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FINAL RECORD OF DECISION FOR SITE 21 BRONSON ROAD LANDFILL NSWC INDIAN HEAD MD

09/01/2011

CH2M HILL

Final

RECORD OF DECISION

for

Site 21—Bronson Road Landfill

Naval Support Facility Indian Head
Indian Head, Maryland

September 2011

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MDE Variance Letter Pursuant to COMAR 26.04.07.21

Acronyms and Abbreviations

µg/L	microgram(s) per liter
AA	area of attainment
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
COC	constituents of concern
COMAR	Code of Maryland Regulations
COPC	constituents of potential concern
CSM	conceptual site model
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IC	institutional control
MDE	Maryland Department of the Environment
mg/kg	milligram(s) per kilogram
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300)
NSF-IH	Naval Support Facility Indian Head
O&M	operation and maintenance
PRG	preliminary remediation goal
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision

SERA	screening-level ecological risk assessment
SRG	site remediation goal
TAL	target analyte list
TCL	target compound list

SECTION 1

Declaration

1.1 Site Name and Location

Site 21, Bronson Road Landfill
Naval Support Facility Indian Head (NSF-IH)
Indian Head, Maryland
CERCLIS ID No. MD 170024684

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedy for Site 21, Bronson Road Landfill, at NSF-IH in Indian Head, Maryland. The locations of NSF-IH and Site 21 are shown in Figure 1-1. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and, to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; Title 40 of Code of Federal Regulations [40 CFR] Part 300). This decision is based on information contained in the Administrative Record file for NSF-IH.

The response action presented in this ROD is necessary to protect the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment. The Department of the Navy (Navy) and the U.S. Environmental Protection Agency (EPA) jointly selected the remedy, and the Maryland Department of the Environment (MDE) concurs with the selected remedy.

1.3 Description of the Selected Remedy

The Selected Remedy consists of installing a protective soil cover, implementing institutional controls (ICs), and groundwater monitoring. Based on the human health and ecological risk assessments performed during the Remedial Investigation (RI) (CH2M HILL, 2004), constituents of concern (COCs) were identified for both soil and groundwater at the site. The COC for the surface soil is arsenic, and the COC for the groundwater beneath the landfill is manganese. Active remediation is not proposed for groundwater because the manganese study conducted in July/August and November 2008 (CH2M HILL 2009) indicated that elevated manganese concentrations are not related to the presence of landfill material. The nearest water body downgradient of the site is approximately 500 feet away. Therefore, sediment and surface water were not investigated because they were not identified as pathways for transport or exposure. As a result, a remedial action is not warranted for sediment and surface water.

The components of this remedy include the following:

- Verify or grade/fill to achieve a minimum 2-foot cover over waste material.

- Construct additional 2 feet of soil cover (consisting of 18 inches of clean fill and 6 inches of topsoil) with a 4 percent slope and a stabilized vegetative cover in accordance with Code of Maryland regulations (COMAR) 26.04.07.26. The seed mixture and mowing schedule for the cover vegetation will be designed to minimize potential impacts from burrowing animals.
- Grade for surface water control and stormwater management.
- Implement ICs, which consist of land-use and groundwater-use restrictions. These include prohibiting (1) digging into or disturbing the existing cover or contents of the landfill, (2) housing, elementary and secondary schools, child care facilities, and playgrounds on the site, (3) use of the shallow groundwater beneath the site and within 100 feet from identifiable sources of contamination and designated subsurface disposal areas (landfill and groundwater plume), as required by the COMAR 26.04.04.05.
- Perform long-term groundwater quality monitoring; a detailed description of the monitoring program will be included in the long-term monitoring plan, which will be prepared after the ROD is signed.
- Conduct 5-year reviews. Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, pursuant to 40 CFR §300.430(f)(4)(ii), the Navy will conduct a statutory remedy review within 5 years after initiating the remedial action and every 5 years thereafter to ensure that the remedy continues to provide adequate protection of human health and the environment.

1.4 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements (ARARs), is cost-effective and technically and administratively implementable, and uses permanent solutions and alternative treatment technologies to the maximum extent possible. A variance to COMAR 26.04.07.21, Industrial Sanitary Landfill Closure requirements, has been granted for the remedy for soil and solid waste. The requirements specify that a Resource Conservation and Recovery Act (RCRA) Subtitle C impermeable cap be installed for the closure of an industrial landfill. The reason for the variance is that a RCRA Subtitle C impermeable cap may result in further degradation of the groundwater quality, and the Selected Remedy is equally protective. The request for the variance is included in the Appendix. MDE has granted a variance to allow a soil cover.

There are no principal threats at the site that require treatment. Treatment of the landfill contents is not practicable in a cost-effective manner because of the large volume of waste. Because there is no treatment, there will be no reduction in toxicity or volume. Although this remedy does not satisfy the statutory preference for treatment, the remedy is expected to adequately meet the remedial action objectives (RAOs) for Site 21. The remedy will reduce the potential for contact with the soil and waste through a soil cover. The Selected Remedy for soil and groundwater also includes ICs, and a groundwater monitoring program as part of the remedy. The Selected Remedy will result in hazardous substances, pollutants, or contaminants left onsite above levels that allow for unlimited use and

unrestricted exposure. Therefore, a statutory review will be conducted within 5 years after initiation of the remedial action and every 5 years thereafter to ensure that the remedy is protective of human health and the environment.

1.5 ROD Data Certification Checklist

The following information is presented in Section 2, the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for Site 21:

- COCs requiring remediation and their respective concentrations (Section 2.5.3)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.6)
- Baseline risk represented by all COCs (Section 2.7)
- Cleanup levels established for constituents requiring remediation and the basis for these levels (Section 2.8 and Table 2-2)
- Key factor(s) that led to the selected remedy (Section 2.10)
- Estimated capital, annual operation and maintenance (O&M), and total present-worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.12.2)
- Principal threat wastes (Section 2.11)

1.6 Authorizing Signatures

Peter R. Nette

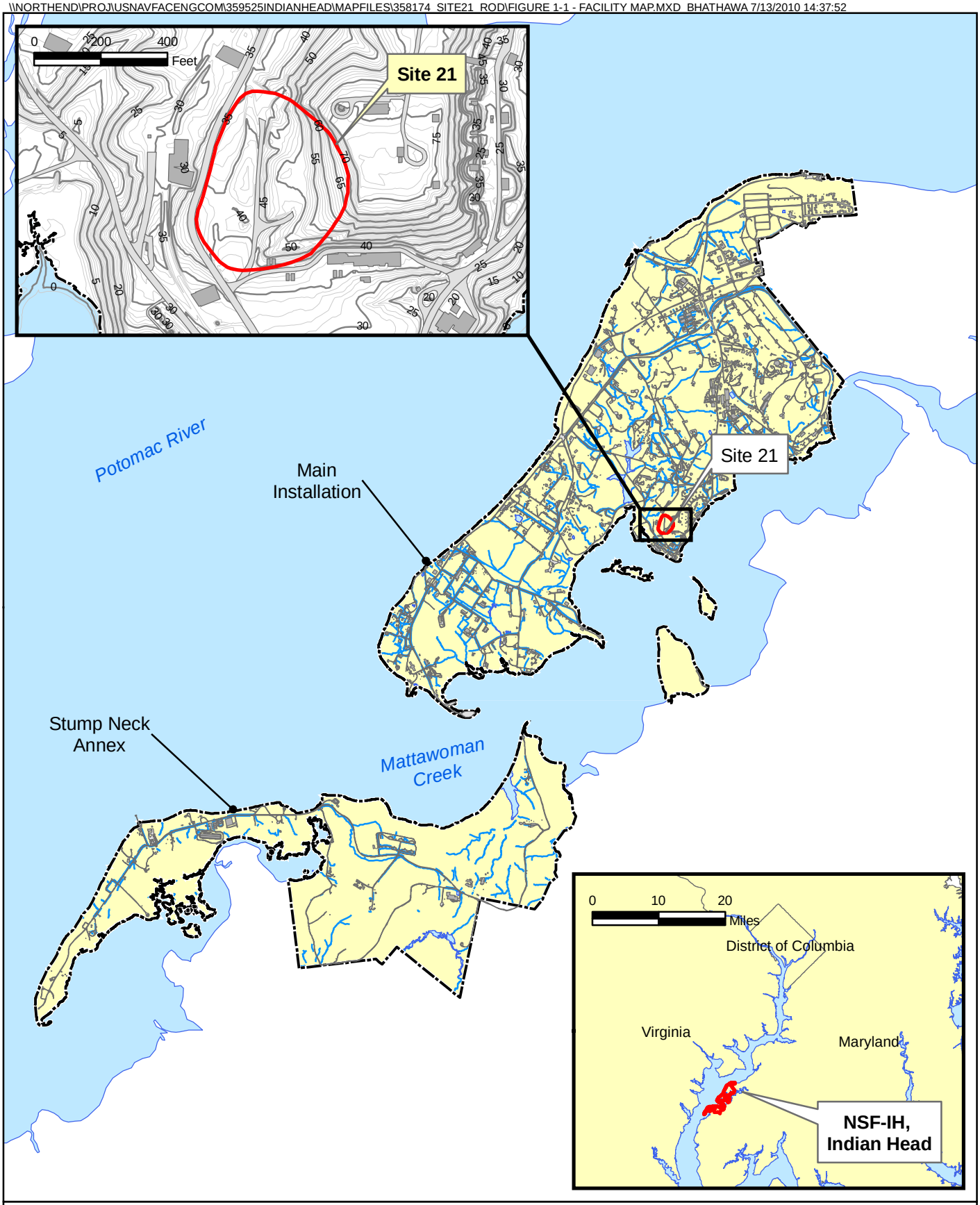
P. R. NETTE
Captain, U.S. Navy
Commanding Officer
NSA South Potomac

27 SEPT 2011
Date

K. Hodge for

Ronald J. Borsellino, Director
Hazardous Site Cleanup Division
U.S. EPA - Region III

9/30/2011
Date



Legend

- IR Site Boundary
- Buildings
- Roads and Paved Areas
- NSF-IH Base Boundary
- Water Bodies

N

0 2,000 4,000 Feet

1 inch = 4,000 feet

Figure 1-1
Facility Map
Record of Decision, Site 21 – Bronson Road Land
NSF-IH, Indian Head, Maryland

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SECTION 2

Decision Summary

This ROD presents the Navy's and EPA's Selected Remedy for Site 21, Bronson Road Landfill, at NSF-IH. MDE concurs with the Selected Remedy.

2.1 Site Name, Location, and Description

NSF-IH is in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. NSF-IH is a Navy facility, consisting of the Main Installation on the Cornwallis Neck Peninsula and the Stump Neck Annex on the Stump Neck peninsula. The Main Installation contains approximately 2,500 acres and is bounded by the Potomac River to the northwest, west, and south; Mattawoman Creek to the south and east; and the town of Indian Head to the northeast. Included as part of the Main Installation are Marsh Island and Thoroughfare Island, which are in Mattawoman Creek (Figure 1-1). Site 21 is located on the Main Installation. The Navy is the lead agency for site activities and provides funding for site cleanups at NSF-IH.

2.2 Site History and Previous Investigations

2.2.1 Site History

Site 21 is located between South Bronson Road and Building 602 (Figure 2-1). It extends from Building 478 on the north to Building 480 on the south. An unpaved road runs along the eastern side of the site. The site was originally the location of a 2-acre gravel-mining pit. Circa 1975, the Naval Ordnance Station Public Works Department began filling the pit with solid waste generated in the explosives manufacturing area. Trenches were excavated in the landfill, and these trenches were estimated to contain approximately 1,500 tons of solid waste and unknown quantities of paint sludge, asbestos, and barium sulfate. This practice ended in November 1981, when a 40-cubic-yard dumpster was placed at the north end of the site to act as a transfer station. The dumpster contents were collected weekly by a private contractor for off-station disposal. The dumpster was removed in 1996, and the area was regraded. The site also accepted sludge from paint spray booths and bagged asbestos until June 1982.

During a site reconnaissance in 1982, it was observed that the landfilled material was partially covered with 6 inches to 1 foot of soil. Uncovered bags of asbestos were observed, as well as several small, dark-brown pools of water that may have been leachate. By 1989, the inactive landfill was completely covered with soil. In the past, 20-foot cliffs surrounded three sides of the site; however, placement of fill from other sites on NSF-IH has brought the ground surface nearly up to the elevation of the cliff tops. Additional soil is no longer being placed on the landfill.

2.2.2 Previous Investigations

Several investigations were conducted at Site 21 between 1983 and 2008. Below is a chronological summary of these investigations.

Initial Assessment Study

An Initial Assessment Study (Fred C. Hart Associates, Inc., 1983) was conducted to identify and assess sites posing a threat to human health or to the environment because of contamination from past hazardous materials operations. The study report did not recommend a confirmation study for Site 21 because the nature of the site hydrogeology would not facilitate contaminant migration. The report instead recommended that the uncovered portion of the landfill should be covered to minimize the potential migration of subsurface or airborne contamination.

Remedial Investigation

Surface soil sampling, monitoring well installation, groundwater sampling, soil boring confirmation, test pit confirmation, and geophysical surveying were conducted between July and August 2000 as part of the RI (CH2M HILL, 2004). The objectives of the RI were to identify the lateral extent and depths of waste disposed at the site and determine whether the waste is a source of contamination to underlying soil or groundwater at the site. Field activities consisted of the following tasks:

- Collection of 20 surface soil samples for target compound list (TCL) organics, target analyte list (TAL) metals, explosives, and total petroleum hydrocarbon analyses
- Installation of four permanent groundwater monitoring wells at depths ranging between 18 feet below ground surface (bgs) and 48 feet bgs
- Collection of groundwater samples from the monitoring wells for TCL organics, TAL inorganics, explosives, and total petroleum hydrocarbon analyses
- Advancement of five soil borings to depths ranging from 22 feet bgs to 49 feet bgs for subsurface lithologic data
- Excavation of seven test pits to assess the extent of the landfill waste
- Geophysical survey, which consisted of electromagnetic and electrical resistivity surveys to locate metallic waste buried at the site and define the boundaries of the landfill

Figure 2-1 shows the sample locations.

The analytical results from the RI are summarized in Section 2.5. Results of the geophysical surveys were used to initially estimate the lateral and vertical extents of the solid waste at the site. Test pits were excavated to confirm the lateral extent, and soil borings were advanced to confirm the vertical extent of the fill at the site. Three areas of buried metal debris were identified—two near South Bronson Road and one on the eastern side of the site. Another area featuring both surface and buried metal debris was identified in the southeastern part along Components Place. The maximum thickness of waste is about 45 feet, based on an electrical resistivity survey point, and is approximately 25 feet based on soil borings. The thickness of landfill content below the groundwater table can be as much as 20 to 30 feet in some areas of the landfill. Pits excavated on the western side of South Bronson Road showed no waste material. Figure 2-1 shows the locations of the geophysical survey and test pits. A baseline human health risk assessment (HHRA) and screening-level ecological risk assessment (SERA) also were performed as part of the RI. The results are presented in Section 2.7.

Pre-Feasibility Study Investigation

A pre-Feasibility Study (FS) investigation was conducted in July 2002 to confirm the concentrations of manganese and perchlorate detected in groundwater (CH2M HILL, 2002). Groundwater samples were collected from the four monitoring wells that were installed during the RI and analyzed for perchlorate, TAL inorganics (total and dissolved), and sulfate. Perchlorate was detected in the upgradient well, IS21MW04, at a concentration of 2,900 micrograms per liter (µg/L). Manganese was detected at a concentration of 10,900 µg/L in monitoring well IS21MW02, and this concentration is lower than the concentration detected during the RI sampling event in 2000 (23,100 µg/L). The results confirmed the presence of perchlorate in the upgradient well IS21MW04, but the source was unknown.

Water levels were measured in the wells to assess groundwater flow conditions. These results and those from the RI indicated that groundwater generally flows to the southwest; however, at times, flow to the west and northwest is expected, most notably in the northern portion of the site. Additionally, there was some uncertainty as to whether groundwater encountered at the upgradient well IS21MW04 flowed toward the landfill or toward the east because the well is near the top of a topographic rise that may represent a groundwater divide.

Investigation of Groundwater Flow and Perchlorate

Because perchlorate had been detected in the upgradient monitoring well (IS21MW04) at a relatively high concentration, an investigation was conducted in December 2002 to determine if perchlorate in groundwater is associated with the landfill (CH2M HILL, 2003). Six soil borings (IS2101 through IS2105, and IS2107) were advanced (Figure 2-1); shallow and deep groundwater samples were collected and analyzed for perchlorate. Based on the groundwater flow direction and analytical results of perchlorate concentrations in soil and groundwater samples, the study concluded that the perchlorate detected at the upgradient well IS21MW04 was not associated with the landfill.

Feasibility Study

An FS was completed to address potential sources of contamination at Site 21 and to evaluate remedial alternatives for mitigating potential hazards associated with the landfill soil and groundwater (CH2M HILL, 2006a). The alternatives evaluated were:

- Alternative 1 – No Action
- Alternative 2 – Protective Soil Cover, ICs, and Groundwater Monitoring
- Alternative 3 – RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring
- Alternative 4 – Excavation and Offsite Disposal

Geochemical Assessment

A geochemical assessment and groundwater modeling were conducted to evaluate the potential effects of installing a RCRA Equivalent Subtitle C cap, which would be compliant with the MDE regulatory requirements for a landfill with waste left in place (CH2M HILL 2006b). The results of the geochemical assessment suggested that installing a RCRA Equivalent Subtitle C cap would further degrade groundwater quality by exacerbating reducing conditions, thereby mobilizing additional manganese.

The results of the groundwater modeling indicated that placement of a RCRA Equivalent Subtitle C cap over the former landfill area would lower the water table about 1.54 feet under the cap area. Results from the RI demonstrated that there is currently up to 22 feet of fill below the water table, so lowering the water table by 1.54 feet would not effectively remove the contact between the fill material and the groundwater flowing through the site. The updated groundwater elevation information also demonstrated that perched groundwater conditions are not present at the site.

The overall conclusion was that a soil cover would be a more environmentally effective remedy that is equally protective of human health and at a cost of approximately $1 million less than a RCRA Equivalent Subtitle C cap.

Manganese Investigation

Based on the geochemical and hydrologic results from the geochemical assessment, an additional investigation was conducted in July/August and November 2008 to further understand the high manganese concentrations in groundwater and associated geochemical conditions in the area of the landfill (CH2M HILL 2009a).

As part of the field activities, four new groundwater monitoring wells (one upgradient [IS21MW05] and three downgradient [IS21MW06 through IS21MW08] of the landfill) and one piezometer (IS21PZ01) were installed within the landfill (Figure 2-1). Soil samples were collected during the installation of the four new monitoring wells. Also, solids were collected from the bottom of the existing downgradient well IS21MW02 to provide a geochemical understanding of manganese in the shallow aquifer parent material. Two sets of groundwater samples were collected from eight monitoring wells (four existing and four new) to understand manganese concentrations in groundwater and geochemical conditions upgradient and downgradient of the landfill.

The results indicated that the manganese concentrations and geochemistry at the site are consistent with natural conditions and are not related to the presence of the former landfill material; however, this conclusion cannot be definitively proven. Therefore, a long-term monitoring program will be conducted to verify that the manganese issue is not exacerbated. Soil data from the soil borings indicated that the landfill material is not enriched in manganese and is not considered to be a source of the manganese in the groundwater.

Agent Orange Investigation

An anonymous call was made to MDE on June 25, 2008, stating that Agent Orange drums were buried at the site; specific coordinates as to the locations of the drums were provided. An investigation was conducted to verify the claim. Groundwater samples were collected from a total of nine wells, consisting of eight monitoring wells (IS21MW01 through IS21MW08) and one piezometer (IS21PZ01) located within the landfill, and were analyzed for Agent Orange-related constituents. No constituents were detected in any of the nine groundwater samples. The Navy and the EPA, in consultation with MDE, recommended no further action for Agent Orange at Site 21 (CH2M HILL, 2009b).

2.2.3 Enforcement Activities

In September 1995, NSF-IH was placed on the National Priorities List, but to date, no enforcement actions have occurred at the site. The Federal Facility Agreement, which was

signed on December 9, 2000, provides for CERCLA-directed enforcement activities at the site. As a result, an RI, FS, and Proposed Plan have been completed for this site.

2.3 Community Participation

The NSF-IH Restoration Advisory Board is made up of representatives from the community, EPA, MDE, and the Navy. Meetings are held two times a year to provide a forum for the exchange of information among all parties, including the public, regarding Installation Restoration activities.

In accordance with Sections 113 and 117 of CERCLA and the NCP at 40 CFR §300.430(f)(2), the RI report (CH2M HILL, 2004), FS report (CH2M HILL, 2006a), and Proposed Plan for Site 21 (CH2M HILL, 2010) were made available to the public in May 2004, September, 2006, and June 2010, respectively. These documents, which are included in the Administrative Record file, can be found in the Information Repositories maintained at the following locations:

Indian Head Town Hall	Charles County Public Library	NSF-IH
4195 Indian Head Hwy.	2 Garrett Ave.	General Library
Indian Head, MD 20640	La Plata, MD 20646-5959	Building 620 (The Crossroads)
(301) 743-5511	(301) 934-9001 * (301) 870-3520	4163 N. Jackson Rd., Indian Head, MD 20640-5117
Hours: Mon - Fri 8:30 a.m. to 4:30 p.m.	Hours: Mon - Thurs 9 a.m. to 8 p.m. Fri and Sun 1-5 p.m. Sat 9 a.m. to 5 p.m.	Hours: Mon - Wed 9 a.m. to 8 p.m. Thurs & Fri 9 a.m. to 5:30 p.m. Sun 12 noon to 4 p.m.

The notice of the availability of the Proposed Plan was published in the *Maryland Independent* newspaper on June 18, 2010. A public comment period was held from June 18, 2010 to July 18, 2010. In addition, a public meeting was held on July 1, 2010, to present the Proposed Plan to a broader community audience.

At this meeting, representatives from the Navy, EPA, and MDE answered questions about the site and the remedial alternative. No oral or written comments were received during the public comment period.

2.4 Scope and Role of Response Action

Site 21 is included in the NSF-IH Installation Restoration Program. The human health and ecological risk assessments performed during the RI and manganese investigation identified unacceptable risks for human exposure in the surface soil and shallow groundwater. The response action addresses these risks using a protective cover, ICs, and groundwater monitoring. This is the final response action planned for this site.

2.5 Site Characteristics

Characteristics of the site, the nature and extent of contamination, and the human health and ecological risk assessments are presented in greater detail in the RI report and in the FS report, and are summarized in the following sections.

2.5.1 Geology and Hydrogeology

The extent of the landfill was delineated using soil boring data, geophysical data, and test pit data. Figure 2-2 shows the extent of waste and fill material on the landfill. The lateral extent of the landfill covers approximately 2.34 acres. Fill was encountered, which consisted of coal, glass, paper, and wood fragments, at a depth of 45 feet bgs in the northern portions of the landfill. The geophysical survey identified mixed buried metallic and nonmetallic debris. Overall, the thickness of the fill may be up to 40 feet to 45 feet, but 5 to 10 feet of this layer is likely to be soil cover. Based on the estimated bottom elevation of the fill from the geophysical survey and borings, the lower part of the waste appears to be below the water table by as much as 20 to 30 feet in some areas of the landfill. The soil at Site 21 is characterized by layers of sandy silt, silty sand, and sand with some gravel.

The depth to groundwater, as determined from the monitoring wells installed at the site, ranges in elevation from about 38.11 feet above mean sea level (upgradient of the site) to 22.08 feet above mean sea level (downgradient of the site). Based on the groundwater elevations, groundwater appears to flow to the southwest, with a hydraulic gradient of approximately 0.22 foot/foot (CH2M HILL 2009a), discharging to Mattawoman Creek. Mattawoman Creek is influenced by the tides and in turn may influence the water table at Site 21. However, based on the distance of Site 21 from the Mattawoman Creek shoreline, the influence of the tides on groundwater flow is likely reduced. The nearest potable water well is Well 18, which lies 450 feet north, (upgradient) of the site.

2.5.2 Conceptual Site Model

The conceptual site model (CSM) integrates information regarding the physical characteristics of the site, potentially exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify exposure routes and receptors evaluated in the risk assessment. A well-defined CSM allows for a better understanding of the risks at a site and aids in identifying the potential need for remediation.

Human Health Receptors

Figure 2-3 presents the CSM for potential human receptors at the site. Human receptors under the current land use scenario are industrial site workers (who perform maintenance activities such as mowing) and adult and adolescent trespassers/visitors. The current receptors could be exposed to surface soil. Human receptors under the future land use scenario are adult and child residents, adult and adolescent trespassers/visitors, industrial workers, and construction workers. Although unlikely because the site is a landfill, it was conservatively assumed that the site could be developed and used for industrial or residential activities in the future. Hypothetical future residential use of the site was evaluated to determine if land use restrictions would be necessary at the site. However, the site is an industrial facility, and it is unlikely that the land use of the industrial facility will change in the future.

Ecological Receptors

Figure 2-4 presents the CSM for ecological receptors at the site. Although the soil at the site had been affected by past disposal activities, subsequent placement of soil as a cover has eliminated much of the exposure potential to ecological receptors. If chemicals are present in the upper soil layers, key exposure routes for ecological receptors would be ingestion of chemicals adsorbed to soil (invertebrates) and direct contact with chemicals in the soil (invertebrates and plants). Other organisms that forage in the area are also potentially exposed to chemicals by direct contact, incidental ingestion of soil, and ingestion of invertebrates and/or plants that have accumulated body burdens.

Contaminant migration has been discussed in detail in Section 7.5.2 of the RI report (CH2M HILL 2004). The following bullets summarize the key points:

- Specific source areas were not identified because elevated levels of contamination are widespread at the site.
- Parts of the site are unvegetated; therefore, wind erosion may cause soil particles to be entrained and transported to other portions. Although vehicular traffic is not common, it may contribute to this process.
- The primary mechanisms for the release of contaminants from surface soil to subsurface soil or from one area to another are infiltration, runoff, and soil erosion caused by runoff.
- Although much of Site 21 is bare ground and surface runoff likely carries a high sediment load, the impact to Mattawoman Creek is insignificant because of the distance (more than 500 feet) between the site and the creek.
- Soil and groundwater sampling suggests there is limited potential for contaminant migration from soil to groundwater.
- Transport of contaminants through groundwater is not considered to be the primary mechanism because of the low mobility of most site-related chemicals.
- Mattawoman Creek is the final receptor of all groundwater from Site 21. Given the low concentrations of constituents identified in groundwater and the site's distance from the creek, releases from groundwater to surface water do not appear to be of concern.

2.5.3 Nature and Extent of Contamination

The nature and extent of contamination in soil and groundwater is described in detail in Section 7.4 of the RI report. The information from the RI report is summarized below. The nature and extent discussion for groundwater also includes information collected post-RI.

Surface Soil

Volatile organic compounds, semi-volatile organic compounds, and explosives were detected at low concentrations. Metals were detected in all samples, with the highest concentrations and most detections in the eastern and northern parts of the site. Arsenic (COC requiring remediation) was detected in all surface soil samples, at concentrations ranging from 3.4 milligrams per kilogram (mg/kg) to 51.8 mg/kg; the mean concentration of 14.6 mg/kg was above the background concentration of 2.2 mg/kg. Additionally, every

sample contained concentrations greater than the background 95 percent upper confidence limit of 2.6 mg/kg. Based on elevated concentrations of arsenic compared to background concentrations, arsenic appears to be site-related. Although other metals were detected, they were not considered to be site-related.

Groundwater

Volatile organic compounds were detected at low concentrations at two locations, but no semi-volatile organic compounds were detected. Very low concentrations of explosives were detected in the monitoring wells. Of particular note, perchlorate was detected in the background monitoring well IS21MW04, but subsequent investigations indicated that it was not site-related. Several inorganics were detected in total and dissolved groundwater samples; most were detected at concentrations above the facility-wide background 95 percent upper confidence limit. The highest concentrations of both total and dissolved metals were detected in downgradient wells IS21MW02 and IS21MW03, with most of the maximum values detected in well IS21MW02.

Manganese was detected at high concentrations in groundwater. Figure 2-5 presents the trend in total manganese concentrations in groundwater at eight monitoring wells at the site. As shown on the figure, the overall trend for total manganese in groundwater decreased from the first two events (September 2000 and July 2002), except in IS21MW03. The groundwater manganese concentrations were compared against the background concentration (824 µg/L) and the regional screening level for tap water (880 µg/L). Based on the available data, it appears that only concentrations at IS21MW02, IS21MW03, and IS21MW07 exceeded these screening levels. It is postulated that the naturally occurring manganese may be mobilized because of naturally occurring reduction/oxidation (redox) conditions in the subsurface. Soil samples collected from the soil borings within the landfill indicated that the landfill material is not enriched in manganese and is not considered to be a source of the manganese in the groundwater.

Thallium was detected during the RI in two unfiltered groundwater samples from monitoring wells IS21MW01 (upgradient well) (6.2 J µg/L) and ISMW2104 (downgradient well) (5.5 J µg/L). However, the final FS (CH2M HILL 2006) identifies that these thallium concentrations are attributed to false positive analytical results.

2.6 Current and Potential Future Land and Resource Uses

Site 21 is currently maintained as open space vegetated with grass. No future land use changes are projected for Site 21, and no other land use for this site is planned by the Navy. It is highly unlikely that Site 21 would be developed for residential use. However, hypothetical future residential use of the site, including the groundwater resource, was evaluated in the risk assessment to assess whether restrictions would be necessary at the site. Shallow groundwater beneath the site is not used for any purpose. The Navy has no plans to develop the groundwater resource in the future. The nearest potable water well is Well 18, which lies 450 feet north (upgradient) of the site.

2.7 Summary of Site Risks

This section presents an overview of the risks associated with the current and future land uses of Site 21. A detailed discussion of potential risks at Site 21 and the risk evaluation process can be found in the RI report (CH2M HILL, 2004), and *Site 21 (Bronson Road Landfill) Manganese Investigation Technical Memorandum, Naval District Washington, Indian Head, Indian Head, Maryland* (CH2M HILL 2009a) (herein referred to as "Manganese Tech Memo").

2.7.1 Human Health Risk Assessment Process

As part of the RI, a baseline HHRA was performed for soil and groundwater at Site 21 to evaluate the current and future effects of constituents in site media on human health. In 2008, an additional HHRA was performed for manganese and iron in groundwater (CH2M HILL, 2009a).

The potential receptors evaluated in the risk assessment for soil were as follows:

- For current uses – adolescent trespasser/visitor, adult trespasser/visitor, and industrial worker
- For future uses – child resident and adult resident

The potential receptors evaluated in the risk assessment for groundwater during the RI were for futures uses - child resident, adult resident, and construction worker.

The HHRA was composed of four parts, as discussed below – identification of constituents of potential concern (COPCs), exposure assessment, toxicity assessment, and risk characterization.

Identification of COPCs

The identification of COPCs was a conservative screening process to identify the chemicals that may be present at the site in concentrations that could result in unacceptable risks to exposed receptors. The maximum detected concentration of each constituent in each medium (soil and groundwater) was compared to a human health risk-based screening value to identify the COPCs. If the maximum detected concentration of a constituent exceeded the screening value, the constituent was identified as a COPC and retained for further evaluation. The EPA Region III risk-based concentrations (RBCs) for residential receptors (EPA, 2004), the current human health risk-based concentrations at the time the RI was prepared, were used as the screening levels to identify COPCs. The RBCs that are based on carcinogenic risk are conservatively set to represent an excess lifetime cancer risk (ELCR) of $1x10^{-6}$, or a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. The EPA Region III RBCs that are based on non-cancer effects are based on a hazard index (HI) of 1. To conservatively account for exposure to more than one constituent that presents non-cancer effects to the same target organ (for example, the liver), the EPA Region III RBCs that were based on non-cancer effects were divided by 10. Constituents eliminated from further evaluation at this step present minimal risks to exposed human receptors.

Section 7.6.2 of the RI report discusses the identification of COPCs and presents the list of COPCs for Site 21. The COPCs in soil that were carried through the HHRA were aluminum, arsenic, chromium, iron, manganese, and vanadium. The COPCs identified in groundwater

were 1,4-dichlorobenzene, aluminum, arsenic, chromium, cobalt, iron, manganese, nickel, thallium, and vanadium.

Exposure Assessment

The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the site, identify potentially exposed populations, and estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures are based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: a source of chemicals that can be released into the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor.

Toxicity Assessment

The toxicity assessment weighs the available evidence regarding the potential for a particular chemical to cause adverse effects in exposed individuals and provides a numerical estimate of the relationship between the extent of exposure and possible severity of adverse effects. Toxicity assessment consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of identifying the potential adverse effects from exposure to a chemical. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the exposed population. From this quantitative dose-response relationship, toxicity values (non-cancer reference doses [RfDs] and carcinogenic slope factors) are derived. These toxicity values are used in conjunction with the exposure assessment to estimate non-cancer hazards and cancer risks associated with exposure to the site media.

EPA has assessed the toxicity of many chemicals and has published the resulting toxicity information and toxicity values in the Integrated Risk Information System and Health Effects Assessment Summary Tables databases (EPA, 1997). Additionally, toxicity information is available from EPA's National Center for Environmental Assessment.

Health effects are divided into two broad groups: non-cancer hazards and cancer risks. This division is based on the different mechanisms of action currently associated with each category. Chemicals causing non-cancer health effects were evaluated independently from those having cancer effects. Some chemicals may produce both non-cancer and cancer effects, and were evaluated in both groups. Non-cancer health effects are evaluated using the RfDs. Cancer risks are evaluated using carcinogenic slope factors. Section 3.3.3 in the RI report provides more detail about the toxicity assessment.

Risk Characterization - Methodology

The risk characterization summarizes and combines the results of the exposure and toxicity assessments to characterize baseline risks. For carcinogens, risk is generally expressed as the incremental probability of an individual developing cancer over a lifetime of exposure to the carcinogen. ELCR is calculated from the following equation:

ELCR = CDI x SF

where:

ELCR = a unitless probability (e.g., 33 percent) of an individual's developing cancer that is in addition to the incidence of cancer in the general population unaffected by these releases

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope factor, (cancer potency factor), expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are usually expressed in scientific notation. An ELCR of 1E-06 indicates that an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an ELCR because exposure to site conditions results in another risk in addition to the risks of cancer from other causes, such as smoking.

The potential for non-cancer effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1.0 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic non-cancer effects from that chemical are unlikely. The HI is generated by adding the HQs for all COPCs that affect the same target organ (such as the liver) or that act through the same mechanisms of action within a medium or across all media to which a given individual may reasonably be exposed. An HI of less than 1.0 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than 1.0 indicates that site-related exposures may present an unacceptable risk to human health.

A detailed discussion of the risk characterization is provided in Sections 3.3.4 and 7.6.4 of the RI report. Uncertainties associated with the risk assessment process and results are presented in Section 3.3.5 of the RI report.

Risk Characterization - Results

The risk assessment tables are provided in Appendix G of the RI report. The Table 7 series summarize the reasonable maximum exposure (RME) and central tendency exposure potential hazards to each receptor. The Table 8 series summarize the cancer RME risks to each receptor. The Table 10 series show only those pathways with total HIs greater than 1.0 or total carcinogenic risks greater than 10^{-6}.

Section 6.0 of the Manganese Tech Memo provides an assessment of the potential human health risk from groundwater based on the updated understanding of groundwater conditions and manganese concentrations.

The HHRA concluded that under current site use conditions, surface soil does not pose an unacceptable risk (both non-cancer and cancer) to adolescent trespassers/visitors, adult trespassers/visitors, or industrial workers. Under future land use conditions, soil does not pose unacceptable non-cancer risks to the adult resident or unacceptable cancer risks to the lifetime child/adult resident. However, under the RME scenario, the HI exceeds the EPA's acceptable HI value of 1.0 for the child resident (HI = 3.0) exposed to surface soil. This risk

was mostly attributable to arsenic, which has an HI of 1.0, with smaller contributions from iron, manganese, and vanadium, all with HIs below 1.0. The central tendency exposure non-cancer risk for the child resident (HI = 0.78), however, was below the acceptable value of 1.0.

The HHRA concluded that under future site use conditions, shallow groundwater poses an unacceptable non-cancer risk to the adult resident, child resident, and construction worker. The HHRA was updated using groundwater data collected during the manganese study conducted in 2008 (CH2M HILL, 2009a). The overall conclusions of the risk assessment did not change based on this new data, and still indicate an unacceptable risk.

Table 2-1 presents the results of the HHRA for surface soil and shallow groundwater. The main risk drivers for these media were:

- Surface Soil
  - Arsenic - through ingestion and dermal contact
- Shallow Groundwater
  - Manganese - through ingestion and dermal contact.

2.7.2 Ecological Risk Assessment

As part of the RI, the Navy conducted an SERA for surface soil at Site 21 (CH2M HILL, 2004). Section 7.7.4.3 in the RI report provides a detailed description of the ecological risk characterization. The results indicated that contaminants in the soil posed minimal risk to ecological receptors because: (1) no lowest observed adverse effect level-based hazard quotients (HQs) exceeded 1 for upper trophic level receptors; (2) concentrations of several metals that exceeded screening values were comparable to background concentrations; and (3) toxicity evaluations for arsenic and mercury (whose concentrations exceeded screening values and background) suggested that significant impacts to plants and soil invertebrates were unlikely.

The average arsenic concentration was 14.6 mg/kg. At this concentration, there are no indications that vegetation is being affected because there is good grass cover in locations that have not been recently disturbed. The average site arsenic concentration was less than other screening benchmarks (such as the screening benchmark of 60 mg/kg for earthworms). The average mercury concentration on the site was 0.23 mg/kg. A study of mercury toxicity to earthworms (not specific to Site 21) by Efroymson et al. (1997a) showed that a minimal effect was observed at mercury concentrations of 0.5 mg/kg. Because the average concentration at the site is below the concentration that produced an effect in the study, the observed mercury concentrations at Site 21 are not expected to pose a significant risk to soil invertebrates. In addition, the average mercury concentration at the site is lower than the 0.3 mg/kg screening benchmark for toxicity to plants (Efroymson et al., 1997b).

Evaluation of contaminant migration suggested that the potential for chemicals to be released from soil to groundwater is low, as well as the potential for discharge to Mattawoman Creek, which is approximately 500 feet from the site. As a result, the downgradient aquatic resources were not evaluated for ecological risk.

2.8 Remedial Action Objectives

Based on the evaluation of site conditions, an understanding of the contaminants, the physical properties in media of concern, the results of risk assessments, and an analysis of ARARs, the following RAOs for Site 21 soil and groundwater were developed:

- Prevent or minimize direct contact of human and ecological receptors with landfill contents
- Prevent surface water from running onto the site and control surface water runoff and erosion
- Prevent unacceptable risks to human receptors from exposure to contaminants in the shallow groundwater
- Return the groundwater to beneficial use to the extent practicable

Several alternatives that would satisfy the RAOs for soil and groundwater were developed in the FS (CH2M HILL 2006a). Before the remedial alternatives in the FS were evaluated, risk-based preliminary remediation goals (PRGs) were calculated for the COCs identified in soil and groundwater. PRGs for surface soil were calculated for a child resident, and PRGs for groundwater were calculated for a child and an adult resident and a construction worker, although it is unlikely that Site 21 will become a residential area. Appendix E of the FS report presents detailed calculations of the PRGs. Following the PRG calculations for the COCs, the site remediation goals (SRGs) were developed, based on the greater of the site-specific, risk-based PRGs, or background concentrations. Table 2-2 summarizes the selection of the SRGs for the COCs in soil and shallow groundwater. Section 2.2.5 of the FS report presents details on development of the SRGs.

To evaluate the COCs that require remediation, their respective maximum concentrations were compared to the SRGs. If the maximum concentration was greater than the SRG, the COC was retained for remediation; if the maximum concentration was less than the SRG, the COC was eliminated from remediation. The only COC requiring remediation is arsenic in surface soil, based on its exceedance of the SRGs. Active remediation is not proposed for groundwater because the manganese study indicated that elevated manganese concentrations are not related to the presence of landfill material. The area of attainment (AA) is defined as the area over which the RAOs, and, therefore, the SRGs, are to be met. Figure 2-5 shows the AA, which encompasses approximately 3.44 acres.

2.9 Summary Descriptions of Remedial Alternatives

Section 4.1 of the FS provides a detailed description of each remedial alternative. A summary of the four alternatives is presented below.

Alternative 1—No Action: This alternative is required by NCP §300.430(a)(6) to be evaluated as a baseline. Under this alternative, no remediation would be taken.

Alternative 1 - Estimated Cost	
Capital Cost	$0
Lifetime O&M Cost	$0
Lifetime Present-Worth O&M Cost	$0
Projected Timeframe to Achieve RAOs	Not Applicable

Alternative 2—Protective Soil Cover, ICs, and Groundwater Monitoring: This alternative involves installing a protective soil cover that complies with COMAR regulations regarding sub-base thickness (a minimum of 3 to 4 feet over waste), topsoil cover, slope, erosion and sediment controls, stabilized vegetative cover, and stormwater management systems. ICs would be established for the AA, including areas affected by landfill contaminants. The ICs would be land- and groundwater-use restrictions, which would be implemented through the base comprehensive work approval permit (CWAP) system. The objectives of the ICs would be to: (1) prohibit digging into or disturbing the existing cover or contents of the landfill, (2) prohibit housing, elementary and secondary schools, child care facilities, and playgrounds on the site, (3) prohibit the use of the groundwater beneath the site until contaminant concentrations were at levels allowing for unlimited use and unrestricted exposure, and (4) prohibit the use of shallow groundwater within 100 feet from identifiable sources of contamination and designated subsurface disposal areas (landfill and groundwater plume) (COMAR 26.04.04.05). Long-term groundwater monitoring also would be performed because it is required under the soil cover or capping remedy to monitor groundwater from the landfill. Five-year reviews would be implemented to ensure that the remedy remains protective.

Alternative 2 - Estimated Cost	
2010 Capital Cost	$1.39 million
Lifetime O&M Cost	$1.68 million
Lifetime Present-Worth O&M Cost	$940,000
Total Present-Worth Cost	$2.33 million
Projected O&M Timeframe	30 years

Alternative 3—RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring: This alternative involves installation of a RCRA Equivalent Subtitle C cap over the entire landfill in conjunction with ICs and long-term monitoring. A Subtitle C cap generally consists of an upper vegetative (topsoil) layer, a drainage layer, and a low permeability layer that consists of a synthetic liner over 2 feet of compacted clay. The ICs and long-term groundwater monitoring would be similar to Alternative 2.

Alternative 3 - Estimated Cost	
2010 Capital Cost	$2.27 million
Lifetime O&M Cost	$2.25 million
Lifetime Present-Worth O&M Cost	$1.04 million
Total Present-Worth Cost	$3.31 million
Projected O&M Timeframe	30 years

Alternative 4—Excavation and Offsite Disposal: This alternative involves excavation of the solid waste and contaminated soil within the landfill area and offsite disposal at a permitted landfill. The excavated area would be filled with clean fill and vegetated. ICs, including long term monitoring as described under Alternative 2 would be established for groundwater only, and 5-year reviews would be conducted. If during the first 5-year review, concentrations remain stable, the manganese would be classified as not landfill-related. The O&M costs for this alternative are relatively small compared to its overall costs, so they are not included in the estimated costs summary.

Alternative 4 - Estimated Cost	
2010 Capital Cost	$20.33 million
Lifetime O&M Cost	$0
Lifetime Present Worth O&M Cost	$0
Total Present-Worth Cost	$20.33 million
Projected O&M Timeframe	5 years

2.10 Summary of Comparative Analysis of Alternatives

The NCP outlines the approach for comparing remedial alternatives at 40 CFR §300.430(e)(9). Evaluation of the alternatives uses "threshold," "primary balancing," and "modifying" criteria. To be considered for remedy selection, an alternative must meet the following threshold criteria:

- Overall protection of human health and the environment - This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs. Alternative 1 would not be protective of human health and the environment, since it would not adequately prevent potential human exposure to contaminants in the soil and groundwater at the site. Therefore, since it fails a threshold criterion, Alternative 1 will not be considered further in this analysis. Alternative 2 satisfies all of the threshold criteria and the primary balancing criteria. Alternatives 2 and 3 are equally protective of human health and the environment because most of the solid waste is in contact with the groundwater, so there is no advantage gained by placement of a RCRA cap to prevent infiltration into the buried waste. However, alternative 2 is preferable to

Alternative 3 because Alternative 3 could result in further degradation of groundwater quality. The results of the geochemical assessment and manganese investigation strongly suggested that the presence of manganese in groundwater is attributable to naturally occurring low redox conditions, and not direct leaching of manganese from the waste material (CH2M HILL 2006 and 2009a). The assessments also suggested that installing a RCRA cap would further degrade groundwater quality by exacerbating reducing conditions, thereby mobilizing additional manganese. Relative ranking of alternatives: 4, 2, 3, 1.

- Compliance with ARARs - Section 121(d) of CERCLA and 40 CFR §300.430(f)(1)(i)(A) require that remedial actions at CERCLA sites at least attain ARARs of federal and state environmental laws and regulations , unless such ARARs are waived under CERCLA Section 121(d)(4). All three alternatives, 2, 3, and 4, would comply equally with the action-, and location-specific ARARs. There is no MCL for manganese, the risk driver in the shallow groundwater. Furthermore, elevated levels of manganese in shallow groundwater have been shown to be naturally occurring and unrelated to the presence of the landfill. Relative ranking of alternatives: equal.

The primary balancing criteria are then considered to analyze which alternative provides the best combination of attributes. The primary balancing criteria are:

- Long-term effectiveness and permanence - This criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. It also considers residual risk that will remain onsite following remediation and the adequacy and reliability of controls. Alternatives 2 and 3 would be equally effective in the long term, since both would require on-going maintenance. Alternative 4 would be the most effective in the long term, since all of the landfill contents would be removed. However, since the landfill is not considered to be the source of the manganese in the shallow groundwater, removal of the landfill would not remedy this problem, and ICs prohibiting groundwater use would still be necessary. Relative ranking of alternatives: 4, 2 and 3 together.

- Reduction in toxicity, mobility, or volume through treatment - This criterion refers to the anticipated performance of the treatment technologies that may be part of the remedy. None of the alternatives satisfy this criterion, since none of the alternatives employ treatment.

- Implementability - This criterion addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other entities are considered. All three alternatives would be implemented using proven technology. Alternative 4 would require coordination with a permitted landfill for disposal of excavated materials. Relative ranking of alternatives: 2 and 3 together, 4.

- Short-term effectiveness - This criterion addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved. All three remaining alternatives would involve some

disturbance to the surrounding community. Alternative 2 would achieve RAOs the fastest, followed by Alternative 3. Alternative 4 would take longer to achieve RAOs and involve a large-scale excavation causing the most disruption to the neighboring community. Relative ranking of alternatives: 2, 3, 4.

- Cost – This criterion refers to costs associated with construction and operation of the remedy; these include capital costs, O&M costs, and present-worth costs. Alternative 2 is the least costly alternative, followed by Alternative 3. Alternative 4 is approximately ten times more costly to implement than Alternative 2. Relative ranking of alternatives: 2, 3, 4.

The alternatives are evaluated further against the two modifying criteria:

- Acceptance by the state – Alternative 1 is not acceptable to the state; Alternatives 2, 3, and 4 are acceptable to the state
- Acceptance by the community - During the public comment period, the community did not provide any comments or voice any objections to the preferred alternative or the other alternatives considered.

Table 2-3 presents the comparative analysis for the threshold and primary balancing criteria for the four remedial alternatives. Section 4 of the FS report and the Proposed Plan provides a detailed description of the comparative analysis of the remedial alternatives.

2.11 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address "principal threats" posed by a site wherever practicable [40 CFR Section 300.430 (a)(1)(iii)(A)]. The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is one that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material. Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

There are no principal threats in any of the media at Site 21, and the contaminants onsite are not categorized as "highly toxic" or "highly mobile."

2.12 Selected Remedy

The Selected Remedy for Site 21 is Alternative 2 - protective soil cover, ICs, and groundwater monitoring. This alternative was selected because it provides adequate overall protection of human health and the environment at a reasonable cost. Alternative 3, which includes a RCRA Equivalent Subtitle C cap over the buried waste, was demonstrated by the geochemical assessment and manganese investigation not to provide any advantage over the soil cover. In fact, it was determined that the RCRA cap might exacerbate reducing conditions and further mobilize manganese, the COC in the shallow groundwater. While Alternative 4 would remove the waste from the site, the cost would be about ten times the cost of Alternative 2, and the protection afforded would not be appreciably higher, since the

source of the groundwater COC, manganese, is believed not to be related to the landfill contents, and the soil cover would prevent exposure to the surface soil COC, arsenic.

2.12.1 Description of the Selected Remedy

The components of the remedy are:

- Verify or grade/fill to achieve a minimum 2-foot cover over waste material.
- Construct additional 2 feet of soil cover (18 inches of clean fill and 6 inches of topsoil) with a 4 percent slope and a stabilized vegetative cover in accordance with COMAR regulation 26.04.07.26. The seed mixture for the cover vegetation will be designed so that it will serve as a bio-barrier to burrowing animals.
- Grade for surface water control and stormwater management.
- Implement ICs, which consist of land-use and groundwater-use restrictions. These include prohibiting: (1) digging into or disturbing the existing cover or contents of the landfill; (2) residential uses, including housing, elementary and secondary school, child care facilities, and playgrounds on the site; (3) use of the shallow groundwater beneath the site until concentrations of contaminants are at levels that allow for unlimited use and unrestricted exposure; and (4) use of shallow groundwater within 100 feet from identifiable sources of contamination and designated subsurface disposal areas (landfill and groundwater plume) (COMAR 26.04.04.05).
- Perform long-term groundwater quality monitoring; a detailed description of the monitoring program will be included in the long-term monitoring plan, which will be prepared after the ROD is signed.
- Conduct 5-year reviews.

The area within Site 21 requiring remediation and the area where ICs will be implemented is shown on Figure 2-5.

After this ROD is signed, as part of the remedial design, the Navy will also prepare the IC plan and long-term monitoring plan, which will be submitted to EPA and MDE for review before implementing the Selected Remedy.

The Navy will be responsible for implementing, maintaining, periodic reporting on, and enforcing the ICs in accordance with the IC plan. Although the Navy may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy will remain ultimately responsible for remedy integrity and will: 1) perform CERCLA 121(c) 5-year reviews; 2) notify the appropriate regulators and/or local government representatives of any known IC deficiencies or violations; 3) provide access to the property to conduct any necessary responses; 4) retain the ability to change, modify, or terminate ICs and any related deed or lease provisions; and 5) ensure that IC objectives are met to maintain remedy protectiveness.

2.12.2 Summary of Estimated Remedy Costs

A summary of the estimated costs for the Selected Remedy is presented in Tables 2-4 and 2-5. The estimated total capital cost of the selected remedy is $1.40 million; the estimated

total lifetime O&M cost is $1.68 million; and the estimated total present-worth cost is $2.34 million (Table 2-5). O&M activities are associated primarily with mowing and field inspections, which are assumed to be performed semiannually for 30 years. Periodic costs are primarily associated with the 5-year reviews.

2.12.3 Expected Outcomes of Selected Remedy

The Navy has no plans to disturb the soil cover that will be placed on the landfill. No community impacts from the selected remedy are expected. The anticipated benefit of the Selected Remedy is the complete mitigation of human health and ecological risks in the surface soil, waste, and shallow groundwater throughout the site following completion of the soil cover and site restoration. Through the IC mechanisms, NSF-IH can enforce restriction of future land and groundwater uses. The integrity of the soil cover will be evaluated as part of the 5-year review process. The groundwater at Site 21 is currently not used for any beneficial uses and will not likely be used as a potable water supply in the future. Table 2-6 summarizes the expected outcomes of the Selected Remedy.

2.13 Statutory Determinations

Remedial actions must meet the statutory requirements of Section 121 of CERCLA. Remedial actions undertaken at National Priorities List sites must achieve adequate protection of human health and the environment, comply with ARARs of both federal and state laws and regulations, be cost-effective, and use, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, and/or mobility of hazardous waste as the principal element and a bias against offsite disposal of untreated wastes. The following discussion summarizes the statutory requirements that are met by the Selected Remedy.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy is considered protective of human health and the environment. Although contaminants will remain onsite, they will be prevented from entering potential exposure pathways by the soil cover and continuous implementation of ICs.

2.13.2 Compliance with ARARs

The Selected Remedy will comply with the location- and action-specific ARARs identified in Tables 2-7 and 2-8 respectively. The landfill cover will be constructed in accordance with the MDE variance provided in the Appendix. Compliance will be met through eliminating the exposure pathways. The landfill soil cover will be maintained, and land-use and water-use restrictions will be documented. Because most of the solid waste volume lies below the water table and the shallow water-bearing unit is not an efficacious source of groundwater, reduced water infiltration would not be a critical criterion to be achieved. Therefore, the Selected Remedy is adequate for Site 21. Active remediation is not proposed for groundwater because the manganese investigation indicated that elevated manganese concentrations are not related to the presence of landfill material. The long-term monitoring of groundwater will confirm that manganese concentrations are consistent with natural conditions.

2.13.3 Long-Term Effectiveness and Permanence

The risks to potential human receptors from the solid waste, soil, and shallow groundwater would be eliminated as long as the soil cover is maintained and ICs are properly enforced. If items in the solid waste deteriorate or otherwise break down, contaminants may be released to the environment via a groundwater pathway. Potential releases will be detected through implementation of the long-term groundwater monitoring program. Therefore, the Selected Remedy fully satisfies the long-term effectiveness and permanence criterion.

2.13.4 Cost-Effectiveness

The Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (40 CFR §300.430(f)(1)(ii)(D)). This conclusion was reached by evaluating the overall effectiveness of the alternatives that satisfied the threshold criteria. Overall effectiveness was evaluated by assessing the five balancing criteria in combination. Overall effectiveness was then compared to cost to assess cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was found to be proportional to its cost, and, therefore, represents a reasonable value for the money to be spent.

2.13.5 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The Navy, EPA, and MDE have concluded that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practical manner at Site 21. The Navy, EPA, and MDE believe that the Selected Remedy provides the best balance of tradeoffs in terms of the balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against offsite treatment and disposal, and considering state and community acceptance.

None of the alternatives evaluated included treatment as a principal element, for the following reasons: (1) there is no principal threat waste at this site that requires treatment; and (2) treatment of the landfill contents is not practicable in a cost-effective manner.

2.13.6 Preference for Treatment as a Principal Element

The Selected Remedy does not use treatments for the reasons given above. Therefore, it does not satisfy the statutory preference for treatment as a principal element. EPA generally expects to use treatment to address principal threat wastes, and no principal threat wastes exist at Site 21.

2.13.7 5-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, pursuant to 40 CFR §300.430(f)(4)(ii), the Navy will conduct a statutory remedy review within 5 years after initiating the remedial action and every 5 years thereafter to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.14 Documentation of Significant Changes

There have been no significant changes to the preferred alternative presented in the Proposed Plan for Site 21, which was made available for public comment from June 18, 2010 to July 18, 2010, and presented at a public meeting on July 1, 2010. The Selected Remedy is the same alternative as the recommended alternative presented in the Proposed Plan.

TABLE 2-1
HHRA – Risk Characterization Results Summary
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Receptor	Current Land Use		Future Land Use	
	Carcinogenic Risk	**Non-Carcinogenic Hazard**	**Carcinogenic Risk**	**Non-Carcinogenic Hazard**
Surface Soil				
Industrial Worker	Acceptable	Acceptable	Acceptable	Acceptable
Adult Trespasser/Visitor	Acceptable	Acceptable	Acceptable	Acceptable
Adolescent Trespasser/Visitor	Acceptable	Acceptable	Acceptable	Acceptable
Construction Worker	NA	NA	NA	NA
Adult Resident	NA	NA	Acceptable	Acceptable
Child Resident	NA	NA	Acceptable	**Not Acceptable (HI = 3)**
Groundwater				
Industrial Worker	NA	NA	NA	NA
Adult Trespasser/Visitor	NA	NA	NA	NA
Adolescent Trespasser/Visitor	NA	NA	NA	NA
Construction Worker	NA	NA	Acceptable	**Not Acceptable (HI = 2.2)**
Adult Resident	NA	NA	Acceptable	**Not Acceptable (HI = 40)**
Child Resident	NA	NA	Acceptable	**Not Acceptable (HI = 94)**

Notes:

HHRA – Human Health Risk Assessment
HI- Hazard Index
NA – Not evaluated, because it is not applicable
Acceptable – HI < 1, for non-carcinogenic hazard and carcinogenic risks below a range of $1x10^{-4}$ to $1x10^{-6}$

TABLE 2-2
Site Remediation Goals for COCs Requiring Remediation
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

COC	Medium	Unit	Maximum Detected Concentration	Frequency of Detection	Facility Background 95% UCL[a]	PRG[b]	Basis for PRG	MCL	SRG	Number of SRG Exceedances	Require Remediation?
Residential Scenario											
Arsenic	Soil	mg/kg	51.8	20/20	2.56	22	Target hazard = 1, Child resident	NA	22[c]	2/20	Yes
Manganese	Groundwater	µg/L	24,700 (dissolved)[f]	4/4[f]	824	290	Target hazard = 1, Child resident	NA	824[d]	1/4[f]	Yes
Construction Worker Scenario											
Manganese	Groundwater	µg/L	23,100 (total)[f]	4/4[f]	824	11000[e]	Target hazard = 1, Construction worker	NA	See Note 1	4/4[f]	Yes

Notes
COC – constituent of concern
UCL – Upper Confidence Limit
PRG – Preliminary Remediation Goal
MCL - Maximum contaminant level
SRG – Site Remediation Goal
mg/kg – milligram(s) per kilogram
µg/L – microgram per liter
NA – Not Available
Shaded cell indicates the SRG for the COC.
[a]NSF-IH background values presented in Background Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).
[b]Calculations of the PRGs are presented in detail in *Final Feasibility Study Report, Site 21 Bronson Road Landfil*l (CH2M HILL 2006).
[c]The SRG was based on the greater of the site-specific, risk-based PRGs or and the facility-wide background (95 percent UCL). The PRG of 22 was selected as the SRG.
[d]The SRG was based on the greater of risk-based PRGs or facility-wide background concentration. The background of 824 was selected as the SRG.
[e]Construction worker risk-based PRG was not used in the PRG selection because it was less conservative than child resident scenario.

[f]The highest concentrations of total and dissolved manganese in groundwater were 23,100 ug/L and 24,700 ug/L from the remedial investigation. Subsequent sampling of the 4 wells sampled and new wells installed in 2009 have yielded managanese concentrations lower than these values. The frequency of detection and number of SRG exceedances reported on this table are based on the remedial investigation data; they also include the site-specific background sample locations.
1. The SRG for the construction worker defaults to the SRG for the child resident.

TABLE 2-3
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Groundwater Remedial Alternatives
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1 No Action	Alternative 2 Protective Soil Cover, ICs, and Groundwater Monitoring	Alternative 3 RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring	Alternative 4 Excavation and Offsite Disposal
Overall Protection of Human Health and the Environment	Not protective of human health and the environment	Adequate protection of human health and the environment. Although contaminants would remain on site, they would be prevented from entering potential exposure pathways by the presence of the soil cover and ICs.	Adequate protection of human health and the environment. Although contaminants would remain on site, they would be prevented from entering potential exposure pathways by the presence of the cap and ICs.	Alternative 4 satisfies the protection of human health and environment criterion because solid waste and contaminated soil that may represent a potential source of contamination would be removed from the site, minimizing the residual contamination and, therefore, minimizing the potential exposure of human and ecological receptors to the contaminated soil and solid waste.
Compliance With ARARs	Non applicable	Would comply with ARARS. With regard to the implementation of Alternative 2, MDE has approved a variance from the requirements of COMAR 26.04.07.21—Industrial Sanitary Landfill Closure, a State ARAR that requires an impermeable cap to be installed for the closure of an industrial landfill, the category that was the best fit for the landfill at Site 21.	Would comply with ARARs.	Would comply with ARARs.

TABLE 2-3
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Groundwater Remedial Alternatives
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1 No Action	Alternative 2 Protective Soil Cover, ICs, and Groundwater Monitoring	Alternative 3 RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring	Alternative 4 Excavation and Offsite Disposal
Long-Term Effectiveness and Permanence	Does not provide long-term effectiveness and permanence. Magnitude of residual risk would remain unchanged. There would be no controls in place.	The risk to potential human and ecological receptors from the waste and contaminated soil would be reduced as long as the integrity of the cover was maintained and ICs were properly enforced. However, if items in the solid waste deteriorate or otherwise broken down, contaminants could be released to the environment via a groundwater pathway. Potential releases would be detected through groundwater monitoring.	Risks to potential human and ecological receptors from the solid waste and contaminated soil would be eliminated as long as the RCRA cap is maintained and ICs were properly enforced. However, if items in the solid waste deteriorated or otherwise broken down, contaminants could be released to the environment via a groundwater pathway. Potential releases would be detected through groundwater monitoring. The long-term adequacy and reliability of controls would be better than Alternative 2 because RCRA cap is more impermeable than a soil cover.	Because the potential sources of contamination would be permanently removed from the site, Alternative 4 would provide the highest level of compliance with the long-term effectiveness and permanence.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Would not reduce toxicity, mobility, or volume of contaminants through treatment.	Would not reduce toxicity, mobility, or volume of contaminants through treatment.	Would not reduce toxicity, mobility, or volume of contaminants through treatment.	Would not reduce the toxicity, mobility, or volume of contaminants through treatment.

TABLE 2-3
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Groundwater Remedial Alternatives
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1 No Action	Alternative 2 Protective Soil Cover, ICs, and Groundwater Monitoring	Alternative 3 RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring	Alternative 4 Excavation and Offsite Disposal
Short-Term Effectiveness	No impact to community, workers, and the environment from remedial activities because this alternative would involve no actions. Would not achieve RAOs.	Impacts to the remediation workers and community during the construction activities (primarily earthwork) would be low to moderate. One-month construction period. Could be minimized or potentially eliminated with proper planning and safe practices. RAOs would be achieved after the construction of the soil cover.	Impacts to the remediation workers and community during the construction activities (primarily earthwork) would be low to moderate. Two-month construction period. Could be minimized or potentially eliminated with proper planning and safe practices. RAOs would be achieved after the construction of the impermeable cap.	Impacts to the remediation workers and community during the construction activities (primarily earthwork and off-site transportation) would be greatest under this alternative but could be minimized with proper planning and safe practices. RAOs would be achieved after excavation and offsite disposal.
Implementability	Alternative 1 would be technically feasible because no actions would be taken.	Alternative 2 would be easily implementable. Material and services for the technologies are available and considered standard practices. Would require long-term administrative commitment.	Alternative 3 would be equally as implementable as Alternative 2. Would require long-term administrative commitment.	Alternative 4 would be technically and administratively feasible because the technologies have become standard practices. Alternative 4 would be implementable and would not require long-term administrative commitment because long-term monitoring and ICs would likely not be required, except for groundwater.

TABLE 2-3
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Groundwater Remedial Alternatives
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1 No Action	Alternative 2 Protective Soil Cover, ICs, and Groundwater Monitoring	Alternative 3 RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring	Alternative 4 Excavation and Offsite Disposal
Cost	Taking no action would require no expenditure of money for either capital or O&M investments.	2010 Capital Cost: $1.40 million Lifetime O&M Cost: $1.68 million Lifetime Present-Worth O&M Cost: $940,000 Total Present-Worth Cost: $2.34 million (Projected time considered for cost estimation is 30 years)	2010 Capital Cost: $2.27 million Lifetime O&M Cost: $2.25 million Lifetime Present-Worth O&M Cost: $1.04 million Total Present-Worth Cost: $3.31 million (Projected time considered for cost estimation is 30 years)	2010 Capital Cost: $20.33 million Lifetime O&M Cost: $0 Lifetime Present-Worth O&M Cost: $0 Total Present-Worth Cost: $20.33 million
State and Community Acceptances	Not Acceptable	Acceptable	Acceptable	Acceptable
General Comment		This has been selected as the preferred remedial alternative.	Provides a conservative scenario in terms of the protectiveness of human health and the environment and the long-term effectiveness and permanence. However, this benefit is marginal compared to Alternative 2 because portions of the solid waste are in contact with groundwater; therefore, contribution of leachate to groundwater contamination may be small.	Provides the most conservative scenario as the waste and resulting surface soil risks would be removed. However, the benefits in terms of the protection of human health and the environment and the long-term effectiveness and permanence would be very marginal compared to Alternatives 2 and 3, because groundwater is expected to retain manganese concentrations that show unacceptable human health risk.

TABLE 2-4
Detailed Cost Estimate of Alternative 2 for Soil and Solid Waste
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

REMEDIAL ALTERNATIVE 2	LOCATION:	MEDIA:		
Protective Soil Cover, LUCs, and Groundwater Monitoring	**Site 21, Bronson Road Landfill** **NSF-IH, Indian Head, Maryland**	**Solid Waste, Contaminated Soil, and Shallow Groundwater**	**Construction time:**	**17.2** weeks
			Operation time:	**30** years
			Post Remediation Monitoring:	**30** years

DESCRIPTION OF ALTERNATIVE:

Existing cover repair and retrofit where necessary. The cover shall have a minimum 24-inch thickness of soil. Implementation of operation and maintenance and LUCs for 30 years, including biannual field inspection and mowing, five-yearly cover repair, and five-year reviews. LUC measures are in the forms of land- and groundwater-use restrictions and long-term groundwater monitoring.

ASSUMPTIONS:

1) The soil cover area is approx. 150000 SF 3.44 acres

2) The RI indicated that the existing thickness of soil cover likely ranges from 5 to 10 ft. No study/investigations have confirmed this statement. The soil and test pits boring indicated that the wastes were exposed in some areas. Therefore, for cost estimating purposes, it is assumed that the percentage of the soil cover area needing a 24-inch soil cover is 100%

3) Perimeter of the soil cover area is approx. 1550 ft

4) Required soil fill material to improve the slope of the existing soil cover is approx. (in CY) 4750 (see the calculation at the end of this appendix)

5) Surface water management would be accomplished through rip rap ditches along the perimeter of the cover.

6) Installation of 2 additional downgradient groundwater monitoring wells.

7) Quaterly sampling for the first 2 years and subsequent annual sampling of groundwater for total and dissolved metals and geochemical parameters for 30 years from all four existing wells and 2 additional wells.
8) All samples would be analyzed for TAL Metals/Cyanide, chlorides, nitrates, and sulphates. In addition field measurements such as DO, ORP, pH, and temperature would also be collected.
9) Data interpretation and report would be prepared following a sampling event.

10) Sources of costs are 2010 RS Means Facilities Construction Cost Data, 2006 ECHOS Environmental Remediation Cost Data - Unit Price, vendor quotes, and professional judgment based on similar projects.

11) All soil volumes are in-place

Cost Component	Qty	Unit	Cost Source/Assumptions	Estimated Activity Duration (day)	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Subcontractor	Total Cost
CAPITAL COSTS												
Institutional Controls/Planning												**$6,000.00**
Site-Specific LUC	1	lump sum	Allowance		$6,000.00	$6,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,000.00
Permitting, Planning, and Reporting												**$52,000.00**
Health and Safety Plan	1	lump sum	Professional Judgment		$17,000.00	$17,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$17,000.00
FSP, QAPP, and DQOs	1	lump sum	Professional Judgment		$35,000.00	$35,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$35,000.00
Site Preparation				**14**								**$33,386.23**
Site clearing (dozer medium)	3.44	acre	M 311313 10 0400	6	$405.00	$1,394.63	$795.00	$2,737.60	$0.00	$0.00	$0.00	$4,132.23
Site demolition (road demolition - assume 4" to 6" asphalt paved, $150/t material T&D, no replacement))	2000	SY	M 024113 17 5050	5	$3.52	$7,040.00	$2.80	$5,600.00	$6.00	$12,000.00	$0.00	$24,640.00
Survey (boundry & markers, small quantity)	3	days	M 022113 13 0400	3	$1,400.00	$4,200.00	$138.00	$414.00	$0.00	$0.00	$0.00	$4,614.00

TABLE 2-4
Detailed Cost Estimate of Alternative 2 for Soil and Solid Waste
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Cost Component	Qty	Unit	Cost Source/Assumptions	Estimated Activity Duration (day)	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Subcontractor	Total Cost
Earthwork				**66**								**$401,711.83**
Borrow, loading, and spreading - common earth, shovel, 1CY bucket (18" thick)	11533	CY	M 312323 15 7000	14	$0.74	$8,534.67	$1.49	$17,184.67	$15.50	$178,766.67	$0.00	$204,486.00
Borrow, loading, and spreading - top soil, shovel, 1CY bucket (6" thick)	5556	CY	M 312323 15 7000	10	$1.33	$7,388.89	$3.03	$16,833.33	$23.00	$127,777.78	$0.00	$152,000.00
Grading - large area	16667	SY	M 312323 17 0020	17	$0.48	$8,000.00	$1.19	$19,833.33	$0.00	$0.00	$0.00	$27,833.33
Compaction - sheepsfoot, 12" lifts, 4 passes	11533	CY	M 312323 23 5720	14	$0.18	$2,076.00	$0.48	$5,536.00	$0.00	$0.00	$0.00	$7,612.00
Trenching for dikes and ditches- 1-4' deep, 1/8 CY backhoe	1550	CY	M 312316 13 0050	11	$4.06	$6,293.00	$2.25	$3,487.50	$0.00	$0.00	$0.00	$9,780.50
Site Restoration and Surface Water Management				**4**								**$23,450.50**
Rip rap , 3' bottom, 3' deep, 2:1 side slope	260	CY	M313713 10 0100	2	$10.00	$2,600.00	$11.80	$3,068.00	$30.00	$7,800.00	$0.00	$13,468.00
Hydroseeding	150	M.SF	M 329219 14 5400	2	$10.90	$1,635.00	$8.65	$1,297.50	$47.00	$7,050.00	$0.00	$9,982.50
Installation of New Groundwater Monitoring Wells				**2**								**$7,415.00**
2" MW constructions (2 new MW, Total of 50 feet)	2	wells		1	$1,375.00	$1,375.00	$0.00	$0.00	$0.00	$0.00	$4,600.00	$5,975.00
(assumed sub costs of $2300/well)												
Well development	6	hrs	2005 BOA Rates (+ 15%)	1	$750.00	$750.00	$0.00	$0.00	$0.00	$0.00	$690.00	$1,440.00
Construction Oversight												**$305,300.00**
Engineer (@ $125/hr & 50 hrs/wk)	17	weeks	E 99 11 0403		$6,250.00	$107,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$107,500.00
Site Health and Safety (@ $140/hr & 50 hrs/wk)	17	weeks	E 99 11 0703		$7,000.00	$120,400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$120,400.00
Superintendent (@ $150/hr & 30 hrs/wk)	17	weeks	E 99 11 0203		$4,500.00	$77,400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$77,400.00
Preconstruction Submittals												**$115,000.00**
Preconstruction survey, design basis, pre-draft, draft, and final design, specifications, and H&S plans	1	lump sum	Professional Judgment		$115,000.00	$115,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$115,000.00
General Conditions												**$45,854.86**
Decontamination, temp. facilities, sed. & erosion control, temp. fence, etc.	1	lump sum	10% of total construction cost		$45,854.86	$45,854.86	$0.00	$0.00	$0.00	$0.00	$0.00	$45,854.86
Contractor Overhead and Profit												**$68,782.28**
Home office cost, etc.	1	lump sum	15% of total construction cost		$68,782.28	$68,782.28	$0.00	$0.00	$0.00	$0.00	$0.00	$68,782.28
Mob/Demob												**$22,927.43**
Mob & demob of equip & personnel	1	lump sum	5% of total construction cost		$22,927.43	$22,927.43	$0.00	$0.00	$0.00	$0.00	$0.00	$22,927.43

TABLE 2-4
Detailed Cost Estimate of Alternative 2 for Soil and Solid Waste
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Cost Component	Qty	Unit	Cost Source/Assumptions	Estimated Activity Duration (day)	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Subcontractor	Total Cost
SUBTOTAL CAPITAL COST						**$667,151.75**		**$75,991.94**		**$333,394.44**	**$5,290.00**	**$1,081,828.13**
Scope Contingency	20%											**$216,365.63**
Bid Contingency	10%											**$108,182.81**
TOTAL CAPITAL COST												**$1,406,376.57**
OPERATION & MAINTENANCE AND PERIODIC ACTIVITIES - PER EVENT COST												
Cover Maintenance (per event)												**$8,105.00**
Biannual mowing - tractor with rotary mower, Mediun	150	M.SF	M 310190 19 1670		$26.50	$3,975.00	$23.00	$3,450.00	$0.00	$0.00	$0.00	$7,425.00
Biannual inspection	8	hrs	E 99 11 0403		$85.00	$680.00	$0.00	$0.00	$0.00	$0.00	$0.00	$680.00
Cover Repair - every five year												**$28,127.53**
Assume 2% of total capital cost	1	lump sum	Professional Judgment		$28,127.53	$28,127.53	$0.00		$0.00	$0.00	$0.00	$28,127.53
Sampling and Analysis (per event)												
Sample Collection												**$5,588.80**
Sample collection - 2 person crew, 10 hrs/day, $100/hr, 10 wells. 12 samples)	2	days	Professional Judgment		$2,300.00	$4,600.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4,600.00
Disposable and decon materials per sample	12	samples	E 33 02 0401, 33 02 0402, 33 02 0561		$0.00	$0.00	$0.00	$0.00	$24.90	$298.80	$0.00	$298.80
Equipment Rental	2	days			$0.00	$0.00	$345.00	$690.00	$0.00	$0.00	$0.00	$690.00
Lab Analysis												**$2,640.00**
Metals	12	samples	BOA Rates		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,800.00	$1,800.00
Chloride, nitrite/nitrate, sulfate	12	samples	BOA Rates		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$840.00	$840.00
Data Interpretation												**$10,000.00**
Report	1	lump sum	Professional Judgment		$10,000.00	$10,000.00	$0.00		$0.00	$0.00	$0.00	$10,000.00
Five-Year Review												**$19,400.00**
Report - Engineer	120	hrs	E 99 11 0403		$115.00	$13,800.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,800.00
Report - Senior Review	40	hrs			$140.00	$5,600.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,600.00
Site Closure												**$30,000.00**
Report development	1	lump sum	Allowance		$30,000.00	$30,000.00	$0.00		$0.00	$0.00	$0.00	$30,000.00

TABLE 2-5
Present Worth Calculation of Remedial Alternative 2 for Soil and Solid Waste
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Location:	Site 21, Bronson Road Landfill, NSF-IH, Indian Head, Maryland	Construction time:	18 week
Media:	Soil	Operation time:	30 years

http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/

PRESENT WORTH CALCULATION

Discount Rate:	**4.50%**	**O&M and Period Cost Contingency:**	**20.00%**		
Year	**Real Cost Incurred**	**Cost Description**	**Cost Type**	**Discount Factor**	**Present Worth**
0	$1,406,377	Capital costs	Capital	1.00	$1,406,377
1	$106,950	Two biannual field inspections and mowings and four quarterly groundwater sampling events	O&M	1.05	$102,345
2	$106,950	Two biannual field inspections and mowings and four quarterly groundwater sampling events	O&M	1.09	$97,938
3	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.14	$33,373
4	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.19	$31,936
5	$98,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repair; and five-year review	O&M, Periodic	1.25	$78,929
6	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.30	$29,245
7	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.36	$27,986
8	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.42	$26,780
9	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.49	$25,627
10	$98,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repair; and five-year review	O&M, Periodic	1.55	$63,336
11	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.62	$23,468
12	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.70	$22,457
13	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.77	$21,490
14	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	1.85	$20,565
15	$98,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repair; and five-year review	O&M, Periodic	1.94	$50,824
16	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.02	$18,832
17	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.11	$18,021
18	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.21	$17,245
19	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.31	$16,502
20	$98,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repair; and five-year review	O&M, Periodic	2.41	$40,784
21	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.52	$15,111

TABLE 2-5
Present Worth Calculation of Remedial Alternative 2 for Soil and Solid Waste
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Year	Real Cost Incurred	Cost Description	Cost Type	Discount Factor	Present Worth
22	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.63	$14,461
23	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.75	$13,838
24	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	2.88	$13,242
25	$98,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repair; and five-year review	O&M, Periodic	3.01	$32,727
26	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	3.14	$12,126
27	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	3.28	$11,604
28	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	3.43	$11,104
29	$38,085	Two biannual field inspections and mowings and an annual groundwater sampling event	O&M	3.58	$10,626
30	$134,360	Two biannual field inspections and mowings; an annual groundwater monitoring event; cover repai	O&M, Periodic, Site Closure	3.75	$35,874
CAPITAL COST	**$1,406,377**				
2010 Dollar LIFETIME O&M	**$1,677,918**		**Lifetime Present Worth O&M**		**$938,397**
TOTAL IMPLEMENTATION CC	**$3,084,295**		**TOTAL PRESENT WORTH**		**$2,344,774**

TABLE 2-6
Expected Outcomes of the Selected Remedy
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Risk	Remedial Action Objective	Remedy Component	Metric/Cleanup Level	Expected Outcome
Landfill wastes	Prevent or minimize direct contact of human and ecological receptors with landfill contents	Soil Cover	Human health risk-based cleanup goal	Current land use (industrial) and prevent contact with landfill waste
Landfill wastes	Prevent surface water from running onto the site and control surface water runoff and erosion	Grade for surface water control and stormwater management	Human health risk-based cleanup goal	Current land use (industrial) and prevent contact with landfill waste; restrict future residential use
Landfill wastes	Prevent or minimize direct contact of human and ecological receptors with landfill contents	Implement ICs prohibiting residential use of the site	Human health risk-based cleanup goal	Current land use (industrial) and prevent contact with landfill waste
Landfill wastes	Prevent or minimize direct contact of human and ecological receptors with landfill contents	Implement ICs prohibiting digging into or disturbing the existing cover or contents of the landfill	Human health risk-based cleanup goal	Current land use (industrial) and prevent contact with landfill waste
Manganese and thallium in shallow groundwater	Prevent unacceptable risks to human receptors from exposure to contaminants in the shallow groundwater	Implement ICs prohibiting the use of groundwater beneath the site	Human health risk-based cleanup goal	Restrict industrial and residential use of the shallow groundwater
Manganese and thallium in shallow groundwater	Return the groundwater to beneficial use to the extent practicable	Implement ICs prohibiting the use of groundwater beneath the site and conduct long-term monitoring of the shallow groundwater to protect human health related to elevated manganese and thallium levels	Human health risk-based cleanup goal	Reduce the concentrations of constituents of concern in the shallow groundwater by pathway interruption rather than by active remediation

TABLE 2-7
Location-specific ARARs
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Location	Requirement	Prerequisites	Citation	ARAR	Comments
Migratory Bird Treaty Act					
Landfill position relative to migratory bird area	Protects almost all species of native birds in the United States from unregulated taking which can include poisoning at hazardous waste sites or harassment during remedial operations.	Presence of migratory birds or their nests or eggs.	Migratory Bird Treaty Act, 16 USC 703	Applicable	The site is located along the Atlantic Migratory Flyway. If migratory birds, or their nests or eggs, are identified at the site, operations will not destroy the birds, nests, or eggs.

Notes:

The location-specific ARARs are the substantive requirements found in *the above-referenced regulations*

ARAR - Applicable or relevant and appropriate requirement

TABLE 2-8
Action-specific ARARs
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Action	Requirement	Prerequisites	Citation	ARAR	Comments
Maryland Stormwater Rules					
Discharge of storm water during construction activities	Requirements for construction activity include the development of a storm water management plan and an erosion and sediment control plan	Performing construction activities which disturb more than one acre of land	COMAR 26.08.04.09(A) 2&5 26.17.02.09 (E)(5)(a) – (e), (6)(a)-(p) 26.17.01.07B(2); (3)(a)-(h), (j)	Applicable	A permit is not required. To comply with the substantive requirements, the noted plans will be prepared as required and control measures implemented to prevent impacts to storm water from site activity.
Maryland Solid Waste Rules					
Soil Cap Design	The closure cap shall be designed to minimize infiltration into the landfill. Alternative proposals for landfill closure may be implemented based on an engineering analysis of the site.	Closure of an industrial waste landfill.	COMAR 26.04.07.21.B, D, H; .26A, B	Relevant and Appropriate	An alternative design was approved for the impermeable liner and drainage layer based on the feasibility study analysis.
Post Closure Monitoring	Conduct post-closure monitoring and maintenance for at least 5 years. Inspect cover, drainage, and monitoring wells and identify any leachate seeps at least twice a year. Correct any problems within 30 days of their observance. Groundwater monitoring wells must be installed and monitoring of contaminated groundwater is required.	After installation of the soil cap	COMAR 26.04.07.20(D)(2); 22	Relevant and appropriate	The substantive requirements will be incorporated into the post-closure landfill and groundwater monitoring program. In addition, CERCLA requires 5-year reviews of remedial actions if wastes are left in place to verify that the remedy is working (40 CFR 300.430[f][4][ii]).

TABLE 2-8
Action-specific ARARs
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Action	Requirement	Prerequisites	Citation	ARAR	Comments
Maryland Environmental Noise Act					
Control of noise during construction	24-hour average sound levels in industrial areas should not exceed 70 dBA. Noise levels emanating from construction or demolition site activities may not exceed: (a) 90 dBA during daytime hours; (b) 75 dBA during night	Actions generating noise	COMAR 26.02.03.03.A(2), (4)	Applicable	During site remediation work, the maximum allowable noise levels will not be exceeded at the site boundaries.
Maryland Well Construction Standards					
Use of groundwater monitoring wells	Specifications for well maintenance including maintaining wells to protect the groundwater resource, maintaining access to the well port such that foreign materials may not enter the well, and maintaining the identification tag.	Maintenance of a monitoring well network.	COMAR 26.04.04.10 A, C, E.	Applicable	Requirements for maintaining the monitoring well network will be incorporated into long-term monitoring plans.

TABLE 2-8
Action-specific ARARs
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

Action	Requirement	Prerequisites	Citation	ARAR	Comments
Maryland General Air Emissions Standards, Prohibitions, and Restrictions					
Construction activities generating dust	Reasonable precautions must be taken to prevent particulate matter from becoming airborne during construction activities. These include the application of water or appropriate chemicals to roads, materials, and stockpiles; covering open-bodied vehicles that are transporting materials or soil likely to create dust, maintenance of roadways including the removal of soil that has been tracked out by equipment.	Potential to emit dust	COMAR 26.11.06.03(D) (1), (2), (4), (6)	Applicable	Dust control measures will be implemented as needed during construction to comply with these rules.

Notes:

The action-specific ARARs are the substantive requirements found in the above-referenced regulations

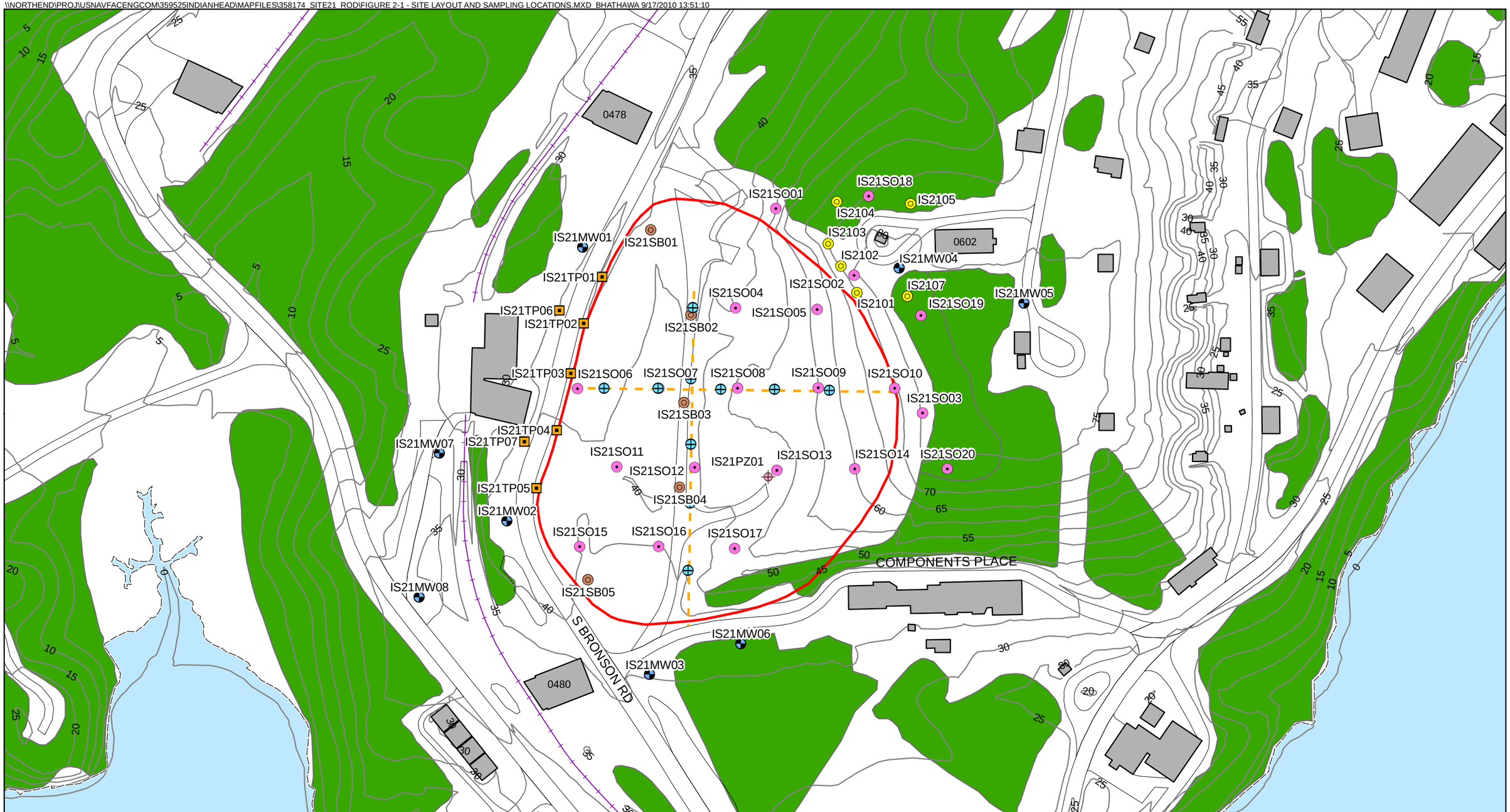
ARAR - Applicable or relevant and appropriate requirement

CERCLA – Comprehensive Environmental Response Compensation and Liability Act

CFR - Code for Federal Regulations

COMAR – Code of Maryland Regulations

\\NORTHEND\PROJ\USNAVFACENGCOM\359525INDIANHEAD\MAPFILES\358174_SITE21_ROD\FIGURE 2-1 - SITE LAYOUT AND SAMPLING LOCATIONS.MXD BHATHAWA 9/17/2010 13:51:10



Legend

- Monitoring Well Location (Sampled during RI, Pre-FS Study Investigation, and Manganese Investigation)
- Piezometer Location (Sampled during Manganese Investigation)
- Surface Soil Sample Location (Sampled during RI)
- Soil Boring (Sampled during RI)
- Soil Boring (Sampled during Investigation of Groundwater Flow and Perchlorate)
- Test Pits (Excavated during RI)
- Data Point Along Electrical Resistivity Profile
- Contours (5ft)
- Road
- Railroad
- Electrical Resistivity Profile
- Approximate Site Boundary
- Buildings
- Installation Boundary
- Wooded Area

N

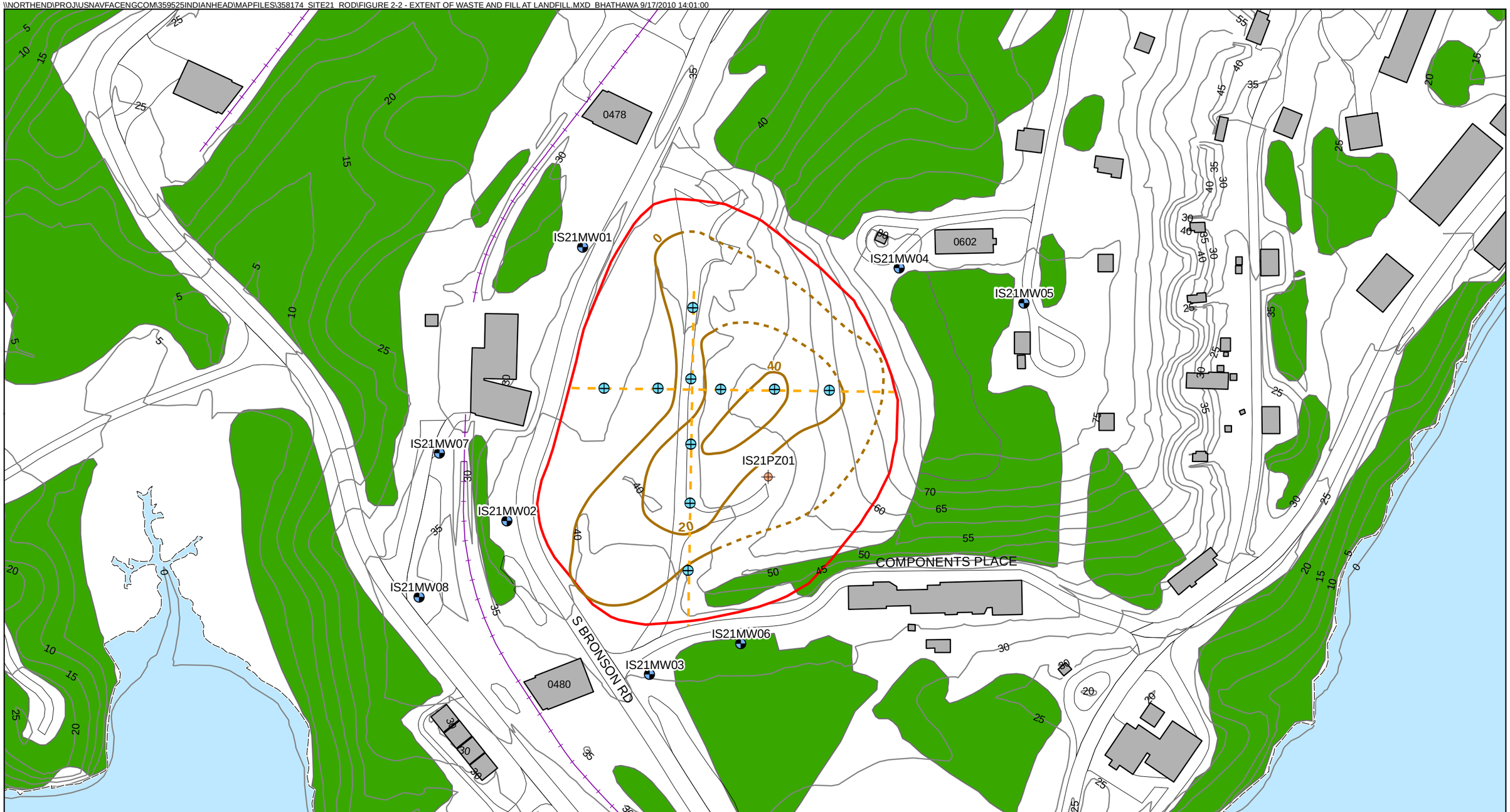
0 60 120 240 Feet

1" = 120'

Figure 2-1
Sampling Locations
Record of Decision, Site 21 – Bronson Road Land
NSF-IH, Indian Head, Maryland

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\359525INDIANHEAD\MAPFILES\358174_SITE21_ROD\FIGURE 2-2 - EXTENT OF WASTE AND FILL AT LANDFILL.MXD BHATHAWA 9/17/2010 14:01:00



Legend

- Monitoring Well Location
- Piezometer Location
- Surface Soil Sample Location (Sampled during RI)
- Data Point Along Electrical Resistivity Profile
- Fill Thickness
- Inferred Fill Thickness
- Electrical Resistivity Profile
- Contours (5ft)
- Road
- Railroad
- Approximate Site Boundary
- Buildings
- Installation Boundary
- Wooded Area

N

0 60 120 240 Feet

1" = 120'

Figure 2-2
Extent of Waste and Fill at Landfill
Record of Decision, Site 21 – Bronson Road Land
NSF-IH, Indian Head, Maryland

CH2MHILL

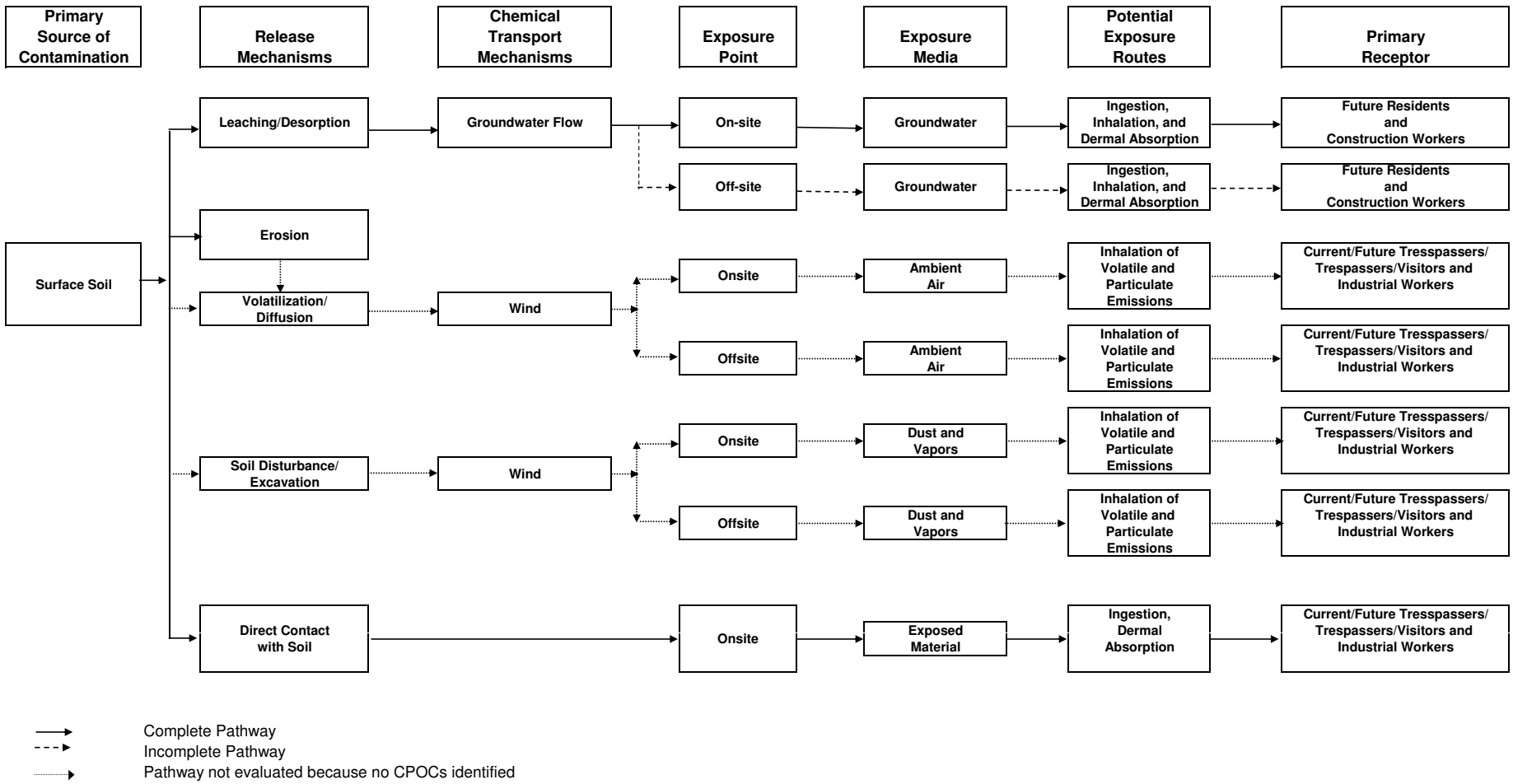


Figure 2-3
Conceptual Site Model for Potential Human Receptors
Record of Decision, Site 21 - Bronson Road Landfill
NSF-IH, Indian Head, Maryland

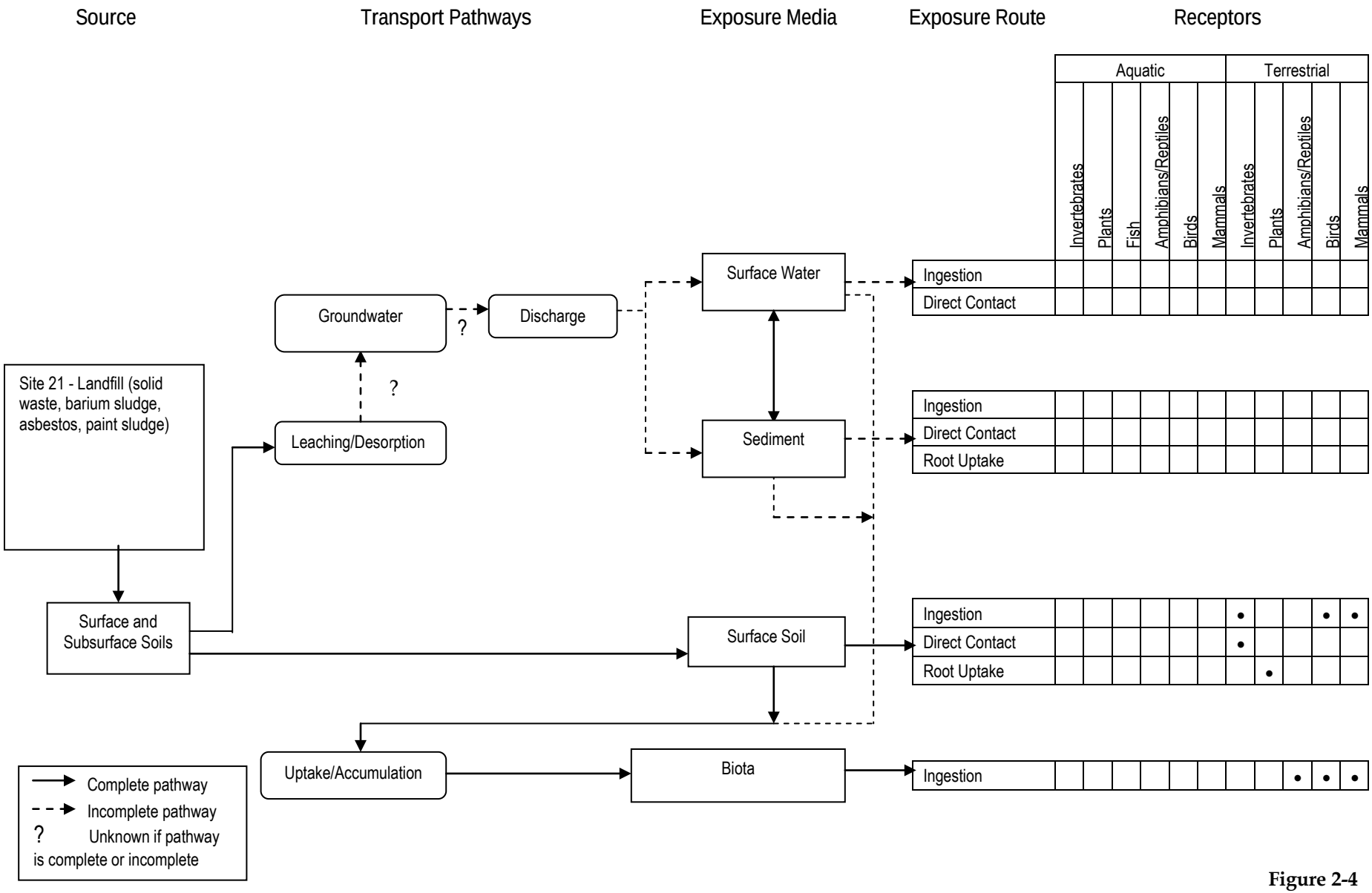


Figure 2-4
Conceptual Site Model for Potential Ecological Receptors
Record of Decision, Site 21 – Bronson Road Landfill
NSF-IH, Indian Head, Maryland

SECTION 3

Responsiveness Summary

The 30-day public comment period for the Selected Remedy for Site 21 began on June 18, 2010, and ended on July 18, 2010. A public meeting was held on July 1, 2010 at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland, to accept oral and written comments on this decision. No oral or written comments were received during the public comment period.

No technical or legal issues have been identified for Site 21 with respect to this ROD.

SECTION 4

References

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Appendix
MDE Variance Approval Letter
Pursuant to COMAR 26.04.07.26

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Shari T. Wilson
Secretary

Robert M. Summers, Ph.D.
Deputy Secretary

August 13, 2010

Mr. Joseph Rail, P.E.
NAVFAC Washington
Washington Navy Yard, Bld. 212
1314 Harwood Street SE
Washington, DC 20374-5018

Re: Naval Support Facility Indian Head Site 21 – Bronson Road Landfill Request for Variance, letter dated May 20, 2010

Dear Mr. Rail:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's (MDE) Hazardous Waste Program has completed its review of the above referenced letter. The Navy is complying with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) with regards to this site. The Code of Maryland Regulations (COMAR) 26.04.07.10 and .21 are therefore Applicable or Relevant and Appropriate Requirements to any action taken at the site.

The FFD in consultation with MDE's Solid Waste Program has reviewed the requested variance. Site conditions are: more than 48% of the waste is believed to be below the current water table, reducing conditions within the landfill have liberated naturally occurring manganese to the water table aquifer above acceptable levels, and the manganese plume diminishes to acceptable levels in the oxygenated aquifer down-gradient of the landfill. A variance is requested at Site 21 for the following reasons: installing a RCRA Subtitle C cap (impermeable cover) would only lower the water table 1.54 feet, leaving 45% of the waste still within the current water table, the impermeable cover would increase reducing conditions within the landfill and surrounding soils potentially increasing the amount of manganese being released to down-gradient groundwater and potentially extending the current areal extent of the manganese plume. Placement of a vegetated soil cover, with the implementation of Land Use Controls will limit direct exposure to waste material for both human and ecological receptors. The remedial alternative, as proposed; given the unique circumstances of the site, will be as protective as a fully compliant COMAR cover system and should not further exacerbate down-gradient groundwater quality.

Considering the foregoing, the FFD, in accordance with the variance provision contained in COMAR 26.04.07.26, will consider favorably the Navy's request for a variance if the following conditions are adequately addressed in the Record of Decision for this site and community response to the proposed plan is favorable:

i. Implementation of adequate institutional controls, including documentation of their effectiveness on at least an annual basis.

ii. Compliance with sediment and erosion control requirements throughout the life of this waste management facility.

iii. Long-term operations and maintenance activities will be implemented to protect the integrity of the soil cover with monitoring adequate to meet the needs of the FFD.

iv. Long-term monitoring of groundwater will be implemented to monitor the effectiveness of the soil cover at Site 21 and to evaluate the potential migration of contaminants down-gradient of the Bronson Road Landfill. Again this monitoring program must meet the needs of the FFD (see tables 1 & 2 provided earlier) in evaluating the adequacy of the remedy and the continued use of the variance provision contained in COMAR.

If you have any questions, please contact me at (410) 537-3791.

Sincerely,

Curtis DeTore
Section Head
Federal Facilities Division

CD:cd

cc: Mr. Dennis Orenshaw
Mr. Horacio Tablada
Mr. Harold L. Dye, Jr.
Mr. Edward Dexter