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INTERIM SOIL RECORD OF DECISION FOR SITE 3 CAUSEWAY LANDFILL MCRD PARRIS ISLAND SC

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TETRA TECH NUS

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Interim Soil Record Of Decision Site/SWMU 3 – Causeway Landfill

for

Marine Corps Recruit Depot

Parris Island, South Carolina

U.S. EPA Identification Number SC6170022762

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0020

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INTERM SOIL RECORD OF DECISION
SITE/SWMU 3 – CAUSEWAY LANDFILL
FOR

MARINE CORPS RECRUIT DEPOT
PARRIS ISLAND, SOUTH CAROLINA
U.S. EPA IDENTIFICATION NUMBER SC6170022762

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services
ARAR	Applicable or Relevant and Appropriate Requirements
B&R Environmental	Brown & Root Environmental
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/s	centimeters per second
CCME	Canadian Council of Ministers of the Environment
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
DON	Department of the Navy
ERA	ecological risk assessment
ER-L	Effects Range - Low
ER-M	Effects Range - Median
FDEP	Florida Department of Environmental Protection
FS	Feasibility Study
HHRA	human health risk assessment
HI	Hazard Index
HQ	Hazard Quotient
ILCR	incremental lifetime cancer risk
LUCAP	Land-Use Control Assessment Plan
LUCIP	Land-Use Control Implementation Plan
LUCs	land-use controls
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MOA	Memorandum of Agreement
MCRD	Marine Corps Recruit Depot
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
mg/kg	milligrams per kilogram
NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policies Act
NOAA	National Oceanographic and Atmospheric Administration
NOAEL	No-observable-adverse-effect level

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
PAHs	Polynuclear aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PELs	Probable Effect Level
RAO	Remedial action objective
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RFA	RCRA facilities assessment
RFI	RCRA facilities investigation
RI	Remedial investigation
RGO	Remedial goal option
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SMCLs	Secondary Maximum Contaminant Levels
SVOCs	Semivolatile organic compounds
SWMU	Solid waste management unit
TAL	Target Analyte List
TBC	To be considered (criteria)
TCL	Target Compound List
TELs	Threshold Effect Level
TtNUS	Tetra Tech NUS, Inc.
U.S. EPA	United States Environmental Protection Agency
U.S.C.	United States Code
VOCs	volatile organic compounds

1.0 DECLARATION FOR THE INTERIM RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Site/Solid Waste Management Unit (SWMU) 3, Causeway Landfill, is located in the northwestern portion of Marine Corps Recruit Depot (MCRD) Parris Island and is an integral part of a causeway connecting Horse Island and Parris Island. The causeway is currently covered with 1 to 2 feet of vegetated soil over most of its length. The causeway is a primarily gravel, two-lane road overlying layers of solid waste, fill dirt, and debris constructed through a tidal marsh of the Broad River (across Ribbon Creek). The causeway is approximately 10 acres in size, 4,000 feet long, 100 feet wide, and 3 to 10 feet high (above the pond surface). The sides of the causeway are variable and conditions include riprap, vegetated soil cover, and eroded wastes. Site/SWMU 3 (Site 3) functioned as the major disposal area for trash and other materials discarded in dumpsters around the MCRD during most of the period between 1960 and 1972.

The Superfund site identification number for MCRD Parris Island is 0403488. The U.S. EPA identification number is SC6170022762.

1.2 STATEMENT OF PURPOSE AND BASIS

This Interim Record of Decision (ROD) document presents a planned interim response action for Site 3 at the MCRD Parris Island, South Carolina. This interim remedial action is the first action being taken at Site 3 and will specifically address buried wastes and contaminated soil at the site. Some of the contaminated sediments at Site 3 will also be addressed as part of the bank stabilization portion of this interim remedy. A final ROD for the site will specifically address those actions intended to address all remaining contaminated sediments at the site.

This Interim ROD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the National Contingency Plan (NCP). The decision is based on information contained within the site's Administrative Record, which is on file at the Beaufort County Public Library's Headquarters Location, 311 Scott Street, Beaufort, South Carolina, 29902. The U.S. Environmental Protection Agency (U.S. EPA) Region 4 and the state of South Carolina concur with this interim response.

1.3 ASSESSMENT OF THE SITE

A remedial investigation (RI) was conducted at Site 3 from May to September 1998 and in August 1999 [Tetra Tech, NUS, Inc. (TtNUS), 1999]. The human health risk assessment (HHRA) which was done as

part of the RI examined current risks associated with Depot maintenance and construction workers possibly being exposed to contaminated media and potential risks posed to recreational users (fisherman) through ingestion of fin fish and shellfish harvested from the surface waters adjacent to Site 3. These situations represent the most sensitive receptor and conservative risk estimates for Site 3. The HHRA evaluated both cancer and noncancer risks.

As presented in the RI, the estimated incremental lifetime cancer risk (ILCR) to construction workers and maintenance workers exceeded one in one million (1.0E-06) but was less than one in 10,000 (1.0E-04). These risks are within U.S. EPA's acceptable risk target range. Noncarcinogenic risk estimates [hazard indices (HIs)] for both the construction worker and the maintenance worker were less than 1.0, indicating that toxic effects would not be anticipated.

Risks calculations associated with recreational fishing adjacent to the site were based on current (1998) surface water and sediment data, as well as biota data collected in 1991. Based on a comparison of 1991 biota results to U.S. Food and Drug Administration criteria, it has been determined that consumption of fin fish and shellfish near the site would not pose a threat to human health. However, the 1991 biota results were also used to calculate risks to human health under U.S. EPA guidance using a frequent consumer (daily – default) and occasional consumer (once per week) of fish from the site. Using these data and these more conservative scenarios for noncarcinogenic risks, a potentially significant risk to human health (HI equals 18) was possible for the hypothetical frequent fish consumer but not for the occasional consumer. ILCR estimates under both scenarios were within the acceptable U.S. EPA risk range of 1.0E-04 to 1.0E-06.

The 1998 surface water and sediment data were also used to estimate risk to human health through theoretical partitioning of contaminants to fish and human consumption of the fish. Under the most stringent scenario (frequent fish consumer and maximum concentrations), the ILCR exceeded 1.0E-04 and noncarcinogenic risks were greater than 1.0. These risk estimates are higher than acceptable U.S. EPA risk criteria. Polynuclear aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), and arsenic were the main contributors to risk. However, under believed typical site conditions (average concentrations and occasional fish consumption) and potential site conditions [frequent (daily) consumption], ILCR estimates were within the acceptable risk ranges. The remedial decision, however, took into account the more conservative approach and takes into account the impact to human receptors.

An ecological risk assessment (ERA) was also completed for Site 3 where potential impacts were considered for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors, and aquatic receptors.

The initial ecological risk screening determined that the maximum concentrations of pesticides, PCBs, PAHs, and several metals, including arsenic, lead, mercury, vanadium, and zinc, exceed U.S. EPA Region 4 screening values, indicating that these chemicals are chemicals of potential concern (COPCs). In addition, several other chemicals were identified as COPCs because of the lack of screening criteria.

Food-chain modeling was also conducted in the ERA. The food-chain modeling evaluated nine representative receptors and found that the majority of the initial COPCs did not represent a threat to site receptors even under a worst-case scenario (organisms constantly exposed to maximum concentrations). Chemicals that pose potential risks under this scenario [chemicals where hazard quotients (HQs) for no-observable-adverse-effects levels (NOAELs) exceed 1.0] consist of PCBs, pesticides, and several metals. The food-chain modeling found that under more realistic conditions that consider mean chemical concentrations, the list of chemicals in which the HQs for NOAELs exceed 1.0 was reduced.

In addition to the risks posed to human health and the environment under current conditions, the potential exists for the structural failure of the sides of the causeway. This occurrence would result in a release of landfill material into the surrounding sediment and surface water. As a result, the interim response action selected in this Interim Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED INTERIM REMEDY

The proposed interim remedial action for Site 3 would consist of the following actions.

- The sides of the causeway will be stabilized with regrading, vegetation, riprap, and/or gabions. These actions will also minimize waste and soil erosion into the environment resulting from water runoff, waves, and/or wind.

- Soil will be also be added to the top and sides of the causeway to ensure that a minimum of 2 feet of compacted cover is present over waste material in order to comply with federal and South Carolina landfill regulations. The 2 feet of soil cover over wastes will protect human health by reducing the ILCR level to 1.0E-06 or less. In other areas of the causeway, 1 foot of additional soil cover will be placed. The additional soil cover will be added to protect terrestrial wildlife. These two actions will result in additional soil cover over approximately two-thirds of the causeway's length. The balance of the causeway waste is currently covered by at least 2 feet of cover soil.

- After the sides of the causeway are stabilized and the soil cover has been placed, a paved road will be constructed that will reduce precipitation infiltration into the waste and reduce erosion of cover material. Also, adjacent sediment will be re-characterized.

- Land-use controls (LUCs) will be implemented to control exposure pathways to contaminants. Long-term monitoring will consist of annual groundwater testing for the first 5 years. A re-evaluation of the site will be performed every 5 years to determine whether changes to the site restrictions and monitoring frequency will be required. Periodic inspections will be conducted to ensure the long-term integrity of the remedy and effectiveness of the LUCs.

By separate Memorandum of Agreement (MOA) with U.S. EPA and the South Carolina Department of Health and Environmental Control (SCDHEC), MCRD Parris Island, on behalf of the Department of the Navy, agreed to implement base-wide, certain periodic site inspection, condition certification and agency notification procedures designed to ensure the maintenance by Depot personnel of any site-specific LUCs deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of that agreement was that through the Navy's substantial good-faith compliance with the procedures called for therein, reasonable assurances would be provided to U.S. EPA and SCDHEC as to the permanency of those interim or final site remedies which included the use of specific LUCs. Pursuant to this MOA, the Depot has developed a Land Use Control Implementation Plan (LUCIP). That LUCIP is the site-specific document that details the implementation of LUCs for Site 3 for the purposes of protecting human health and the environment under existing and potential future conditions. The Site 3 LUCIP is presented in Appendix A of this interim ROD.

Quarterly visual inspections and reviews will be conducted for the purposes of verifying that all necessary LUCs have been implemented and are being properly maintained. An annual report will be prepared and forwarded to U.S. EPA and SCDHEC signed by the Depot Commanding General (with copy to SOUTHNAVFACENGCOM), certifying the continued retention of all implemented LUCs associated with Site 3.

Although the terms and conditions of the aforementioned MOA are not specifically incorporated or made enforceable herein by reference, it is understood and agreed by the Navy, U.S. EPA and SCDHEC that the contemplated permanence of the remedy reflected herein shall be dependent upon the Depot's substantial good-faith compliance with the specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the environment.

1.5 STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed; complies with those federal and state requirements

that are applicable or relevant and appropriate for this limited-scope action; and is cost-effective. This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for Site 3. 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 the wastes found at the site was deemed to be impracticable. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective. Subsequent actions will address fully threats, including contaminated sediments, posed by conditions at the site. Because this remedy will result in wastes remaining on-site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within 5 years after commencement of the remedial action. Because this is an interim action ROD, review of this site and remedy will be ongoing as MCRD Parris Island continues to develop remedial alternatives for Site 3.

1.6 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF THE REMEDY

Signature	S. A. Cheney Brigadier General Commanding General	Date

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 2-1. 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. The Superfund site identification number for MCRD Parris Island is 0403488. The U.S. EPA identification number is SC6170022762.

Site 3, Causeway Landfill, is located in the northwestern portion of MCRD Parris Island and is an integral part of a causeway connecting Horse Island and Parris Island, as shown in Figure 2-2. The causeway is currently covered with 1 to 2 feet of vegetated soil over most of its length. The causeway is a primarily gravel, two-lane road overlying layers of solid waste, fill dirt, and debris constructed through a tidal marsh of the Broad River (across Ribbon Creek). Site 3 is bounded to the northeast by a pond and to the southwest by tidal marsh. The causeway is approximately 10 acres in size, 4,000 feet long, 100 feet wide, and 3 to 10 feet above the pond surface. The sides of the causeway are variable and conditions include riprap, vegetated soil cover, and eroded wastes.

The Navy is the lead agency for this Interim ROD with the U.S. EPA Region 4 and South Carolina Department of Health and Environment Controls (SCHDEC) serving as support agencies. Representatives of National Oceanic and Atmospheric Administration (NOAA), South Carolina Department of Natural Resources (SCDNR), and U.S. Fish and Wildlife Service also serve as natural resource trustees. For cleanup efforts at all Navy and Marine Corps bases funds are requested from the Environmental Restoration, Navy (ER,N) appropriation.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Site 3 functioned as the major disposal area for trash and other materials discarded in dumpsters around the MCRD during most of the period between 1960 and 1972. Between 1960 and 1965, this landfill received approximately 75 percent of the solid waste generated by the Depot. The site was inactive between 1966 and 1968. Between 1969 and 1972, the site received all the Depot's solid waste. The solid waste disposed at the site included empty pesticide containers, oily rags, spent absorbent, petroleum and chlorinated solvent sludge, perchloroethylene still bottoms, mercury amalgam and

beryllium waste, PCB-contaminated oil, and metal shavings. In 1972, landfilling operations ceased at Site 3.

The causeway was constructed in two separate sections across a tidal marsh of the Broad River. One section began in the northeastern edge of Horse Island and was built primarily with fill dirt taken from the borrow pits on Horse Island. Some solid wastes were also reportedly placed in this section of the causeway. The other section started near the southern end of Talasesa Street on Parris Island and was built with the solid waste mentioned in the previous paragraph and with fill dirt. Aerial photos taken in 1951, 1965, and 1972 illustrate that the two sections of causeway gradually extended into the marsh until they met in 1972. At its completion in 1972, the causeway was approximately 10 acres in size, 4,000 feet long, 100 feet wide, and 10 feet high (above the water surface), with a gravel road surface and rip-rap sides overgrown with vegetation. Limited information is available concerning the presence and areal extent of fill material used to cover the landfill after disposal activities were discontinued in 1972. No landfill activity has taken place at Site 3 since 1972.

Environmental investigations of Site 3 began in 1986. The following reports describe the results of investigations at Site 3 to date 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].
- Remedial Investigation (RI) Verification Step (McClelland Consultants, Inc., 1990).
- Interim RCRA Facility Assessment of United States Marine Corps, Recruit Depot Parris Island, South Carolina (Kearney, A.T., Inc., 1990).
- Extended Site Inspection Report – Causeway Landfill [ABB Environmental Services, Inc. (ABB-ES), 1993].
- RCRA Facility Investigation (RFI)/RI Work Plan for Sites/SWMUs 1, 2, 3, and 15 and SWMU 41 [Brown and Root Environmental (B&R Environmental), 1998].
- RFI/RI Report for Site/SWMU 3 - Causeway Landfill (TtNUS, 1999a).
- Feasibility Study (FS)/Corrective Measures Study Report for Site/SWMU 3 – Causeway Landfill (TtNUS, 2000a).

- Proposed Plan for Soil Interim Remedial Action at Site/SWMU 3 – Causeway Landfill (TtNUS, 2000b).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

On June 9, 2000, the Proposed Plan for Soil Interim Remedial Action at Site 3 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. This Proposed Plan recommended the following preferred remedy.

- Installation of slope stabilization and erosion controls along the sides of the full length of the causeway
- Placement of a soil cover over the sides and top of portions of the causeway
- Construction of an asphalt road along the length of the causeway
- Recharacterization of the sediment
- Implementation of land-use controls and long-term monitoring

The public notice of the Proposed Plan was published in the *Beaufort Gazette* on June 12, 19, and 26, 2000. Additionally, a public information session was held on June 27, 2000, to present the results of the RI and the FS, explain the preferred remedy, and solicit comments from the community. At this information session, representatives from Southern Division, Naval Facilities Engineering Command, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 3 and the response actions under consideration. No comments were made during the public information session or received during the public comment period. The Community Relations Responsiveness Summary is included in Appendix B of this decision document.

2.4 SCOPE AND ROLE OF THE INTERIM RESPONSE ACTION AT SITE 3

Site 3 is one of approximately 45 sites being evaluated for potential contamination at the MCRD Parris Island. To date, Site 3 has been regulated under both the CERCLA and Resource Conservation and Recovery Act (RCRA) requirements. 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 National Oceanic and Atmospheric Administration (NOAA), South Carolina Department

of Natural Resources (SCDNR), and U.S. Fish and Wildlife Service joined the team as natural resource trustees.

This interim response action is the first phase being taken at Site 3 and will specifically address buried wastes and contaminated soils at the site. Some of the contaminated sediments at Site 3 (sediments adjacent to the causeway) will be addressed during the bank stabilization portion of this interim remedy. A final ROD for the site will specifically address those actions intended to address all remaining contaminated sediments at the site.

Surface water at the site has been slightly impacted by site contaminants. The proposed interim remedy will prevent future migration of contaminants from the soils and wastes to the surface water. The surface water of Site 3 will be further addressed with the remaining contaminated sediments.

Groundwater at this site has been affected by site contaminants; however, since the groundwater is not usable as a potable water supply and other groundwater contact pathways are minor, the groundwater does not represent a significant risk to human receptors. In addition, the proposed interim remedy will reduce migration of contaminants to groundwater.

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 RFI/RI report for Site 3 (TtNUS, 1999).

2.5.1 Geology

Four geological units are present in the Beaufort-Jasper County area. These units from the oldest (Eocene age) to the youngest (Pleistocene age) are the Santee Limestone, Cooper Marl, Hawthorn Formation, and Pleistocene sands and clays. Soils at MCRD Parris Island have been mapped by the U.S. Soil Conservation Service as both individual soils and groupings of soils (units) (Stuck, 1980). The Depot has been mapped as having 15 individual soil types, but only eight types are present beneath MCRD Parris Island. Three soil units have been mapped for the Depot (the Wando-Seabrook-Seewee, Coosaw-Williman-Ridgeland, and Bohicket-Capers-Handsboro Soil Units).

Surface soils collected from the causeway landfill during the 1998 field event consisted of fine to medium sands with a varying silt content. Riprap consisting of concrete fragments was observed along the banks of the causeway. Sediment samples collected from the marsh and pond along the causeway consisted of silts and clays, with a varying sand content.

Generally, the shallow subsurface geology of the study area consists of fill material and a heterogeneous mixture of tidal and storm-deposited clay and sand. In the center of the causeway, fill material was encountered to depths of at least 10.5 to 18 feet below ground surface (bgs). The fill soils consisted of sand with a varying amount of silt. The observed refuse within the soil boring samples consisted of a large amount of wood fragments along with metal fragments (cans), paper, plastics, and fragments of concrete and brick.

The boundary between fill and natural material is fairly distinct. Beneath the fill, the sediment consists of tidal sands with a varying silt content to a depth of 28 feet bgs. From the depth of 28 feet bgs to termination of the boring at 40 feet bgs, clay was encountered. A falling head permeability test performed on an undisturbed soil sample resulted in an estimated vertical hydraulic conductivity of 4.4×10^{-8} centimeters per second (cm/s).

Cross-sections of Site 3 are presented in Figures 2-3 and 2-4.

2.5.2 Hydrogeology

Two primary aquifers are present within the Beaufort-Jasper County area: the surficial Pleistocene aquifer and the Floridan Aquifer. These aquifers are generally separated by the Hawthorn Formation and Cooper Marl, which act as confining units to the underlying Floridan Aquifer.

In the MCRD Parris Island area, the shallow unconfined aquifer generally consists of permeable, fine to medium Pleistocene age sands. Surface relief is relatively low. The area is drained by fresh and brackish water streams inland and by tidal streams along the coast. The water table in the MCRD Parris Island area usually ranges from 0 to 10 feet bgs and is most commonly found at a depth of 3 feet bgs. Water-table fluctuations are a function of recharge, evaporation, and transpiration and have been observed to be as great as 6.5 feet at some locations (Glowacz, et al., 1980). The direction of groundwater flow in the upper portion of the shallow surficial aquifer is generally toward the nearest surface water body, such as a pond, river, tidal creek, or the ocean.

In the Beaufort-Jasper County area, the Floridan Aquifer system occurs near the land surface, and confining beds vary from essentially 0 to more than 150 feet in thickness. Groundwater in the Floridan Aquifer occurs in solutionally enlarged openings or cavities in the limestone. In general, groundwater occurs in a series of broadly defined water-bearing (permeable) zones that serve as aquifers and are separated by less permeable rocks. Two hydrogeologic zones within the Floridan Aquifer lie beneath the MCRD Parris Island area: a 200-foot-thick upper hydrogeologic unit that contains an upper permeable

zone and an 800-foot-thick lower hydrogeologic unit that has a somewhat lower permeability compared to the upper unit.

In general, a surficial groundwater table exists at Site 3. If continuous throughout the site, the underlying clay is thick enough to act as a confining unit to the overlying sands of the upper surficial aquifer. The upper surficial aquifer across Site 3 is approximately 18 to 20 feet thick, based on the depth of the clay unit encountered. Based on slug test data, the geometric average hydraulic conductivity for the three shallow surficial aquifer wells was 1.28 feet per day (4.53×10^{-4} cm/s) and the deep surficial well was 0.65 feet per day (2.30×10^{-4} cm/s). The values for the shallow and deep wells are within the typical range of hydraulic conductivity for clayey, silty sands, silts, and sandy silts.

The upper surficial aquifer at Site 3 is generally divided from the Floridan Aquifer by the Hawthorn Formation, which acts as a confining unit. The Hawthorn Formation is a phosphatic sand and clay unit with a reported thickness of approximately 2 to 40 feet in the study area.

2.5.3 Human Health Conceptual Site Model/Current and Potential Future Land and Resource Uses

As described previously, Site 3 is an integral part of a causeway connecting Horse Island and Parris Island, in the north section of MCRD Parris Island. The causeway is a gravel, two-lane road, consisting of alternate layers of solid waste and fill dirt constructed along a tidal marsh of the Broad River. The site is not currently used for residential purposes nor is it anticipated be used as such in the future. The MCRD plans to use the site only as a traffic route and recreational area as documented in the MCRD Parris Island Master Plan. The area has been used as such since 1972. Similarly, site groundwater is not currently used as a potable water supply nor is it expected to be used as such in the future. This scenario is based on configuration of the site, the high total dissolved solids content of the groundwater and the current and future use of the site as a landfill. There are no off-site residents located downgradient in the immediate vicinity of the site who might use groundwater as a potable water supply. The surface water of Site 3 is not currently used as a potable water supply; however, the pond on the north side of the causeway is used for recreational fishing purposes.

The sources of contamination at the site are the wastes disposed within the causeway. Contaminants may be released from the causeway by mechanisms such as stormwater runoff and subsequent erosion of surface soil; leaching of COPCs from soil and waste via infiltrating water and subsequent migration to the water table; wind erosion of surface soil (fugitive dust); and volatilization of chemicals from soil (volatile emissions).

As a general rule, once released from the source, 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.

Potential receptors were identified by analyzing the interaction of current land use practices and the identified sources of contamination. The receptors evaluated in the RI consisted of construction workers, maintenance workers, and on-site recreational users.

2.5.4 Ecology

Site 3 consists of a causeway constructed across a tidal marsh in the northern portion of MCRD Parris island. A 30-foot-wide gravel road extends along the length of the causeway. A 10- to 40-foot-wide strip of mowed grass exists on each side of the gravel road. Scattered hackberry trees (*Celtis laevigata*), shrubs, and a variety of weedy plants are located along the banks of the causeway. Common plant species include Eastern baccharis (*Baccharis halimifolia*), ragweed (*Ambrosia artemisiifolia*), and amaranth (*Amaranthus* spp). The marsh on the north side of the causeway is primarily a ponded area of open water. The marsh south of the causeway is a vast expanse of thickly vegetated cordgrass (*Spartina alterniflora*), intersected by several tidal channels.

The frequently mowed portions of the causeway provide only marginal wildlife habitat, and few terrestrial wildlife species are expected to utilize those areas. Some portions of the banks of the causeway, however, are thickly vegetated and provide habitat for small mammals such as the Eastern mole (*Scalopus aquaticus*), short-tailed shrew (*Blarina carolinensis*), cotton rat (*Sigmodon hispidus*), and cotton mouse (*Peromyscus gossypinus*). Raccoons (*Procyon lotor*) and opossums (*Didelphis virginiana*) are expected to forage along the water's edge. Based on the existence of only marginal terrestrial wildlife habitat and the absence of evidence such as tracks and scat, the use of the site by larger mammals is probably minimal. Some bird species forage on the causeway, especially along the edges of the vegetated areas.

The saltwater marsh provides habitat for a diverse assemblage of fauna, particularly fish and crustaceans. Several species of animals probably prey upon these fish and crustaceans. These include 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 ponded area north of the site occasionally receives tidal inflow via two sets of three culverts beneath the causeway. This tidal flow results in saline conditions in the pond, thereby limiting aquatic organisms in the pond to marine species. Fish such as red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), summer flounder (*Paralichthys dentatus*), whiting (*Menticirrhus americanus*), and striped mullet (*Mugil cephalus*), as well as a variety of mollusks and crustaceans, are known to occur in the marsh on both sides of the causeway.

Endangered and threatened species that utilize the site consist of the bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), and American alligator (*Alligator mississippiensis*). An active bald eagle nest is located near the southeastern end of the causeway, and the associated pair of eagles is known to frequently forage in the vicinity of the site. The bald eagle is state and federally listed as threatened. Wood storks (state and federally listed as endangered) forage in various locations throughout the Depot, and they could occasionally forage near the site. Two alligators are frequently observed in the ponded area north of the causeway. Although common in some parts of its range, the alligator is federally listed as threatened due to its similarity in appearance to the endangered American crocodile (*Crocodylus acutus*).

Although other endangered and threatened species occur in Beaufort County, the site provides poor habitats for these species. For example, the manatee (*Trichechus manatus*), shortnose sturgeon (*Acipenser brevirostrum*), and various sea turtles have been seen, at least occasionally, in the Broad River, Beaufort River, and Port Royal Sound. However, these species usually are not associated with shallow marsh areas present at Site 3. With the exception of the bald eagle, wood stork, and alligator, the likelihood of endangered and threatened species in the vicinity of the site is remote.

2.6 NATURE AND EXTENT OF CONTAMINATION

This section summarizes the nature and extent of contamination observed at Site 3 during the 1998 and 1999 RI. A more detailed presentation of this information is available in the RFI/RI Report for Site 3 (TtNUS, 1999).

The nature, extent, and concentration of hazardous substance contamination at Site 3 were studied during the RI conducted from May to September 1998 and in August 1999. Concentrations of analytes detected by laboratory analyses are reported in micrograms per kilogram (µg/kg) or milligrams per kilogram (mg/kg) for soil samples and micrograms per liter (µg/L) for water samples. For instance, a concentration of 8,600 mg/kg for iron means that 8,600 milligrams of iron are present in each kilogram of soil. A kilogram is a unit measure of weight equal to about 2.2 pounds. One thousand micrograms equal 1 milligram, 1,000 milligrams equal 1 gram, and 1,000 grams equal 1 kilogram. A liter is a unit measure of volume roughly equal to a quart.

Samples were collected from Site 3 in the spring and summer of 1998. Additional sediment samples were collected in August 1999 to better delineate results obtained during the 1998 testing. During the 1998 field investigation sampling, 16 surface soil samples, four filtered and non-filtered groundwater samples, 20 filtered and non-filtered surface water samples, and 20 sediment samples were collected and analyzed. In 1999, 12 additional sediment samples were collected. Summary statistics for 1998 surface soil, groundwater, and surface water analytical results and 1998 and 1999 sediment results are presented in Tables 2-1 though 2-5.

Surface soils were found to contain several PAHs, PCBs, pesticides, lead, arsenic, aluminum, iron, mercury, vanadium, and zinc at concentrations greater than present in background soils and in exceedance of the most stringent residential human health risk-based concentrations (RBCs) or ecological screening values. Because of the presence of asphalt at the site and the common application of pesticides at the base, PAHs and pesticides may or may not result from waste disposal activities.

Benzene, chlorobenzene, 1,4-dichlorobenzene, arsenic, iron, thallium, and alpha-BHC were detected in the site groundwater at concentrations that exceed the most stringent human health criteria (drinking water standards). The presence of a salt-water marsh surrounding the site and the measured salinity of the groundwater restrict the use of site groundwater as a potable water supply. Chlorobenzene was the only groundwater analyte that exceeded ecological screening values for surface water. This volatile organic compound (VOC) was not detected in surface water or sediment samples, indicating that migration from the fill area was not significant.

Fluoranthene, mercury, and silver were detected in surface water at concentrations in excess of the most stringent human health RBCs or ecological screening values. Each chemical exceeded the criteria in one of 20 samples.

Sediments were found to contain several PAHs, PCBs, pesticides, lead, arsenic, aluminum, copper, iron, mercury, and zinc at concentrations greater than present in background sediments and in exceedance of the most stringent residential human health RBCs or ecological screening values. Because of the presence of asphalt at the site and the common application of pesticides at the base, the PAHs and pesticides may or may not be from site-related waste disposal activities.

2.7 SUMMARY OF SITE RISKS

The Site 3 RI analytical data were evaluated to determine baseline risks to human health and the environment. The baseline risk assessment estimates what risks the site would pose if no action were taken. It provides the basis for taking action and identifies the contaminants and the exposure pathways

that need to be addressed by the remedial action. Sections 2.7.1 and 2.7.2 summarize the results of the baseline risk assessment for this site.

In addition to the risks posed to human health and the environment under current conditions, the potential exists for the future structural failure of the sides of the causeway. This occurrence would result in a release of landfill material into the surrounding sediment and surface water. As a result, the interim response action selected in this Interim Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment or from pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

2.7.1 Human Health Risk Assessment

A baseline HHRA was performed to characterize and quantify potential health risks at Site 3, in the absence of remedial action. The results of the HHRA were also used to focus the evaluation of remedial action alternatives. The HHRA for Site 3 was conducted using guidance from the U.S. EPA (U.S. EPA, 1989 and 1992), including regional supplemental guidance (U.S. EPA Region IV, 1995a). Methodologies presented in the Master Workplan for MCRD, Parris Island, South Carolina (B&R Environmental, 1998b) were also used to develop the baseline risk assessment for this site. During this evaluation, a list of COPCs was developed for each environmental medium (e.g., surface soil, sediment, etc.) sampled at Site 3. Table 2-6 presents the chemicals selected as human health COPCs. COPCs are chemicals that need further evaluation to determine if, in fact, the concentrations found at the site pose a risk to human health and the environment.

The human health risk assessment considered exposure of construction workers and maintenance workers to site media. The estimated ILCR to construction workers and maintenance workers exceeded 1.0E-06 but was less than 1.0E-04. These risks are within the acceptable U.S. EPA target risk range. The noncarcinogenic risk estimates (HIs) for both the construction worker and the maintenance worker were less than 1.0, indicating that toxic effects are not anticipated. A summary of human health ILCRs and HIs for the construction worker and maintenance worker is presented in Table 2-7.

The human health risk assessment also considered environmental exposure from recreational fishing at the site. These risk calculations were based on current (1998) surface water and sediment data, as well as biota data collected in 1991.

Based on a comparison of 1991 biota results to U.S. Food and Drug Administration criteria, consumption of fin fish and shellfish at the site does not represent a threat to human health. However, using U.S. EPA guidance, the 1991 biota results were also used to calculate risks to human health under a frequent

consumer (daily – default) and occasional consumer (once per week) of fish from the site. Using these data and these more conservative scenarios for non carcinogenic risks, a potentially significant risk to human health was possible for the hypothetical frequent fish consumer HI=18 but not for the occasional consumer. ILCR estimates under both scenarios were within the acceptable U.S. EPA risk range of 1.0E-04 to 1.0E-06.

The 1998 surface water and sediment data were also used to estimate risk to human health through theoretical partitioning of contaminants to fish and human consumption of the fish. Under the most stringent scenario (frequent fish consumer and maximum concentrations), the ILCR exceeded 1.0E-04 and noncarcinogenic risks were greater than 1.0. These risk estimates are higher than acceptable U.S. EPA risk criteria. PAHs, pesticides, PCBs, and arsenic were the main contributors to risk. However, under more typical site conditions (average concentrations and occasional fish consumption), ILCR estimates were within the acceptable U.S. EPA risk range of 1.0E-04 to 1.0E-06 and the noncarcinogenic risk estimate was less than 1.0.

A summary of human health ILCRs and HIs for the recreational user is presented in Table 2-7.

There is some uncertainty associated with the baseline HHRA developed for Site 3. Conservative assumptions were used throughout the entire risk assessment; consequently, the final estimate risks may be overestimated. The major source of 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 estimation of risk, where the maximum concentrations were used as the exposure point concentration, 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.

No fish tissue samples were collected during the field investigation, therefore exposure point concentrations for fish tissue were estimated from surface water and sediment concentrations and bioconcentration factors. Bioconcentration factors only estimate the uptake for chemicals from surface water and sediment and do not consider what happens to the chemical after uptake by fish. Most aquatic animals are able to metabolize polynuclear aromatic hydrocarbons (PAH), a category of SVOCs, and excrete then rapidly. Consequently, the use of bioconcentration factors to estimate PAHs concentration in fish tissue most likely overestimates the actual PAH concentration in fish tissue and subsequently results in an overestimation of risk.

2.7.2 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, U.S. EPA, 1998), which served as the basis for the ERA methodology. Furthermore, the ERA was conducted in accordance with Navy policy [Department of the Navy (DON), 1999] and other available guidance documents (U.S. EPA, 1995b; Wentsel et al., 1996) and publications (Ingersoll et al., 1997; Suter, 1993; Calabrese and Baldwin, 1993).

For ecological receptors, potential impacts were considered for benthic receptors, soil invertebrates, terrestrial and aquatic plants, terrestrial receptors (short-tailed shrew, cotton mouse, raccoon, American robin), and aquatic receptors (great blue heron, bald eagle, red-tailed hawk, mummichog, and red drum).

Initially, COPCs were determined by comparing the maximum concentrations of detected chemicals in Site 3 surface water, groundwater, sediment, and surface soil to U.S. EPA Region IV ecological screening levels. When the HQ (ratio of the maximum concentration to its respective screening level) exceeded 1.0, adverse impacts were considered possible, and the chemical was retained as a COPC. An HQ of 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 since most guidelines are conservatively derived.

The initial ecological risk screening determined that the maximum concentrations of pesticides, PCBs, PAHs, and several metals including arsenic, lead, mercury, vanadium, and zinc exceed U.S. EPA Region 4 screening values, indicating a potential ecological risk (COPCs). In addition, several other chemicals were identified as COPCs because of the lack of screening criteria. Table 2-8 presents the chemicals selected as ecological COPCs during this initial screening.

Modeling of contaminant exposure via the food chain was performed to investigate potential risks to representative receptors. All 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 incidental ingestion of soil or sediment were estimated and the resulting intake value was divided by no-observed-adverse-effects-levels (NOAELs) and lowest-observed-adverse-effects-levels (LOAELs) to obtain food-chain HQs. The food-chain modeling evaluated nine representative receptors and found that the majority of the initial COPCs do not represent a threat to site receptors even under a worst-case scenario (organisms constantly exposed to maximum concentrations). Chemicals that pose potential risks under this scenario consist of PCBs, pesticides, and several metals. The food-chain modeling found that, under more realistic conditions that consider mean chemical concentrations, the list of chemicals in which HQs for NOAELs exceed 1.0 was reduced.

The following table summarizes maximum HQs calculated during the initial COPC screening process and food-chain modeling.

Receptor	Exposure Route	Hazard Quotients
Terrestrial and aquatic plants, soil invertebrates, benthic receptors (COPC initial screening)	Direct contact, ingestion of soil, sediment, and prey, uptake by plants	U.S. EPA Region IV Screening Values[1], HQs for Soil (maximum = 51), sediment (237.7), surface water (52.4) and groundwater (1.2)
Terrestrial Food Chain Receptors – Maximum Concentrations - Shrew - Mouse - Robin - Hawk	Ingestion of plants, soil, and prey	Food Chain Modeling, Maximum HQs[1] 25 40.9 45 6.3
Aquatic Food-Chain Receptors – Maximum Concentrations - Raccoon - Heron - Mummichog - Red Drum - Eagle	Ingestion of sediment and fish/prey	Food Chain Modeling, Maximum HQs[1] 120 55.7 2.5 < 1.0 33.6

[1] Maximum HQ result does not include aluminum.

2.8 INTERIM RESPONSE ACTION

The response action selected in this Interim ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. In the development of the interim response action, remedial action objectives (RAOs) were initially generated. Next, remedial alternatives were derived for the purposes of achieving the RAOs and federal and state Applicable or Relevant and Appropriate Requirements (ARARs). Lastly, the remedial alternatives were evaluated and compared. This process is discussed in the following sections.

2.8.1 Remedial Action Objectives

Based on the results of the RI, the following RAOs pertaining to soil were developed for protection of human health and the environment at Site 3:

- Control human exposure (the existing maintenance worker, the future construction worker, and the recreational user) to chemicals of concern (COCs) in surface soil at concentrations in excess of remedial goal options (RGOs).

- Control exposure of ecological receptors to COCs in surface soil at concentrations greater than RGOs.

- Eliminate the migration of COCs from the fill material to sediment, surface water, and groundwater.

- Comply with chemical-specific, location-specific, and action-specific federal and state ARARs.

For the FS, three categories of human health RGOs were developed based on ILCR levels of 1.0E-04, 1.0E-05, and 1.0E-06. In each of these scenarios, the value corresponding to a noncarcinogenic HI of 1.0 was used as the RGO if it was lower than the ILCR. RGOs were modified to eliminate background and typical facility pesticide concentration effects.

Three categories of ecological RGOs were also developed for the FS: low, medium, and high. The low risk values correspond to the lowest screening values available and generally represent chemical concentrations at which adverse impacts to ecological receptors, including soil invertebrates, plants, and food-chain receptors, would not be expected. At chemical concentrations greater than the low-risk values, some adverse risks to sensitive organisms may occur. The low risk values are very conservative and most sample locations exceed one or more of these values. Moderate risk levels correspond to chemical concentrations at which adverse impacts to ecological receptors are likely. At concentrations greater than the moderate risk levels, adverse impacts to invertebrates, plants, and food-chain receptors would be expected with the degree of impact related to the contaminant concentrations and effected area. Approximately two-thirds of the soil sample locations at Site 3 exceed the moderate risk values. The high-risk values are approximately 10 times the moderate risk values and were calculated to help identify hot spots. Less than 10 percent of the sample locations exceed the high-risk goals. Low, moderate, and high risk values are also modified to eliminate background and typical facility pesticide concentration effects.

Based on discussions of the MCRD Parris Island partnering team, the following remedial goals have been established for soil.

Site 3 Soil COCs	Range of Detections 1998-1999 RI/RFI	Site 3 Soil Cleanup Levels	Basis
Semivolatile organic compounds (µg/kg)			
Benzo(a)anthracene	3 – 3,000	1,000	Ecological [1]
Benzo(a)pyrene	4.1 – 4,000	890/1,000	Human Health [2] / Ecological [1]
Benzo(b)fluoranthene	2.2 – 3,400	1,000	Ecological [1]
Benzo(g,h,i)perlyene	9.3 – 2,500	1,000	Ecological [1]
Benzo(k)fluoranthene	1.7 – 1,300	1,000	Ecological [1]
Chrysene	3.6 – 2,900	1,000	Ecological [1]
Indeno(1,2,3-cd)pyrene	2.6 – 2,600	1,000	Ecological [1]
Inorganics (mg/kg)			
Arsenic	0.44 – 11.8	7.79	Ecological [3]
Lead	5.5 – 264	61.9	Ecological [3]
Mercury	0.0375 – 0.43	0.11	Ecological [4]
Zinc	5.7 – 205	95.5	Ecological [3]

(1) Dutch Soil Cleanup Act "b" Values (Beyer, 1990)
(2) Site-specific Human Health Remedial Goal Options – ILCR = 1.0E-06 (TtNUS, 2000a)
(3) Cleanup goals that correspond to a low-observable-effects threshold HQ = 1.0 (TtNUS, 2000a)
(4) MCRD background values (TtNUS, 1999)

2.8.2 Description of Remedial Alternatives

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

Alternative 1 – No Action. Evaluation of a 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 in soil may eventually be reduced to cleanup levels through natural attenuation processes, but no monitoring would be performed to quantify this reduction. As existing soil cover erosion continues, eroded soil may collect in depositional areas where contaminant levels may actually increase. Mechanisms would not be in place to determine whether the alternative would comply with ARARs or achieve RAOs. There are no costs associated with the no-action alternative.

Alternative 2a – Partial Containment. This alternative would serve primarily to protect humans from exposure to contaminated soil and the contents of the landfill. This protection would be achieved by

assuring that a minimum of 2 feet of clean soil cover is present over waste material and that the sides of the causeway are stable. In areas where a concern to terrestrial ecological receptors is present but only under a high risk scenario, 1 foot of soil cover would be placed over existing soil. The soil cover described in this alternative would be placed over the southeastern half of the causeway. As part of the bank stabilization, excavation or covering of the sediments found to be the most contaminated would occur (sediments adjacent to the causeway). After construction, the cover would be inspected after major storm events and annually to ensure the integrity of the cover. LUCs as detailed in Appendix A would be implemented at the site. The estimated time to implement this alternative is 1 year. The costs associated with Alternative 2a are:

Capital Costs:	$4,094,000
Operating Costs:	55,400 to 71,400 $ per year.
30-year present worth:	$4,835,000

Alternative 2b – Full Containment. This alternative would also serve to protect humans from exposure to contaminated soil and the contents of the landfill. This protection would be achieved by assuring that a minimum of 2 feet of clean soil cover is present over waste material and that the sides of the causeway are stable. Alternative 2b provides equal protection to human health as Alternative 2a; however, Alternative 2b is more protective of ecological receptors. Because areas where a concern to terrestrial ecological receptors is present even under a low risk scenario, a minimum of 1 foot of soil cover would be placed over existing soil. Assuming such a scenario, soil cover would be placed over the entire length of the causeway under this alternative. As part of the bank stabilization, excavation or covering of the sediments found to be the most contaminated would occur (sediments adjacent to the causeway). After construction, the cover would be inspected after major storm events and annually to ensure the integrity of the cover. LUCs as detailed in Appendix A would be implemented at the site. The estimated time to implement this alternative is 1 year. The costs associated with Alternative 2b are:

Capital Costs:	$4,527,000
Operating Costs:	55,400 to 71,400 $ per year
30-year present worth:	$5,267,000

Alternative 3a – Partial Containment with Further Sediment Evaluation. Alternative 3a consists of all the components of Alternative 2a; however, Alternative 3a also contemplates the supplemental delineation of sediment found on the pond side of the causeway. The estimated time to implement this alternative is 1 year. The costs associated with Alternative 3a are:

Capital Costs:	$4,160,000

Operating Costs: 55,400 to 71,400 $ per year
30-year present worth: $4,901,000

Modified Alternative 3a – Partial Containment with Further Sediment Evaluation. Under this preferred alternative, Alternative 3a is modified to include a minimum of 1 foot of soil cover over soils that present a moderate risk to ecological receptors in lieu of only addressing high risk soils. This would involve placing a soil cover over approximately two-thirds of the causeway. The estimated time to implement this alternative is 1.5 years. The costs associated with Modified Alternative 3A are:

Capital Costs: $4,722,000
Operating Costs: 58,700 to 74,700 $ per year
30-year present worth: $5,500,000

Alternative 3b – Full Containment with Further Sediment Evaluation. Alternative 3b consists of all the components of Alternative 2b; however, Alternative 3b also contemplates the supplemental delineation of sediment found on the pond side of the causeway. The estimated time to implement this alternative is 1 year. The costs associated with Alternative 3b are:

Capital Costs: $4,652,000
Operating Costs: 55,400 to 71,400 $ per year
30-year present worth: $5,392,000

2.8.3 Applicable or Relevant and Appropriate Requirements and Remedial Alternatives

SARA requires that all remedial actions meet ARARs (unless waived) and the NCP. Preferred SARA remedial actions involve treatment that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous contaminants. In accordance with SARA, a list of ARARs was prepared to determine the appropriate extent of cleanup at Site 3. The ARARs, presented in Tables 2-9 and 2-10, include both federal and state regulations and associated guidance documents/to be considered criteria (TBCs).

2.8.4 Summary of Comparative Analysis of Remedial Alternatives

The remedial alternatives under consideration for Site 3 were evaluated against the following criteria, in accordance with U.S. EPA guidance (U.S. EPA, 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 are eliminated, reduced, or controlled.

2. Compliance with ARARs. The purpose of this evaluation criterion is to assess whether each alternative will meet federal and state ARARs. Compliance with ARARs is one of the statutory requirements for remedy selection.

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 their long-term effectiveness and the degree of permanence they afford, 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 costs and operation and maintenance 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

Alternative 1 would not be protective of human health and the environment.

The action alternatives (Alternatives 2a, 2b, Modified 3a, 3a, and 3b) would provide equal protection to maintenance and construction workers and the recreational user through the covering of waste and impacted soil with cover material. These alternatives provide varying levels of protection to terrestrial wildlife. Based on the areal extent of the soil cover provided in the action alternatives, Alternatives 2b and 3b would provide the most protection to terrestrial wildlife, followed by Modified Alternative 3a, and then Alternatives 2a and 3a.

Bank stabilization and erosion control measures associated with the action alternatives would minimize the migration of wastes and impacted soil into the surrounding sediment and surface water, thereby reducing human health and ecological exposure risks. Furthermore, risks would be reduced because implementation of these actions would involve excavating or covering sediment adjacent to the causeway (the most contaminated sediment).

Compliance with ARARs

Alternative 1 would not comply with several location-specific ARARs (e.g., Executive Orders pertaining to floodplain management and protection of wetlands and Coastal Zone Management Act). Additionally, Alternative 1 would not comply with several federal and state action-specific ARARs regarding final cover requirements for landfills.

Alternatives 2a, 2b, 3a, Modified 3a, and 3b would attain all chemical-, location-, and action-specific ARARs in the long term. These alternatives would also utilize slope stabilization and erosion control measures and provide soil cover over waste and impacted soil. These actions would also minimize waste migration into surrounding sediment and ecological contact with the waste contents of the causeway.

Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence would not be determined under Alternative 1.

Alternatives 2a, 2b, 3a, Modified 3a, and 3b would utilize reliable and readily implementable on-site remedial measures to both cover and prevent the migration of wastes thereby reducing risk to potential human and ecological receptors. These measures in combination with planned long-term monitoring and the application of LUCs would provide adequate long-term effectiveness of the interim remedy.

Reduction of Toxicity, Mobility or Volume Through Treatment

None of the alternatives would reduce the toxicity, mobility, or volume of the surface soil COCs through treatment. Some reduction would however result from biodegradation, natural dispersion, dilution, or other attenuating factors. Although a statutory preference for treatment exists for CERCLA remedial actions, U.S. EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites is for waste containment because the volume and types of wastes in municipal landfills like Site 3 generally makes treatment impracticable (U.S. EPA, 1993).

Short-Term Effectiveness

This evaluation criteria is not applicable to Alternative 1.

Under Alternatives 2a, 2b, 3a, Modified 3a, and 3b, vegetation along the sides of the causeway would be removed causing increased erosion rates in these areas. The eroded soil would be transported to and possibly affect the adjacent wetlands. However, measures (e.g. silt fences) to minimize the impact on the wetlands during bank stabilization would be employed.

Workers would be protected during implementation of the remedy through the use of personal protection equipment. The RAOs would be achieved when the cover is completed in approximately 1.5 years.

Implementability

This evaluation criterion is not applicable to Alternative 1. The implementation of Alternatives 2a, 2b, 3a, Modified 3a, and 3b is both technically and administratively feasible and practable.

Cost

The costs of the alternatives are as follows. Note that the cost estimates in this interim ROD do not include efforts associated with sediment remediation.

Alternative	Capital Costs ($)	Operating Costs ($/year)	30-Year Present Worth ($)
1	0	0	0
2a	4,094,000	55,400 to 71,400	4,835,000
2b	4,527,000	55,400 to 71,400	5,267,000
3a	4,160,000	55,400 to 71,400	4,901,000
Modified 3a	4,722,000	58,700 to 74,700	5,500,000
3b	4,652,000	55,400 to 71,400	5,392,000

Modified Alternative 3a has a slightly higher 30-year present worth than Alternative 3b because Modified Alternative 3a contains actions for covering sediment found to have a moderate risk to aquatic receptors.

State and Community Acceptance

The U.S. EPA guidance also requires that the remedial alternatives be evaluated for regulatory acceptance and public acceptance. These evaluations were addressed through the release of the Site 3 Proposed Plan on June 9, 2000 and the 45-day public comment period, which ended on July 27, 2000. No comments were received during the public information session held on June 27, 2000 or submitted during the public comment period. A summary of the comments received is included in the Responsiveness Summary, Appendix B.

2.9 Selected Remedy

The selected alternative for interim remediation is Modified Alternative 3a. The components of the interim remedial action will consist of the following items. Illustrations of the interim soil remedy are presented in Figures 2-5 and 2-6.

Slope Stabilization and Erosion Control. The sides of the entire causeway will be stabilized with regrading, compacted fill, vegetation, riprap, and/or gabions. These actions will minimize the potential for further erosion of causeway wastes due to the actions of rain runoff, waves, and/or wind to the pond and marsh. Limited sediment excavation or covering of the sediments along the base of the causeway will occur as part of these measures. The sediment areas addressed by slope stabilization include the most contaminated sediments found at Site 3. Addressing these sediments will eliminate most of the site risks identified to human and ecological receptors by sediment exposure.

Soil Cover. Additional compacted soil cover will be placed over approximately two-thirds of the causeway to minimize the potential for human and ecological contact with waste and impacted soil. Additionally, these actions will be conducted to minimize the migration of contaminants to nearby surface water and sediment due to runoff, waves, and/or wind. The proposed interim remedy includes ensuring a minimum of 2 feet of compacted soil cover over waste materials. This action is being conducted to protect human health and the environment. The 2 feet of compacted soil will protect human health by reducing the ILCR to 1.0E-06. The proposed interim remedy also includes an additional 1 foot of soil cover over existing soil that poses moderate to high risks to terrestrial wildlife. The additional soil cover will protect terrestrial wildlife to a moderate level [minimum of clean-up goals that correspond to a low-observable-effects threshold HQ of 1.0 and/or Dutch Soil Clean-up Act "B" values (Beyer, 1990)]. Except for soil macroinvertebrates (e.g., worms), moderate risk values are considered protective of most terrestrial ecological receptors.

Roadway Construction/Sediment Testing. A paved road will be constructed that will reduce precipitation infiltration into the waste and reduce erosion of cover material. Also, sediment will be re-characterized. These sediments will be addressed in a future Proposed Plan and ROD.

Land-Use Controls and Long-Term Monitoring. LUCs will be implemented to control or eliminate pathways of exposure to COCs at the site. The specific LUCs are contained in the LUCIP which is in Appendix A. Prohibitions on unauthorized intrusive/construction activity will be implemented. Additionally, current site restrictions regarding prohibitions on swimming and wading will be maintained. Through the Depot's LUC and the site's LUCIP, residential development of the site and the use of the site's groundwater as potable water will also be prohibited. Quarterly reviews (per the MOA) will be conducted to ensure the long-term integrity of the remedy and effectiveness of the land-use controls. Also, to verify the effectiveness of the proposed interim remedy, a monitoring program will be established that consists of annual groundwater testing for the first 5 years. Four groundwater samples will be collected each year and analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. A re-evaluation of the site will be performed every 5 years per CERCLA requirements to determine whether changes to the site restrictions and monitoring frequency will be required.

A detailed breakdown of costs of the preferred alternative is provided in Appendix C.

2.10 STATUTORY DETERMINATIONS

This proposed interim action is protective of human health and the environment in the short term because the interim action:

- Minimizes human and ecological exposures to impacted surface soil where concentrations of contaminants represent a human health ILCR greater than 1.0E-06 or moderate risk to terrestrial wildlife.
- Provides a minimum of 2 feet of soil cover over existing waste materials within the causeway structure, making it consistent with federal and South Carolina regulations.
- Stabilizes the sides of the causeway, eliminating further impacts to the soils and sediments of the site.

This interim action also complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action. Although the preferred alternative is the most costly alternative, it is the only alternative that meets all remedial action objectives.

This Interim ROD is intended to provide adequate protection until a final ROD is signed. This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for Site 3. 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. Instead, it was determined that a presumptive remedy approach providing for waste containment was more appropriate and adequately protective. Subsequent actions will address the threats, including contaminated sediments, posed by conditions at the site. Because this remedy will result in wastes remaining on-site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within 5 years after commencement of the remedial action. Because this is an interim action ROD, review of this site and remedy will be ongoing as MCRD Parris Island continues to develop remedial alternatives for Site 3

The U.S. EPA and SCDHEC (as support agencies) concur with the preferred alternative for the interim remedy. It is the U.S. Navy's judgment that the preferred alternative is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment. The preferred alternative satisfies the statutory requirements in CERCLA Section 121(b), which state that the selected alternative must be protective of human health and the environment, comply with ARARs, be cost-effective, utilize permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfy the statutory preference for treatment as a principle element where practical.

2.11 EXPLANATION OF SIGNIFICANT CHANGES

As the lead agency, Southern Division Naval Facilities Engineering Command prepared and issued the Proposed Plan for Soil Interim Remedial Action at Site 3 on June 9, 2000 (TtNUS, 2000). This Proposed

Plan described the rationale for a final response at Site 3. The SCDHEC, U.S. EPA Region 4, and the public concur with this final response. Therefore, no significant changes were made to the Proposed Plan for Soil Interim Remedial Action. This response action may be re-evaluated in the future if conditions at Site 3 indicate that an unacceptable risk to public health or the environment may exist at this site.

TABLE 2-1

SUMMARY OF STATISTICS - SURFACE SOIL
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All[1]	Background.	Maximum Exceed Backgrd.
Volatiles (ug/kg)								
2-Butanone	1/16	360	5 - 10	PAI-03-SS-008-01	360	26	NA	NA
Acetone	2/6	120 - 240	14 - 900	PAI-03-SS-008-01	180	169	NA	NA
Chloroform	4/16	1 - 2	5 - 10	PAI-03-SS-011-01	1.5	2.8	NA	NA
Semivolatiles (ug/kg)								
2-Methylnaphthalene	1/15	300	340 - 380	PAI-03-SS-001-01	300	187	NA	NA
4-Methylphenol	1/15	120	340 - 380	PAI-03-SS-001-01	120	175	NA	NA
Acenaphthene	1/16	4000	94 - 4600	PAI-03-SS-001-01	4,000	726	NA	NA
Acenaphthylene	1/16	1800	47 - 2300	PAI-03-SS-001-01	1,800	350	NA	NA
Anthracene	6/16	1.7 - 340	1.9 - 93	PAI-03-SS-001-01	66	33	NA	NA
Benzo(a)anthracene	10/16	3 - 3000	8.6 - 230	PAI-03-SS-001-01	335	225	NA	NA
Benzo(a)pyrene	10/16	4.1 - 4000	8.6 - 230	PAI-03-SS-001-01	438	290	NA	NA
Benzo(b)fluoranthene	15/16	2.2 - 3400	3.6	PAI-03-SS-001-01	263	247	NA	NA
Benzo(g,h,i)perylene	5/16	9.3 - 2500	7.5 - 370	PAI-03-SS-001-01	527	198	NA	NA
Benzo(k)fluoranthene	11/16	1.7 - 1300	3.6 - 93	PAI-03-SS-001-01	130	97	NA	NA
Bis(2-Ethylhexyl)phthalate	1/15	2300	340 - 370	PAI-03-SS-015-01	2,300	320	NA	NA
Carbazole	3/15	48 - 670	340 - 380	PAI-03-SS-001-01	256	194	NA	NA
Chrysene	13/16	3.6 - 2900	9.1 - 230	PAI-03-SS-001-01	274	230	NA	NA
Dibenzofuran	1/15	340	340 - 380	PAI-03-SS-001-01	340	190	NA	NA
Fluoranthene	14/16	6.4 - 5100	5.5 - 22	PAI-03-SS-001-01	472	414	NA	NA
Indeno(1,2,3-cd)pyrene	10/16	2.6 - 2600	8.6 - 230	PAI-03-SS-001-01	279	193	NA	NA
Phenanthrene	14/16	2.2 - 1200	7.2 - 190	PAI-03-SS-001-01	129	119	NA	NA
Pyrene	10/16	13 - 4500	9.4 - 460	PAI-03-SS-001-01	527	360	NA	NA
Pesticides/PCBs (ug/kg)								
4,4'-DDE	1/16	4.1	1.7 - 190	PAI-03-SS-012-01	4.1	12	NA	NA
4,4'-DDT	2/16	1.8 - 4.5	1.8 - 190	PAI-03-SS-012-01	3.2	12	NA	NA
Alpha-Chlordane	1/16	96	0.87 - 1900	PAI-03-SS-001-01	96	96	NA	NA
Aroclor-1254	1/16	56	8.6 - 9.4	PAI-03-SS-009-01	56	7.7	NA	NA
Aroclor-1260	4/16	11 - 100	8.6 - 9.4	PAI-03-SS-013-01	41	14	NA	NA
Gamma-Chlordane	1/16	53	0.87 - 1900	PAI-03-SS-001-01	53	93	NA	NA
Inorganics (mg/kg)								
Aluminum	16/16	2370 - 10800	0	PAI-03-SS-010-01	5,745	5,745	7,270	Yes
Antimony	2/16	0.17 - 0.33	0.15 - 0.23	PAI-03-SS-015-01	0.25	0.10	ND	Yes
Arsenic	16/16	0.44 - 11.8	0	PAI-03-SS-003-01	1.7	1.7	1.4	Yes
Barium	16/16	5.8 - 81.2	0	PAI-03-SS-001-01	16	16	24	Yes
Beryllium	3/16	0.11 - 0.58	0.02 - 0.38	PAI-03-SS-004-01	0.38	0.12	0.10	Yes
Cadmium	6/16	0.04 - 0.53	0.02 - 0.03	PAI-03-SS-001-01	0.21	0.09	ND	Yes
Calcium	16/16	461 - 56100	0	PAI-03-SS-015-01	11,082	11,082	766	Yes
Chromium	16/16	3.5 - 15.9	0	PAI-03-SS-004-01	8.4	8.4	6.2	Yes
Cobalt	16/16	0.14 - 1.7	0	PAI-03-SS-004-01	0.61	0.61	0.36	Yes
Copper	13/16	1.3 - 10.7	0.46 - 1.6	PAI-03-SS-004-01	3.9	3.3	1.5	Yes
Iron	16/16	2180 - 7370	0	PAI-03-SS-004-01	4,788	4,788	3,920	Yes
Lead	16/16	5.5 - 264	0	PAI-03-SS-001-01	31	31	13	Yes
Magnesium	16/16	150 - 2250	0	PAI-03-SS-004-01	646	646	515	Yes
Manganese	16/16	8.1 - 66.9	0	PAI-03-SS-015-01	28	28	129	No
Mercury	6/16	0.0375 - 0.43	0.02 - 0.03	PAI-03-SS-009-01	0.13	0.06	0.11	Yes
Nickel	16/16	0.39 - 6.1	0	PAI-03-SS-002-01	2.0	2.0	1.8	Yes
Potassium	16/16	115 - 1380	0	PAI-03-SS-004-01	370	370	313	Yes
Selenium	2/16	0.28 - 0.41	0.14 - 0.5	PAI-03-SS-010-01	0.35	0.15	0.29	Yes
Silver	1/16	0.09	0.05 - 0.06	PAI-03-SS-015-01	0.09	0.03	ND	Yes
Sodium	6/16	192 - 5480	164 - 441	PAI-03-SS-004-01	1,854	801	241	Yes
Vanadium	16/16	4.7 - 21.4	0	PAI-03-SS-004-01	10	10	10	Yes
Zinc	16/16	5.7 - 205	0	PAI-03-SS-001-01	27	27	10	Yes

NA = Not Applicable
ND = Non-Detect
Average All is the arithmetic average where 1/2 of the detection limit was used for ND results when calculating the average

TABLE 2-2

SUMMARY STATISTICS - GROUNDWATER
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All[1]
Volatiles (µg/L)						
Benzene	2/4	0.3 - 21	1	PAI-03-GW-001-01	11	5.6
Carbon Disulfide	1/4	0.3	1	PAI-03-GW-002-01	0.30	0.45
Chlorobenzene	2/4	0.6 - 130	1	PAI-03-GW-001-01	65	33
Chloroform	1/4	0.3	1	PAI-03-GW-004-01	0.30	0.45
Ethylbenzene	1/4	0.3	1	PAI-03-GW-001-01	0.30	0.45
Toluene	2/4	0.3	1	PAI-03-GW-002-01	0.30	0.40
Xylenes, Total	1/4	0.3	1	PAI-03-GW-001-01	0.30	0.45
Semivolatiles (µg/L)						
1,4-Dichlorobenzene	1/4	10	5	PAI-03-GW-001-01	10	4.4
2-Methylnaphthalene	1/4	1	5	PAI-03-GW-003-01	1.0	2.1
4-Methylphenol	1/4	73	5	PAI-03-GW-003-01	73	20
Acenaphthene	1/4	2	5	PAI-03-GW-003-01	2.0	2.4
Anthracene	1/4	1	5	PAI-03-GW-003-01	1.0	2.1
Bis(2-Ethylhexyl)phthalate	3/4	1	5	PAI-03-GW-001-01	1.0	1.4
Fluorene	1/4	1	5	PAI-03-GW-003-01	1.0	2.1
N-Nitrosodiphenylamine	1/4	1	5	PAI-03-GW-001-01	1.0	2.1
Naphthalene	2/4	1	5	PAI-03-GW-001-01	1.0	1.8
Phenanthrene	1/4	1	5	PAI-03-GW-003-01	1.0	2.1
Pesticides/PCBs (µg/L)						
alpha-BHC	1/4	0.12	0.05	PAI-03-GW-002-01	0.12	0.05
Inorganics - Unfiltered (µg/L)						
Arsenic	4/4	2.2 - 34.5	0	PAI-03-GW-001-01	11	11
Barium	4/4	93.5 - 854	0	PAI-03-GW-004-01	357	357
Calcium	3/3	60600 - 474000	0	PAI-03-GW-004-01	203,033	203,033
Chromium	2/4	7.6 - 27	6.4	PAI-03-GW-004-01	17	10
Iron	3/3	14600 - 32600	0	PAI-03-GW-004-01	23,633	23,633
Magnesium	3/3	76400 - 508000	0	PAI-03-GW-004-01	235,133	235,133
Manganese	3/3	112 - 708	0	PAI-03-GW-004-01	391	391
Potassium	3/3	63600 - 209000	0	PAI-03-GW-004-01	128,533	128,533
Sodium	3/3	588000 - 4610000	0	PAI-03-GW-004-01	2,119,333	2,119,333
Thallium	1/4	2.6	1.8 - 9	PAI-03-GW-004-01	2.6	2.2
Inorganics - Filtered (µg/L)						
Arsenic	4/4	1.2 - 31.1	0	PAI-03-GW-001-01-F	9.3	9.3
Barium	4/4	93.3 - 901	0	PAI-03-GW-004-01-F	373	373
Calcium	3/3	63400 - 492000	0	PAI-03-GW-004-01-F	210,500	210,500
Chromium	1/4	24.8	6.4	PAI-03-GW-004-01-F	25	8.6
Iron	3/3	14600 - 31500	0	PAI-03-GW-004-01-F	23,500	23,500
Magnesium	3/3	75400 - 543000	0	PAI-03-GW-004-01-F	247,800	247,800
Manganese	3/3	113 - 711	0	PAI-03-GW-004-01-F	395	395
Potassium	3/3	64800 - 223000	0	PAI-03-GW-004-01-F	134,933	134,933
Sodium	3/3	576000 - 5130000	0	PAI-03-GW-004-01-F	2,295,333	2,295,333
Thallium	1/4	3.8	1.8 - 9	PAI-03-GW-004-01-F	3.8	2.5

NA - Not Applicable
ND - Non-Detect
[1]Average All is the arithmetic average where 1/2 of the detection limit was used for ND results when calculating the average

TABLE 2-3

SUMMARY STATISTICS - SURFACE WATER
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All[1]	Background	Maximum Level Exceed Backgrd.
Volatiles (ug/L)								
Acetone	1/1	3	0	PAI-03-SW-023	3.0	3.0	NA	NA
Semivolatiles (ug/L)								
Anthracene	1/20	0.38	0.048 - 0.054	PAI-03-SW-014	0.38	0.04	NA	NA
Benzo(a)anthracene	1/20	0.66	0.12 - 0.14	PAI-03-SW-014	0.66	0.09	NA	NA
Benzo(a)pyrene	2/20	0.075 - 0.72	0.12 - 0.14	PAI-03-SW-014	0.40	0.10	NA	NA
Benzo(b)fluoranthene	2/20	0.06 - 0.67	0.048 - 0.49	PAI-03-SW-014	0.37	0.07	NA	NA
Benzo(g,h,i)perylene	1/20	0.89	0.19 - 0.22	PAI-03-SW-014	0.89	0.14	NA	NA
Benzo(k)fluoranthene	2/20	0.025 - 0.25	0.048 - 0.49	PAI-03-SW-014	0.14	0.05	NA	NA
Bis(2-Ethylhexyl)phthalate	6/20	2 - 7	10	PAI-03-SW-025	4.5	4.9	NA	NA
Butylbenzyl Phthalate	1/20	5	10 - 10.5	PAI-03-SW-028	5.0	5.0	NA	NA
Chrysene	2/20	0.09 - 1.2	0.12 - 0.14	PAI-03-SW-014	0.65	0.12	NA	NA
Fluoranthene	3/20	0.1 - 1.9	0.12 - 0.14	PAI-03-SW-014	0.71	0.16	NA	NA
Indeno(1,2,3-cd)pyrene	2/20	0.075 - 0.39	0.12 - 0.14	PAI-03-SW-014	0.23	0.08	NA	NA
Phenanthrene	3/20	0.05 - 1.4	0.0955 - 0.11	PAI-03-SW-014	0.50	0.12	NA	NA
Pyrene	1/20	1.3	0.24 - 0.27	PAI-03-SW-014	1.30	0.19	NA	NA
Inorganics - Non-filtered (ug/L)								
Aluminum	18/20	242 - 88600	44.5 - 90.8	PAI-03-SW-027	5,951	5,360	3,113	Yes
Antimony	4/20	1.8 - 3.2	1.7 - 3.7	PAI-03-SW-014	2.5	1.3	ND	NA
Arsenic	1/20	96.1	1.5 - 3.5	PAI-03-SW-027	96	6	5	Yes
Barium	13/20	13 - 227	12.4 - 15.9	PAI-03-SW-025	41	29	38	Yes
Beryllium	1/20	4.4	0.2	PAI-03-SW-027	4.4	0.32	ND	NA
Cadmium	1/20	2	0.3	PAI-03-SW-027	2.0	0.24	ND	NA
Calcium	20/20	126000 - 274000	0	PAI-03-SW-013	245,325	245,325	637,000	No
Chromium	3/20	0.79 - 164	0.7 - 0.8	PAI-03-SW-027	55	9	23	Yes
Cobalt	1/20	21.1	0.6	PAI-03-SW-027	21	1.3	ND	NA
Copper	8/20	1.4 - 152	1.2 - 3.2	PAI-03-SW-027	23	10	7.0	Yes
Iron	18/20	163 - 110000	16.6 - 91.7	PAI-03-SW-027	6,783	6,107	2,091	Yes
Lead	1/20	132	1 - 17	PAI-03-SW-027	132	9.1	ND	NA
Magnesium	20/20	230000 - 841000	0	PAI-03-SW-025	727,250	727,250	1,918,667	No
Manganese	19/20	5.3 - 840	0.4	PAI-03-SW-027	80	76	53	Yes
Mercury	1/20	0.15	0.1	PAI-03-SW-027	0.15	0.06	ND	NA
Nickel	1/20	39.8	1	PAI-03-SW-027	40	2	ND	NA
Potassium	20/20	146000 - 478000	0	PAI-03-SW-014	400,675	400,675	831,333	No
Silver	4/20	0.68 - 2.1	0.6 - 0.7	PAI-03-SW-021-AVG	1.12	0.48	ND	NA
Sodium	20/20	1950000 - 6820000	0	PAI-03-SW-025	5,947,500	5,947,500	16,226,667	No
Vanadium	1/20	269	0.5 - 6.1	PAI-03-SW-027	269	15	18	Yes
Zinc	4/20	12.7 - 294	1.9 - 8.3	PAI-03-SW-027	97	22	11	Yes
Inorganics - Filtered (ug/L)								
Aluminum	2/20	323 - 650	22.7 - 120	PAI-03-SW-025-F	487	82	ND	Yes
Antimony	4/20	1.8 - 4.2	1.7 - 4.9	PAI-03-SW-019-F	2.8	1.5	ND	Yes
Arsenic	2/20	2.3 - 12.9	1.5 - 3.5	PAI-03-SW-027-F	7.6	1.7	4.3	Yes
Barium	20/20	15 - 279	0	PAI-03-SW-028-F	227	227	256	Yes
Calcium	20/20	137000 - 282000	0	PAI-03-SW-025-F	244,275	244,275	645,333	No
Copper	3/20	1 - 1.7	1.2 - 7.5	PAI-03-SW-011-F	1.3	1.2	13	No
Iron	2/20	175 - 549	16.6 - 93.8	PAI-03-SW-025-F	362	46	18	Yes
Magnesium	20/20	249000 - 843000	0	PAI-03-SW-025-F	721,500	721,500	1,918,000	No
Manganese	15/20	7.4 - 156	0.4 - 1.9	PAI-03-SW-028-F	42	32	18	Yes
Potassium	20/20	159000 - 495000	0	PAI-03-SW-009-F	444,625	444,625	890,667	No
Silver	1/20	0.71	0.6 - 0.7	PAI-03-SW-013-F	0.71	0.33	ND	Yes
Sodium	20/20	2110000 - 6970000	0	PAI-03-SW-022-F	5,968,250	5,968,250	15,986,667	No
Vanadium	1/20	11	0.5 - 1.9	PAI-03-SW-027-F	11	0.92	15	No
Zinc	18/20	25.2 - 84.8	3.5 - 15.4	PAI-03-SW-012-F	55	50	66	Yes

NA - Not Applicable
ND - Non Detect
Average All is the arithmetic average where 1/2 of the detection limit was used for ND results when calculating the average

TABLE 2-4

SUMMARY STATISTICS - 1998 SEDIMENT SAMPLES
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detects	Average of Positive Results	Average All[1]	Background	Maximum Exceed Backgrd.
Volatiles (ug/kg)								
2-Butanone	6/17	8 - 61	6 - 37	PAI-03-SD-014-01	24	14	NA	NA
Acetone	2/6	150 - 170	39 - 100	PAI-03-SD-026-01	160	75	NA	NA
Carbon Disulfide	6/21	3 - 40	6 - 37	PAI-03-SD-014-01	21	12	NA	NA
Chloroform	2/21	1	8 - 38	PAI-03-SD-016-01	1.0	9.2	NA	NA
Semivolatiles (ug/kg)								
Anthracene	4/21	3.7 - 770	2.3 - 260	PAI-03-SD-022-01	197	55	NA	NA
Benzo(a)anthracene	6/21	5.1 - 1200	5.7 - 650	PAI-03-SD-022-01	222	105	NA	NA
Benzo(a)pyrene	6/21	8.1 - 1200	5.7 - 650	PAI-03-SD-022-01	227	106	NA	NA
Benzo(b)fluoranthene	13/21	1.8 - 990	23 - 260	PAI-03-SD-022-01	96	73	NA	NA
Benzo(g,h,i)perylene	2/21	24 - 570	9.2 - 1000	PAI-03-SD-022-01	297	99	NA	NA
Benzo(k)fluoranthene	5/21	3 - 420	2.3 - 260	PAI-03-SD-022-01	95	39	NA	NA
Carbazole	1/21	570	440 - 1600	PAI-03-SD-022-01	570	409	NA	NA
Chrysene	13/21	3.2 - 1900	60 - 650	PAI-03-SD-022-01	183	148	NA	NA
Dibenzofuran	1/21	190	440 - 1600	PAI-03-SD-022-01	190	391	NA	NA
Fluoranthene	9/21	15 - 3500	5.7 - 650	PAI-03-SD-022-01	437	225	NA	NA
Fluorene	1/21	13	11 - 1300	PAI-03-SD-027-01	13	105	NA	NA
Indeno(1,2,3-cd)pyrene	6/21	5.8 - 660	5.7 - 650	PAI-03-SD-022-01	128	78	NA	NA
Phenanthrene	9/21	5.8 - 2400	4.6 - 520	PAI-03-SD-022-01	282	153	NA	NA
Pyrene	8/21	11 - 2700	11 - 1300	PAI-03-SD-022-01	375	225	NA	NA
Pesticides/PCBs (ug/kg)								
4,4'-DDD	2/21	40 - 290	2.3 - 140	PAI-03-SD-014-01	165	41	NA	NA
4,4'-DDE	1/21	45	2.3 - 140	PAI-03-SD-014-01	45	29	NA	NA
4,4'-DDT	1/21	34	2.3 - 140	PAI-03-SD-021-01	34	29	NA	NA
Alpha-Chlordane	1/21	28	1.1 - 1400	PAI-03-SD-028-01	28	146	NA	NA
Aroclor-1254	3/21	65 - 250	11 - 40	PAI-03-SD-020-01	137	28	NA	NA
Aroclor-1260	2/21	45 - 70	11 - 40	PAI-03-SD-015-01	58	15	NA	NA
Gamma-Chlordane	1/21	28	1.1 - 1400	PAI-03-SD-028-01	28	146	NA	NA
Inorganics (mg/kg)								
Aluminum	21/21	1510 - 29700	0	PAI-03-SD-026-01	13,060	13,060	24,284	Yes
Antimony	3/21	0.34 - 0.74	0.19 - 0.66	PAI-03-SD-014-01	0.48	0.22	ND	Yes
Arsenic	16/21	2.3 - 19.8	0.22 - 0.97	PAI-03-SD-024-01	8	6	12	Yes
Barium	16/21	3.6 - 53.8	17 - 36.2	PAI-03-SD-022-01	18	17	28	Yes
Beryllium	11/21	0.29 - 1.4	0.02 - 0.46	PAI-03-SD-026-01	0.82	0.48	0.98	Yes
Cadmium	10/21	0.12 - 0.44	0.03 - 0.12	PAI-03-SD-010-01	0.27	0.15	0.28	No
Calcium	21/21	408 - 32800	0	PAI-03-SD-010-01	3,849	3,849	4,002	Yes
Chromium	21/21	3.3 - 50.3	0	PAI-03-SD-026-01	22	22	35	Yes
Cobalt	19/21	0.11 - 5.6	0.07	PAI-03-SD-026-01	2.2	2.0	2.6	Yes
Copper	21/21	1.8 - 46.9	0	PAI-03-SD-020-01	15	15	10	Yes
Iron	21/21	1100 - 28000	0	PAI-03-SD-024-01	12,745	12,745	21,450	Yes
Lead	21/21	6.4 - 105	0	PAI-03-SD-017-01	30	30	21	Yes
Magnesium	21/21	267 - 6710	0	PAI-03-SD-023-01	3,222	3,222	6,437	Yes
Manganese	21/21	9.7 - 205	0	PAI-03-SD-026-01	70	70	186	Yes
Mercury	6/21	0.05 - 0.35	0.02 - 0.09	PAI-03-SD-028-01	0.14	0.06	0.09	Yes
Nickel	19/21	0.42 - 13.9	0.12 - 0.81	PAI-03-SD-020-01	6.0	5.5	6.0	Yes
Potassium	21/21	170 - 4570	0	PAI-03-SD-026-01	2,028	2,028	3,190	Yes
Selenium	7/21	0.32 - 1.1	0.19 - 1	PAI-03-SD-028-01	0.62	0.34	ND	Yes
Silver	1/21	0.13	0.07 - 0.23	PAI-03-SD-020-01	0.13	0.07	ND	Yes
Sodium	20/21	377 - 26600	1960	PAI-03-SD-023-01	9,706	9,290	19,110	Yes
Thallium	1/21	0.62	0.18 - 0.89	PAI-03-SD-027-01	0.62	0.21	0.41	Yes
Vanadium	21/21	2.6 - 63.7	0	PAI-03-SD-026-01	29	29	50	Yes
Zinc	21/21	5.2 - 159	0	PAI-03-SD-020-01	43	43	45	Yes
Cyanide	1/21	0.71	0.44 - 1.8	PAI-03-SD-018-01	0.71	0.48	ND	Yes

NA = Not Applicable
ND = Non Detect
1 Average All is the arithmetic average where 1/2 of the detection limit was used for ND results when calculating the average

TABLE 2-5

SUMMARY STATISTICS - 1999 SEDIMENT DELINEATION SAMPLES
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Range of Positive Detects	Range of Nondetects	Location of Maximum Positive Detect	Average of Positive Detects	Average All[1]	Background	Maximum Exceed Backgrd.
Semivolatile Organics (ug/kg)								
Acenaphthene	1/3	98	120 - 330	PAI-03-SD-29-01-AVG	98.0	108	NA	NA
Anthracene	1/3	4	2.4 - 6.6	PAI-03-SD-29-01-AVG	4.00	2.83	NA	NA
Benzo(a)anthracene	2/3	8.9 - 18	16	PAI-03-SD-29-01-AVG	13.5	11.6	NA	NA
Benzo(a)pyrene	3/3	8.2 - 22	ND	PAI-03-SD-30-01	16.7	16.7	NA	NA
Benzo(b)fluoranthene	3/3	7.8 - 19	ND	PAI-03-SD-30-01	14.8	14.8	NA	NA
Benzo(k)fluoranthene	3/3	4.5 - 10.25	ND	PAI-03-SD-29-01-AVG	7.78	7.78	NA	NA
Chrysene	2/3	6.1 - 13.25	16	PAI-03-SD-29-01-AVG	9.68	9.12	NA	NA
Fluoranthene	3/3	13 - 39	ND	PAI-03-SD-29-01-AVG	24.3	24.3	NA	NA
Indeno(1,2,3-cd)pyrene	2/3	9.9 - 14	59	PAI-03-SD-29-01-AVG	12.0	17.8	NA	NA
Pyrene	2/3	13 - 35.5	33	PAI-03-SD-29-01-AVG	24.3	21.7	NA	NA
Pesticides/PCBs (ug/Kg)								
4,4'-DDD	2/6	62 - 70	24 - 28	PAI-03-SD-38-01	66.0	30.7	NA	NA
4,4'-DDE	2/6	60 - 75	24 - 28	PAI-03-SD-36-01	67.5	31.2	NA	NA
Aroclor-1254	2/3	76 - 250	18	PAI-03-SD-34-01-AVG	163	112	NA	NA

ND - Non-Detect.
NA - Not Applicable
1 Average All is the arithmetic average where 1/2 of the detection limit was used for the ND results when calculating the average.

TABLE 2-6

CHEMICALS RETAINED AS HUMAN HEALTH COPCs
SITE 3- CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Surface Soil	Soil to Air	Soil to Groundwater	Groundwater	Sediment	Surface Water	Fish Tissue[1]	Fish Tissue[2]
VOCs								
Benzene				X				
Chlorobenzene				X				
Chloroform				X				
SVOCs								
1,4-Dichlorobenzene				X				
4-Methylphenol				X				
Benzo(a)anthracene	X		X		X			X
Benzo(a)pyrene	X				X	X		X
Benzo(b)fluoranthene	X				X	X		X
Benzo(k)fluoranthene						X		
Bis(2-ethylhexyl)phthalate						X		
Carbazole			X					X
Chrysene						X		
Indeno(1,2,3-cd)pyrene	X					X		X
PESTICIDES/PCBS								
alpha-BHC				X				
alpha-chlordane								X
gamma-chlordance								X
Aroclor-1254							X	X
Aroclor-1260								X
Dieldrin							X	
DDD								X
DDE							X	X
DDT								X
Heptachlor Epoxide							X	
INORGANICS								
Aluminum	X				X	X		
Arsenic	X			X	X	X		X
Barium				X				
Coppper								X
Iron	X			X	X	X		
Manganese				X		X		
Mercury							X	X
Thallium				X				
Vanadium					X			

Notes
X - Indicates chemical was retained as a COPC.
1 - Based on fish tissue samples from Extended Site Inspection (ABB Environmental Services, Inc., August, 1993).
2 - Based on calculated concentrations of chemicals in fish tissue from the ecological risk assessment.

TABLE 2-7

SUMMARY OF HUMAN HEALTH CANCER RISKS AND HAZARD INDICES
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Receptor	Media	Exposure Route	ILCR	Chemicals with ILCR > 1.0E-04	Chemicals with ILCR > 1.0E-05	Chemicals with ILCR > 1.0E-06	Hazard Index	Chemicals with HI > 1
Construction Worker	Soil	Ingestion	1.8E-06	--	--	cPAHs	0.16	--
		Dermal Contact	4.7E-06	--	--	cPAHs	0.06	--
		Total	6.5E-06	--	--	cPAHs	0.22	--
	Groundwater	Dermal Contact	4.0E-08	--	--	--	0.06	--
	Sediment	Ingestion	1.3E-07	--	--	--	0.05	--
		Dermal Contact	2.6E-07	--	--	--	0.01	--
		Total	4.0E-07	--	--	--	0.06	--
	Surface Water	Ingestion	1.4E-07	--	--	--	0.05	--
		Dermal Contact	1.0E-05	--	--	cPAHs	0.09	--
		Total	1.0E-05	--	cPAHs	--	0.14	--
		Total All Media	1.7E-05			Total All Media	0.47	
Maintenance Worker	Soil	Ingestion	3.7E-06	--	--	cPAHs, Arsenic	0.01	--
		Dermal Contact	4.7E-05	--	cPAHs	Arsenic	0.02	--
		Total	5.1E-05	--	cPAHs	Arsenic	0.04	--
	Sediment	Ingestion	8.2E-07	--	--	--	0.01	--
		Dermal Contact	7.9E-06	--	--	cPAHs, Arsenic	0.01	--
		Total	8.7E-06	--	--	cPAHs, Arsenic	0.03	--
		Total All Media	5.9E-05			Total All Media	0.06	
Recreational Users	Fish (Measured Tissue)	Conservative	5.0E-05	--	Aroclor 1254	Dieldrin, DDE	2.4	Aroclor 1254
		Site-Specific	3.5E-06	--		Aroclor 1254	0.83	--
	Fish (Calculated Sediment/Surface Water - Maximum Concentration)	Conservative	1.8E-03	cPAHs, Aroclor 1254, Arsenic	DDE, alpha-chlordane, Aroclor 1260	Carbazole, DDD, DDT, gamma-chlordane	18	Aroclor 1254, Arsenic, Mercury
		Site-Specific	1.3E-04	--	cPAHs, Aroclor 1254, Arsenic	DDE, Aroclor 1260	6.1	Aroclor 1254, Arsenic, Mercury
	Fish (Calculated Sediment/Surface Water - Average Concentration)	Conservative	2.0E-04	--	cPAHs, DDE, alpha-chlordane, gamma-chlordane, Aroclor 1254, Aroclor 1260, Arsenic	Carbazole, DDT	2.2	Aroclor 1254
		Site-Specific	1.4E-05	--	--	cPAHs, DDE, alpha-chlordane, gamma-chlordane, Aroclor 1254, Arsenic	0.76	--

CPAHs: Carcinogenic polynuclear aromatic hydrocarbons
*Conservative: U.S. EPA Region IV default parameters (see Table 6-18 of the Site 3 RI)
Site-Specific: Values based on site specific conditions (see Table 6-18 of the Site 3 RI)
ILCR: Incremental Lifetime Cancer Risk

TABLE 2-8

CHEMICALS RETAINED AS ERA STEP 2 ECOLOGICAL COPCs
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

Chemical	Surface Water	Sediment	Surface Soil	Groundwater
VOCs				
2-Butanone		X	X	
Acetone	X	X	X	
Carbon Disulfide		X		X
Chlorobenzene				X
Chloroform		X	X	
Xylenes, Total				X
SVOCs				
2-Methylnaphthalene			X	X
4-Methylphenol			X	X
Acenaphthylene			X	
Anthracene		X	X	
Benzo(a)anthracene	X	X	X	
Benzo(a)pyrene	X	X	X	
Benzo(b)fluoranthene	X	X	X	
Benzo(g,h,i)perylene	X		X	
Benzo(k)fluoranthene	X		X	
Bis(2-Ethylhexyl)phthalate	X		X	X
Carbazole		X	X	
Chrysene	X	X	X	
Dibenzofuran		X	X	
Fluoranthene	X	X	X	
Indeno(1,2,3-cd)pyrene	X	X	X	
Phenanthrene		X	X	
Pyrene	X	X	X	
PESTICIDES/PCBs				
4,4'-DDD		X		
4,4'-DDE		X	X	
4,4'-DDT		X	X	
Alpha-Chlordane		X	X	
Gamma-Chlordane		X	X	
Aroclor-1254		X	X	
Aroclor-1260		X	X	
INORGANICS				
Aluminum	X	X	X	
Antimony	X			
Arsenic	X	X	X	
Barium	X	X		X
Beryllium	X	X		
Chromium	X			
Cobalt	X	X		
Copper	X	X		
Cyanide		X		
Iron	X	X	X	X
Lead	X	X	X	

TABLE 2-8

CHEMICALS RETAINED AS ERA STEP 2 ECOLOGICAL COPCs
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

Chemical	Surface Water	Sediment	Surface Soil	Groundwater
Manganese	X	X		X
Mercury	X	X	X	
Nickel	X			
Selenium		X		
Silver	X			
Thallium		X		
Vanadium	X	X	X	
Zinc	X	X	X	

TABLE 2-9

FEDERAL ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 4

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Chemical-Specific ARARs			
Safe Drinking Water Act MCLs, MCLGs, and SMCLs	40 CFR 140-143	Not applicable	Would be used as protective levels for groundwater that are current or potential drinking water sources; however, groundwater is saline to brackish and is not a viable drinking water source.
Ambient Water Quality Criteria	Section 304 of the Clean Water Act	Relevant and appropriate	Criteria for assessing the need for surface water remedial action/corrective measures.
Clean Air Act National Ambient Air Quality Standards	42 U.S.C §7401- 7642, 40 CFR Part 50	Potentially applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
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.
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.
Risk-Based Concentration	U.S. EPA Region III, 1998	TBC	Benchmark values for assessing the need for soil and groundwater 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 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, 1997a and 1997b	TBC	Benchmark values for assessing the need for soil remedial action/corrective measures.
Canadian Council of Ministers of the Environment 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, 1998	TBC	Memorandum consists of benchmark values for assessing the need for surface soils, sediment and surface water remedial action/corrective measures.
ER-L and ER-M Levels	Long et al., 1995	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.
PELs and TELs	FDEP, 1994	TBC	Benchmark values for assessing the need for sediment remedial action/corrective measures.

TABLE 2-9

FEDERAL ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 4

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Location-Specific ARARs			
U.S. EPA's Groundwater Protection Strategy	U.S. EPA, 1984	TBC	Surficial groundwater at Site 3 is likely designated Class IIIA.
Clean Water Act Section 404 River and Harbors Act, Section 10	40 CFR 230, 33 CFR 320-330	Not applicable	Prohibits the unauthorized obstruction or alteration of any navigable waters of the United States; however, waters within the vicinity of Site 3 are not classified as navigable waters.
Floodplain Management	Executive Order 11988	Applicable	Site 3 is located within the 100-year floodplain.
Protection of Wetlands	Executive Order 11990	Applicable	Site 3 is located within a wetlands area.
Endangered Species Act	16 U.S.C 1531 et seq.	Applicable	A bald eagle is known to nest in the vicinity of Site 3. Wood storks and alligators are sometimes observed in the vicinity.
Fish and Wildlife Coordination Act	16 U.S.C 661 et seq., 40 CFR Part 122.49	Applicable	Ensures that remedial action/corrective measures protect nearby wetlands and protected habitats.
Coastal Zone Management Act	16 U.S.C. 1451 et seq.	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Historic Sites, Buildings, and Antiquities Act	16 U.S.C. 461 et seq.	Potentially Applicable	This Act would be applicable if information is found to classify Site 3 as a historic or prehistoric property of national significance
Archaeological and Historic Preservation Act of 1974	16 U.S.C. 469 et seq.	Potentially Applicable	This Act would be applicable if historic and archaeological artifacts were to be affected by remedial activities. No such artifacts are known to exist within the boundaries of Site 3.
Archeological Resources Protection Act of 1979	16 U.S.C. 479(aa) et seq.	Potentially Applicable	This Act would be applicable if archeological artifacts were discovered during remedial activities.
Native American Grave Protection and Repatriation Act of 1990	25 U.S.C. 3001 et seq.	Potentially Applicable	This Act would be applicable if human remains were discovered during remedial activities.
Bald Eagle Protection Act of 1940, as Amended	16 U.S.C. 688 et seq.	Potentially Applicable	This Act includes provisions for prohibiting the disturbance of bald eagles. Because a bald eagle is known to nest within the vicinity of Site 3, remedial activities would need to be conducted to minimize the disturbance to this species.
Conservation Programs on Military Reservations (Sikes Act) of 1960, as Amended	16 U.S.C. 670(a) et seq.	Applicable	This act requires that military installations manage natural resources for multipurpose uses and public access appropriate for those uses consistent with the military department's mission.
Marine Mammal Protection Act of 1972 as Amended	16 U.S.C. 1361 et seq.	Not Applicable	Marine mammals are not known to inhabit the Pond or Ribbon Creek. Marine mammals are usually not associated with shallow marshes and small tidal inlets like those near Site 3.

TABLE 2-9

FEDERAL ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 3 OF 4

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Action-Specific ARARs			
Solid Waste Disposal Act/ Resource Conservation Recovery Act Subtitle C	42 U.S.C 6905, 6912a, 6924-6925		
• Standards for Hazardous Waste Generators	40 CFR 262	Potentially applicable	Applicable for removed site wastes determined to be hazardous.
• Standards for Hazardous Waste Transporters	40 CFR 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 Treatment, Storage and Disposal Facilities	40 CFR 264	Potentially applicable	These regulations would be applicable to waste removed from the site including both on-site and off-site management.
• Interim status standards for owners and operators of hazardous waste TSD facilities	40 CFR 265	Relevant and appropriate	Establishes design and operating criteria for hazardous landfills. Because the type of waste disposed in the causeway was primarily nonhazardous in nature, these requirements are not applicable; however, certain aspects are relevant and appropriate.
• RCRA Land Disposal Restrictions Requirements	40 CFR 268	Potentially applicable	Treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste would be subject to land disposal restrictions.
Hazardous and Solid Waste Amendments of 1984	42 U.S.C. 6926	Potentially Applicable	Establishes a corrective actions program requiring four basic elements (assessment, investigation, corrective measures study, implementation).
RCRA Subtitle D	40 U.S.C 6901	Relevant and appropriate	Establishes design and operating criteria for solid waste (nonhazardous) landfills; however, disposal activities ceased prior to the effective date of the regulation.
The Clean Water Act National Pollution Discharge Elimination System	40 CFR 122	Potentially applicable	These requirements are applicable for all alternatives that include a water discharge.
Toxic Substances Control Act	40 CFR 761	Not an ARAR	Remedial action/corrective measures may be driven by reducing PCB concentrations in affected media to meet published levels.
U.S. EPA Clean Air Act New Source Performance Standards	40 CFR 60	Not an ARAR	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.
Clean Air Act National Emission Standards for Hazardous Air Pollutants	40 CFR 60	Potentially applicable	Existing source types are not present on site.

TABLE 2-9

FEDERAL ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 4 OF 4

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
DOT Hazardous Materials Transportation	49 CFR	Potentially applicable	These rules are considered potentially applicable to wastes shipped off site for laboratory analysis, treatment, or disposal.
OSHA Standards	29 CFR 1910.120	Applicable	On site activities are required to follow OSHA requirements.
National Environmental Policies Act	42 U.S.C 4321 et seq.	Relevant and appropriate	Remedial action/corrective measures could constitute significant activities, thereby making NEPA requirements ARARs; however, activities conducted in accordance with the NCP are considered to meet the substantive NEPA requirements.
Soil Conservation Act	U.S.C. 5901 et seq.	Applicable	During remedial activities, implementation of soil conservation practices would be required.
Presumptive Remedy for CERCLA Municipal Landfill Sites	U.S. EPA, 1993	TBC	Site 3 was constructed with municipal trash and solid waste from the Depot. Through this directive, U.S. EPA has identified containment as the presumptive remedy for such landfill sites.
Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills	U.S. EPA, 1996c	TBC	Provides the framework for determining the applicability of the containment presumptive remedy to military landfills.

Acronyms

CCME = Canadian Council of Ministers of the Environment
CFR = Code of Federal Regulations
ER-L = Effects Range - Low
ER-M = Effects Range - Median
FDEP = Florida Department of Environmental Protection
MCLs = Maximum Contaminant Levels
MCLGs = Maximum Contaminant Level Goals
NEPA = National Environmental Policies Act
PELs = Probable Effect Level
SMCLs = Secondary Maximum Contaminant Levels
TELs = Threshold Effect Level
U.S.C = United States Code

TABLE 2-10

STATE OF SOUTH CAROLINA ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
Chemical-Specific ARARs			
State Primary Drinking Water Regulations Groundwater Sources and Treatment Surface Water Sources and Treatment MCL in Drinking Water Control of Lead and Copper	R.61-58 to R.61-58.11 R.61-58.2 R.61-58.3 R.61-58.5 R.61-58.11	Not applicable	Would be used as protective levels for groundwaters that are current or potential drinking water sources.
South Carolina Hazardous Waste Management Act Hazardous Waste Management Regulations	§44-56-10 R.61-79	Potentially applicable	Would be used to identify a material as a hazardous waste and thus determine the applicability and relevance of Hazardous Waste Management Regulations.
Location-Specific ARARs			
Water Classifications and Standards	R.61-68	Applicable	Surficial groundwater is not an underground source of drinking water. Surface water near Site 3 is classified as shellfish harvesting waters.
Coastal Zone Management Act	§48-39-10	Applicable	Ensures that remedial action/corrective measures protect coastal resources.
Groundwater Mixing Zone Application Guidance	SCDHEC, 1997b	TBC	Guidance for completing an application to obtain groundwater waiver for non-attainment of Maximum Contaminant Levels.
Action-Specific ARARs			
Well Standards	R.61-71	Potentially applicable	Applicable if remedial action/corrective measures involving the installation or abandonment of monitoring wells.
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 Treatment, Storage and Disposal (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.
• Interim status standards for owners and operators of hazardous waste TSD facilities	R.61-79.265	Relevant and appropriate	Establishes design and operating criteria for hazardous landfills. Because the type of waste disposed in the causeway was primarily non-hazardous in nature, these requirements are not applicable; however, certain aspects are relevant and appropriate.
• Land Disposal Restrictions Requirements	R.61-79.268	Potentially applicable	Treatment or disposal of contaminated media and/or disposal of treatment residuals that may be considered hazardous waste would be subject to land disposal restrictions.
Air Pollution Control Regulations and Standards	R.61-62	Potentially applicable	Remedial action/corrective measures involving treatment of media could result in emissions to the atmosphere.

TABLE 2-10

STATE OF SOUTH CAROLINA ARARs AND TBCs
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

ARAR	Citation/Reference	ARAR Type	Rationale for Use at MCRD Parris Island
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 co-mingled with other wastes.
Solid Waste Management: Municipal Solid Waste Landfills	R.61-107.258	Relevant and appropriate	Contains design and construction requirements for municipal landfills; however, disposal activities ceased prior to the effective date of the regulation.
Sanitary Landfill Design, Construction, and Operation	R.61-70	Relevant and appropriate	Contains design and construction requirements for sanitary landfills; however, disposal activities ceased prior to the effective date of the regulation.
Standards for Stormwater Management and Sediment Reduction	R.72-300 and R.72-405	Potentially applicable	Applicable if remedial action/corrective measures involve land-disturbance activities.
General Objectives and Components of Contamination Assessments and Remedial Actions	SCDHEC, 1994	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 following if remedial action/corrective measures involve land-disturbance activities.

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S. C.

QUADRANGLE LOCATION

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

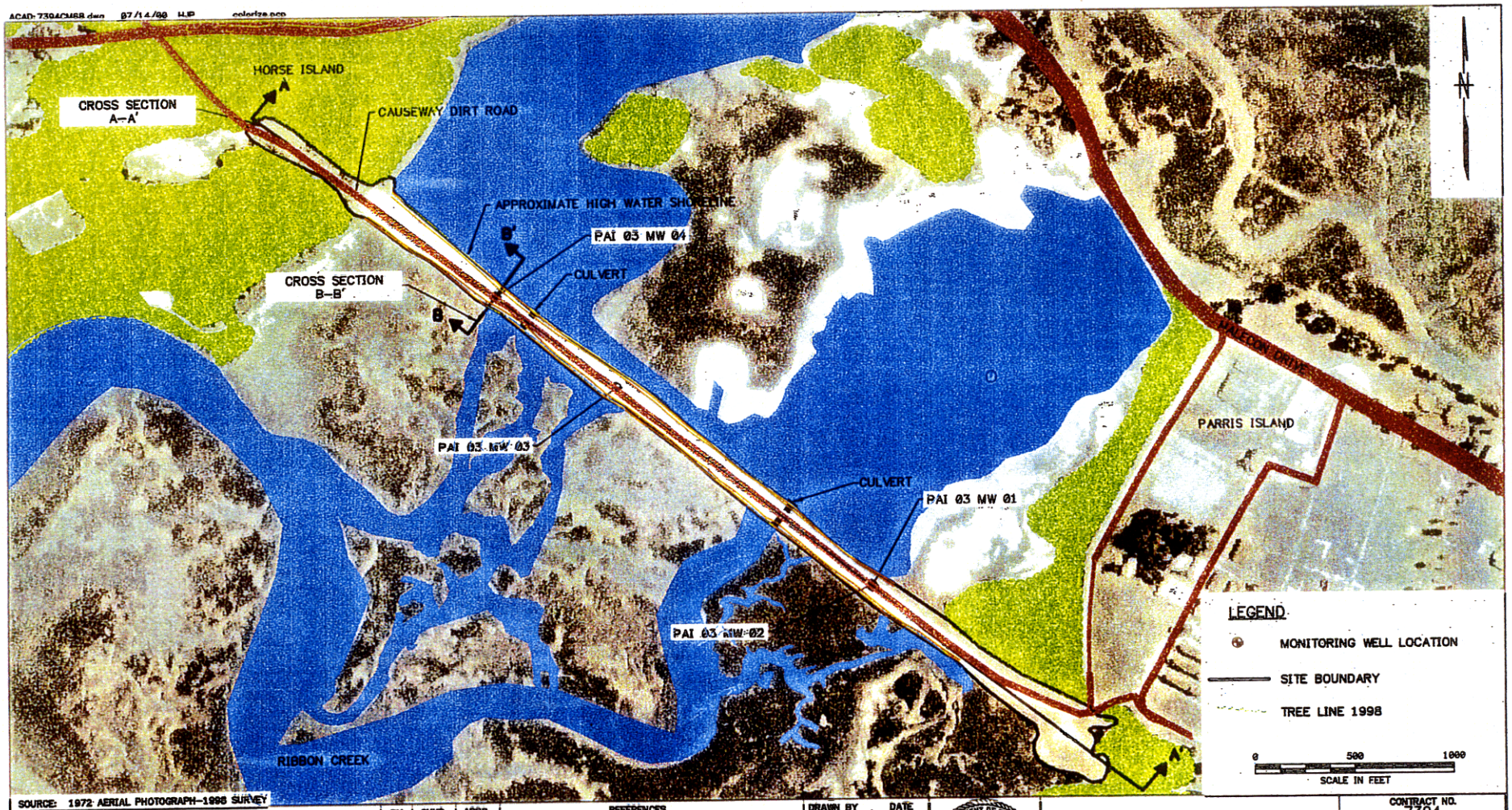
0 3000 6000

SCALE IN FEET

DRAWN BY HJP DATE 4/2/00	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMD	SITE 3 AND DEPOT LOCATION MAP MCRD PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 7394
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 REV. 0

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

232 ABIV



SOURCE: 1972 AERIAL PHOTOGRAPH–1998 SURVEY

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 11/30/98
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

EXTENT OF SITE 3 – AERIAL VIEW
SITE 3–CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2–2
REV. 0

FORM CADD NEL SHIV_BHDWG – REV 0 – 1/20/98

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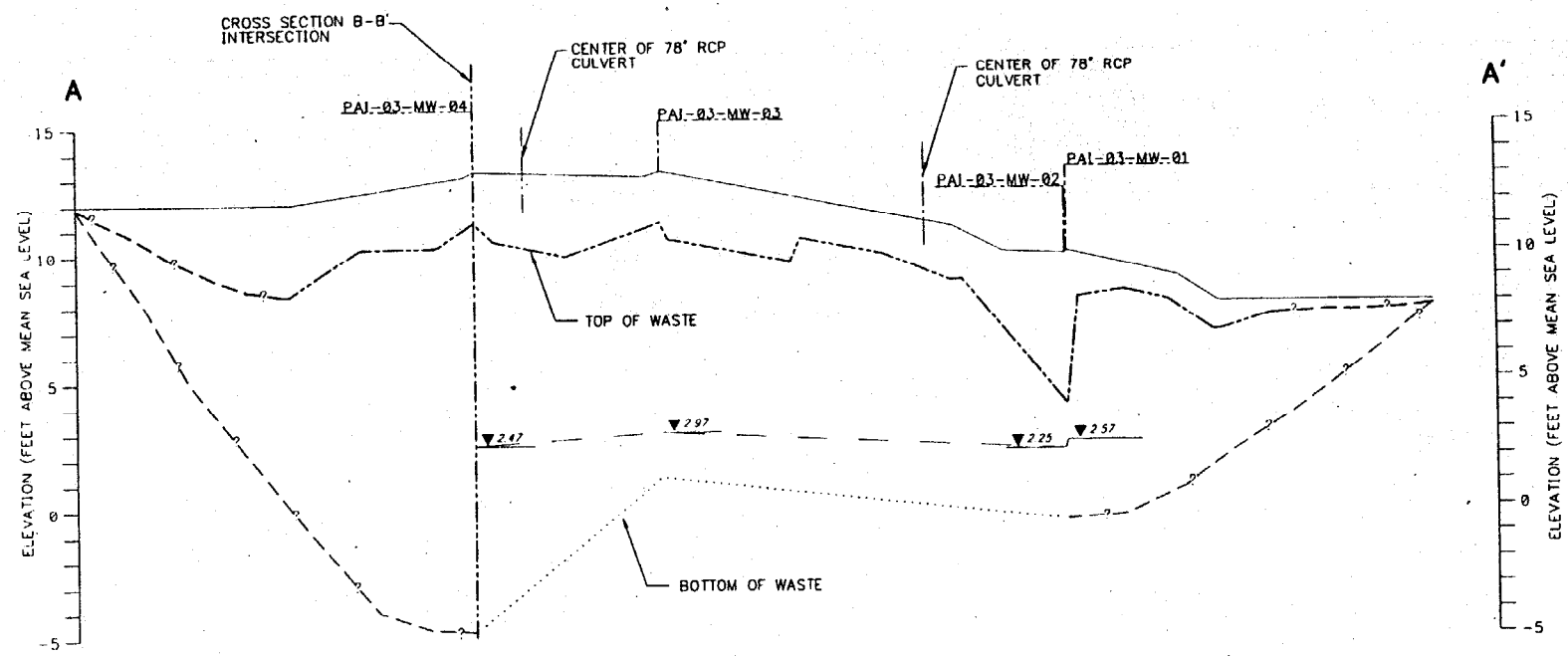
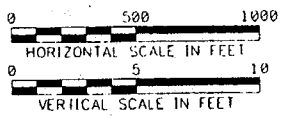




LEGEND:

- PAI-03-MW-04 — MONITORING WELL
- EXISTING GROUND SURFACE (DASHED WHERE INFERRED)
- TOP OF WASTE (DASHED WHERE INFERRED)
- 2.47 ▼ — GROUNDWATER ELEVATION
- BOTTOM OF WASTE (DASHED WHERE INFERRED)

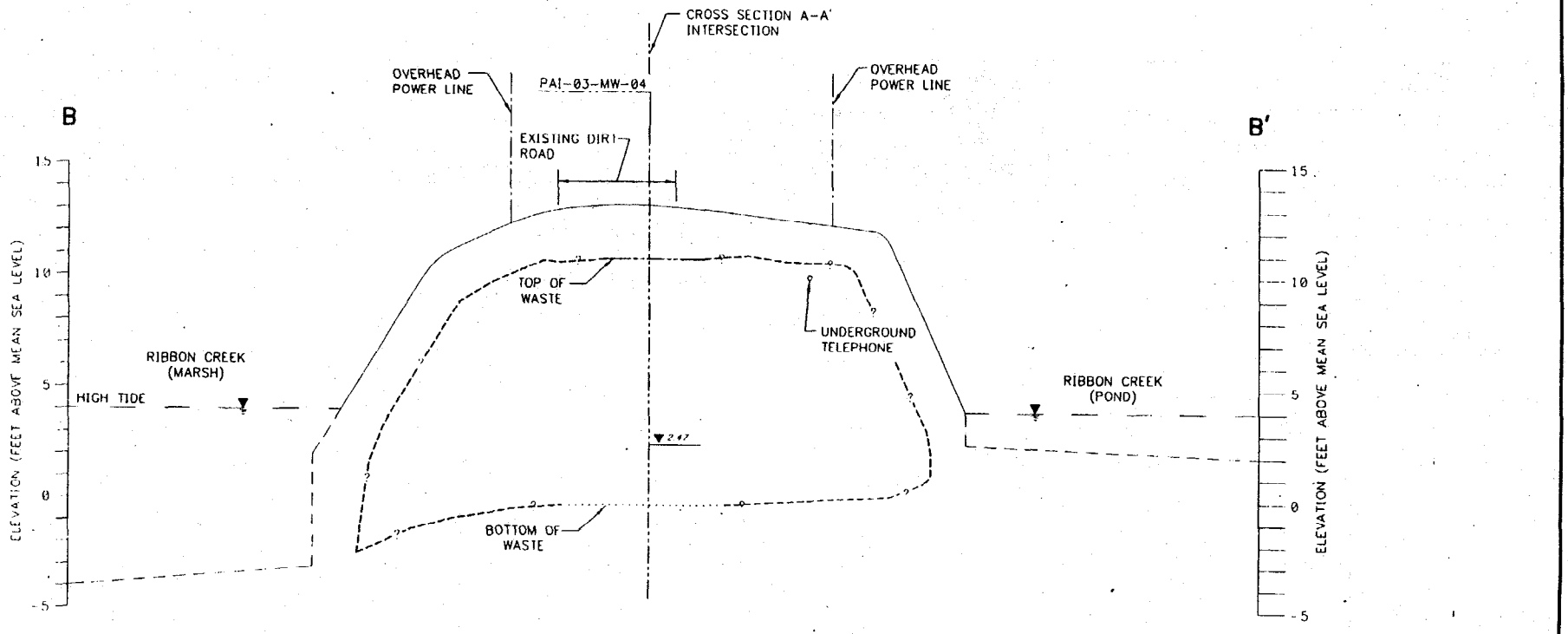
NO	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 7/14/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION A-A' - EXISTING CONDITIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-3
REV. 0

FORM CADD NO SOUTH-BHDCN - REV 3 - 9/9/98



LEGEND:

- PAI-03-MW-04 — MONITORING WELL
- EXISTING GROUND SURFACE (DASHED WHERE INFERRED)
- TOP OF WASTE (DASHED WHERE INFERRED)
- 247 ▼ — GROUNDWATER ELEVATION
- BOTTOM OF WASTE (DASHED WHERE INFERRED)

0 20 40 HORIZONTAL SCALE IN FEET

0 5 10 VERTICAL SCALE IN FEET

NO	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 5/12/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION B-B' - EXISTING CONDITIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 7394
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-4 REV 0

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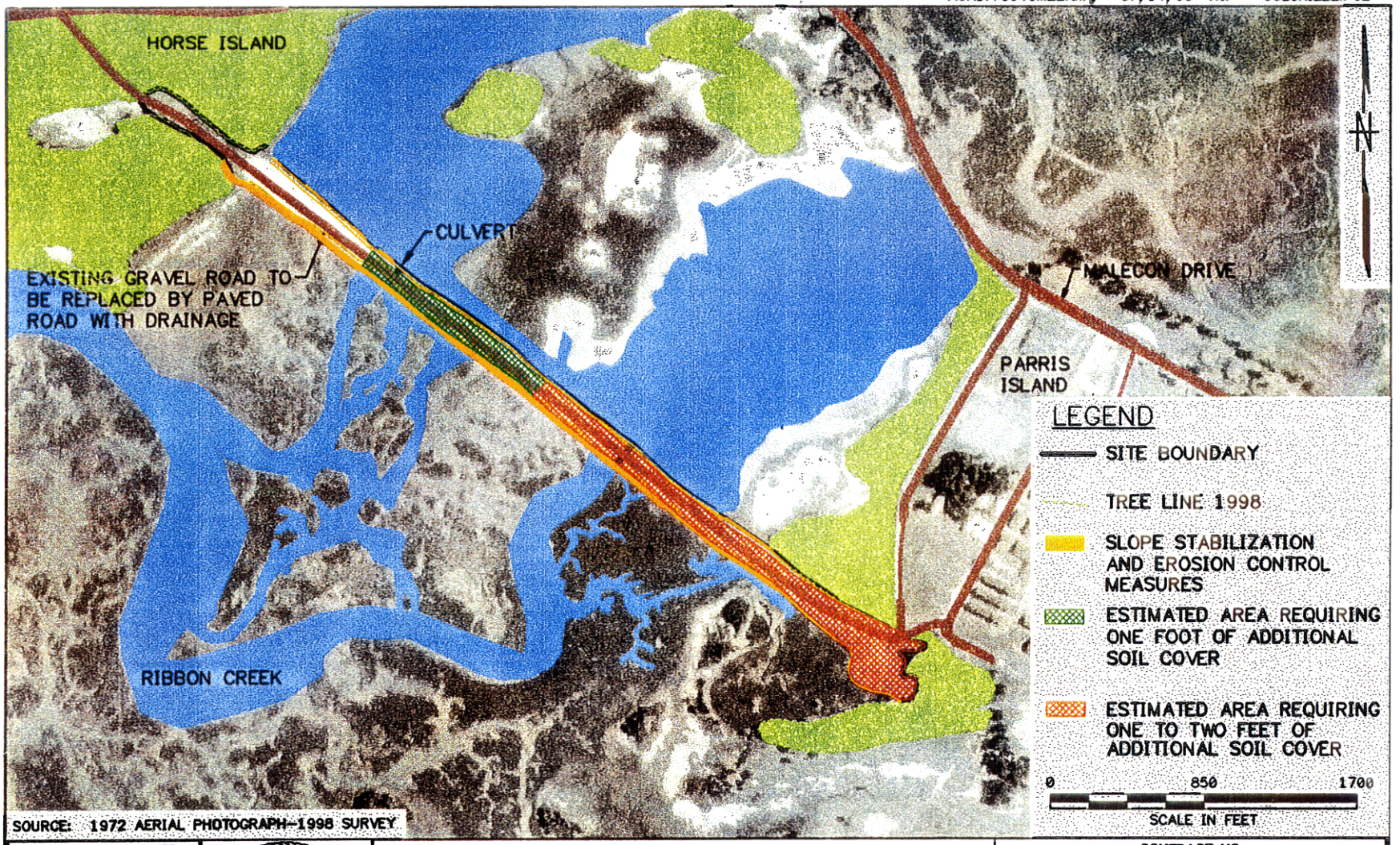

SOURCE: 1972 AERIAL PHOTOGRAPH-1998 SURVEY

DRAWN BY HJP DATE 7/14/00	INTERIM SOIL REMEDY SITE 3 – CAUSEWAY LANDFILL MCRD PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 7394
CHECKED BY DATE		APPROVED BY DATE
COST/SCHED-AREA		APPROVED BY DATE
SCALE AS NOTED		DRAWING NO. FIGURE 2-5 REV. 0

DEPARTMENT OF THE NAVY ★ SOUTHERN DIV FACILITIES ENGINEERING COMD ★

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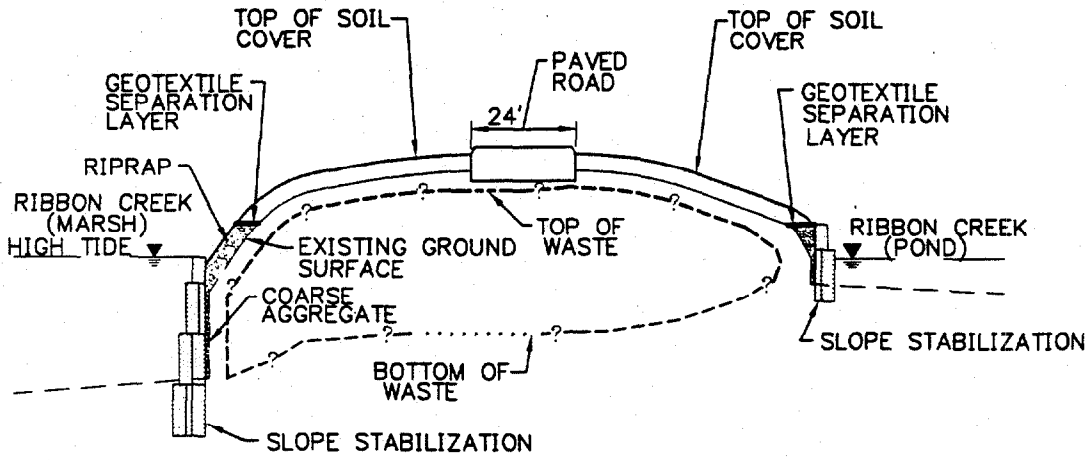
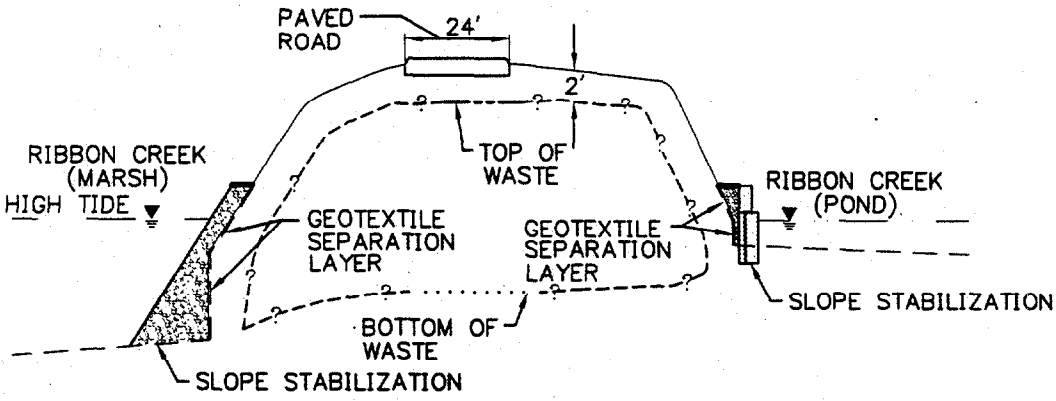
INTERIM SOIL REMEDY (1 FOOT ADDITIONAL COVER)



INTERIM SOIL REMEDY (2 FEET COVER MINIMUM)



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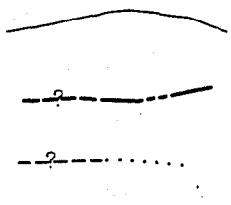

EXISTING GROUND SURFACE (DASHED WHERE INFERRED)

TOP OF WASTE (DASHED WHERE INFERRED)

BOTTOM OF WASTE (DASHED WHERE INFERRED)

DRAWN BY HJP DATE 7/14/00	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMD	TYPICAL CROSS SECTIONS SITE/SWMU 3 – CAUSEWAY LANDFILL MCRD PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 7394
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COST/SCHED–AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 2–6 REV. 0

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

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TtNUS, 2000a. Final Feasibility/Corrective Measures Study for Site/SWMU 3 – Causeway Landfill, MCRD Parris Island, South Carolina, June.

TtNUS, 2000b. Final Proposed Plan for Soil Interim Remedial Action at Site/SWMU 3 – Causeway Landfill, MCRD Parris Island, South Carolina, June.

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APPENDIX A

SITE 3 LAND USE CONTROL IMPLEMENTATION PLAN

Land-Use Control Implementation Plan For Site 3
Marine Corps Recruit Depot
Parris Island, South Carolina

This document identifies Land-Use Controls (LUCs) restricting Site 3, Causeway Landfill, at the Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina. LUCs will be implemented for the purposes of (a) restricting human contact with solid waste material and surface soil, groundwater, surface water, and sediment contaminated with organic and inorganic constituents; (b) restricting human ingestion of fin fish and shellfish harvested from the pond adjacent to Site 3; (c) restricting soil disturbance activities (i.e., construction activities); and (d) prohibiting residential development of the site.

1. SITE DESCRIPTION

Site 3 is a primarily gravel, two-lane road overlying layers of solid waste, fill dirt, and debris deposited in a tidal marsh across Ribbon Creek as shown in Figure 2-2 of the main text. Site 3 functioned as the major disposal area for solid waste and other materials discarded in dumpsters around the MCRD during most of the period between 1960 and 1972. After implementation of an Interim Soil Remedy for Site 3, 2 feet of soil cover will be present over the waste and materials at the site, and the sides of the causeway will be stabilized to prevent migration of waste into the marsh and pond.

A human health risk assessment (HHRA) was conducted at Site 3 that evaluated risks to human receptor populations that may come in contact with site contaminants. The HHRA concluded that risk estimates for site construction workers and maintenance workers are considered to be acceptable by the U.S. EPA. Risk estimates to recreational users (fishermen) are not considered to be acceptable by the U.S. EPA under scenarios that assume daily fish consumption over a 30-year period and higher concentrations of contamination in the pond. Although not specifically addressed in the RI, Site 3 may also present potential effects to human receptors if the site were to be used for residential purposes. Consequently, the Depot, U.S. EPA Region 4 and the SCDHEC agreed that LUCs should be implemented at Site 3.

2. LOCATION

MCRD Parris Island (as shown in Figure 2-1 of the main text) 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. Site 3 is located in the northwestern portion of MCRD Parris Island and is an integral part of a causeway connecting Horse Island and Parris Island.

3. LAND-USE CONTROL OBJECTIVES

The Site 3 Proposed Plan for Soil Interim Remedial Action (TtNUS, 2000) calls for the initial implementation and continued application of appropriate restrictions on future usage of the property encompassing Site 3 while it is owned by the federal government. These restrictions will apply until/unless site remediation is conducted to restore the site for unrestricted use. Should the Navy later decide to transfer, by deed, ownership in the property encompassing Site 3 to any private person or entity, then the provisions of paragraph Deed Covenants and Conveyance of Title as set forth on page A-3 of this Land-Use Control Implementation Plan (LUCIP) shall apply. Until that time, the following LUCs addressed in the following section will remain in effect.

4. LUCS IMPLEMENTED TO ACHIEVE OBJECTIVES

Quarterly visual inspections and reviews will be conducted for the purposes of verifying that all necessary LUCs have been implemented and are being properly maintained. An annual report will be prepared and forwarded to U.S. EPA and SCDHEC signed by the Depot Commanding General (with copy to SOUTHNAVFACENGCOM), certifying the continued retention of all implemented LUCs associated with Site 3.

Authorized Activities. The following activities are permissible within the confines of Site 3:

- Activities or uses that will not result in residential site development or otherwise allow for continuous, long-term exposure to children residing relatively close to the site (e.g., playgrounds).
- Recreational use of the site (e.g., fishing and jogging) that does not affect the integrity of the soil cover over the causeway.
- Unintrusive site maintenance activities (e.g., mowing) that do not affect the integrity of the soil cover over the causeway.
- Intrusive activities, as required, to maintain or replace existing monitoring wells. Required personnel protection equipment will be at least Level D unless conditions indicate otherwise.

Unauthorized Activities. Those activities and uses that are inconsistent with the objectives of this LUCIP and that, if implemented at Site 3, could pose an increased risk of harm to health, safety, public welfare, or the environment. The following activities will not be permitted within the confines of Site 3:

- Construction of facilities specifically intended for use as residential housing or child care.

- Intrusive construction activity without the use of Level D personal protection equipment (PPE) (e.g., long sleeve shirt, gloves, and Tyvek® coveralls and boot covers if the potential exists for soiling work attire). Also, intrusive construction activity without the use of continuous air monitoring to determine whether upgrades to Level C or B PPE may be required.

- Extraction of groundwater except as required for groundwater monitoring.

- Swimming or wading in the pond or trespassing in the marsh within 200 feet of the causeway.

- Subsistence fishing from the pond (addressed by placement of signs at Site 3).

- Any activities or uses not specifically stated under "authorized activities" listed above that could result in continuous, long-term exposure to children.

Proposed Changes in Use. Any proposed changes in permissible uses at Site 3 that may result in the development of Site 3 for residential use shall be evaluated by the MCRD Parris Island Natural Resources and Environmental Affairs Office (NREAO) to determine whether or not the proposed changes might pose potential risks to human health or the environment. Any proposed change in use of the site will be subject to review and approval by U.S. EPA Region 4 and the South Carolina Department of Human Health and Environmental Control (SCDHEC) in accordance with the approved LUC-MOA.

Deed Covenants and Conveyance of Title. Should the decision later be made to transfer ownership of the property encompassing Site 3 to any private person or entity, then the Navy shall either (1) take all actions necessary to remediate the site to then-existing residential (i.e., unrestricted use) cleanup standards prior to effecting such transfer or (2) deed record with the Beaufort County Register of Deeds appropriate restrictive covenants prohibiting future residential usage of the property. Should the Navy not have the requisite legal authority to record such deed restrictions, then it shall take all steps necessary to ensure that the cognizant federal agency with such authority does so unless the property is remediated to residential standards prior to such transfer. Should cleanup of the site not be effected to residential standards, then notification will be given to U.S. EPA Region 4 and SCDHEC at least 30 days prior to any conveyance of title to the site to any third party(ies) and the purchaser(s) of the site will be advised via the deed documentation as to then-existing site conditions and any/all associated LUCs and long-term monitoring requirements.

Posting. This LUCIP will be referenced in all MCRD Parris Island Utility Maps and in MCRD Parris Island's Base Master Plan. In conjunction with MCRD Parris Island's Base Master Plan and utility maps, this LUCIP

is included in the Land-Use Control Assurance Plan Agreement. No maintenance or construction activities on or near Site 3 should be planned without first referring to these documents.

5. DECISION DOCUMENTS

The following decision documents have been issued for Site 3:

- Interim Record of Decision (IROD) for Soil Remedial Action at Site 3, MCRD Parris Island, South Carolina dated September 2000.

6. OTHER PERTINENT INFORMATION (REFERENCES)

TtNUS, 1999. RCRA Facilities Investigation/Remedial Investigation for Site/SWMU 3, MCRD Parris Island, South Carolina. Prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina, November.

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APPENDIX B

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

A public comment period was held from June 9, 2000 to July 27, 2000 for the Proposed Plan for Soil Interim Remedial Action at Site 3. On June 9, 2000, 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 June 12, 19, 26, 2000. This local newspaper targets the communities closest to MCRD Parris Island. Furthermore, a public information session was held on June 27, 2000, to present the results of the RI and the FS, explain the preferred remedy, and solicit comments from the community. At this information session, representatives from Southern Division, Naval Facilities Engineering Command, MCRD Parris Island, U.S. EPA Region 4, and SCDHEC were available to discuss aspects of Site 3 and the response actions under consideration.

No comments were made during the public information session or received during the public comment period.

APPENDIX C

MODIFIED ALTERNATIVE 3A COST ESTIMATE

Site/SWMU 3 - Causeway Landfill
Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed Plan

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal	Comments	Source
1 MOBILIZATION/DEMOBILIZATION													
1.1 Office Trailer	18	mo	$500.00	$0.00	$0.00	$0.00	$9,000	$0	$0	$0	$9,000		m99-015-904-0350 & 0700
1.2 Storage Trailer	18	mo	$85.00	$0.00	$0.00	$0.00	$1,530	$0	$0	$0	$1,530		m99-015-904-1350
1.3 Construction Survey Services	1	ls	$40,000.00	$0.00	$0.00	$0.00	$40,000	$0	$0	$0	$40,000	pre-/post-constr, quant., thicknesses, sample locations	m99-013-306-1600, m99-013-306-1300
1.4 Equipment Mobilization/Demobilization	1	ls	$50,000.00	$0.00	$0.00	$0.00	$50,000	$0	$0	$0	$50,000		
1.5 Site Utilities	18	mo	$1,000.00	$0.00	$0.00	$0.00	$18,000	$0	$0	$0	$18,000	including temporary set-up/tear-down.	
2 DECONTAMINATION													
2.1 Equipment Decon Pad (Installation and Removal)	1	ls		$5,900.00	$6,700.00	$700.00	$0	$5,900	$6,700	$700	$13,300		past experience, similar site
2.2 Decontamination Water	30,000	gal		$0.25	$0.00	$0.00	$0	$7,500	$0	$0	$7,500		
2.3 Decon Water Storage Tank (6,000 gallon)	18	mo	$577.50	$0.00	$0.00	$0.00	$10,395	$0	$0	$0	$10,395		e99-1903-0405
2.4 Clean Water Storage Tank (4,000 gallon)	18	mo	$472.50	$0.00	$0.00	$0.00	$8,505	$0	$0	$0	$8,505		e99-1903-0403
2.5 PPE (1p * 5 days * 24 weeks)	120	day		$30.00	$0.00	$0.00	$0	$3,600	$0	$0	$3,600		
3 SEDIMENT REMOVAL / COVER													
3.1 Storm Water Management	0	event	$25,000.00	$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		
3.2 Contaminant Delineation Sampling & Analysis	1	event	$50,000.00	$0.00	$0.00	$0.00	$50,000	$0	$0	$0	$50,000		
3.3 Excavation (2 cy, hydraulic excavator, Level D)	0	cy		$0.00	$1.96	$3.92	$0	$0	$0	$0	$0	labor & equipment 4x for 25 % prod	m99-022-238-0260 plus level D adjustment
3.4 Haul Sediment (12 cy trucks, 0.5 mile)	0	lcy		$0.00	$3.96	$8.44	$0	$0	$0	$0	$0	labor & equipment 4x for 25 % prod	m99-022-266-0320 plus level D adjustment
3.5 Condition Waste (5 cy, track loader)	0	lcy		$0.00	$1.24	$3.78	$0	$0	$0	$0	$0	labor & equipment 2x for 50 % prod	m99-022-262-0400 plus level D adjustment
3.6 Waste Profiling	0	event	$1,500.00	$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		
3.7 Structural Fill (off-site borrow source, place)	0	lcy		$8.00	$1.64	$3.92	$0	$0	$0	$0	$0	labor & equipment 4x for 25 % prod	m99-022-238-0260
3.8 Confirmatory Sampling	0	event	$15,000.00	$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		
3.9 Haul to Landfill (40 miles, 27 cy/trip)	0.0	tons	$7.49	$0.00	$0.00	$0.00	$0	$0	$0	$0	$0	$3.75/loaded mile x 40 miles	vendor quote
3.10 Disposal (Non-Haz Landfill)	0.0	tons	$22.00	$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		vendor quote (Ridgeland SC Subtitle D landfill
3.11 Cover Soil (off-site borrow source, 18")	3,017	cy		$10.00	$0.31	$0.84	$0	$30,170	$935	$2,534	$33,640		m99-022-262-0010
3.12 Mob / Demob of clamshell crane	1	ea	$6,000.00	$0.00	$0.00	$0.00	$6,000	$0	$0	$0	$6,000	includes full set up	estimate based on m-99 mob/demob figures
3.13 150' boom crane (place soil cover in standing water)	30	day	$2,366.00	$0.00	$0.00	$0.00	$70,980	$0	$0	$0	$70,980	rental per day including equip and cre	m99-016-460-1400
3.14 Geotextile (450 sy plus 15% for joints and waste)	12,067	sy		$1.30	$2.24	$0.50	$0	$15,687	$27,030	$6,034	$48,751	labor 8x for working in stading water	m99-022-412-1550 mat 2x - heavier geotextile
3.15 Rip Rap	1,676	cy		$20.20	$27.60	$8.40	$0	$33,855	$46,258	$14,078	$94,191	labor 4X for working in stading water	m99-022-712-0100
3.16 Super Silt Fence	500	lf		$1.40	$1.44	$0.00	$0	$700	$720	$0	$1,420	4x for super silt	m99-022-704-1100
3.17 Hay Bales (install, remove, and mat)	500	lf		$6.00	$0.29	$0.10	$0	$3,000	$145	$50	$3,195		m99-022-704-1250
3.18 Turbidity Curtain	500	lf		$7.60	$0.94	$0.00	$0	$3,800	$470	$0	$4,270		past experience, similar site
4 BANK STABILIZATION													
4.1 Geotechnical Investigation & Laboratory Testing	1	ls	$30,000.00	$0.00	$0.00	$0.00	$30,000	$0	$0	$0	$30,000		estimated
4.2 Coarse Aggregate	1,667	lcy		$11.25	$6.26	$4.90	$0	$18,754	$10,435	$8,168	$37,357	labor & equipment 2x for 50 % prod	m99-022-254-3060 plus gravel
4.3 Gabion (baskets)	2,676	ea		$50.00	$10.73	$0.00	$0	$133,800	$28,713	$0	$162,513		vendor quote
4.4 Gabions (stone)	5,348	cy		$20.20	$0.82	$1.96	$0	$108,030	$4,385	$10,482	$122,897	labor & equipment 2x for 50 % prod	m99-022-238-0260
4.5 Rip Rap	7,132	cy		$20.20	$6.90	$8.40	$0	$144,066	$49,211	$59,909	$253,186	mat'l cost adjusted including hauling	m99-022-712-0100
4.6 Cover Soil (off-site borrow source)	2,093	lcy		$10.00	$0.31	$0.84	$0	$20,930	$649	$1,758	$23,337		m99-022-262-0010
4.7 Top Soil (off-site borrow source)	698	lcy		$14.63	$0.56	$1.52	$0	$10,212	$391	$1,061	$11,664	labor & equipment 2x for 50 % prod	m99-022-208-4220 see comment for grading
4.8 Geotextile	19,727	sy		$1.30	$0.28	$0.00	$0	$25,645	$5,524	$0	$31,169	labor & equipment 2x for 50 % prod	m99-022-412-1550 mat 2x - heavier geotextile
4.9 Erosion Control Mat	14,902	sy		$3.85	$1.48	$0.52	$0	$57,373	$22,055	$7,749	$87,177	labor & equipment 2x for 50 % prod	m99-022-704-0060
4.10 Vegetation	66.4	msf	$75.00	$0.00	$0.00	$0.00	$4,980	$0	$0	$0	$4,980		
4.11 Miscellaneous Excavation / Surface Preparation	1329	cy		$0.00	$1.64	$3.92	$0	$0	$2,180	$5,210	$7,389	labor & equipment 4x for 25 % prod	m99-022-238-0330 plus level D adjustment
4.12 Haul Material (12 cy trucks, 1 mile)	1728	lcy		$0.00	$3.96	$8.44	$0	$0	$6,843	$14,584	$21,427	labor & equipment 4x for 25 % prod	m99-022-266-0330 plus level D adjustment
4.13 Condition Waste (5 cy, track loader)	1728	lcy		$0.00	$1.24	$3.78	$0	$0	$2,143	$6,532	$8,675	labor & equipment 2x for 50 % prod	m99-022-262-0400 plus level D adjustment
5 SOIL COVER													
5.1 Cover Soil (off-site borrow source)	22,264	lcy		$10.00	$0.31	$0.84	$0	$222,640	$6,902	$18,702	$248,244	1000 cy additional for modified cover	m99-022-262-0010
5.2 Top Soil (off-site borrow source)	8,421	lcy		$14.63	$0.56	$1.52	$0	$123,199	$4,716	$12,800	$140,715	1000 cy additional for modified cover	m99-022-208-4220
5.3 Erosion Control Mat	2431	sy		$3.85	$0.74	$0.26	$0	$9,359	$1,799	$632	$11,790		m99-022-704-0060
5.4 Vegetation	492.2	msf	$75.00	$0.00	$0.00	$0.00	$36,915	$0	$0	$0	$36,915		
6 PAVEMENT													
6.1 Structural Fill	4,061	lcy		$8.00	$0.31	$0.84	$0	$32,488	$1,259	$3,411	$37,158		m99-022-262-0010
6.2 Pavement Subbase (4")	14,493	sy		$2.06	$0.30	$0.60	$0	$29,856	$4,348	$8,696	$42,899		m99-022-308-0302 plus vendor quote
6.3 Pavement Base (4")	14,493	sy		$5.40	$0.50	$0.43	$0	$78,262	$7,247	$6,232	$91,741		m99-025-104-0200
6.4 Pavement Wearing Course (2")	14,493	sy		$29.00	$3.33	$2.95	$0	$420,297	$48,262	$42,754	$511,313		m99-025-104-0852
7 WETLAND RESTORATION / REPLACEMENT													
7.1 Wetland Mitigation	0	acre	$15,000.00				$0	$0	$0	$0	$0		
7.2 Wetland Replacement	4.5	acre	$65,000.00				$292,500	$0	$0	$0	$292,500		
8 E&S CONTROL MEASURES													
8.1 Marsh Channel Rip Rap	2,297	cy		$20.20	$10.35	$12.60	$0	$46,399	$23,774	$28,942	$99,116	labor & equipment 1.5x for decr prod	m99-022-712-0100
8.2 Silt Fence	11,000	lf		$0.35	$0.36	$0.00	$0	$3,850	$3,960	$0	$7,810	silt fence in adverse conditions	m99-022-704-1100
8.3 Turbidity Curtain	6,000	lf		$7.60	$0.94	$0.00	$0	$45,600	$5,640	$0	$51,240	Cherry Pt. Site 16 cost	past experience, similar site
9 MISCELLANEOUS SITE WORK													
9.1 Clearing and Grubbing	10	acres	$1,500.00	$0.00	$0.00	$0.00	$15,000	$0	$0	$0	$15,000		past experience, similar site
9.2 Relocate Telephone Utility	1	event		$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		
9.3 Relocate Electric Utility	1	event		$0.00	$0.00	$0.00	$0	$0	$0	$0	$0		
10 OFFICE SUPPORT/FIELD SUPPORT													
10.1 Field Oversight Personnel (1 person - 1/2 time)	1560	hours		$0.00	$25.00	$0.00	$0	$0	$39,000	$0	$39,000		
10.2 Office Oversight Personnel (2 people - 1/8 time)	780	hours		$0.00	$30.00	$0.00	$0	$0	$23,400	$0	$23,400		
11 PROJECT DOCUMENTATION													
11.1 Pre- and Post-Construction Submittals	200	hours		$0.00	$30.00	$0.00	$0	$0	$6,000	$0	$6,000		
11.2 Permitting/Planning Documents	500	hours			$50.00		$0	$0	$25,000	$0	$25,000		
Subtotal Direct Costs less Subcontract								$1,634,972	$416,092	$261,019	$2,312,083		
Local Area Adjustments								102.0%	80.5%	85.5%			m99- Savannah, GA and Charleston, SC
Subtotal								$1,667,672	$334,954	$223,171	$2,225,797		
Overhead on Labor Cost @ 0.3									$100,486		$100,486		
G & A on Labor Cost @ 0.1									$33,495		$33,495		

Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed Plan

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal	Comments	Source
G & A on Material Cost @ 0.1								$166,767			$166,767		
Total Direct Cost								$1,834,439	$468,936	$223,171	$2,526,545		
Indirects on Total Direct Labor Cost @ 0.75									$351,702		$351,702		
Profit on Total Direct Cost @ 0.1											$252,655		
Subtotal											$3,130,902		
Health & Safety Monitoring @ 0.005											$15,655		
Total Field Cost											**$3,146,556**		
Subtotal Subcontractor Cost							$643,805				$643,805		
G & A on Subcontract Cost @ 0.1							$64,381				$64,381		
Profit on Subcontractor Cost @ 0.05											$32,190		
Subcontractor Cost											**$740,378**		
Subtotal											**$3,886,932**		
Contingency on Total Field and Subcontractor Costs @ 0.15											$583,040		
Engineering on Total Field Cost @ 0.08											$251,724		
TOTAL COST											**$4,721,696**		

Site/SWMU 3 - Causeway Landfill
Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed Plan
Annual Cost

Item	Item Cost Annually	Item Cost per 5 Years	Notes
Site Maintenance			
landscaping / grass cutting	$12,000.00		based on 2 cuts per month for 12 months mob/demob, equipment (truck, mowers, etc.), misc. materials and hand tools
rip rap	$8,000.00		annual rip rap repair/replacement (100 cy/yr at $38.00 per year)
gabions	$10,000.00		annual gabion basket replacement (100 /yr at $100 ea.)
top soil	$7,000.00		annual top soil replacement (400 lcy/yr at $17.00/lcy)
vegetation	$4,000.00		annual vegetation replacement (50 msf at $75/msf)
wetlands vegetation	(1) ***see note below***		wetland vegetation cost of about $15,000/acre and assume more replacement early, tapering off to none after year five - see note below
Sampling	$3,150.00		(2) 4 GW and 3 sediment samples at about $450 per sample including dups, travel, living, and per diem
Analysis	$4,550.00		(2) 7 samples at about $650 per sample including dups, blanks, shipping, etc.
Annual Report	$10,000.00		Yearly Site Inspection Report (not inclusive of sampling and analysis costs)
Site Review		$16,000.00	Prepare Site Conditions Report for years 5, 10, 15, 20, 25, and 30
TOTALS	$58,700.00	$16,000.00	

(1) * Wetlands Vegetation costs by year**

Year	Area (acres)	Cost	
1	0.675	$10,000	assumes approximately 15% of total will need replaced after year one
2	0.450	$7,000	assumes approximately 10% of total will need replaced after year twc
3	0.250	$4,000	assumes approximately 5% of total will need replaced after year three
4	0.000	$0	assumes approximately 0% of total will need replaced after year four
5	0.000	$0	assumes 0% of total will need replaced from year 5 out

(2) **Sampling and Analysis occurs every year for the first 5 years.

Site/SWMU 3 - Causeway Landfill
Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed PI
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$4,721,696		$4,721,696.24	1.000	$4,721,696
1		$68,700.00	$68,700.00	0.935	$64,235
2		$65,700.00	$65,700.00	0.873	$57,356
3		$62,700.00	$62,700.00	0.816	$51,163
4		$58,700.00	$58,700.00	0.763	$44,788
5		$74,700.00	$74,700.00	0.713	$53,261
6		$58,700.00	$58,700.00	0.666	$39,094
7		$58,700.00	$58,700.00	0.623	$36,570
8		$58,700.00	$58,700.00	0.582	$34,163
9		$58,700.00	$58,700.00	0.544	$31,933
10		$74,700.00	$74,700.00	0.508	$37,948
11		$58,700.00	$58,700.00	0.475	$27,883
12		$58,700.00	$58,700.00	0.444	$26,063
13		$58,700.00	$58,700.00	0.415	$24,361
14		$58,700.00	$58,700.00	0.388	$22,776
15		$74,700.00	$74,700.00	0.362	$27,041
16		$58,700.00	$58,700.00	0.339	$19,899
17		$58,700.00	$58,700.00	0.317	$18,608
18		$58,700.00	$58,700.00	0.296	$17,375
19		$58,700.00	$58,700.00	0.277	$16,260
20		$74,700.00	$74,700.00	0.258	$19,273
21		$58,700.00	$58,700.00	0.242	$14,205
22		$58,700.00	$58,700.00	0.226	$13,266
23		$58,700.00	$58,700.00	0.211	$12,386
24		$58,700.00	$58,700.00	0.197	$11,564
25		$74,700.00	$74,700.00	0.184	$13,745
26		$58,700.00	$58,700.00	0.172	$10,096
27		$58,700.00	$58,700.00	0.161	$9,451
28		$58,700.00	$58,700.00	0.150	$8,805
29		$58,700.00	$58,700.00	0.141	$8,277
30		$74,700.00	$74,700.00	0.131	$9,786
				TOTAL PRESENT WORTH	**$5,503,326**