been exceeded. If a background value is greater than a screening level that has been exceeded, the background value is also bolded.

TABLE 2-5

SUMMARY STATISTICS - SURFACE WATER RESULTS
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Dection	Range of Positive Detects	Location of Maximum Positive Detections	Average All	Background Level	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum Detection > Background?
Volatiles (ug/L)								
2-Butanone	2/2	2.1 - 2.6	PAI-10-SW-03-00	2.35	NA	1,900 (a)	NA	NA
Acetone	1/3	13	PAI-10-SW-13-00	7.70	NA	610 (a)	NA	NA
Carbon Disulfide	5/13	0.2 - 1 .	PAI-10-SW-02-00	0.477	NA	1000 (a)	NA	NA
Semivolatiles (ug/L)								
Bis(2-Ethylhexyl)phthalate	2/13	1 - 10.25	PAI-10-SW-08-00-AVG	2.98	NA	**1.8**	NA	NA
Butylbenzyl Phthalate	5/13	1 - 2	PAI-10-SW-04-00	2.00	NA	3000	29.4	NA
Phenol	1/13	7	PAI-10-SW-04-00	2.85	NA	21000	58	NA
Inorganics (ug/L) - Unfiltered								
Aluminum	13/13	499 - 12900	PAI-10-SW-04-00	2692	3113	37,000 (a)	NA	YES
Arsenic	13/13	2.4 - 9	PAI-10-SW-01-00	5.41	**5.13**	**0.018**	NA	YES
Barium	13/13	20.1 - 34.8	PAI-10-SW-04-00	25.6	38.4	2,600 (a)	NA	NO
Calcium	13/13	238000 - 374000	PAI-10-SW-03-00	338500	637000	NA	NA	NO
Chromium	13/13	9.5 - 32.1	PAI-10-SW-04-00	17.4	22.5	55,000 (a,b)	NA	YES
Iron	13/13	292 - 7890	PAI-10-SW-04-00	1683	**2091**	**300**	NA	YES
Magnesium	13/13	726000 - 1120000	PAI-10-SW-03-00	997615	1918667	NA	NA	NO
Manganese	13/13	30.3 - 214	PAI-10-SW-05-00	139	**53.1**	**50**	NA	YES
Potassium	13/13	264000 - 406000	PAI-10-SW-03-00	362154	831333	NA	NA	NO
Selenium	2/13	14.675 - 18	PAI-10-SW-11-00	6.16	NA	170	NA	NA
Sodium	13/13	6570000 - 10200000	PAI-10-SW-03-00	8493462	16226667	NA	NA	NO
Vanadium	12/13	13.4 - 33.9	PAI-10-SW-04-00	18.0	18.2	260 (a)	NA	YES
Inorganics (ug/L) - Filtered								
Arsenic	13/13	2.2 - 7.9	PAI-10-SW-03-00-F	5.02	4.30	NA	36	YES
Barium	13/13	17.3 - 253	PAI-10-SW-12-00-F	131.41	256.0	NA	NA	NO
Calcium	13/13	248000 - 383000	PAI-10-SW-03-00-F	340643	650000	NA	NA	NO
Chromium	13/13	8 - 22.8	PAI-10-SW-06-00-F	14.87	20.0	NA	103	YES
Magnesium	13/13	743000 - 1110000	PAI-10-SW-03-00-F	1004571	1900000	NA	NA	NO
Manganese	13/13	23.2 - 211	PAI-10-SW-02-00-F, PAI-10-SW-01-00-F	133	18.0	NA	NA	YES
Potassium	13/13	269000 - 405000	PAI-10-SW-03-00-F	363286	890000	NA	NA	NO
Sodium	13/13	6750000 - 10200000	PAI-10-SW-03-00-F	8445000	15900000	NA	NA	NO
Thallium	2/13	14 - 30.1	PAI-10-SW-11-00-F	5.63	NA	NA	**21.3**	YES
Vanadium	12/13	10.1 - 23	PAI-10-SW-03-00-F	14.5	15.0	NA	NA	YES
Zinc	6/13	61.4 - 84.7	PAI-10-SW-09-00-F	38.2	66.0	NA	86	YES

Associated Samples:

PAI-10-SW-01	PAI-10-SW-05	PAI-10-SW-09	PAI-10-SW-13
PAI-10-SW-02	PAI-10-SW-06	PAI-10-SW-10	PAI-10-SW-14
PAI-10-SW-03	PAI-10-SW-07	PAI-10-SW-11	
PAI-10-SW-04	PAI-10-SW-08	PAI-10-SW-12	

1. Criteria as published in FR 63:68354-68364 unless otherwise noted. For inorganics, unfiltered results are screened against human health criteria.
2. U.S. EPA Region 4 Ecological Screening Values (saltwater). For inorganics, filtered results are screened against ecological criteria.

a. Water quality criteria not available EPA Region III RBC for tap water ingestion used (Cancer benchmark value = 1E-6, HI = 1.0).
b. Value for trivalent chromium; hexavalent chromium was not detected in surface water.

NA = Not applicable.
Bold values indicate that the screening level has been exceeded. If a background value is greater than a screening level that has been exceeded, the background value is also bolded.

TABLE 2-6

SUMMARY STATISTICS - SEDIMENT WASTE RESULTS (1995)
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Results	Location of Maximum Positive Result	Average of All Results	Background	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum > Background
Semivolatile Organics (mg/kg)								
Bis(2-Ethylhexyl)phthalate	1/2	10	PI-12-01(35)/PI-012-01(35)	5.20	NA	46	**0.182**[a]	NA
Di-n-octyl phthalate	1/2	0.9	PI-12-01(35)/PI-012-01(35)	0.605	NA	1600	**0.182**[a]	NA
Diethyl Phthalate	1/2	0.029	PI-12-02(36)/PI-012-02(36)	0.515	NA	63000	0.182[a]	NA
Pesticides/PCBs (mg/kg)								
4,4'-DDE	2/2	0.096 - 0.52	PI-12-01(35)/PI-012-01(35)	0.308	NA	1.9	**0.00207**	NA
4,4'-DDT	1/1	0.038	PI-12-02(36)/PI-012-02(36)	0.038	NA	1.9	**0.00119**	NA
Aroclor-1254	1/2	24	PI-12-01(35)/PI-012-01(35)	12.0	NA	**0.32**	**0.0216**	NA
Dieldrin	1/1	0.0062	PI-12-02(36)/PI-012-02(36)	0.006	NA	0.04	**0.00002**	NA
Endrin	1/2	1.2	PI-12-01(35)/PI-012-01(35)	0.602	NA	23	**0.00002**	NA
alpha-BHC	1/2	0.0031	PI-12-02(36)/PI-012-02(36)	0.013	NA	0.1	NA	NA
Inorganics (mg/kg)								
Aluminum	2/2	9580 - 11700	PI-12-02(36)/PI-012-02(36)	10640	24284	78000	NA	NO
Antimony	2/2	3.3 - 9.4	PI-12-02(36)/PI-012-02(36)	6.35	NA	31	**2**	YES
Arsenic	2/2	40.6 - 49.7	PI-12-02(36)/PI-012-02(36)	45.2	**12.2**	**0.43**	**7.24**	YES
Barium	2/2	66.8 - 73.2	PI-12-01(35)/PI-012-01(35)	70.0	28.0	550	NA	YES
Cadmium	2/2	1.8 - 4.7	PI-12-02(36)/PI-012-02(36)	3.25	0.278	39	**0.676**	YES
Calcium	2/2	4600 - 6670	PI-12-02(36)/PI-012-02(36)	5635	4002	NA	NA	YES
Chromium	2/2	37.8 - 119	PI-12-02(36)/PI-012-02(36)	78.4	35.2	120000 [b]	**52.3**	YES
Cobalt	2/2	8.2 - 22.7	PI-12-02(36)/PI-012-02(36)	15.5	2.63	4700	NA	YES
Copper	2/2	168 - 489	PI-12-02(36)/PI-012-02(36)	329	10.1	3100	**18.7**	YES
Iron	2/2	122000 - 307000	PI-12-02(36)/PI-012-02(36)	214500	21450	**23000**	NA	YES
Lead	2/2	589 - 2930	PI-12-02(36)/PI-012-02(36)	1760	20.6	**400 (c)**	**30.2**	YES
Magnesium	2/2	3990 - 6220	PI-12-02(36)/PI-012-02(36)	5105	6437	NA	NA	NO
Manganese	2/2	297 - 1480	PI-12-02(36)/PI-012-02(36)	889	186	1600	NA	YES
Nickel	2/2	41.4 - 86.9	PI-12-02(36)/PI-012-02(36)	64.2	5.95	1600	**15.9**	YES
Potassium	2/2	1470 - 2210	PI-12-02(36)/PI-012-02(36)	1840	3190	NA	NA	NO
Selenium	2/2	0.86 - 1.2	PI-12-01(35)/PI-012-01(35)	1.03	NA	390	NA	YES
Silver	2/2	1.1 - 1.2	PI-12-01(35)/PI-012-01(35)	1.15	NA	390	**0.733**	YES
Sodium	2/2	8870 - 11200	PI-12-01(35)/PI-012-01(35)	10035	19110	NA	NA	NO
Vanadium	2/2	27.6 - 44.9	PI-12-02(36)/PI-012-02(36)	36.3	49.6	550	NA	NO
Zinc	2/2	751 - 1520	PI-12-02(36)/PI-012-02(36)	1136	45.0	23000	**124**	YES

Associated Samples:
PI-012-01(35)/PAI-10-SDW-01
PI-012-02(36)/PAI-10-SDW-02

1 U.S. EPA Region 3 Soil Residential RBCs (April 13, 2000).
2 U.S. EPA Region 4 Ecological Screening Values.
a Bis(2-ethylhexyl)phthalate was used as a surrogate for other phthalates.
b Value for hexavalent chromium.
c Office of Solid Waste and Emergency Response (OSWER) screening level.

NA = Not applicable.
Bolded cells indicate that the screening level has been exceeded. If a background value is greater than a screening level that has been exceeded, the background value is also bolded.

TABLE 2-7

SUMMARY STATISTICS - SEDIMENT RESULTS (1998 AND 1999)
SITE 12/SWMU 10-JERICHO ISLAND
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

Parameter	Frequency of Dection	Range of Positive Detects	Location of Maximum Positive Detections	Average All	Background Level	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum Detection > Background?
VOLATILES (mg/kg)								
2-Butanone	2/16	0.005 - 0.020	PAI-10-SD-07-01	0.0291	NA	47,000	NA	NA
2-Hexanone	1/16	0.0044	PAI-10-SD-15-01	0.0280	NA	3,100	NA	NA
4-Methyl-2-pentanone	6/16	0.004 - 0.0537	PAI-10-SD-06-01	0.0315	NA	6,300	NA	NA
Acetone	8/16	0.025 - 0.39	PAI-10-SD-08-01	0.1503	NA	7,800	NA	NA
Carbon Disulfide	13/16	0.0019 - 0.031	PAI-10-SD-08-01	0.0183	NA	7,800	NA	NA
Toluene	8/16	0.0025 - 0.023	PAI-10-SD-08-01	0.0175	NA	16,000	NA	NA
Xylenes, Total	3/16	0.0018 - 0.0023	PAI-10-SD-04-01	0.0167	NA	160,000	NA	NA
SEMIVOLATILES (mg/kg)								
Acenaphthene	1/18	0.12	PAI-10-SD-20-01	0.0712	NA	4,700	**0.00671**	NA
Benzo(a)anthracene	1/16	0.018	PAI-10-SD-013-01A	0.00761	NA	0.87	0.0748	NA
Benzo(a)pyrene	7/16	0.011 - 0.038	PAI-10-SD-008-01A	0.0141	NA	0.087	0.0888	NA
Benzo(b)fluoranthene	2/16	0.025 - 0.120	PAI-10-SD-008-01A	0.0200	NA	0.87	**0.0888** [a]	NA
Benzo(k)fluoranthene	1/15	0.018	PAI-10-SD-013-01A	0.0078	NA	8.7	0.0888 [a]	NA
Bis(2-Ethylhexyl)phthalate	8/18	0.045 - 0.44	PAI-10-SD-07-01	0.331	NA	46	**0.182**	NA
Chrysene	1/16	0.044	PAI-10-SD-013-01A	0.00924	NA	87	0.108	NA
Di-n-octyl phthalate	1/18	0.063	PAI-10-SD-06-01	0.347	NA	1,600	0.182[b]	NA
Fluoranthene	1/16	0.092	PAI-10-SD-013-01A	0.0184	NA	3,100	0.113	NA
Indeno(1,2,3-cd)pyrene	1/16	0.026	PAI-10-SD-014-01A	0.0080	NA	0.87	NA	NA
Pentachlorophenol	1/18	0.18	PAI-10-SD-14-02	0.805	NA	5.3	NA	NA
Pyrene	1/16	0.089	PAI-10-SD-013-01A	0.0121	NA	2,300	0.153	NA
PESTICIDES/PCBs (mg/kg)								
4,4'-DDT	1/18	0.066	PAI-10-SD-14-02	0.00855	NA	1.9	**0.00119**	NA
Alpha-Chlordane	1/18	0.012	PAI-10-SD-14-02	0.00317	NA	1.8[(d)]	**0.0005**[c]	NA
Gamma-Chlordane	1/18	0.014	PAI-10-SD-14-02	0.00328	NA	1.8[(d)]	**0.0005**[c]	NA
Methoxychlor	1/18	0.68	PAI-10-SD-14-02	0.0628	NA	390	NA	NA
INORGANICS (mg/kg)								
Aluminum	18/18	1870 - 52700	PAI-10-SD-08-01	9844	24284	78,000	NA	YES
Antimony	2/18	3.5 - 6.8	PAI-10-SD-09-01	2.20	NA	31	**2**	YES
Arsenic	18/18	0.35 - 18.5	PAI-10-SD-08-01	4.65	**12.2**	**0.43**	**7.24**	YES
Barium	11/18	5.7 - 62.9	PAI-10-SD-08-01	12.09	28.0	5,500	NA	YES
Beryllium	13/18	0.21 - 2	PAI-10-SD-08-01	0.41	0.977	160	NA	YES
Cadmium	3/18	0.002 - 0.84	PAI-10-SD-14-01	0.23	0.278	39	**0.676**	YES
Calcium	18/18	338 - 5550	PAI-10-SD-13-01	1420	4002	NA	NA	YES
Chromium	18/18	3.2 - 75	PAI-10-SD-08-01	16.3	35.2	120,000[(e)]	**52.3**	YES
Cobalt	9/18	0.92 - 10.3	PAI-10-SD-14-02	2.20	2.63	4,700	NA	YES
Copper	10/18	0.03 - 113	PAI-10-SD-14-01	9.71	10.1	3,100	**18.7**	YES
Iron	18/18	1420 - 43100	PAI-10-SD-08-01	11212	21450	**23,000**	NA	YES
Lead	18/18	3.1 - 203	PAI-10-SD-14-01	22.6	20.6	400[(f)]	**30.2**	YES
Magnesium	18/18	1130 - 15100	PAI-10-SD-08-01	3127	6437	NA	NA	YES
Manganese	17/18	13.3 - 210	PAI-10-SD-08-01	49.7	186	1,600	NA	YES
Mercury	7/18	0.06 - 0.35	PAI-10-SD-14-01	0.07	0.090	23[(g)]	**0.13**	YES
Nickel	18/18	1.3 - 1060	PAI-10-SD-14-02	63.1	5.95	1,600	**15.9**	YES
Potassium	18/18	684 - 9090	PAI-10-SD-08-01	1762	3190	NA	NA	YES
Selenium	3/18	0.1 - 10.7	PAI-10-SD-20-01	1.16	NA	390	NA	YES
Sodium	18/18	3920 - 60800	PAI-10-SD-08-01	12321	19110	NA	NA	NO

TABLE 2-7

SUMMARY STATISTICS - SEDIMENT RESULTS (1998 AND 1999)
SITE 12/SWMU 10-JERICHO ISLAND
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

Parameter	Frequency of Dection	Range of Positive Detects	Location of Maximum Positive Detections	Average All	Background Level	Human Health Screening Criteria [1]	Ecological Screening Criteria [2]	Maximum Detection > Background?
Thallium	1/18	0.36	PAI-10-SD-14-02	0.72	0.405	5.5	NA	NO
Vanadium	18/18	4.9 - 112	PAI-10-SD-08-01	23.1	49.6	550	NA	YES
Zinc	12/18	8.5 - 197	PAI-10-SD-14-01	30.6	45.0	23,000	**124**	YES
MISCELLANEOUS PARAMETERS								
Ph	16/16	6.7 - 7.8	PAI-10-SD-14-02	7.41	NA	NA	NA	NA
Total Organic Carbon	16/16	0.67 - 4.7	PAI-10-SD-08-01	1.61	NA	NA	NA	NA

Associated Sample Locations:

PAI-10-SD-01-01	PAI-10-SD-05-01	PAI-10-SD-09-01	PAI-10-SD-13-01	PAI-10-SD-19-01
PAI-10-SD-02-01	PAI-10-SD-06-01	PAI-10-SD-10-01	PAI-10-SD-14-01	PAI-10-SD-20-01
PAI-10-SD-03-01	PAI-10-SD-07-01	PAI-10-SD-11-01	PAI-10-SD-14-02	
PAI-10-SD-04-01	PAI-10-SD-08-01	PAI-10-SD-12-01	PAI-10-SD-15-01	

1. U.S. EPA Region 3 Soil Residential RBCs (April 13, 2000).
2. U.S. EPA Region 4 Ecological Screening Levels.

a Benzo(a)pyrene was used as surrogate for benzo(b)fluoranthene and benzo(k)fluoranthene.
b Bis(2-ethylhexyl) phthalate was used as surrogate for di*n*-octyl phthalate.
c Chlordane was used as surrogate for alpha- and gamma-chlordane.
d Value for chlordane.
e Value for trivalent chromium; hexavalent chromium was not detected in sediment.
f OSWER screening level.
g Value for mercuric chloride.

NA = Not applicable.
Bold values indicate that the screening level has been exceeded. If a background value is greater than a screening level that has been exceeded, the background value is also bolded.

TABLE 2-8

CHEMICALS RETAINED AS HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN (COPCs)
SITE 12- JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Surface Soil	Groundwater	Surface Water	Sediment	Sediment Waste	Soil to Air	Soil to Groundwater
Volatile Organic Compounds							
Acetone		X					
Chloroform		X					
Semivolatile Organic Compounds							
Benzo(a)pyrene	X						
Bis(2-Ethylhexyl)phthalate			X				
Pesticides/PCBs							
Aroclor-1254					X		
Inorganics							
Aluminum		X	X	X			
Antimony	X			X	X		
Arsenic	X	X	X	X	X		
Cadmium		X			X		
Copper					X		
Iron	X	X	X	X	X		
Lead	X				X		
Manganese	X	X	X	X	X		
Nickel				X			
Thallium		X					
Vanadium			X	X			

Notes
X - Indicates chemical was retained as a Human Health COPC.

TABLE 2-9

SUMMARY OF CANCER RISKS AND HAZARD INDICES
SITE 12 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $>10^{-4}$	Chemicals with Cancer Risks $>10^{-5}$	Chemicals with Cancer Risks $>10^{-6}$	Cumulative HI	Chemicals with HI > 1
Construction Worker	Soil	Ingestion	2.6E-06	--	--	Arsenic	1.3	--
		Dermal Contact	8.7E-07	--	--	--	0.2	--
		Total	3.5E-06	--	--	Arsenic	1.4	--
	Groundwater	Dermal Contact	3.1E-08	--	--	--	0.1	--
	Sediment	Ingestion	7.9E-08	--	--	--	0.1	--
		Dermal Contact	2.5E-08	--	--	--	0.0	--
		Total	1.0E-07	--	--	--	0.1	--
	Surface Water	Ingestion	1.0E-08	--	--	--	0.0	--
		Dermal Contact	2.3E-08	--	--	--	0.0	--
		Total	3.4E-08	--	--	--	0.0	--
	Sediment Waste	Ingestion	6.9E-07	--	--	--	1.0	--
		Dermal Contact	1.4E-07	--	--	--	0.1	--
		Total	8.3E-07	--	--	--	1.1	--
		Total All Media	4.5E-06				2.7	
Adolescent Trespasser	Soil	Ingestion	3.0E-06	--	--	Arsenic	0.15	--
		Dermal Contact	1.8E-06	--	--	Arsenic	0.03	--
		Total	4.9E-06	--	--	Arsenic	0.18	--
	Sediment	Ingestion	5.5E-07	--	--	--	0.04	--
		Dermal Contact	3.1E-07	--	--	--	0.008	--
		Total	8.5E-07	--	--	--	0.04	--
	Surface Water	Ingestion	1.1E-07	--	--	--	0.004	--
		Dermal Contact	6.1E-07	--	--	--	0.03	--
		Total	7.2E-07	--	--	--	0.03	--
	Sediment Waste	Ingestion	4.8E-06	--	--	Aroclor-1254, Arsenic	0.69	--
		Dermal Contact	1.8E-06	--	--	Arsenic	0.08	--
		Total	6.6E-06	--	--	Aroclor-1254, Arsenic	0.76	--
		Total All Media	1.3E-05				1.0	
Adolescent Recreational User	Soil	Ingestion	3.0E-06	--	--	Arsenic	0.15	--
		Dermal Contact	1.8E-06	--	--	Arsenic	0.03	--
		Total	4.9E-06	--	--	Arsenic	0.18	--
	Sediment	Ingestion	5.5E-07	--	--	--	0.04	--
		Dermal Contact	3.1E-07	--	--	--	0.008	--
		Total	8.5E-07	--	--	--	0.04	--
	Surface Water	Ingestion	1.1E-07	--	--	--	0.004	--
		Dermal Contact	6.1E-07	--	--	--	0.03	--
		Total	7.2E-07	--	--	--	0.03	--
	Sediment Waste	Ingestion	4.8E-06	--	--	Aroclor-1254, Arsenic	0.69	--
		Dermal Contact	1.8E-06	--	--	Arsenic	0.08	--
		Total	6.6E-06	--	--	Aroclor-1254, Arsenic	0.76	--
		Total All Media	1.3E-05				1.0	
Adult Recreational User	Soil	Ingestion	1.2E-06	--	--	Arsenic	0.09	--
		Dermal Contact	1.0E-06	--	--	--	0.03	--
		Total	2.2E-06	--	--	Arsenic	0.13	--
	Sediment	Ingestion	2.1E-07	--	--	--	0.02	--
		Dermal Contact	1.8E-07	--	--	--	0.008	--
		Total	3.9E-07	--	--	--	0.03	--
	Surface Water	Ingestion	4.2E-08	--	--	--	0.002	--
		Dermal Contact	3.5E-07	--	--	--	0.03	--
		Total	3.9E-07	--	--	--	0.03	--
	Sediment Waste	Ingestion	1.9E-06	--	--	Arsenic	0.44	--
		Dermal Contact	1.0E-06	--	--	--	0.07	--
		Total	2.9E-06	--	--	Arsenic	0.51	--
		Total All Media	5.9E-06				0.70	
Child Resident	Soil	Ingestion	8.5E-05	--	Arsenic	PAHs	6.9	Arsenic, Iron
		Dermal Contact	1.3E-05	--	Arsenic	PAHs	0.41	--
		Total	9.9E-05	--	Arsenic	PAHs	7.3	Arsenic, Iron
	Groundwater	Ingestion	2.9E-04	Arsenic	--	--	42	Arsenic, Iron, Manganese, Thallium
		Dermal Contact	1.2E-06	--	--	Arsenic	0.69	--
		Inhalation	1.5E-07	--	--	--	0.38	--
		Total	2.9E-04	Arsenic	--	--	43	Arsenic, Cadmium, Iron, Manganese, Thallium
	Sediment	Ingestion	2.0E-06	--	--	Arsenic	0.21	--
		Dermal Contact	2.9E-07	--	--	--	0.01	--
		Total	2.3E-06	--	--	Arsenic	0.23	--
	Surface Water	Ingestion	2.0E-07	--	--	--	0.01	--
		Dermal Contact	5.7E-07	--	--	--	0.05	--
		Total	7.7E-07	--	--	--	0.06	--
	Sediment Waste	Ingestion	1.7E-05	--	Arsenic	Aroclor-1254	4.1	Aroclor-1254, Iron
		Dermal Contact	1.7E-06	--	--	Arsenic	0.12	--
		Total	1.9E-05	--	Arsenic	Aroclor-1254	4.2	Aroclor-1254, Iron
		Total All Media	4.1E-04				55	

TABLE 2-9

SUMMARY OF CANCER RISKS AND HAZARD INDICES
SITE 12 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5}	Chemicals with Cancer Risks >10^{-6}	Cumulative HI	Chemicals with HI > 1
Adult Resident	Soil	Ingestion	3.6E-05	--	Arsenic	--	0.74	--
		Dermal Contact	1.1E-05	--	Arsenic	--	0.09	--
		Total	4.8E-05	--	Arsenic	PAHs	0.82	--
	Groundwater	Ingestion	4.9E-04	Arsenic	--	--	71	Arsenic, Cadmium, Iron, Manganese, Thallium
		Dermal Contact	2.8E-06	--	--	Arsenic	1.6	--
		Inhalation	2.5E-07	--	--	--	0.63	--
		Total	4.9E-04	Arsenic	--	--	73	Acetone, Arsenic, Cadmium, Iron, Manganese, Thallium
	Sediment	Ingestion	8.5E-07	--	--	--	0.02	--
		Dermal Contact	2.5E-07	--	--	--	0.003	--
		Total	1.1E-06	--		Arsenic	0.03	--
	Surface Water	Ingestion	1.7E-07	--	--	--	0.002	--
		Dermal Contact	1.4E-06	--	--	Bis(2-ethylhexyl)phthalate	0.03	--
		Total	1.6E-06	--	--	Bis(2-ethylhexyl)phthalate	0.03	--
	Sediment Waste	Ingestion	7.4E-06	--	--	Aroclor-1254, Arsenic	0.44	--
		Dermal Contact	1.4E-06	--	--	Arsenic	0.03	--
		Total	8.8E-06	--	--	Aroclor-1254, Arsenic	0.47	--
		Total All Media	5.5E-04				74	
Lifelong Resident	Soil	Ingestion	1.2E-04	Arsenic	--	PAHs	NA	--
		Dermal Contact	2.5E-05	--	Arsenic	PAHs	NA	--
		Total	1.5E-04	Arsenic	--	PAHs	NA	--
	Groundwater	Ingestion	7.8E-04	Arsenic	--	--	NA	--
		Dermal Contact	4.0E-06	--	--	Arsenic	NA	--
		Inhalation	4.0E-07	--	--	--	NA	--
		Total	7.8E-04	Arsenic	--	--	NA	--
	Sediment	Ingestion	2.8E-06	--	--	Arsenic	NA	--
		Dermal Contact	5.4E-07	--	--	--	NA	--
		Total	3.4E-06	--	--	Arsenic	NA	--
	Surface Water	Ingestion	3.7E-07	--	--	--	NA	--
		Dermal Contact	2.0E-06	--	--	Bis(2-ethylhexyl)phthalate	NA	--
		Total	2.3E-06	--	--	Bis(2-ethylhexyl)phthalate	NA	--
	Sediment Waste	Ingestion	2.5E-05	--	Arsenic	Aroclor-1254	NA	--
		Dermal Contact	3.1E-06	--	--	Arsenic	NA	--
		Total	2.8E-05	--	Arsenic	Aroclor-1254	NA	--
		Total All Media	9.6E-04				NA	

- Indicates that the chemical exceeds the U.S. EPA's acceptable carcinogenic risk range of 1 in 10,000 (1.0E-04) to 1 in 1,000,000 (1.0E-06) or the U.S. EPA threshold value Hazard Index of 1.0.

TABLE 2-10

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
SITE 12 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Surface Soil	Sediment	Sediment Waste	Ground-water	Surface Water
Volatile Organic Compounds					
2-Butanone			X		X
2-Hexanone	X		X		
4-Methyl-2-pentanone	X		X		
Acetone	X		X	X	X
Carbon disulfide	X		X	X	X
Chloroform	X				
Chloromethane	X				
Toluene			X		
Trichloroethene				X	
Xylenes, Total			X		
Semivolatile Organic Compounds					
2-Methylnaphthalene	X				
Acenaphthene			X		
Acenaphthylene	X				
Benzo(a)anthracene	X				
Benzo(a)pyrene	X				
Benzo(b)fluoranthene	X		X		
Benzo(k)fluoranthene	X				
Benzoic acid				X	
Bis(2-ethylhexyl)phthalate	X	X	X		X
Chrysene	X				
Di-n-octyl phthalate		X			
Fluoranthene	X				
Fluorene	X				
Indeno(1,2,3-cd)pyrene			X		
Naphthalene	X				
Pentachlorophenol	X		X		
Phenanthrene	X				
Pyrene	X				
Total PAHs	X	X			
Pesticides/PCBs					
4,4'-DDE	X	X			
4,4'-DDT		X	X		
alpha-BHC		X			
Aroclor-1254		X			
Alpha-chlordane			X		
Gamma-chlordane			X		
Dieldrin		X			
Endrin		X			
Methoxychlor			X		
Inorganics					
Aluminum	X	X	X	X	X
Antimony	X	X	X		
Arsenic	X	X	X		
Barium		X	X	X	X
Beryllium			X		
Cadmium	X	X	X		
Chromium	X	X	X		
Cobalt		X	X	X	
Copper	X	X	X	X	
Iron	X	X	X	X	X
Lead	X	X	X		
Manganese	X	X	X	X	X
Mercury	X		X		
Nickel		X	X	X	
Selenium		X	X		
Silver	X	X			
Thallium			X		X
Vanadium	X	X	X	X	X
Zinc		X	X		

Notes
X - Indicates chemical was retained as an ecological COPC.

TABLE 2-11

SELECTION OF SURFACE SOIL REMEDIAL GOALS
FOR THE PROTECTION OF HUMAN AND ECOLOGICAL RECEPTORS
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

Surface Soil COCs	Maximum Concentration	Background/ Typical Facility Concentration [1]	Region 9 Residential Soil PRG [2]	Selected Human Health Surface Soil Remedial Goal	Region 4 ESV [3]	Selected Ecological Remedial Goal
PAHs (ug/kg)						
B(a)P Equivalents [4]	3286	NA	434[6]	434[6]	NA	NR
Total PAHs [5]	16888	NA	NA	NA	1000	1000
VOLATILES (ug/kg)						
Chloroform	7.5	NA	240	NR	1	NR
SEMIVOLATILES (ug/kg)						
Bis(2-ethylhexyl)phthalate	480	NA	35000	NR	NA	NR
Pentachlorophenol	240	NA	3000	NR	2	NR
PESTICIDES/PCBs (ug/kg)						
4,4'-DDE	43	31.6	1700	NR	2.07	31.6 [1]
INORGANICs (mg/kg)						
Antimony	8	ND	31	NR	3.5	3.5
Arsenic	50.8	1.44	0.39	1.83 [8]	10	10
Cadmium	3.2	NA	37	NR	1.6	1.6
Chromium	18.1	6.23	210	NR	10	10
Copper	189	1.52	2900	NR	40	40
Iron	99700	3920	23000	23000	200	3920 [1]
Lead	1100	12.5	400 [7]	400	50	50
Manganese	522	129	1,800	NR	100	129 [1]
Mercury	0.89	0.11	23	NR	0.1	0.1
Nickel	26.5	1.8	1600	NR	30	30
Zinc	1020	9.7	23000	NR	50	50

1 Background/typical facility concentrations taken from Site 1 RI/RFI (TtNUS, 2000). Pesticide values are typical facility concentrations.
2 U.S. EPA Region 9 PRG Residential Soil Table (U.S. EPA, 2000).
3 U.S. EPA Region 4 Ecological Screening Values (U.S. EPA, 1998).
4 B(a)P equivalents = benzo(a)anthracene (0.1) + benzo(a)pyrene (1.0) + benzo(b)fluoranthene (0.1) + benzo(k)fluoranthene (0.01) + chyrsene (0.001) + dibenzo(a,h)anthracene (1.0) + indeno(1,2,3-cd)pyrene (0.1).
5 Total PAHs = low molecular weight PAHs + high molecular weight PAHs.
* Low molecular weight = 2-methylnaphthalene + acenaphthene + acenaphthylene + anthracene + fluorene + naphthalene + phenanthrene.
* High molecular weight PAHs = benzo(a)anthracene + benzo(a)pyrene + chyrsene + dibenzo(a,h)anthracene + fluoranthene + pyrene.
* One-half of the detection limit is used for nondetected PAHs to calculate total PAHs and B(a)P equivalents.
6 Calculated as 7 x benzo(a)pyrene Region 9 PRG.
7 OSWER Soil Screening Level for Residential Landuse (U.S. EPA, 1994).
8 Remedial Goal is PRG + Background per U.S. EPA guidance.

NA = Not available.
ND = Nondetect.
NR = Not relevant.
B(a)P = Benzo(a)pyrene
ESV = ecological screening value
OSWER = Office of Solid Waste and Emergency Response
PRG = preliminary remediation goal
ug/kg= microgram per kilogram
mg/kg = milligram per kilogram

TABLE 2-12

SELECTION OF SEDIMENT REMEDIAL GOALS
FOR THE PROTECTION OF HUMAN AND ECOLOGICAL RECEPTORS
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

COCs	Maximum Concentration In Sediment	Maximum Concentration In Sediment Wastes	Background/ Typical Facility Sediment Concentration [1]	Region IX Residential Soil PRG [2]	Selected Site 12 Human Health Sediment Remedial Goals	Region IV ESV [3]	Selected Site 12 Ecological Remedial Goals
PAHs (ug/kg)							
B(a)P Equivalents [4]	113	ND	NA	434 [6]	NR	NA	NR
Total PAHs [5]	1878	ND	NA	NA	NR	1684	1684
SEMIVOLATILES (ug/kg)							
Bis(2-ethylhexyl)phthalate	440	10000	NA	35000	NR	182	182
Di-n-octyl phthalate	63	900	NA	1200000	NR	NA	NA
Pentachlorophenol	180	ND	NA	3000	NR	NA	NA
PESTICIDES/PCBs (ug/kg)							
4,4'-DDE	ND	520	31.6	1700	NR	2.07	31.6
4,4'-DDT	66	38	34.5	1700	NR	1.19	34.5
Alpha Chlordane	12	ND	13.9	1600 [7]	NR	0.5 [7]	NR
Arochor-1254	ND	24000	NA	220	220	NA	NR
Dieldrin	ND	6.2	ND	30	NR	0.02	0.02
Endrin	ND	1200	ND	18000	NR	0.02	0.02
Gamma Chlordane	14	ND	13.2	1600 [7]	NR	0.5 [7]	13.2
INORGANICs (mg/kg)							
Antimony	6.8	9.4	ND	31	NR	2	2
Arsenic	18.5	49.7	12.2	0.39	12.59 [9]	7.24	12.2
Cadmium	0.84	4.7	0.278	37	NR	0.676	0.676
Chromium	75	119	35.2	210	NR	52.3	52.3
Hexavelent Chromium	ND	NA	NA	30 [10]	NR	0.4	NR
Copper	113	489	10.1	2900	NR	18.7	18.7
Iron	43100	307000	21450	23000	23000	NA	NR
Lead	203	2930	20.6	400 [8]	400	30.2	30.2
Manganese	210	1480	186	1800	NR	NA	NR
Mercury	0.35	ND	0.09	23	NR	0.13	0.13
Nickel	1060	86.9	5.95	1600	NR	15.9	15.9
Silver	ND	1.2	ND	390	NR	0.733	0.733
Zinc	197	1520	45	23000	NR	124	124

1 Background/typical facility sediment concentrations taken from Site 1 RI/RFI (TtNUS, 2000). Pesticide values are typical facility concentrations.
2 U.S. EPA Region IX PRG Residential Soil Table (U.S. EPA, 2000).
3 U.S. EPA Region IV Ecological Screening Values (U.S. EPA, 1998).
4 B(a)P equivalents = benzo(a)anthracene (0.1) + benzo(a)pyrene (1.0) + benzo(b)fluoranthene (0.1) + benzo(k)fluoranthene (0.01) + chyrsene (0.001) + dibenzo(a,h)anthracene (1.0) + indeno(1,2,3-cd)pyrene (0.1).
5 Total PAHs = low molecular weight PAHs + high molecular weight PAHs.
* Low Molecular Weight = 2-methylnaphthalene + acenaphthene + acenaphthylene + anthracene + fluorene + naphthalene + phenanthrene.
* High Molecular Weight PAHs = benzo(a)anthracene + benzo(a)pyrene + chyrsene + dibenzo(a,h)anthracene + fluoranthene + pyrene.
* If a PAH is detected, one half of the detection limit should be used for nondetected PAHs to calculate total PAHs and B(a)P equivalents.
6 Calculated as 7 x benzo(a)pyrene Region IX PRG.
7 Based on total chlordane.
8 OSWER Soil Screening Level for Residential Landuse (U.S. EPA, 1994).
9 Remedial Goal is PRG + Background per EPA guidance.
10 Strictest value for Region IX hexavelent chromium.

NA = Not available.
ND = Nondetect.
NR = Not relevant.
B(a)P = Benzo(a)pyrene
ESV = ecological screening value
OSWER = Office of Solid Waste and Emergency Response
PRG = preliminary remediation goal
ug/kg= microgram per kilogram
mg/kg = milligram per kilogram

TABLE 2-13

FEDERAL ARARs AND TBCs
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 3

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Chemical-Specific ARARs/TBC			
U.S. EPA Health Advisories	U.S. EPA, 1996a	To be considered criteria (TBC)	Benchmark values for assessing the need for groundwater remedial action/corrective measures.
Preliminary Remediation Goals (PRGs)	U.S. EPA Region 9, 2000b	TBC	Benchmark values for assessing the need for soil, groundwater, and air remedial action/corrective measures.
Generic Soil Screening Levels	U.S. EPA, 1996b	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Dutch Soil Clean-Up Act Ecological Screening Values	Beyer, 1990	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Dutch Ministry of Housing, Spatial Planning, and Environment (MHSPE) Intervention Values and Target Values – Soil Quality Standards	MHSPE, 1994	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Oak Ridge National Laboratory Toxicity Benchmarks for Soil	Efroymson, et al., 1997a and 1997b	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines	CCME, 1997	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Ecological Risk Assessment at Military Bases	U.S. EPA Region 4, 2000a	TBC	Includes benchmark values for assessing the need for surface soils, sediment, and surface water remedial action/corrective measures.
Effects Range-Low (ER-L) and Effects Range-Median (ER-M) Levels	Long et al., 1995	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.
Probable Effects Levels (PELs) and Threshold Effects Levels (TELs)	Florida Department of Environmental Protection, 1994	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.
Location-Specific ARARs/TBC			
U.S. EPA's Groundwater Protection Strategy and Guidelines for Ground Water Classification	U.S. EPA, 1984 U.S. EPA, 1986	TBC	Surficial groundwater at Site 12 is considered Class III [Ground Water Not a Potential Source of Drinking Water] because of high salinity and TDS in excess of 13,000mg/l.

TABLE 2-13

FEDERAL ARARs AND TBCs
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 3

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
CWA Section 404 River and Harbors Act, Section 10	40 CFR 230, 33 CFR 320-330	Applicable	Prohibits the unauthorized obstruction or alteration of any U.S. navigable water. The waters within the vicinity of Site 12, most notably Archers Creek, are classified as navigable waters and therefore the Act is applicable.
Floodplain Management	Executive Order 11988	TBC	Site 12 is located within a 100-year floodplain.
Protection of Wetlands	Executive Order 11990	TBC	Site 12 is located within a saltwater marshland.
Endangered Species Act Section 7	16 United States Code (U.S.C) 1531 et seq. 50 CFR 402 et seq.	Applicable	Wood storks and alligators are known to live in the general area.
Fish and Wildlife Coordination Act	16 U.S.C 661 et seq., 33 CFR 320-330	Applicable	Ensures that remedial action/corrective measures protect nearby wetlands and protected habitats.
Coastal Zone Management Act Section 301	16 U.S.C. 1451 et seq.	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Action-Specific ARARs/TBC			
RCRA Subtitle C – Hazardous Waste Identifications and Listing Regulations	40 CFR 261	Potentially applicable	Would be used to identify a material as a hazardous waste and thus determine the applicability and relevance of RCRA C Hazardous Waste Rules.
• Standards for Hazardous Waste Generators	40 CFR 262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.
• Standards for Hazardous Waste	40 CFR 263	Potentially applicable	Applicable for site wastes determined hazardous that are transported off site.
• Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 CFR 264	Potentially applicable	These regulations would be applicable to hazardous waste removed from the site including both on-site and off-site management.
• RCRA Land Disposal Restrictions (LDR) Requirements	40 CFR 268	Potentially applicable	If off-site treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste is necessary, it would be subject to LDRs.
United States Department of Transportation Hazardous Materials Transportation Regulations	49 CFR 171-180	Applicable	These rules are applicable when hazardous materials are transported off site for laboratory analysis, treatment, or disposal.

TABLE 2-13

FEDERAL ARARs AND TBCs
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 3 OF 3

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Soil Conservation Act	16 U.S.C. 590 et seq.	Applicable	During remedial activities, implementation of soil conservation practices would be required.

TABLE 2-14

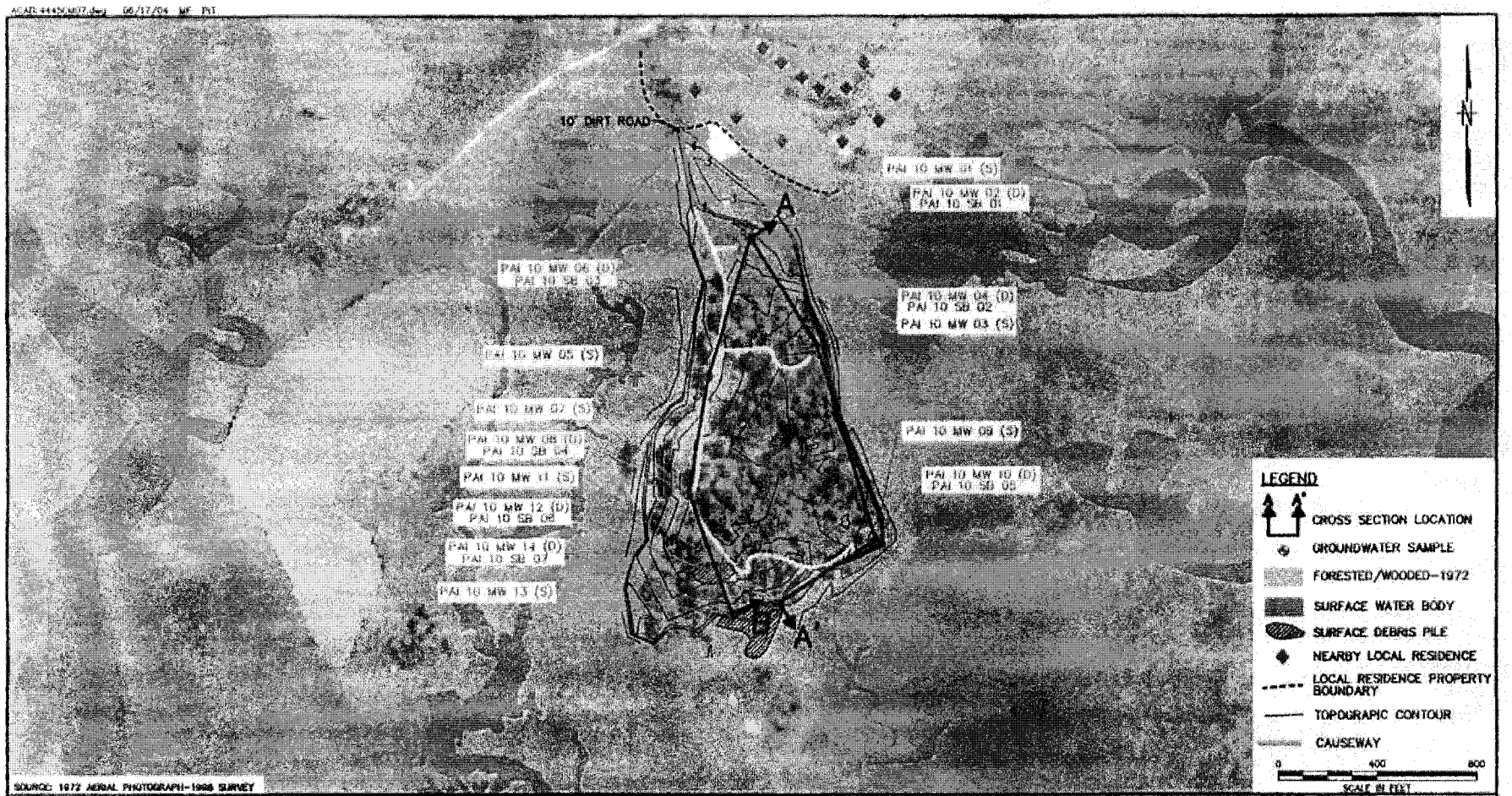
STATE OF SOUTH CAROLINA ARARs AND TBCs
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Location-Specific ARARs			
Water Classifications and Standards Classified Water	R.61-68 R.61-69	Applicable	Surficial groundwater is not an underground source of drinking water due to high salinity and total dissolved solids levels. The surface water at Site 12 is classified as SA (tidal saltwaters).
Coastal Zone Management Act	§48-39-10	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Action-Specific ARARs/TBC			
Well Standards	R.61-71	Applicable	Remedial action/corrective measures involve the abandonment of monitoring wells.
Solid Waste Management: Collection, Temporary Storage, and Transportation of Solid Waste	R.61-107.5	Potentially applicable	Applicable if solid waste is generated during remedial action/corrective measures.
Solid Waste Management: Construction, Demolition, and Land Clearing Debris Landfills	R.61-107.11	Relevant and appropriate	Construction, demolition, and land-clearing debris is commingled with other wastes.
Hazardous Waste Management Act (§44-56-30)			
• Standards for Hazardous Waste Generators	R.61-79.262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.
• Standards for Hazardous Waste Transporters	R.61-79.263	Potentially applicable	Applicable for removed site wastes determined to be hazardous that are transported off site.
• Standards for Owners and Operators of Hazardous Waste TSD Facilities	R.61-79.264	Potentially applicable	These regulations would be applicable to waste removed from the site including both on-site and off-site management.
• Land Disposal Restrictions (LDR) Requirements	R.61-79.268	Potentially applicable	If off-site treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste is necessary, it would be subject to LDRs.
Standards for Stormwater Management and Sediment Reduction	R.72-300 and R.72-405	Applicable	Applicable if remedial action/corrective measures involve land-disturbance activities.

TABLE 2-14

STATE OF SOUTH CAROLINA ARARs AND TBCs
SITE 12/SWMU 10 - JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
General Objectives and Components of Contamination Assessments and Remedial Actions	SCDHEC, 1994	To be considered criteria (TBC)	Provides guidance for conducting remedial action activities.
Soil/Groundwater Remediation Guidance Document	SCDHEC, 1992	TBC	Provides guidance for conducting groundwater and soil remediation.
Stormwater and Management and Sediment Control Handbook for Land Disturbance Activities	SCDHEC, 1997a	TBC	Guidance document to be followed if remedial action/corrective measures involve land-disturbance activities.

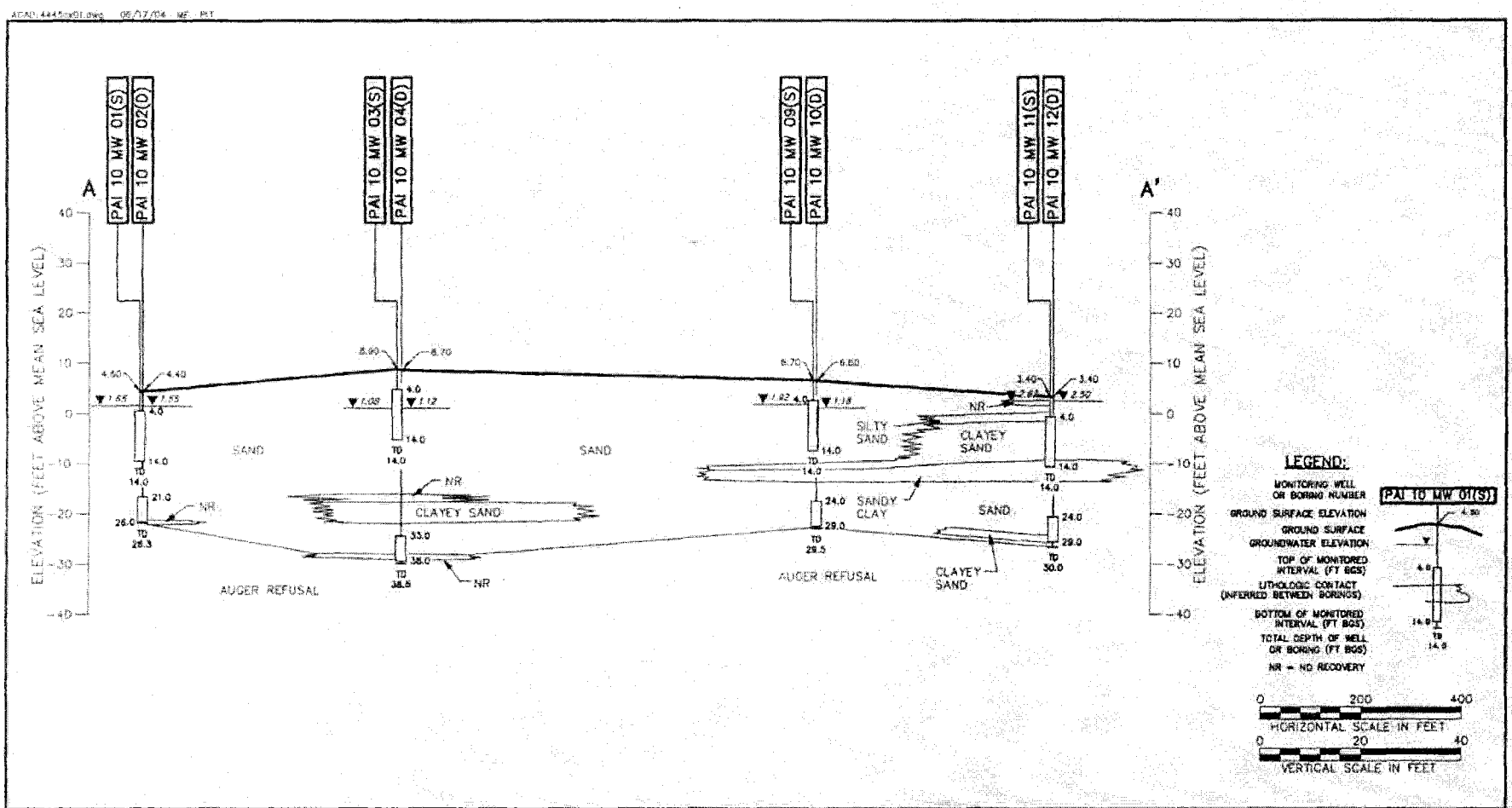


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 6/17/04
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

SOIL BORING AND MONITORING WELL LOCATION MAP
SITE 12/SWMU 10
JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 4445
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0



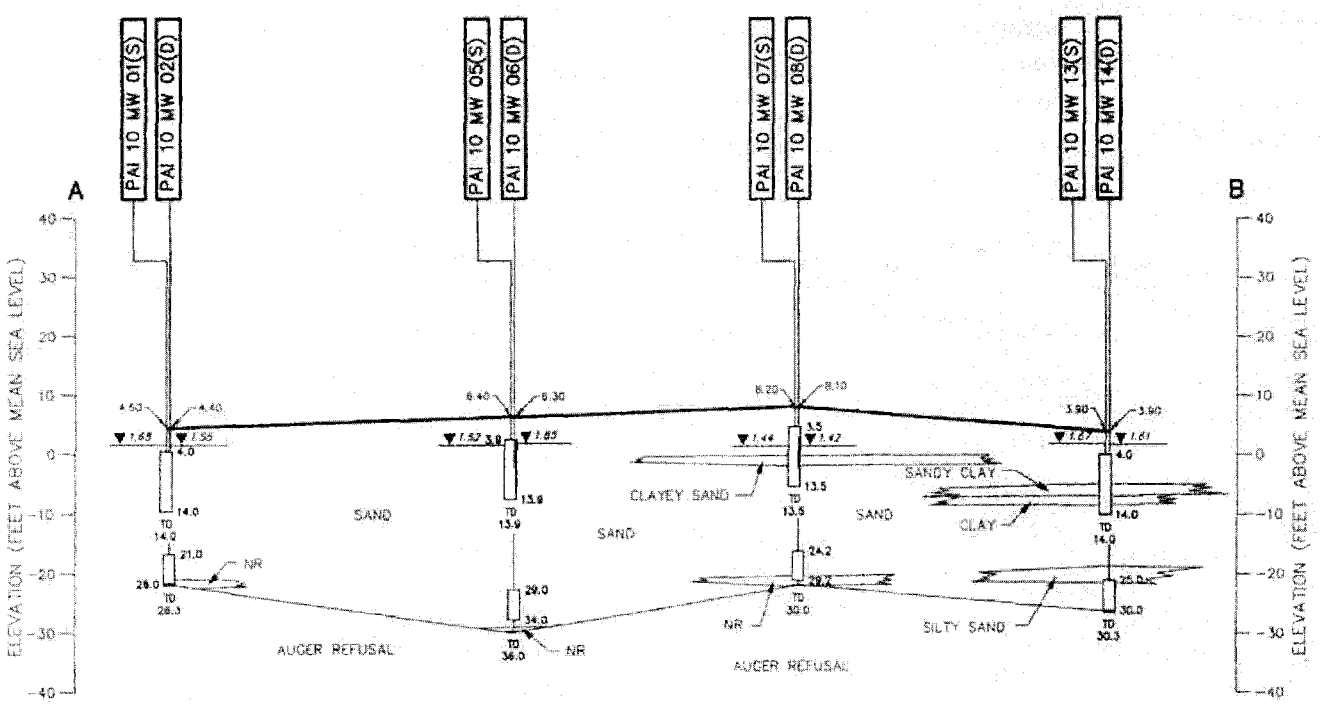
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY mf DATE 6/17/04
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION A–A'
SITE 12/SWMU 10
JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 4445
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-2
REV. 0

ACAD 4445cs02.dwg 06/17/04 MF PIT



LEGEND:

MONITORING WELL OR BORING NUMBER — PAI 10 MW 01(S)

GROUND SURFACE ELEVATION — 4.50

GROUND SURFACE

GROUNDWATER ELEVATION

TOP OF MONITORED INTERVAL (FT BGS) — 4.00

LITHOLOGIC CONTACT (INFERRED BETWEEN BORINGS)

BOTTOM OF MONITORED INTERVAL (FT BGS) — 14.0

TOTAL DEPTH OF WELL OR BORING (FT BGS) — TD 14.0

0 200 400
HORIZONTAL SCALE IN FEET

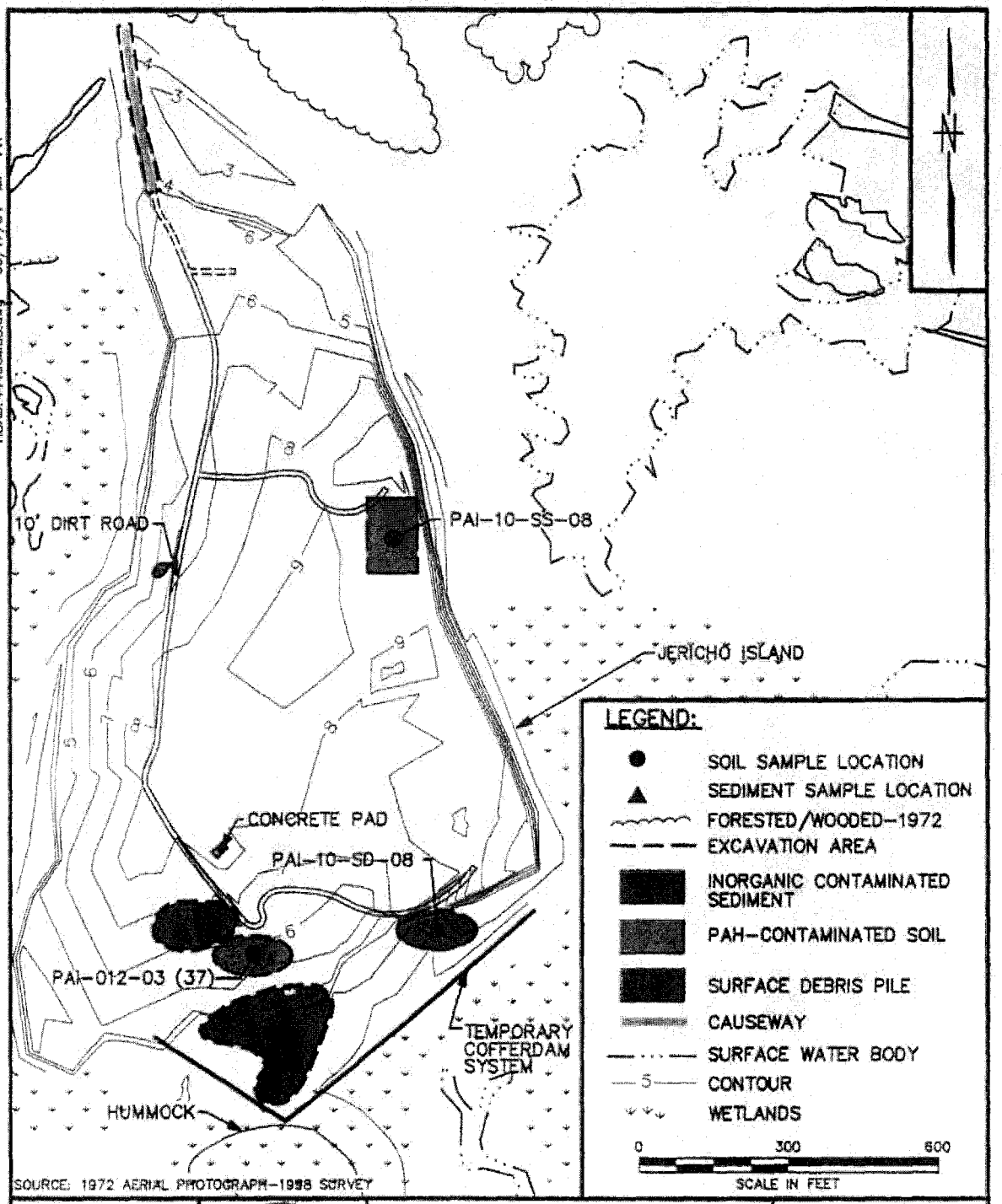
0 20 40
VERTICAL SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY mf DATE 6/17/04
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

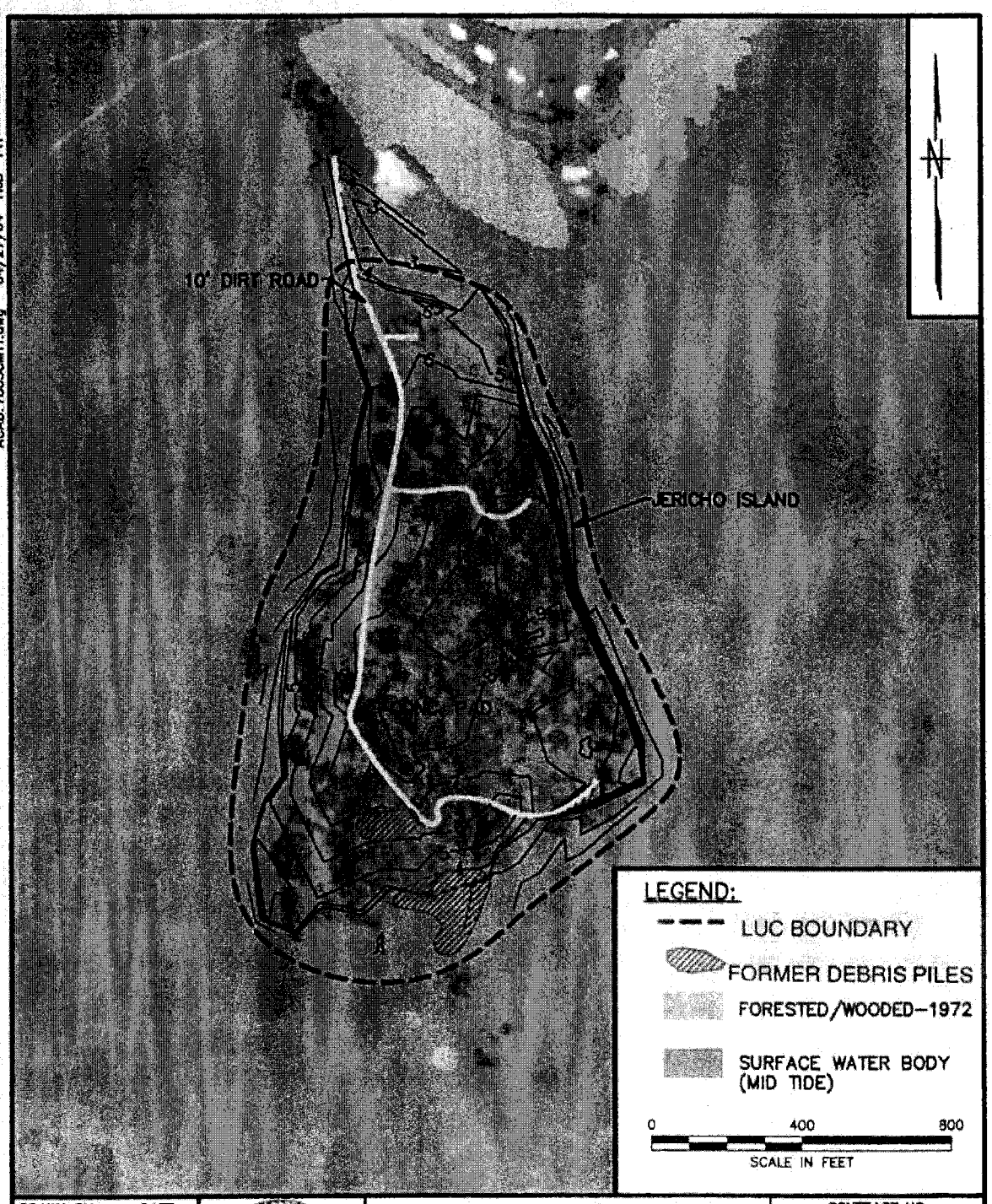
CROSS SECTION A-B
SITE 12/SWMU 10
JERICHO ISLAND DISPOSAL AREA
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 4445
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-3
REV. 0



DRAWN BY MF DATE 6/17/04		PREFERRED REMEDY-EXCAVATION AND OFF-SITE DISPOSAL OF WASTE MATERIALS, SOIL, AND SEDIMENT SITE 12/SWMU 10 JERICHO ISLAND DISPOSAL AREA MCRD PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 4445
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-4 / REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98



ACAD: 7803CM11.dwg 04/27/04 HJB PIT

DRAWN BY HJP DATE 8/2/01		AREA SUBJECT TO LUC SITE 12/SWMU 10 JERICHO ISLAND DISPOSAL AREA MCRD PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 7803
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			FIGURE 2-5 REV. 1

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

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APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

A public comment period was held from 4 August 2005 to 5 October 2005 for the Proposed Plan for Waste, Soil, and Sediment Remedial Action at Site 12. On 29 July 2004, the Proposed Plan was made available to the public in the Information Repository located at the Beaufort County Public Library's Headquarters location at 311 Scott Street, Beaufort, South Carolina, 29902. Public notice of the Proposed Plan was also published in the Beaufort Gazette on 6 August, 10 August, and 17 August 2005. This local newspaper targets the communities closest to MCRD Parris Island. Furthermore, a public information session was held on 17 August 2005 to present the results of the Remedial Investigation/RCRA Facilities Investigation and the Feasibility Study/Corrective Measures Study, to explain the preferred remedy, and to solicit comments from the community. At this information session, representatives from the Naval Facilities Engineering Field Division South, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 12 and the response action under consideration.

In addition, an MCRD representative attended a meeting of the Board for the Shell Point Neighborhood Association on 26 September 2005. MCRD believes that the public generally supports the project, although there were concerns with the road's ability to support the traffic. MCRD participated in informal discussions regarding the neighborhood concerns, which have been formally submitted to MCRD and SCDHEC (see below).

The following formal comments were submitted during the public comment period by Ms. Carolyn Davis, spokesperson for the Board for the Shell Point Neighborhood Association. These comments and Navy responses are as follows.

Comments:

Ms. Davis provided the following bullet list of issues:

- Road use, route and maintenance.
- Enter and exit the neighborhood at the shortest route.
- How many trucks per day to expect.
- Debris from trucks in the neighborhood and on the road. Will this be maintained continually.
- If road is damaged, who will repair it after the work is finished. The roads are not designed for these large trucks.
- Knowledge of the status of Jericho Island after the cleanup.

Responses:

The Navy appreciates the Board's effort and thought in consideration of the Proposed Plan and offers the following in response to your comments:

- **Road use, route and maintenance:** The truck traffic will be limited to the shortest route through the neighborhood, entering and departing adjacent to the Bi-Lo shopping center. The route will be inspected and swept at least once per day, at the end of each day, to verify that mud or debris has not been deposited on roadways. A flagman will be used for trucks making a left turn onto HWY 802. This will expedite truck traffic by preventing traffic backing up into the neighborhood while waiting for trucks to make the turn onto 802.
- **Enter/exit neighborhood using the shortest route:** As described in the previous response, truck traffic will enter and depart adjacent to the Bi-Lo shopping center. Signs and a flag man will be used to ensure traffic control.
- **How many trucks per day:** Approximately 650 total truckloads are anticipated to complete the soil excavation. The number will vary day-to-day. On average, 20-30 trucks per day can be anticipated over a one-month duration, but 40 per day may occur on occasion. The overall project duration and site activities will be performed in a two-month period. Sporadic truck traffic for materials and equipment deliveries will take place over the duration of the project.
- **Debris from trucks on the road:** Prior to entering the public roads there will be a vehicle wash station to remove debris. In addition the route will be swept at the end of each day. To control any dust the contractor will water down the work and traffic areas.
- **Road damage:** A contractor to the US Navy is completing The Jericho Island work. In the unlikely event that the contractor does not address any road damage, the Navy is prepared to facilitate road repair.
- **Status of Jericho Island after cleanup:** Cleanup of Jericho Island will meet stringent residential re-use requirements. Although the causeway to Jericho Island is also being removed to physically prevent unauthorized access, the level of cleanup is independently expected to prevent hypothetical future residents or trespassers from exposure to hazardous materials on Jericho Island. The level of cleanup will be sufficient such that no land use restrictions will be required by US EPA.

The Navy will provide a fact sheet describing the completed cleanup, with before and after photographs, to the MCRD public notification mailing list. To join the mailing list, please provide your name and address to timothy.j.harrington@usmc.mil or call 843-228-3423.

APPENDIX B

MODIFIED ALTERNATIVE 4
COST ESTIMATE

MARINE CORPS RECRUIT DEPOT
Parris Island, South Carolina
Site 12/ Swmu 10 - Jericho Island Disposal Area
Modified Alternative 4: Excavation and Off-site Disposal of Waste Materials, Soils and Sediment
Capital Cost

9/8/2006 2:10 PM

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plar	500	hr			$30.00		$0	$0	$15,000	$0	$15,000
1.2 Prepare Property Easemen	200	hr			$30.00		$0	$0	$6,000	$0	$6,000
2 MOBILIZATION/DEMOBILIZATION											
2.1 Office Trailer	5	mo	$345.00				$1,725	$0	$0	$0	$1,725
2.2 Field Office Support	5	mo		$136.00			$0	$680	$0	$0	$680
2.3 Storage Trailer (1)	5	mo	$103.00				$515	$0	$0	$0	$515
2.4 Electrical Generator	5	mo		$978.75		$1,005.00	$0	$4,894	$0	$5,025	$9,919
2.5 Construction Survey	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
2.6 Equipment Mobilization/Demobilization	5	ea			$64.00	$264.00	$0	$0	$320	$1,320	$1,640
2.7 Site Utilities (2 Cell Phones)	10	mo	$150.00				$1,500	$0	$0	$0	$1,500
2.8 Field Construction Management (3p * 5 days/week	27	mwk			$2,400.00		$0	$0	$64,800	$0	$64,800
3 DECONTAMINATION											
3.1 Decontamination Services	5	mo	$3,400.00				$17,000	$0	$0	$0	$17,000
3.2 Equipment Decon Pad	1	ls		$5,800.00	$6,650.00	$700.00	$0	$5,800	$6,650	$700	$13,150
3.3 Decon Water	5,000	gal		$0.20			$0	$1,000	$0	$0	$1,000
3.4 Decon Water Storage, 6,000 gallon	5	mo				$600.00	$0	$0	$0	$3,000	$3,000
3.5 Decon Water Storage, 4,000 gallon	5	mo				$540.00	$0	$0	$0	$2,700	$2,700
3.6 PPE (6 p * 5 days * 13 weeks)	660	day		$30.90			$0	$20,394	$0	$0	$20,394
3.7 Disposal of Decon Waste (liquid and solid)	5	mo	$900.00				$4,500	$0	$0	$0	$4,500
4 SITE PREPARATION											
4.1 Clear & Grub Access Road	0.2	ac			$1,075.00	$2,700.00	$0	$0	$215	$540	$755
4.2 Access Road Geotextile	545	sy		$0.84	$0.06	$0.02	$0	$458	$33	$11	$501
4.3 Road Gravel 8" thick	545	sy		$5.45	$1.89	$1.00	$0	$2,970	$1,030	$545	$4,545
5 EXCAVATION AND RESTORATION OF CONTAMINATED AREAS											
5.1 Clear Trees and Brush	2.5	ac			$1,075.00	$2,700.00	$0	$0	$2,688	$6,750	$9,438
5.2 Cofferdam	500	lf	$39.00	$12.00	$20.00	$15.00	$19,500	$6,000	$10,000	$7,500	$43,000
5.3 Excavate Waste Material (Level C	4,325	cy			$5.96	$6.21	$0	$0	$25,777	$26,858	$52,635
5.4 Dewatering Pump	45	day			$83.00	$23.00	$0	$0	$3,735	$1,035	$4,770
5.5 Filter Pumped Water	45	day		$240.00	$300.00	$175.00	$0	$10,800	$13,500	$7,875	$32,175
5.6 Verification Sampling and Testing (TCLP)	6	ea	$1,407.00		$50.00	$20.00	$8,442	$0	$300	$120	$8,862
5.7 Verification Sampling and Testing (TCL and TAL)	24	ea	$1,407.00		$50.00	$20.00	$33,768	$0	$1,200	$480	$35,448
5.8 Disposal of Non-Hazardous Materials	5,450	ton	$40.00				$218,000	$0	$0	$0	$218,000
5.90 Disposal of Oversized Material Offsite	20	ton	$40.00				$800	$0	$0	$0	$800
5.10 Disposal of Hazardous Materials	605	ton	$120.00				$72,600	$0	$0	$0	$72,600
5.11 Backfill Excavated Areas (subsoil	2,244	cy		$5.30	$0.90	$1.86	$0	$11,893	$2,020	$4,174	$18,087
5.12 Backfill Excavated Areas (topsoil	1,700	cy		$17.87	$3.63	$3.31	$0	$30,379	$6,171	$5,627	$42,177
5.13 Revegetation	12,200	sy		$0.26	$1.16	$0.18	$0	$3,172	$14,152	$2,196	$19,520
5.14 Wetland Restoration	692	csf		$16.39	$8.88		$0	$11,342	$6,145	$0	$17,487
6 EXCAVATION AND RESTORATION OF CAUSEWAY											
6.1 Clear Brush	0.12	ac			$1,075.00	$2,700.00	$0	$0	$130	$325	$455
6.2 Cofferdam	700	lf	$39.00	$12.00	$20.00	$15.00	$27,300	$8,400	$14,000	$10,500	$60,200
6.3 Excavate Material (Level C	778	cy			$5.96	$6.21	$0	$0	$4,636	$4,830	$9,466
6.4 Dewatering Pump	10	day			$83.00	$23.00	$0	$0	$830	$230	$1,060
6.5 Filter Pumped Water	10	day		$240.00	$300.00	$175.00	$0	$2,400	$3,000	$1,750	$7,150
6.6 Verification Sampling and Testing (TCLP)	2	ea	$1,407.00		$50.00	$20.00	$2,814	$0	$100	$40	$2,954
6.7 Verification Sampling and Testing (TCL and TAL)	10	ea	$1,407.00		$50.00	$20.00	$14,070	$0	$500	$200	$14,770
6.8 Disposal of Non-Hazardous Materials	1,089	ton	$40.00				$43,556	$0	$0	$0	$43,556
6.9 Backfill Excavated Areas (topsoil	194	cy		$17.87	$3.63	$3.31	$0	$3,475	$706	$644	$4,824
6.10 Wetland Restoration	90	csf		$16.39	$8.88		$0	$1,475	$799	$0	$2,274
7 SITE RESTORATION/MONITORING WELLS											
7.1 Access Road Removal	545	cy			$1.70	$0.72	$0	$0	$927	$392	$1,319
7.2 Access Road Disposal	820	ton	$40.00				$32,800	$0	$0	$0	$32,800

MARINE CORPS RECRUIT DEPOT
Parris Island, South Carolina
Site 12/ Swmu 10 - Jericho Island Disposal Area
Modified Alternative 4: Excavation and Off-site Disposal of Waste Materials, Soils and Sediment
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
7.3 Access Road Stand	90	cy		$7.89	$0.91	$1.68	$0	$710	$82	$151	$943
7.4 Access Road Revegetation (Wetland Restoration	50	csf		$16.39	$8.88		$0	$820	$444	$0	$1,264
7.5 Abandon Existing Wells	315	lf	$5.25				$1,654	$0	$0	$0	$1,654
Subtotal							$503,543	$127,061	$205,887	$95,519	$932,011
Local Area Adjustments							100.0%	96.2%	82.0%	82.0%	
							$503,543	$122,233	$168,828	$78,325	$872,929
Overhead on Labor Cost @ 30%									$50,648		$50,648
G & A on Labor Cost @ 10%									$16,883		$16,883
G & A on Material Cost @ 10%								$12,223			$12,223
G & A on Subcontract Cost @ 10%							$50,354				$50,354
Total Direct Cost							$553,898	$134,456	$236,359	$78,325	$1,003,038
Indirects on Total Direct Cost @ 35%			(excluding disposal costs)								$236,018
Profit on Total Direct Cost @ 10%											$100,304
Subtotal											$1,339,360
Health & Safety Monitoring @ 2%											$26,787
Total Field Cost											$1,366,147
Contingency on Total Field Costs @ 20%											$273,229
Engineering on Total Field Cost @ 10%											$136,615
TOTAL COST											**$1,775,991**

Modified Alternative 4
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$1,775,991			$1,775,991	1.000	$1,775,991
1		$0	$25,000	$25,000	0.935	$23,375
2			$25,000	$25,000	0.873	$21,825
3			$25,000	$25,000	0.816	$20,400
4			$25,000	$25,000	0.763	$19,075
5			$25,000	$25,000	0.713	$17,825
6			$25,000	$25,000	0.666	$16,650
7			$25,000	$25,000	0.623	$15,575
8			$25,000	$25,000	0.582	$14,550
9			$25,000	$25,000	0.544	$13,600
10			$25,000	$25,000	0.508	$12,700
11			$25,000	$25,000	0.475	$11,875
12			$25,000	$25,000	0.444	$11,100
13			$25,000	$25,000	0.415	$10,375
14			$25,000	$25,000	0.388	$9,700
15			$25,000	$25,000	0.362	$9,050
16			$25,000	$25,000	0.339	$8,475
17			$25,000	$25,000	0.317	$7,925
18			$25,000	$25,000	0.296	$7,400
19			$25,000	$25,000	0.277	$6,925
20			$25,000	$25,000	0.258	$6,450
21			$25,000	$25,000	0.242	$6,050
22			$25,000	$25,000	0.226	$5,650
23			$25,000	$25,000	0.211	$5,275
24			$25,000	$25,000	0.197	$4,925
25			$25,000	$25,000	0.184	$4,600
26			$25,000	$25,000	0.172	$4,300
27			$25,000	$25,000	0.161	$4,025
28			$25,000	$25,000	0.15	$3,750
29			$25,000	$25,000	0.141	$3,525
30			$25,000	$25,000	0.131	$3,275
				TOTAL PRESENT WORTH		**$2,086,216**

D H E C
PROMOTE PROTECT PROSPER
C. Earl Hunter, Commissioner
Promoting and protecting the health of the people and the environment.

September 29, 2006

Commanding Officer
Department of the Navy
SOUTHNAVFACENGCOM
ATTN: Mr. Art Sanford
2155 Eagle Drive
North Charleston, South Carolina 29406

RE: Concurrence
Record of Decision, Site 12/SWMU 10 – Jericho Island Disposal Area
Marine Corp Recruit Depot, Parris Island
SC6 170 022 762

Dear Mr. Sanford:

The Corrective Action Engineering Section and Division of Hydrogeology of the South Carolina Department of Health and Environmental Control (Department) have completed the review of the above referenced document, which was received by the Department on September 25, 2006. The purpose of this Record of Decision (ROD) is to formalize the remedy for SWMU 10. The remedy includes the removal and disposal of debris piles, contaminated soils and sediments, the removal of the causeway connecting Jericho Island to the mainland, and land use controls to prohibit the use of groundwater.

The Proposed Plan for SWMU 10 was public noticed on August 6, 2005. A public information session was held on August 17, 2005 to explain the proposed remedy and solicit comments. No comments were received objecting to the proposed remedy.

The Department has deemed the remedy to be protective of human health and the environment and satisfies the RCRA corrective action requirements of Section VI of the Federal Facilities Agreement (FFA) effective March 31, 2006. Consequently, the Department concurs with this ROD.

If you have any questions or concerns, please feel free to contact Jerry Stamps at (803) 896-4285.

Sincerely,

Richard A. Haynes

Richard Haynes, P.E., Director
Division of Waste Management
Bureau of Land and Waste Management

cc:
Tim Harrington, MCRD Parris Island
Don Hargrove, Hydrogeology
Priscilla Wendt, SCDNR
Russell Berry, EQC Region 8, Beaufort
Lila Koroma-Llamas, EPA Region 4
Tom Dillon, NOAA
Mark Sladic, TtNUS