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FINAL REMEDIAL INVESTIGATION REPORT AT STUMP NECK ANNEX SOLID WASTE MANAGEMENT UNIT 14 (SWMU 14) NAVAL SUPPORT FACILITY NSWC INDIAN HEAD MD

04/01/2014

CH2M HILL

Final

Remedial Investigation Report
Stump Neck Annex – SWMU 14

Naval Support Facility Indian Head
Indian Head, Maryland

Contract Task Order JU40

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Naval Facilities Engineering Command
Washington

Under the

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Prepared by

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Executive Summary

Introduction

This report presents the results of a Remedial Investigation (RI) conducted at Stump Neck Solid Waste Management Unit (SWMU) 14, at Naval Support Facility Indian Head (NSF-IH) Stump Neck Annex, in Indian Head, Maryland. This RI report was prepared by CH2M HILL under the Department of the Navy (Navy), Naval Facilities Engineering Command, Atlantic Division, Comprehensive Long-Term Environmental Action Navy 1000 Contract N62470-08-D-1000, Contract Task Order JU40, in accordance with the *Final Uniform Federal Policy-Sampling and Analysis Plan for Stump Neck SWMU 14 Remedial Investigation* (CH2M HILL, 2011). This RI report is being submitted to Naval Facilities Engineering Command Washington, NSF-IH, the U.S. Environmental Protection Agency (EPA) Region III, and the Maryland Department of the Environment to support a site management decision for the site.

The activities described herein are part of the overall Installation Restoration Program being implemented at NSF-IH under the Comprehensive Environmental Response Compensation and Liability Act. The work was conducted pursuant to the Federal Facility Agreement between the Navy and EPA Region III (EPA/Navy, 2000). This RI report presents the data collected during the field investigation, as well as interpretations and evaluations relating to the nature and extent of contamination (i.e., contaminant types, concentrations, distribution, and migration pathways) and contaminant fate and transport. This report also discusses the assessment of the potential risks to human health and the environment and recommendations regarding additional activities.

Site Background

Stump Neck SWMU 14 is located in the Stump Neck Annex, approximately 300 feet south of the Potomac River. The approximate area of Stump Neck SWMU 14 is 2.4 acres. The site consists of a photographic laboratory (Building 22SN), X-ray facility (Building 2009), and the two associated septic tanks, discharge lines, and drain fields.

A Site Screening Process investigation was completed at the site to identify the potential contaminants in subsurface soil, and groundwater. Analytical results were evaluated and compared against human health and ecological risk screening criteria and installation-specific background concentrations in a two-step screening process. The risk screening concluded that cobalt in the groundwater may pose an unacceptable risk to human receptors. No ecological or human health risk was identified for the subsurface soil. Based on the results for the Site Screening Process investigation, the Indian Head Installation Restoration Team concluded in December 2008 that Stump Neck SWMU 14 should proceed to the RI phase. In December 2010, the Team decided that in addition to investigating the nature and extent of metals in groundwater, the nature and extent of metals in surface soil should be examined because surface soil had not been characterized previously. Initial sampling and analysis described in this report have been completed. Additional sampling items refer to future sampling and analysis necessary to complete delineation of the nature and extent of contamination.

Objectives and Scope of Work

Field activities associated with the RI were conducted between September 7 and October 1, 2010. The work consisted of surface soil sampling, and monitoring well installation and groundwater sampling. The objectives of the RI were as follows:

- Define the nature and extent of metals contamination in the shallow groundwater
- Determine if there is a groundwater divide at the site

- Define the nature and extent of metals contamination in the surface soil in the vicinity of the septic system drain fields
- Define the nature and extent of metals contamination in the surface soil in the low-lying wet area downgradient of the site
- Assess whether metals constituents detected in the groundwater and surface soil present potential unacceptable human health or ecological risk
- Decide if further action is warranted to meet the Navy's objective of unrestrictive use of the site

Conclusions and Recommendations

In general, the site-related constituent concentrations within the surface soil in the vicinity of the septic drain fields and low-lying area were no higher than elsewhere within the site, indicating there is not a significant source of contamination to the surface soils. Within groundwater, the highest concentrations of cobalt were detected in the vicinity of the original (circa 1968) septic drain field, indicating that cobalt within groundwater at the site is likely a result of releases from the original septic system.

Although there does not appear to be a groundwater divide within the boundary of the site, the shallow water-bearing zone is of limited extent and is not hydraulically connected to the local shallow aquifer. The water- bearing zone is further limited by the underlying clay that is continuous across the site and is of sufficiently low hydraulic conductivity to limit downward migration of potential contamination. Groundwater flows from the site northeast towards Mattawoman Creek.

The baseline human health risk assessment concluded that there are no unacceptable risks for current receptors (industrial workers and both adult and adolescent trespassers/visitors) exposed to soil or groundwater. Potentially unacceptable risks from cobalt are associated with future industrial and hypothetical residential use of the site through exposure to or use of groundwater as a potable water supply. However, potable use of the groundwater is not anticipated for future land use. The screening ecological risk assessment concluded that there are potential risks to ecological receptors from exposure to chromium in surface soil and barium in groundwater; however, given the limited site habitat, and likely high site-specific dilution factor, the potential for ecological risk is likely overestimated. In addition, barium concentrations in groundwater were elevated slightly above background concentrations in only one of nine wells and therefore are likely characteristic of background conditions.

Based on the results of the site characterization and risk assessments, a Feasibility Study is recommended to evaluate remedial alternatives to address elevated levels of cobalt in groundwater at SWMU 14. Because there is limited habitat for ecological receptors and there were no human health risks associated with surface soil, no further action is recommended for the surface soil.

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Acronyms and Abbreviations

95 percent UCL	95 percent upper confidence limit
µg/L	micrograms per liter
ADAF	age-dependent adjustment factor
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CNO	Chief of Naval Operations
COC	constituent of concern
COPC	constituent of potential concern
CSF	cancer slope factor
CSM	conceptual site model
CTE	central tendency exposure
DABS	dermal absorption factor
Eco-SSL	ecological soil screening level
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESV	ecological screening value
GI	gastrointestinal
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
LD_{50}	median lethal dose
LOAEL	lowest observed adverse effect level
MATC	Maximum Acceptable Toxicant Concentration
mg/kg	milligrams per kilogram
MMOA	mutagenic mode of action
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NOAEL	no observed adverse effect level
NSF-IH	Naval Support Facility Indian Head
PPRTV	Provisional Peer-Reviewed Toxicity Values
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RFA	Resource Conservation and Recovery Act (RCRA) Facility Assessment
RfD	reference dose

RI	Remedial Investigation
RME	reasonable maximum exposure
RSL	regional screening level
SERA	screening-level ecological risk assessment
SI	site inspection
SMDP	Scientific Management Decision Point
SSL	soil screening level
SSP	Site Screening Process
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCL	target compound list
TOC	total organic carbon
TRV	toxicity reference value
UF	uncertainty factor
UFP-SAP	Uniform Federal Policy-Sampling and Analysis Plan
UTL	upper tolerance limit
VOC	volatile organic compound

SECTION 1
Introduction

This report presents the results of a Remedial Investigation (RI) conducted at Stump Neck Solid Waste Management Unit 14 (SWMU 14), at Naval Support Facility Indian Head (NSF-IH) Stump Neck Annex, in Indian Head, Maryland. This RI report was prepared by CH2M HILL under the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Atlantic Division, Comprehensive Long-Term Environmental Action Navy 1000 Contract N62470-08-D-1000, Contract Task Order JU40, in accordance with the *Final Uniform Federal Policy-Sampling and Analysis Plan* (UFP-SAP) *for Stump Neck SWMU 14 Remedial Investigation* (CH2M HILL, 2011). This RI report is being submitted to NAVFAC Washington, NSF-IH, the U.S. Environmental Protection Agency (EPA) Region III, and the Maryland Department of the Environment to support a site management decision for the site.

The activities described herein are part of the overall Installation Restoration Program being implemented at NSF-IH under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The work was conducted pursuant to the Federal Facility Agreement between the Navy and EPA Region III (EPA/Navy, 2000). This RI report presents the data collected during the field investigation, as well as interpretations and evaluations relating to the nature and extent of contamination (that is, contaminant types, concentrations, distribution, and migration pathways) and contaminant fate and transport. This report also discusses the assessment of the potential risks to human health and the environment and recommendations regarding future actions.

1.1 Objectives

As specified in the approved UFP-SAP (CH2M HILL, 2011), the objectives of the RI were:

- Define the nature and extent of elevated metal concentrations detected in the shallow groundwater.
- Determine if there is a groundwater divide at the site.
- Define the nature and extent of metals constituents in the surface soil in the vicinity of the septic system drain fields.
- Define the nature and extent of metals constituents in the surface soil in the low-lying wet area downgradient of the site.
- Assess whether metals constituents detected in the groundwater and surface soil present potential unacceptable human health or ecological risk.
- Decide if further action is warranted to meet the Navy's objective of unrestrictive use of the site.

The objectives were accomplished through the following field and laboratory analytical activities: (1) installation and sampling of permanent groundwater monitoring wells; (2) collection and analysis of surface soil samples within the site boundary and within the low-lying area northwest of the site; (3) collection of soil samples for geotechnical analysis; and (4) characterization of the stratigraphy of the soil boring and monitoring well locations.

The analytical data collected during the RI were evaluated (as appropriate) as part of a baseline human health risk assessment (HHRA) and a screening-level ecological risk assessment (SERA) to assess whether the concentrations of constituents detected in the surface soil and groundwater present potentially unacceptable risks to current and potential future receptors at the site.

1.2 Report Organization

This report summarizes the data collected during the RI, presents an interpretation of the data, documents the nature and extent of contamination for affected media, and provides recommendations for future activities at the site. The evaluations of contaminant-migration pathways and transport mechanisms for affected media are also discussed as part of an assessment of potential human-health and environmental risks associated with current site conditions.

This report is divided into the following sections:

1. **Introduction:** Describes the objectives and scope of the RI, as well as the organization of this RI report.
2. **Environmental Setting:** Describes the current and historical land uses associated with the site, discusses previous investigations conducted at the site, and summarizes the physical characteristics of the site, such as climate, geology, hydrology and ecology.
3. **Remedial Investigation Activities:** Provides details of the sampling and data-gathering methods and approaches used during the field activities.
4. **Investigation Findings:** Presents the analytical data pertaining to each media type and discusses the nature and extent of contamination at the site.
5. **Contaminant Fate and Transport:** Describes contaminant migration at the site in the context of the mobility and persistence of the contamination.
6. **Baseline Human Health Risk Assessment:** Describes the potential effects of identified contaminants on human health.
7. **Ecological Risk Assessment (Steps 1-3A):** Describes the potential effects of identified contaminants on the environment.
8. **Conclusions and Recommendations:** Summarizes the results of the RI and the potential risks posed to human health and the environment, and provides recommendations for additional activities at the site.
9. **References:** Lists documents and other sources of information cited in this report.

Tables and figures are provided at the end of each section. Appendices follow the References section.

SECTION 2

Environmental Setting

This section discusses the physical characteristics of NSF-IH Stump Neck Annex and SWMU 14, including the topography and climate, soils, hydrology, geology, hydrogeology, and ecology.

2.1 Base Description and History

NSF-IH is a Navy facility in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. The facility consists of two tracts of land: the Main Installation area on the Cornwallis Neck Peninsula and the Stump Neck Annex across Mattawoman Creek from the Main Installation (Figure 2-1).

The Stump Neck Annex was purchased by the U.S. government in 1901. The property covers approximately 1,084 acres and is bounded by to the north by Mattawoman Creek and the Potomac River, to the east by the General Smallwood State Park and Sweden Point Marina, and to the south by Chicamuxen Creek, agricultural lands, and low-density residential development. The Chicamuxen Wildlife Management Area is adjacent to and south of the Stump Neck Annex. Both the Main Installation and the Stump Neck Annex are on the National Priorities List. The sites, however, separated by the Mattawoman Creek (noncontiguous), have separate EPA identification numbers and perform dissimilar operations.

At various times during its operation, NSF-IH has served as a gun and armor proving ground, a powder factory, a propellant plant, and a research facility. Originally, Stump Neck Annex provided a safety buffer for testing larger naval guns that were fired into the Potomac River and at Stump Neck. Currently, the primary mission of Stump Neck Annex is to provide explosive ordnance disposal technology and logistics management. More specifically, operations at Stump Neck Annex serve in the development of war-essential elements of intelligence, equipment, and procedures to counter munitions, both U.S. and foreign, as required to support Department of Defense components and the peacetime security needs of other agencies.

2.2 Site Description and Previous Investigations

2.2.1 SWMU 14 Site Description

SWMU 14 is on the north side of the Stump Neck Annex portion of NSF-IH, approximately 300 feet south of the Potomac River (Figure 2-2). In general, SWMU 14 is a topographically flat area atop a small hill and covers approximately 2.4 acres. The site consists of a photographic laboratory (Building 22SN), X-ray facility (Building 2009), and two unused septic tanks (an original and a newer one) and associated discharge lines and drain fields (Figure 2-2).

The original septic tank system at Stump Neck SWMU 14 was constructed in approximately 1968 approximately 8 to 10 ft bgs. Photographic development chemicals containing silver, hydroquinone, and sodium thiosulfate were historically discharged for an unknown period (though not continuously) to the original septic system (A.T. Kearney, Inc., 1990). The septic effluent was chlorinated before discharging to the Potomac River. At the time of a 1990 Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (A.T. Kearney, Inc., 1990), waste fixer containing silver was no longer being discharged to the septic system, but was placed in containers in Building 22SN and transported offsite for silver recovery. No evidence of release was documented during a visual site inspection (SI) conducted as part of the RFA.

The 1990 RFA report stated that the original septic system was replaced with a new system following the visual SI. Available construction documents indicate that the original septic tank was abandoned in place. The 1990 RFA report stated that the new septic system eliminated surface discharges to the Potomac River. It also stated that the new septic system handled only sanitary wastewater from Building 22SN and was inspected weekly, in accordance with National Pollutant Discharge Elimination System permit conditions. The

National Pollutant Discharge Elimination System outfall was sampled monthly. No violations of the permit were documented for exceedances other than dissolved oxygen and/or chlorine limits.

The 1990 RFA Report did not account for discharges from Building 2009 that continued to discharge into the new septic tank system. Waste fixer from the X-ray facility, which contains silver, was treated on-site for silver recovery and then released to the septic system with the wash water and developer.

The NSF-IH, formerly known as Indian Head Division Naval Surface Warfare Center (1998), documented failing septic systems at the Stump Neck Annex, including the newer septic system that serviced Buildings 22SN and 2009. NSF-IH noted that the drain field had become clogged due to an overload of sewage into the system, causing floating solids to rise through the tank and clog the downstream drainpipes. This resulted in periodic back-ups of sewage from the septic tank into Building 22SN.

Since 2002, Buildings 22SN and 2009 have been connected to a pipeline that conveys sanitary and process wastewater from the building to the NSF-IH wastewater treatment plant. Consequently, neither of the two septic systems at the site is in use. Currently, silver-contaminated waste fixer from the X-ray facility is treated onsite for silver recovery and then released to the sewer pipeline with the wash water and developer. In 1999, the photographic laboratory was converted to a completely digital system and no longer discharges waste into the sanitary sewer system.

The photographic laboratory is currently vacant and neither of the septic systems at the site is in use.

2.2.2 Previous Investigations

Stump Neck SWMU 14 was included in a January 2002 Desktop Audit Decision Document (Tetra Tech [formerly Tetra Tech NUS, Inc.], 2002a), which was signed by Remedial Project Managers from NSF-IH, Engineering Field Activity Chesapeake, and EPA Region III, with concurrence by the Maryland Department of the Environment. The Decision Document concluded that, due to the lack of available investigation data, SWMU 14 should be retained as an Area of Concern pending additional investigation of the original septic drain field associated with wastewater discharge at the site.

Between 2005 and 2008, CH2M HILL conducted a Site Screening Process (SSP) investigation to identify the potential contaminants in subsurface soil and groundwater at SWMU 14 (CH2M HILL, 2009). During the investigation, subsurface soil samples were collected from seven locations within the septic drain fields. The subsurface soil samples were collected from the 1-foot interval just above the shallow groundwater (14 to 24 feet below ground surface [bgs]) and were analyzed for target compound list (TCL),volatile organic carbons (VOCs), TCL] semivolatile organic carbons (SVOCs), target analyte list (TAL)metals, total organic carbon (TOC), and pH. Surface soil was not investigated as part of the SSP.

Two permanent monitoring wells were installed as a part of the SSP, IU14MW01 within the older septic system drain field and IU14MW02 in the newer drain field. Groundwater samples were collected from IU14MW01 in November 2005; however, because of inadequate groundwater production, IU14MW02 was not sampled. In August 2007, IU14MW02 was abandoned. Monitoring well IU14MW03 was installed nearby at a deeper depth (30 feet bgs) to intercept the surficial water table. Groundwater samples were collected from IU14MW01 and IU14MW03 and analyzed for TCL VOCs, TCL SVOCs, TAL metals (filtered and unfiltered), hardness, TOC, pH and hydrogen ion concentration. The samples were further analyzed for radioactive cobalt-60 because there is a radiographic processing facility adjacent to the site where radioactive cobalt may have been used and disposed, however, cobalt-60 was not detected above detection limits.

In situ groundwater samples were also collected from seven locations within the septic drain fields and near the former septic tank during the August 2007 event. *In situ* groundwater samples were analyzed for total and dissolved TAL metals. Three *in situ* groundwater samples were also collected from the vicinity of IU14MW02 and analyzed for TCL VOCs and TCL SVOCs.

Between July and September 2008, a third phase of sampling was performed to further characterize the extent of cobalt in groundwater. The sampling approach involved setting up a grid with 50-foot spacing across the site, and collecting one groundwater sample from the approximate center point of each grid square (that is, from locations where no data currently exist) for a total of 20 samples. In addition, three upgradient groundwater samples were collected: 1) at the southwestern side of Building 2009, 2) approximately 200 feet east of Building 2009, and 3) just north of Archer Avenue, southwest of Building 2009. All 23 groundwater samples were analyzed for total and dissolved cobalt.

Analytical results from the investigation were evaluated and compared against human health and ecological risk screening criteria and installation-specific background concentrations. The risk screening concluded that cobalt in the groundwater may pose an unacceptable risk to human and ecological receptors and was recommended for further assessment. The investigation also indicated the possibility of a groundwater divide within the site boundary, as evidenced by the cobalt concentrations detected at levels greater than background values both north and south of the suspected source area. No ecological and human health risk was identified for the subsurface soil.

Based on the results for the SSP, the Indian Head Installation Restoration Team concluded that Stump Neck SWMU 14 should proceed to the RI phase. In December 2010, the Team decided that in addition to evaluating the nature and extent of metals in groundwater, the nature and extent of metals in surface soil should be assessed because surface soil had not been previously characterized.

2.3 Climate

The climate is typical of the humid temperate continental climatic zone in which the facility lies. This zone has hot, humid summers and relatively mild winters. Because of its proximity to the Potomac River and its tributaries,
NSF-IH Stump Neck Annex experiences less-extreme temperatures, higher precipitation, and higher humidity than inland areas. The average daily maximum temperature is 67.5 degrees Fahrenheit, and the average daily minimum temperature is 45 degrees Fahrenheit. The warmest part of the year is in late July, and the coldest is in late January and early February. The growing season is approximately 190 days, from mid-April through mid-October (U.S. Department of Agriculture, 1974).

2.4 Topography

NSF-IH lies within the Atlantic Coastal Plain physiographic province, approximately 8 to 10 miles east of the fall line that marks the western extent of the physiographic province. Both peninsulas, the Main Installation and Stump Neck Annex, have gently rolling to undulating topography, with elevations ranging from sea level to approximately 111 feet above mean sea level. The higher elevations are in the northern portion of the installation. Generally, the land surface slopes to the east and southeast, with slopes of 5 percent or less. The western side of the facility is characterized by 40- to 50-foot bluffs, whereas the slope on the eastern side is more gradual, except for a few areas with 10- to 40-foot bluffs (Tetra Tech NUS, Inc., 2002b).

2.5 Soils

The soils at NSF-IH consist of silty and sandy loams with minor amounts of gravel and tend to have low permeability and low shrink-swell potential. Four dominant soil associations are found there (U.S. Department of Agriculture, 1974):

- **Beltsville-Gravelly Land-Bourne:** Level to moderately sloping soils, moderately well-drained and loamy, and moderately deep. They also include dense, root-inhibiting fragipans and steep, gravelly soil materials.
- **Beltsville-Exum-Wickham:** Level to moderately sloping, moderately well-drained and well-drained loamy soils. Soils within this association are moderately deep, and include dense, root-inhibiting fragipans and steep, gravelly soil materials.

- **Evesboro-Keyport-Elkton:** Level to moderately sloping, excessively drained, sandy soils and moderately well-drained and poorly drained, level to gently sloping, loamy soils with clayey subsoil.

- **Bibb-Tidal Marsh-Swamp:** Level or nearly level, poorly drained soils, generally located on floodplains and in miscellaneous unclassified wetlands.

2.6 Hydrology

There are three principal waterways in the immediate vicinity of NSF-IH: the Potomac River, Mattawoman Creek, and Chicamuxen Creek. A number of natural drainage channels on the installation receive rapid flow during intense summer storms, but usually flow intermittently with discharges from storm and industrial sewers. At Stump Neck SWMU 14, overland flow from the site is typically north to the adjacent Mattawoman Creek (CH2M HILL, 2011).

2.7 Geology

The surficial geology of NSF-IH comprises Cretaceous fluviodeltic, Tertiary marine, and Quaternary fluvial deposits, which include the Cretaceous Upper Patapsco Formation, the Tertiary Aquia Formation, and the Quaternary deposits of the Potomac River system. The upland is an erosional remnant of the Upper Patapsco Formation capped by a thin layer of Tertiary Aquia Formation. The Quaternary sediments make up most of the surficial exposures and are generally thickest in the lower relief areas (Hiortdahl, 1990).

The U.S. Geological Survey reports that the early Potomac River cut paleochannels across the Indian Head Peninsula during the Quaternary period. A paleochannel is evident where Quaternary deposits form a belt along the northeast end and the southeastern part of the facility. The southern section of the paleochannel extends across the entire southern region of the facility. Portions of these units subsequently have been eroded by the current Potomac River and Mattawoman Creek systems (Hiortdahl, 1990).

Soils at SWMU 14 consist of fluvial silts and clayey sands and gravel from the ground surface to an approximate depth of 31 feet bgs. The sand and gravel layer is underlain by lean clay from an approximate depth of 31 feet to depths greater than 34 feet bgs. However, the thickness of this clay layer is unknown. Lean clay consistent with that observed within the site boundary was also observed at the base of the bluff along the Potomac River to the north (CH2M HILL, 2011).

2.8 Hydrogeology

The shallow, water-bearing zones (water table aquifer) of the facility are controlled by the shallow soil deposits. In general, the water table appears to be between 7 and 10 feet bgs. Lithologies of the water-bearing zones are usually restricted to silty and sandy clay zones. A thin layer of the Tertiary deposits overlie the Upper Patapsco confining unit along the upland area. Soils in this area are very stiff, with lithologies ranging from silt to silty clays (Ensafe/Allen & Hoshall, 1994). Data collected during Phase I and Phase II of the NSF-IH SI (Ensafe/Allen & Hoshall, 1994) generally indicated that the inorganic quality of the water table aquifer is poor. Analytical results of groundwater samples indicate elevated concentrations of total dissolved solids in the water table aquifer, suggesting that water from the surficial zones is not suitable as a potable water source. The water table aquifer is not used as a potable water source on the peninsula.

In general, at SWMU 14, groundwater occurs at 20 feet bgs within silt and clayey sands. Shallow groundwater flow is to the north towards Mattawoman Creek. Shallow groundwater at SWMU 14 is limited to that which infiltrates from the unpaved areas of the site and it not hydraulically connected to the local shallow aquifer, which occurs beneath the underlying clay layer.

2.9 Ecology

The habitat at the site and outside the perimeter fence is wooded with mixed hardwoods, consisting primarily of mature oaks, beech, and sweetgum, with little understory present. The wooded area provides potential refuge and foraging habitats for various birds and mammals. The low-lying area between the site and the river does not provide viable habitat for aquatic receptors because standing water is not present and any water that accumulates there is transitory. The shoreline and near-shore area provide habitat for aquatic biota such as fish, aquatic insects, amphibians, and reptiles, and habitat for receptors such as shore birds and semi-aquatic mammals (for example, raccoon).

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI\FIGURE 2-1 - FACILITY LOCATION.MXD BHATHAWAY 9/20/2012 12:48:36 PM

Legend

- Approximate Site Boundary
- Buildings
- Roads and Paved Areas
- Wooded Area
- NSF-IH Base Boundary

N

0 2,000 4,000 Feet

1 inch = 4,000 feet

Figure 2-1
Facility Location Map
Remedial Investigation Report for Stump Neck SWMU 14
NSF-IH, Indian Head, Maryland

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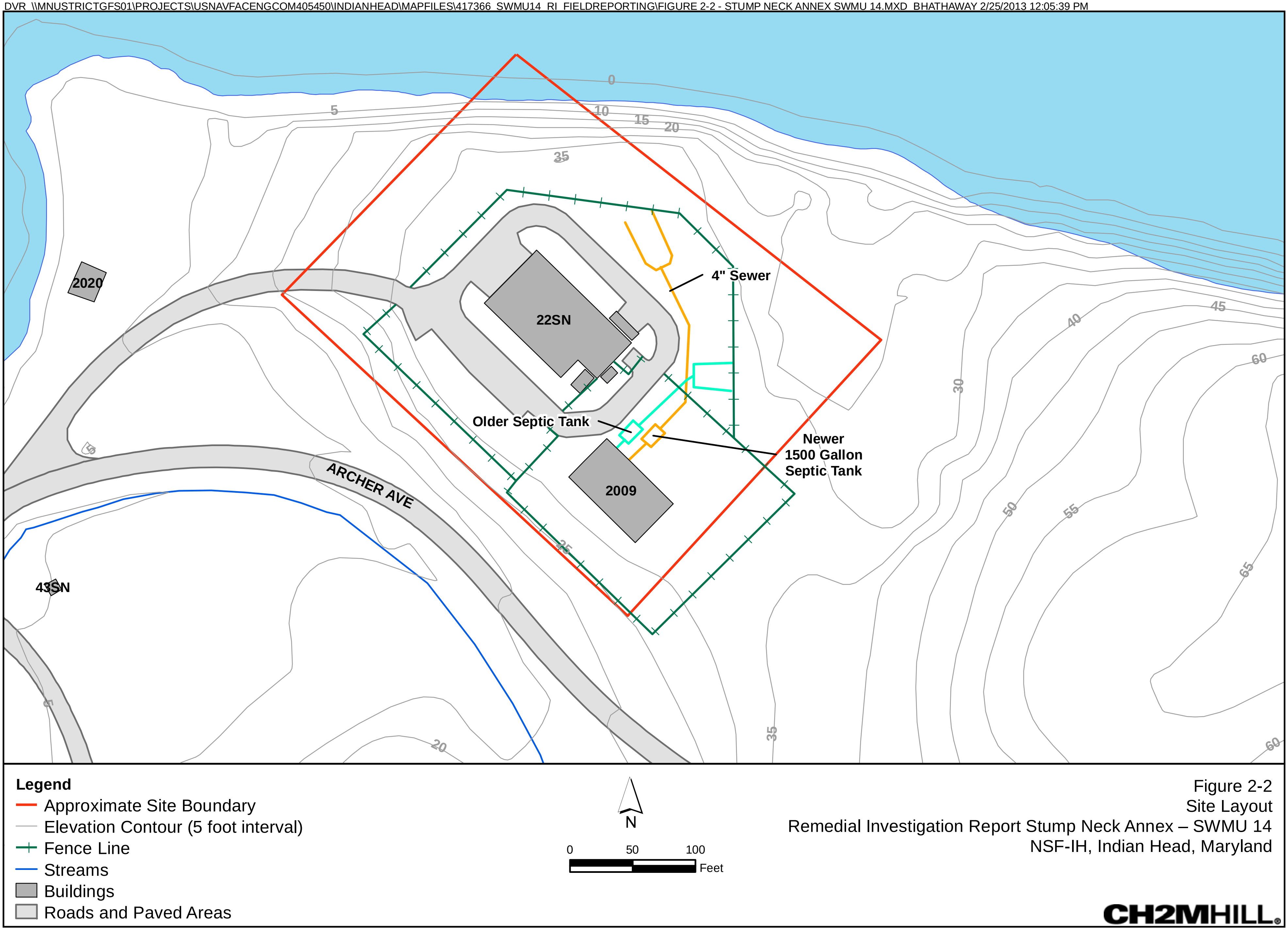

Figure 2-2
Site Layout
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

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SECTION 3

Field Activities

3.1 Field Investigation

Field activities were implemented in accordance with the *Master Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Installation Restoration Program and Munitions Response Program Environmental Investigations, Naval Support Facility Indian Head, Indian Head, Maryland* (herein referred to as master plans) (Tetra Tech, 2009) and the *Final Uniform Federal Policy – Sampling and Analysis Plan for Stump Neck SWMU 14 Remedial Investigation* (herein referred to as UFP-SAP) (CH2M HILL, 2011), except as noted in Section 3.2.

Fieldwork was conducted in two phases, from August 8 through October 7, 2011 and from July 10 through July 11, 2012, to augment the data collected during the 2005 – 2008 SSP investigation. Field activities consisted of:

- Utility clearance
- Vegetation clearing and removal
- Synoptic water level measurements
- Surface soil sampling
- Soil borings and abandonment
- Monitoring well installation and development
- Monitoring well groundwater sampling
- Investigation-derived waste (IDW) management

Utility clearance was completed at each boring location before intrusive activities began. Vegetation removal was completed to allow access to monitoring well locations and soil boring. Table 3-1 summarizes the sampling and analysis conducted during the RI. The soil borings were logged for stratigraphy. Detailed soil boring logs and monitoring well construction diagrams are provided in Appendix A. The Maryland State Well Completion Reports are provided in Appendix B. The monitoring well locations were professionally surveyed by ECLS, Inc. of Erwin, North Carolina, following installation; soil sampling locations were surveyed with a portable global positioning system unit. The complete survey reports are found in Appendix C.

All samples were collected using clean, dedicated sampling devices, and placed in certified-clean containers provided by the laboratory. Quality assurance/quality control (QA/QC) samples were collected, as specified in the UFP-SAP, for each medium. Samples were packed in clean coolers with ice and shipped to the laboratories via overnight courier under executed chains-of-custody. The samples complied with method holding time requirements. Except for hexavalent chromium analysis, all samples were analyzed by Katahdin Analytical Services of Scarborough, Maine. Surface soil samples collected in July 2012 for hexavalent chromium were analyzed by ALS Environmental of Rochester, New York. Geotechnical analyses were performed by McCallum Testing Laboratories of Chesapeake, Virginia. Field activities are described in more detail in the following sections.

3.1.1 Synoptic Water Level Measurement

One round of synoptic water level measurements was collected on July 10, 2012 (Table3-2) to refine groundwater flow characteristics. To facilitate groundwater measurements, the well caps were removed to allow the groundwater level in the well to equilibrate to atmospheric conditions. The depth-to-water measurements were made using an electronic water level meter and were recorded to the nearest 0.01 foot relative to the top of casing, and were subsequently converted to elevations using the surveyed well casing elevations.

3.1.2 Surface Soil Sampling

Twelve surface soil samples were collected in September and October 2011 from the unpaved areas within and surrounding the old and new septic system drain fields (IU14SS01 through IU14SS03 and IU14SS08 through IU14SS12) and from locations spaced across the low-lying wet area downgradient of the developed area at the site (IU14SS04 through IU14SS07). Sample locations were biased toward areas where runoff containing site contaminant(s) may have accumulated. The samples were analyzed for TAL metals (including mercury and cyanide). Nine additional surface soil samples from new locations (IU14SS13 through IU14SS21) and two from previously sampled locations (IU14SS09A and IU14SS10A) were collected in July 2012 and analyzed for total chromium and hexavalent chromium, to further characterize chromium detected in the 2011 surface soil samples. The surface soil samples were collected from a depth interval of 0 to 0.5 foot bgs using a hand trowel and were homogenized before being placed in a sample container. The surface soil sample locations are shown on Figure 3-1.

3.1.3 Soil Borings and Abandonment

Nine soil borings (IU14MW04-IU14MW09, IU14MW11, IU14DP31, and IU14DP32)) for stratigraphic characterization were advanced with direct-push technology using a 2-inch-diameter macro-core sampler fitted with disposable acetate liners to facilitate continuous logging. In addition, Shelby tube samples were collected from two of the northernmost monitoring well locations, IU14MW04 (28 to 30 feet bgs) and IU14MW06 (22 to 24 feet bgs) for the following geotechnical laboratory tests: hydrometer, sieve, permeability, and Atterburg limits. The locations are shown on Figure 3-1. Seven of the nine boring locations were converted to permanent monitoring wells, as described below. Two borings were not converted to monitoring wells because the water- bearing unit was not encountered; they were abandoned in accordance with Code of Maryland regulations.

3.1.4 Monitoring Well Installation and Development

Six permanent monitoring wells (IU14MW04 through IU14MW09) were installed in August 2011; an additional monitoring well (IU14MW11) was installed in June 2012. The monitoring wells were installed using hollow stem auger drilling methods at the locations shown on Figure 1. The borings described in Section 3.1.2 were over-drilled using a 4.25-inch inner-diameter hollow stem auger. The monitoring wells were constructed of 2-inch-inner-diameter Schedule 40 polyvinyl chloride (PVC) risers with a 10-foot, 0.010-inch machine-slotted Schedule 40 PVC screen, except in the case of IU14MW11, which was completed with a 5-foot screen. The well screen depth interval was installed to the top of the clay layer. A Morie Grade No. 2 sand filter pack was tremied into the annular space between the borehole wall and the screen to an elevation roughly 2 feet above the top of the screen. A minimum 2-foot-thick bentonite seal was tremied in place on top of the sand filter pack, followed by a bentonite grout to roughly 1 foot bgs. Monitoring wells IU14MW04 through IU14MW07, IU14MW11, IU14MW01, and IU14MW03 were completed as stickup wells with a concrete pad and protective bollards. Monitoring wells IU14MW08 and IU14MW09 were completed at the surface with a concrete pad and a flush-mounted steel cover. A well construction summary is provided in Table 3-2.

Following installation and curing of the grouted plug, the wells were developed by surging and pumping approximately three well volumes of groundwater from each well. Groundwater purging continued until fine-grained material was removed and stability of the field parameters was obtained. The wells were surveyed for vertical and horizontal coordinates. Elevation points surveyed were the top of the PVC riser and the ground surface, as shown on Table 3-2.

3.1.5 Monitoring Well Groundwater Sampling

Groundwater samples were collected from seven new monitoring wells (IU14MW04 through IU14MW09 and IU14MW11) and two existing monitoring wells (IU14MW01 and IU14MW03) (Figure3-1). Before sampling, water level measurements were collected to obtain the water table elevation at the site. The water levels were measured from the top of the PVC casing using an electronic water level meter graduated in increments of 0.01 foot. Groundwater measurements are summarized on Table 3-2.

Each well was purged using a peristaltic pump and tubing set at the midpoint of each well screen interval. During well purging, field indicator parameters, pH, specific conductivity, turbidity, oxidation-reduction potential, dissolved oxygen, and temperature were measured using an electronic water-quality meter equipped with a flow-through cell. Groundwater was purged from each monitoring well until field parameters had stabilized for three consecutive readings, as defined in the UFP-SAP. The stabilized water quality parameters are shown on Table 3-3.

Groundwater samples were then collected in laboratory-supplied containers.. The samples were sent for analysis of total and dissolved TAL metals (including mercury and cyanide), sulfate, sulfide, ferrous iron, pH, TOC, and hardness.

3.1.6 Investigation-derived Media and Waste Management

Investigation derived media consisting of soil cuttings and purged groundwater and investigation derived waste consisting of decontamination water and disposable sampling equipment, such as gloves, polyethylene tubing, acetate macro-core liners, and trowels was generated during the SWMU 14 RI field activities The materials were placed in 55-gallon drums in preparation for characterization and proper disposal. Thirteen drums of groundwater and 11 drums of soil were generated during the investigation. On August 17, 2011, samples from both the aqueous (IU14IDW-WW-0811) and solid (IU14IDW-WS-0811) IDW drums were submitted to Katahdin for toxicity characteristic leaching procedure, reactivity, corrosivity and ignitability analyses. The IDW was characterized as nonhazardous and the results were submitted to the Base Program Manager and to CH2M HILL's subcontractor, Capitol Environmental Services of Roanoke, Virginia, for preparation of a waste profile. CH2M HILL submitted the waste profile to the Base Program Manager for review and approval. Once the waste profile sheet was signed, CH2M HILL scheduled waste pickup.

3.2 Deviations from the UFP-SAP

The following deviations occurred:

1. The location for monitoring well IU14MW08 was moved across Archer Avenue from its original proposed location because the water-bearing unit was not encountered at the original proposed location. The boring was terminated within clay at 15 feet bgs without encountering the water table.
2. The monitoring well IU14MW10 (IU14DB32) was not installed in June 2012 because the water-bearing unit was not present at this location. The borehole was advanced to a depth of 20 feet bgs and allowed to remain open for 2 days. No water was observed in the borehole following 2 days and the borehole was abandoned in accordance with Code of Maryland regulations by tremie-grouting with a Portland/bentonite grout.
3. The direct-push technology groundwater grab sample IU14DP31 was not collected during the July 2012 sampling event because the water-bearing unit was not encountered. The borehole was advanced to a depth of 16 feet bgs and allowed to remain open for 2 days; however, no water was observed in the boring and the borehole was subsequently tremie-grouted with a Portland/bentonite grout.

TABLE 3-1
Summary of Sampling and Analysis
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

Station ID	Sample ID	Sample Date	Medium	Sample Depth (feet bgs)	Total Metals	Dissolved Metals	Ferrous Iron	Sulfate	Sulfide	Cyanide	Hardness	% Soilds	pH	Total Organic Crbon (TOC)	Chromium	Hexavalent Chromium	Full TCLP & RCI
IU14SS01	IU14SS01-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS01	IU14SS01P-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS02	IU14SS02-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS03	IU14SS03-000H	9/8/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS04	IU14SS04-000H	10/7/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS05	IU14SS05-000H	10/7/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS06	IU14SS06-000H	10/7/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS06	IU14SS06P-000H	10/7/2011	Surface Soil	0-0.5	X					X		X					
IU14SS07	IU14SS07-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS08	IU14SS08-000H	9/8/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS09	IU14SS09-000H	9/8/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS10	IU14SS10-000H	9/8/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS10	IU14SS10P-000H	9/8/2011	Surface Soil	0-0.5	X							X					
IU14SS11	IU14SS11-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14SS12	IU14SS12-000H	9/9/2011	Surface Soil	0-0.5	X					X		X	X				
IU14MW01	IU14GW01-0911	9/8/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW01	IU14GW01P-0911	9/8/2011	Groundwater	--	X	X				X							
IU14MW03	IU14GW03-0911	9/8/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW04	IU14GW04-0911	9/9/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW05	IU14GW05-0911	9/6/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW06	IU14GW06-0911	9/6/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW07	IU14GW07-0911	9/8/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW08	IU14GW08-0911	9/9/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW09	IU14GW09-0911	9/7/2011	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14-IDW	IU14-IW-081711	8/17/2011	IDW	--													X
IU14-IDW	IU14-IS-081711	8/17/2011	IDW	--													X
IU14-QC	IU14-EB-090711-SS	9/7/2011	QC	--	X					X							
IU14-QC	IU14-EB-100711-SS	10/7/2011	QC	--	X					X							
IU14-QC	IU14-EB-090711-GW	9/7/2011	QC	--	X	X				X							
IU14SS09	IU14SS09A-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS09	IU14SS09AP-0001	7/11/2012	Surface Soil	0-0.5											X	X	
IU14SS10	IU14SS10A-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS13	IU14SS13-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS14	IU14SS14-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS15	IU14SS15-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS16	IU14SS16-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS17	IU14SS17-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS18	IU14SS18-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	

TABLE 3-1
Summary of Sampling and Analysis
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

Station ID	Sample ID	Sample Date	Medium	Sample Depth (feet bgs)	Total Metals	Dissolved Metals	Ferrous Iron	Sulfate	Sulfide	Cyanide	Hardness	% Soilds	pH	Total Organic Crbon (TOC)	Chromium	Hexavalent Chromium	Full TCLP & RCI
IU14SS19	IU14SS19-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS20	IU14SS20-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14SS20	IU14SS20P-0001	7/11/2012	Surface Soil	0-0.5											X	X	
IU14SS21	IU14SS21-0001	7/11/2012	Surface Soil	0-0.5									X		X	X	
IU14MW01	IU14GW01-0712	7/10/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW01	IU14GW01P-0712	7/10/2012	Groundwater	--	X	X				X							
IU14MW03	IU14GW03-0712	7/10/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW04	IU14GW04-0712	7/11/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW05	IU14GW05-0712	7/10/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW06	IU14GW06-0712	7/10/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW07	IU14GW07-0712	7/10/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW08	IU14GW08-0712	7/11/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW09	IU14GW09-0712	7/11/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14MW011	IU14GW11-0712	7/11/2012	Groundwater	--	X	X	X	X	X	X	X		X	X			
IU14-QC	IU14EB01071012	7/10/2012	QC	--	X	X				X							
IU14-QC	IU14EB01071112-GW	7/11/2012	QC	--	X	X				X							
IU14-QC	IU14EB01071112-SS	7/11/2012	QC	--											X	X	

Notes:
Sample IDs containing "P" are duplicate samples.

bgs - below ground surface
QC - quality control
IDW - investigation-derived waste
TOC - total organic carbon
TCLP - Toxicity Characteristic Leaching Procedure
RCI - reactivity, corrosivity, ignitability

TABLE 3-2

Groundwater Elevation Summary - July 2012

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Well ID	Surface Completion	Ground Elevation (ft. amsl)	Top of Casing Elevation (ft. amsl)	Depth to Groundwater (ft. btoc)	Depth to Groundwater (ft. bgs)	Groundwater Elevation (ft. amsl)
IU14MW01	Stickup	32.35	34.87	24.65	22.13	10.22
IU14MW03	Stickup	32.72	35.90	26.50	23.32	9.40
IU14MW04	Stickup	31.95	34.97	26.68	23.67	8.29
IU14MW05	Stickup	31.87	35.35	29.10	25.62	6.25
IU14MW06	Stickup	22.08	25.52	20.78	17.34	4.74
IU14MW07	Stickup	31.47	34.98	25.86	22.35	9.12
IU14MW08	Flush-Mount	24.73	24.47	15.09	15.36	9.38
IU14MW09	Flush-Mount	21.55	21.41	11.13	11.27	10.28
IU14MW11	Stickup	11.38	14.47	4.15	1.06	10.32

in. —inches
ft.— feet
bgs—below ground surface
amsl—above mean sea level
btoc—below top of casing

TABLE 3-3

Monitoring Well Water Quality Parameters

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Well	Date	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (°C)	Redox Potential (mV)
IU14MW01	9/8/2011	5.35	0.554	0.8	1.0	18.22	261
IU14MW03	9/8/2011	4.60	0.236	0.3	5.5	17.44	359
IU14MW04	9/9/2011	4.97	0.609	0.2	3.0	17.21	349
IU14MW05	9/6/2011	5.27	0.550	2.4	1.0	16.47	275
IU14MW06	9/6/2011	4.80	0.177	2.6	0.0	16.53	263
IU14MW07	9/8/2011	4.74	0.262	8.4	3.0	18.07	321
IU14MW08	9/9/2011	5.12	0.346	0.0	3.0	20.57	303
IU14MW09	9/7/2011	4.40	0.111	1.3	0.8	20.06	352
IU14MW01	7/10/2012	4.81	0.183	0.0	5.5	17.16	143.7
IU14MW03	7/10/2012	5.56	0.488	0.0	1.5	17.92	58.2
IU14MW04	7/11/2012	4.71	0.593	0.0	4.0	20.35	180.4
IU14MW05	7/10/2012	5.30	0.423	1.3	1.5	17.58	62.1
IU14MW06	7/10/2012	4.77	0.174	0.77	5	17.6	151.2
IU14MW07	7/10/2012	4.74	0.229	0.2	3.0	17.67	132.4
IU14MW08	7/11/2012	4.76	0.239	0.1	2.0	19.97	85.7
IU14MW09	7/11/2012	4.54	0.090	0.1	1.0	19.40	73.4
IU14MW11	7/11/2012	5.74	0.429	25.4	4.5	24.38	181.9

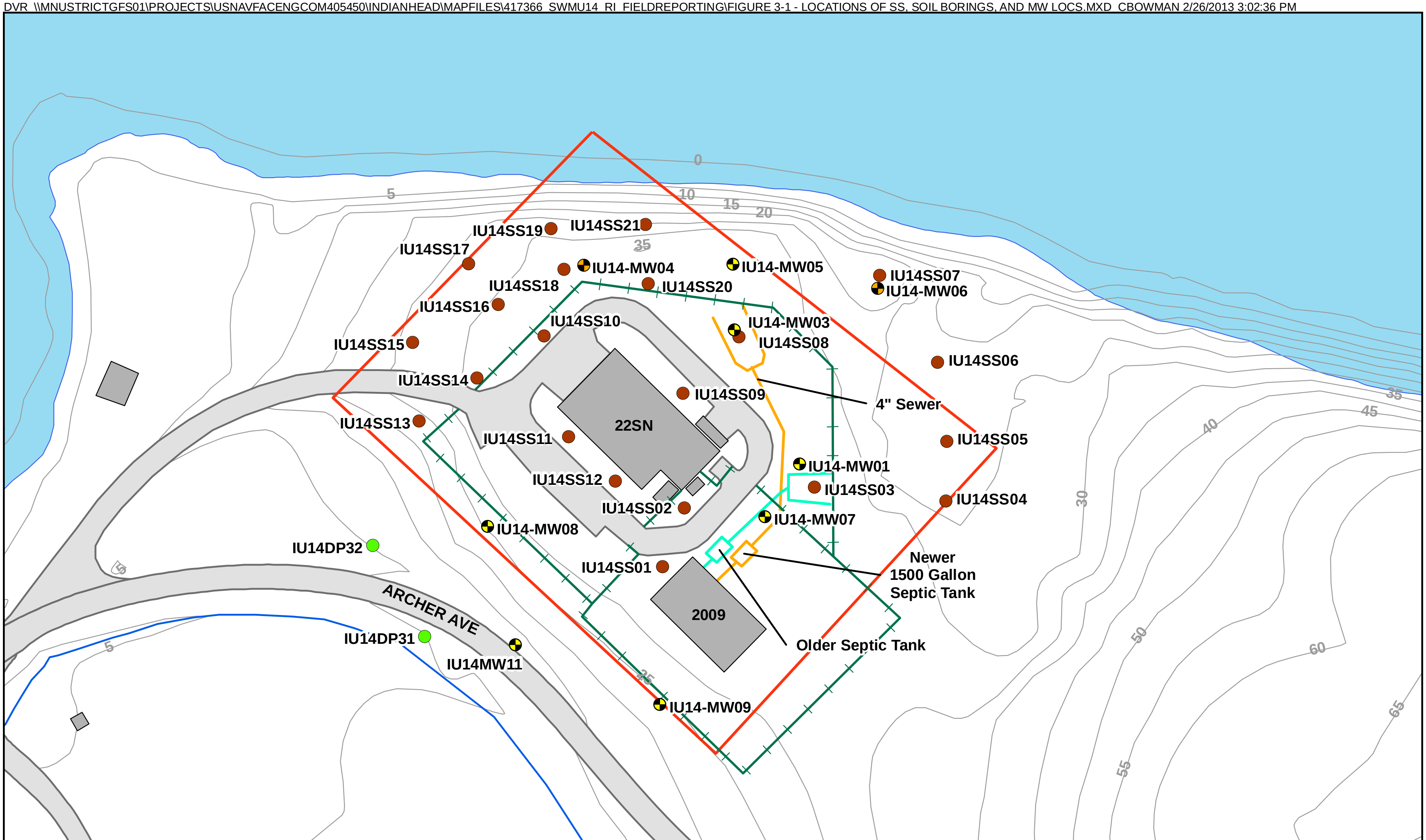
mg/L—milligrams per liter.

mS/cm—millisiemens per centimeter.

mV—millivolts.

NTU—nephelometric turbidity units.

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 3-1 - LOCATIONS OF SS, SOIL BORINGS, AND MW LOCS.MXD CBOWMAN 2/26/2013 3:02:36 PM



Legend

- Surface Soil Sample Location
- Direct Push Boring Location
- Monitoring Well Location
- Monitoring Well and Geotech Sample Location
- Approximate Site Boundary
- Elevation Contour (5 foot interval)
- Fence Line
- Streams
- Buildings
- Roads and Paved Areas

N

0 50 100 Feet

Figure 3-1
Locations of Surface Soil Samples, Soil Borings, and Monitoring Wells
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

CH2MHILL

SECTION 4

Investigation Findings

4.1 Introduction

This section presents the nature and extent of metals contamination at SWMU14 based on sampling activities and data analyses from the RI field investigation and SSP. Because this RI report is intended to present the findings of the SSP, only the analytical results of surface soil and monitoring well groundwater sampling from the RI will be discussed in the following sections. However, the results of the groundwater investigation conducted during the SSP were used to delineate the extent of contamination. A description of the stratigraphy at the site and a discussion of RI analytical procedures are also provided. Subsurface soil at the site was eliminated from further analysis, based on the results of human health and ecological risk screening conducted as part of the SSP, and is not discussed further in this RI report. Details of the SSP investigation can be found in the SSP report (CH2M HILL, 2009).

4.2 Data Management and Evaluation

The data quality was evaluated to assess the usability of the analytical results. Analytical data quality is dependent on laboratory performance, matrix interference, ambient laboratory and field conditions, and field sampling technique. Data quality is used to assess whether the project's data quality objectives were met. The data quality assessment involved reviewing the results of the laboratory QC review, the data validation reports, and the data validation qualifiers applied to the data.

4.2.1 Laboratory Quality Control Review

Before releasing the analytical results, the laboratory reviewed the sample and QC data to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. The QC data were also reduced and the results were reviewed to ascertain whether they were within the laboratory-defined limits for accuracy and precision. Nonconforming results were identified and were discussed in the data package cover letter and associated case narrative.

4.2.2 Data Validation

The management and tracking of data from the time of field collection to receipt of validated electronic analytical results are of primary importance because these activities affect the overall quality of the analytical results. Field samples and their corresponding analytical tests were recorded on chain-of-custody forms. Chain-of-custody entries were checked against the UFP-SAP (CH2M HILL, 2011 and 2012). A check was also made that the proper number and types of QA/QC samples were collected for each media. QA/QC samples consisted of equipment blanks, trip blanks, duplicate samples, matrix spike/matrix spike duplicates, and laboratory blanks.

The samples collected during this RI were analyzed for various groups of parameters. Analytical data reports for these samples were submitted for data validation. Data reports were submitted in hard copy and electronic versions. Procedures used for the validation process were in *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA Region III, 1993a). These steps (data validation and electronic data handling) reduced inherent uncertainties associated with data authenticity and usability. The complete data validation reports for the RI data can be found in Appendix D.

4.2.3 Data Quality Evaluation

CH2M HILL conducted a data quality evaluation, which consisted of reviewing the analytical data for systematic errors. An evaluation of data quality is made based on the number of, severity of, and distribution of data qualifiers. The "J," "K," "L," "UJ," and "UL" qualifiers indicate that the data values are estimated, but they also can indicate the presence of a QC issue and are considered usable by risk assessors when evaluating risk to human health and the environment. The following is a brief interpretation of the data validation qualifiers that have been identified.

- Data qualified with a "B" indicate that the analyte has not been detected above the level reported in an equipment blank, trip blank, or laboratory QA/QC sample. The concentration of a "B-qualified" result is less than 5 times the concentration of the constituent (10 times for common lab contaminants) for an associated QA/QC result. If the sample concentration is less than 5 times (10 times for common lab contaminants) the associated blank concentration, the conclusion is that the parameter was not detected.
- Data qualified with a "J" indicate that the analyte was positively identified, but the concentration value was either measured below the contract-required quantification limit or contract-required detection limit, or estimated due to QA/QC deficiencies. The vast majority of the "J" qualifiers are present because the analyte concentration is between the method detection limit and the instrument reporting limit.
- Data qualified with a "K" indicate that the analyte was positively identified, but the reported value may be biased high. Therefore, the actual value may be lower.
- Data qualified with a "L" indicate that the analyte was positively identified, but the reported value may be biased low. Therefore, the actual value may be higher.
- Data qualified with a "U" indicate that the analyte was not detected. The associated concentration value indicates the approximate sample concentration necessary to be detected.

The RI data for SWMU 14 are of sufficient quality to support risk and site assessment. The data quality objectives for this project were to collect data of adequate quality to perform human health and ecological risk assessments, and to define the nature and extent of contamination of the site. In this case, data quality did not hinder any of these objectives and therefore, met the data quality objectives for the project.

4.3 Site-specific Stratigraphy

Each boring was advanced to the depth of the underlying clay layer, approximately 30 feet bgs. Two cross-section lines are shown on Figure 4-1, and the cross section diagrams of the subsurface are shown on Figures 4-2 and 4-3. Review of the cross sections indicates that the silty clayey sand and silt unit represents a limited groundwater-bearing zone within the hill that the site sits atop, and that does not extend beyond the road due to the lateral 'pinching out' of these units.

Grain size analysis was completed for soil cores collected at the soil borings for monitoring wells IU14MW06 (22-24 feet bgs) and IU14MW04 (28 to 30 feet bgs). Results indicate that the sample from the IU14MW04 boring was clayey sand with 82.8 percent sand, 16.8 percent silt, and.4 percent clay. The sample from the IU14MW06 boring was collected from a lower elevation and was clay with 27.3 percent sand, 39.6 percent silt, and 33.2 percent clay. Permeability testing indicated that the IU14MW06 Shelby tube sample was clay with a permeability coefficient of $3.74\ X10^{-7}$ centimeters per second. There was insufficient material present in the IU14MW04 Shelby tube sample to conduct permeability testing because the sample was collected at a higher elevation and did not fully penetrate the clay layer. The geotechnical laboratory results are provided in Appendix E.

4.4 Groundwater Level Elevations and Groundwater Flow Direction

Water level measurements were recorded for the nine monitoring wells shown on Table 3-2 on July 10, 2012. Figure 4-4 is an interpreted potentiometric surface contour map for the surficial groundwater aquifer using the groundwater level elevation data. Based on this map, shallow groundwater flows are predominately to the northeast toward Mattawoman Creek.

Further review of the cross sections (Figure 4-2 and 4-3) indicates that recharge to the groundwater bearing zone is limited to infiltration from the unpaved areas on top of the hill. Limited infiltration is expected on the slope due to surface water drainage. As the limited extent water bearing zone is recharged, shallow groundwater flows along the clay and seeps from the bluff along Mattawoman Creek. There does not appear to be a groundwater divide within the boundary of the site; however the vertical and lateral migration of shallow groundwater is limited by the underlying clay layer, such that shallow groundwater is not hydraulically connected to the local shallow aquifer which occurs beneath the underlying clay layer.

4.5 Nature and Extent of Contamination

The nature and extent discussion is based on the analytical results ; constituents of potential concern (COPCs) identified for hypothetical residential exposures to surface soil and groundwater from the HHRA (Section 6); COPCs identified for surface soil and groundwater in the SERA (Section 7; and established facility-wide metals background levels. COPCs were identified by comparing site analytical data to screening criteria considered protective of human receptors (Section 6.2.4) and ecological receptors (Section 7.5). Based on team discussions in March and April 2012, the COPCs were further refined by comparing the maximum concentration identified for each COPC to its respective 95 percent upper tolerance limit (UTL) background concentration as reported in the *Background Soil Investigation Report for Indian Head and Stump Neck Annex* (Tetra Tech NUS, 2002b) to investigate the extent of potential site-related contamination. Table 4-1 summarizes the site-related COPCs identified for each medium. The distribution of site-related COPCs is discussed in the sections below. A summary of the detected metals (including mercury and cyanide) in surface soil and groundwater is presented in Tables 4-2 and 4-3, respectively. Raw analytical results are included in Appendix F.

4.5.1 Surface Soil

A total of 12 samples (from locations IU14SS01-IU14SS12) were collected for TAL metals, cyanide, and mercury analyses during the September and October 2011 sampling event. A total of 11 samples (from locations IU14SS09A, IU14SS10A, and IU14SS13-IU14SS21) were collected for total chromium and hexavalent chromium analyses in July 2012 sampling event.

The results indicated that 23 metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, hexavalent chromium, total chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, thallium, vanadium, and zinc) were present in all surface soil samples in which they were analyzed. Selenium and sodium were also detected frequently, but not in every sample.

Table 4-1 presents the site-related COPCs identified by comparing the maximum concentrations of each HHRA and SERA COPC to the 95 percent UTL background concentrations of those constituents. Figure 4-5 shows the distribution of site-related COPCs in surface soil. Concentrations of site- related COPCs were no higher in the vicinity of the septic drain fields or the low-lying area than elsewhere within the site. There is no discernible pattern to the distribution of site-related COPCs in the surface soil.

4.5.2 Groundwater

A total of eight groundwater samples were collected from monitoring wells IU14MW01 and IU14MW03-IU14MW09 during the September 2011 event. During the July 2012 event, nine groundwater samples were collected from IU14MW01, IU14MW03-IU14MW09, and IU14MW11. During both events, both filtered and unfiltered samples were analyzed for TAL metals (including mercury and cyanide), sulfate, sulfide, ferrous iron, pH, TOC, and hardness. No significant difference was identified between the total and dissolved sample data. The highest concentrations of metals in groundwater were detected in samples collected in and around the original septic drain field and the northern portion of the site along the bluff.

Of the 21 total and dissolved metals detected in groundwater (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium sodium, thallium, vanadium and zinc), only three (cobalt, nickel, and barium) were determined to be site-related by comparing the maximum concentrations of each HHRA and SERA COPC to the 95 percent UTL background concentrations of those constituents. Figure 4-6 shows the spatial distribution of site- related COPCs in groundwater. The site-related COPCs detected in the direct-push groundwater sampling from the SSP (the IU14GP-series borings) can also be seen on the figure because they were used for delineation purposes but were not included in the risk assessment calculations. The highest concentrations of site-related groundwater COPCs were detected in samples collected in and around the original leach field and the northern portion of the site along the bluff.

The SSP identified potentially unacceptable human health risks associated with groundwater exposure due to cobalt concentrations (CH2M HILL, 2009). During the RI, total and dissolved cobalt were found to exceed screening levels and background concentrations at every monitoring well location except IUMW04 and IUMW11. The highest concentrations of total and dissolved cobalt during both the RI and SSP occur in and around monitoring well IU14MW01 and west across the site to monitoring well IU14MW08. Concentrations of dissolved cobalt detected in samples from monitoring well IU14MW01 have decreased over time to from a maximum of 1,080 micrograms per liter (µg/L) in 2005 to the current maximum site concentration of 554µg/L. Figure 4-7 shows the extent of cobalt in groundwater.

TABLE 4-1

Summary of Human Health and Ecological COPCs Exceeding Background Concentrations

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Medium	Contaminant Group	HHRA COPCs Exceeding Background	SERA COPCs Exceeding Background
Surface Soil [1]	Metals	Aluminum	Chromium (hexavalent)
		Chromium	Chromium
		Cobalt	
		Iron	
		Manganese	
		Nickel	
Groundwater [2,3]	Metals	Cobalt	Barium
		Nickel	

Notes:

[1] NSF-IH surface soil background concentrations are the 95% Upper Tolerance Limit (UTL) Values for Non-clay-like Surface Soils Presented in theBackground Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).

[2] NSF-IH groundwater background values for human health COPCs are the 95% Upper Tolerance Limit (UTL) Non-Turbid, Unfiltered Results Presented in the Background Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).

[3] NSF-IH groundwater background values for eco COPCs are the 95% Upper Tolerance Limit (UTL) Filtered Results Presented in the Background Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).

HHRA - baseline human health risk assessment

SERA - screening ecological risk assessment

TABLE 4-2

Constituents Detected in Surface Soil

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Station ID	IU14SS01		IU14SS02	IU14SS03	IU14SS04	IU14SS05	IU14SS06		IU14SS07	IU14SS08	IU14SS09		
Sample ID	IU14SS01-000H	IU14SS01P-000H	IU14SS02-000H	IU14SS03-000H	IU14SS04-000H	IU14SS05-000H	IU14SS06-000H	IU14SS06P-000H	IU14SS07-000H	IU14SS08-000H	IU14SS09-000H	IU14SS09A0001	IU14SS09AP0001
Sample Date	09/09/11	09/09/11	09/09/11	09/08/11	10/07/11	10/07/11	10/07/11	10/07/11	09/09/11	09/08/11	09/08/11	07/11/12	07/11/12
Chemical Name													
Total Metals (MG/KG)													
Aluminum	11,400	7,540	16,700	5,840	10,000 L	11,300	8,350	8,990	8,080	9,300	4,220	NA	NA
Antimony	0.11	0.12	0.21 L	0.09 J	0.12	0.15	0.14	0.15	0.2	0.36	0.19	NA	NA
Arsenic	2	4	4.4	3.6	3.4	3.6	2.8	3.7	3.4	3.7	4.4	NA	NA
Barium	35.1	32.3	74.4	23.7	33.2	41.8	55.3	61.2	35.4	240	27.8	NA	NA
Beryllium	0.25	0.43	0.46	0.37	0.42	0.46	0.64	0.71	0.49	0.35	0.2	NA	NA
Cadmium	0.16	0.06	0.12	0.04 J	0.03 J	0.05 J	0.11 J	0.13	0.06 J	0.26	0.18	NA	NA
Calcium	3,880	485	2,390	347	247	310	287	382	363	597	927	NA	NA
Chromium (hexavalent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.77	0.23 J
Chromium	19.4	12.9	23.3 K	12.6	16	16.3	13.2	14.6	16	16.4	65.2	19.8	24.4
Cobalt	5	7.1	4.8	4.6	4.7	7	19.9	17.4	11.1	6.8	15.9	NA	NA
Copper	32.3	6.4	12.1	5	21.7	10.2	8.2	8.6	7.8	7.5	6	NA	NA
Iron	11,300	14,800	25,300	13,000	14,800	16,000	11,500	14,100	15,500	15,500	11,500	NA	NA
Lead	14.2	11	18.3 K	7.2	32.1 L	25.4	18.5	21.3	28.3	36.6	27.4	NA	NA
Magnesium	3,140	578	1,120 K	415	800 K	888	676	660	720	696	12,800	NA	NA
Manganese	73.1	172	55.6 K	95.6	229	215	753	747	262	342	182	NA	NA
Mercury	0.02 J	0.02 J	0.02 J	0.02 J	0.06	0.07	0.06	0.07	0.09	0.08	0.05	NA	NA
Nickel	11.7	5.5	7.3	4.9	7.9	8.1	9.1	8.8	8	7.1	277	NA	NA
Potassium	410	546	678 K	434	596 K	651	493	544	394	506	278	NA	NA
Selenium	0.22 B	0.3 B	0.55	0.31 B	0.27 J	0.5	0.47 J	0.63	0.52	0.38 B	0.25 B	NA	NA
Silver	0.32	1.5	0.03 J	1.1	6.3 L	0.43	0.32	0.34	0.12	25	1.2	NA	NA
Sodium	572	15.4 B	69.7 J	17.7 B	17.9 B	24.8 B	20.3 B	22.2 B	24.4 B	32.8 B	37.8 B	NA	NA
Thallium	0.1	0.09	0.19	0.08 J	0.13	0.16	0.14	0.15	0.14	0.11	0.06 J	NA	NA
Vanadium	25.6	20.5	32.4 K	16	29.1	36.8	26.9	36.1	27.3	31	15.2	NA	NA
Zinc	62	23.3	32.7 K	16.8	22.8	24.4	27	27.8	27.5	50.7	60.2	NA	NA
Wet Chemistry													
% Solids (pct)	86	87	82	82	87	79	78	74	74	77	80	NA	NA
pH (ph)	7.2	NA	7.6	5.1	4.1	4	4.4	NA	4.4	5.4	6.1	5.4	NA

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Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT - Percent
PH - pH units

TABLE 4-2

Constituents Detected in Surface Soil

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Station ID	IU14SS10			IU14SS11	IU14SS12	IU14SS13	IU14SS14	IU14SS15	IU14SS16	IU14SS17	IU14SS18	IU14SS19	IU14SS20		IU14SS21
Sample ID	IU14SS10-000H	IU14SS10P-000H	IU14SS10A0001	IU14SS11-000H	IU14SS12-000H	IU14SS130001	IU14SS140001	IU14SS150001	IU14SS160001	IU14SS170001	IU14SS180001	IU14SS190001	IU14SS200001	IU14SS20P0001	IU14SS210001
Sample Date	09/08/11	09/08/11	07/11/12	09/09/11	09/09/11	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12
Chemical Name															
Total Metals (MG/KG)															
Aluminum	8,110	8,680	NA	10,300	6,790	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	0.43	0.48	NA	0.26	0.26 L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	3.5	3.7	NA	3.8	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	60.2	63.6	NA	54.1	35.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.46	0.52	NA	0.52	0.43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.24	0.25	NA	0.15	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	1,370	1,420	NA	1,770	1,320	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (hexavalent)	NA	NA	0.76	NA	NA	0.22 U	0.22 U	0.23 U	0.24 U	0.21 U	0.22 U	0.21 U	0.75	0.34 J	0.24 U
Chromium	23	46.8	20.4 K	16.5	15.4 K	19.5	86	14.4	34.8	18.4	18.8	19.6	18.4	18.9	20.1
Cobalt	10.6	11	NA	6.2	4.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	15.1	20.8	NA	11.9	13.4 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	13,100	14,100	NA	16,000	12,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	105	181	NA	35.2	43.5 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	793	845	NA	1,540	1,340 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	273	343	NA	170	167 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.05	0.08	NA	0.23	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	6.8	7.2	NA	13.4	8.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	381	402	NA	642	592 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.43 B	0.51 J	NA	0.39 B	0.34 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	5.8	4.7	NA	0.19	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	337	348	NA	45.8 B	36.8 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.13	0.14	NA	0.14	0.09 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	25.9	27.7	NA	28.5	21.6 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	134	136	NA	77.2	61 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry															
% Solids (pct)	75	70	NA	73	80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	6.6	NA	6	6.6	6.9	6.4	7	4.2	4.9	4	4	4.2	3.9	NA	4.2

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Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be low
L - Analyte present, value may be biased low, actual value may be highe
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT - Percent
PH - pH units

TABLE 4-3

Constituents Detected in Groundwater

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Station ID	IU14MW01			IU14MW03			IU14MW04		IU14MW05		IU14MW06		IU14MW07	
Sample ID	IU14GW01-0911	IU14GW010712	IU14GW01P0712	IU14GW03-0911	IU14GW03P-0911	IU14GW030712	IU14GW04-0911	IU14GW040712	IU14GW05-0911	IU14GW050712	IU14GW06-0911	IU14GW060712	IU14GW07-0911	IU14GW070712
Sample Date	09/08/11	07/10/12	07/10/12	09/08/11	09/08/11	07/10/12	09/09/11	07/11/12	09/06/11	07/10/12	09/06/11	07/10/12	09/08/11	07/10/12
Chemical Name														
Total Metals (UG/L)														
Aluminum	22.2 B	22.8 B	18.9 B	45.8 B	81.5 B	29.4 B	136 J	120 B	75.9 B	109 B	96.6 B	45.3 B	90.4 B	97.3 B
Antimony	0.5 U	0.11 B	0.07 J	0.06 B	0.07 B	0.13 B	0.08 B	0.11 B	0.08 B	0.09 B	0.08 B	0.11 B	0.1 B	0.06 B
Arsenic	4 U	3 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Barium	40.2	43.8	43	68	71	68.7	158	197	61.1	49.4	66.8	61	82.3	81.8
Beryllium	0.33 J	0.32 J	0.32 J	0.3 J	0.31 J	0.22 J	0.49 J	1	0.33 J	0.49 J	0.18 J	0.26 J	0.55 J	1.1
Cadmium	0.05 J	0.19 J	0.15 J	0.07 J	0.04 J	1.3	0.84 J	1.6	0.18 J	0.12 J	0.06 J	3.5	0.41 J	0.39 J
Calcium	6,210 L	5,920	5,760	11,900	12,100	14,300	14,100	16,000	16,400	11,400	9,230	9,180	8,660	8,800
Cobalt	595 L	554	550	238	234	280	8.6	12.7	221	301	37.4	39.6	433	554
Copper	0.89 B	1.3 B	1.4 J	5.8	5.6	9.6	1 J	1.8 B	8	8.9 B	0.72 B	1.3 B	2.1 J	2.2 B
Iron	60 U	26.4 B	13.2 B	23.5 B	26.1 B	53.2 J	60 U	13.5 B	252	248	114	263	21.4 B	17.6 B
Lead	0.5 U	0.17 B	0.12 J	0.16 B	0.15 B	0.2 B	0.51 J	0.37 B	0.21 B	0.16 B	0.52 J	0.27 B	0.17 B	0.28 B
Magnesium	2,640	2,430 J	2,380 J	5,440	5,400	5,960	8,660	9,640	6,420	4,520	4,540	4,480	4,630	4,500
Manganese	37.4	42.9	34	133	129	136	319	264	324	252	149	133	288	213
Mercury	0.01 J	0.1 U	0.1 U	0.05 J	0.03 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 B	0.1 U	0.1 U	0.02 J
Nickel	5.4	5.6	4.8	9.5	8.8	13	34.6	47.7	9.5	9.2	17.8	31.8	37	42.1
Potassium	2,740	2,890	2,800	10,700	10,000	13,400	3,120	3,130	20,300	16,300	3,880	3,780	4,690	4,010
Selenium	1.2 B	0.72 B	0.23 B	1.3 B	1.9 B	3 U	1.5 B	0.61 J	0.78 B	3 U	2.4 B	0.86 B	2.2 B	0.58 B
Sodium	25,500 L	27,300	26,800	48,500	46,800	56,800	68,700	75,000	45,000	44,300	11,600	11,900	25,200	27,600
Thallium	0.4 U	0.4 U	0.4 U	0.06 B	0.06 B	0.1 J	0.4 U	0.4 U	0.08 B	0.07 J	0.06 B	0.1 J	0.4 U	0.4 U
Vanadium	0.64 B	0.64 B	1.9 B	4 U	4 U	4 U	0.54 B	0.94 B	4 U	1.9 B	1.2 B	5.3 B	0.69 B	3.5 B
Zinc	35.7 B	15.5 B	14 B	29.2 B	24.1 B	9 B	64.1 B	64.5	33 B	32.5 B	22 B	9.3 B	96.4 B	75.3 B
Dissolved Metals (UG/L)														
Aluminum, Dissolved	21.2 B	18.6 B	19.5 B	51.4 B	54.9 B	30.1 B	113 J	105 B	57.8 B	86.6 B	59.6 B	38.4 J	71.6 B	97.2 B
Antimony, Dissolved	0.1 B	0.5 U	0.1 J	0.07 B	0.08 B	0.08 J	0.12 B	0.08 B	0.1 B	0.09 J	0.09 B	0.1 J	0.11 B	0.12 J
Arsenic, Dissolved	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	2.4 J
Barium, Dissolved	41.3	51.8	52.4	70	70.9	67.6	154	194	57	49.2	70.9	62.2	84.8	78.2
Beryllium, Dissolved	0.34 J	0.31 J	0.33 J	0.26 J	0.27 J	0.23 J	0.49 J	1	0.28 J	0.44 J	0.19 J	0.3 J	0.55 J	0.98 J
Cadmium, Dissolved	0.03 J	0.14 J	0.18 J	0.05 J	0.06 J	1.1	0.74 J	1.3	0.11 J	0.17 J	0.2 U	1.1	0.38 J	0.39 J
Calcium, Dissolved	6,470	6,240	6,330	12,100	12,300	14,200	13,500	15,800	14,800	11,300	9,830	9,280	9,060	8,460
Chromium, Dissolved	3.1 B	4 B	4.1 B	2.2 B	2 B	1 B	3.2 B	2.3 B	1.1 B	2.6 B	2.7 B	3.2 J	3.6 B	3.9 B
Cobalt, Dissolved	632	534	535	247	242	280	8.1	11.3	214	298	21.8	40.8	456	529
Copper, Dissolved	0.68 B	1.3 B	1.5 J	6.7	6.3	9.3 B	4.8	3.2 B	8.2	9.9 B	1 B	2.4 B	2.8 J	2.5 B
Iron, Dissolved	60 U	60 U	60 U	18.9 B	35.7 B	56.8 J	60 U	60 U	223	222	256	236	17.5 B	16.5 B
Lead, Dissolved	0.11 B	0.08 B	0.08 J	0.13 B	0.1 B	0.16 B	0.61 B	0.28 B	0.15 B	0.35 B	0.35 B	0.37 B	0.15 B	0.22 B
Magnesium, Dissolved	2,790	2,360 J	2,350 J	5,460	5,400	5,940	8,300	9,600	5,970	4,460	5,100	4,600 J	4,910	4,560 J
Manganese, Dissolved	38.5	34.1	35.4	131	129	139	303	250	299	245	186	138	301	207
Mercury, Dissolved	0.1 U	0.02 B	0.02 J	0.02 B	0.1 U	0.05 B	0.1 U	0.06 B	0.1 U	0.1 U	0.1 U	0.02 B	0.02 B	0.02 B
Nickel, Dissolved	5.4	4.9	4.9	9.9	9.8	13.2	37.8	47	9.5	9.6	31	31.2	37.9	38.4
Potassium, Dissolved	2,900	2,670	2,780	10,900	11,000	12,800	2,970	3,210	19,200	16,500	4,090	3,880	4,970	4,030
Sodium, Dissolved	27,100	25,800	26,800	48,400	48,200	58,200	66,800	79,000	42,900	43,800	10,100	11,800 J	26,300	28,200
Thallium, Dissolved	0.4 U	0.4 U	0.4 U	0.06 B	0.07 B	0.12 J	0.4 U	0.4 U	0.06 B	0.06 J	0.06 B	0.11 J	0.4 U	0.4 U
Vanadium, Dissolved	0.65 J	1 B	1.2 B	1 J	0.65 J	0.97 B	0.71 B	4 U	4 U	2.9 B	2.7 J	5.1 J	0.51 J	0.7 B
Zinc, Dissolved	14.4	15.3 B	17.7 B	9.9 J	18.1	27.7 B	51.8	59.2	14.9	11 B	7.2 J	11.3 B	75.5	75.9 B
Wet Chemistry														
Ferrous iron (mg/l)	0.05 U	0.08 J	NA	0.05 U	NA	0.07 J	0.05 U	0.07 J	0.05 U	0.08 J	0.22	0.29	0.061 J	0.08 J
Hardness (mg/l)	26	18	NA	54	NA	57	73	80	61	43	38	39	40	37
pH (ph)	5.3	4.8	NA	5.8	NA	5.6	5.1	5.3	5.8	5.4	5.4	4.7	5.4	4.7
Sulfate (mg/l)	42	33	NA	54	NA	63	3	4.8	92	98	43	49	22	26
Sulfide (mg/l)	0.75 U	1.2	NA	0.75 U	NA	1.7	0.75 U	0.8 J	0.75 U	1.1	0.75 U	0.95 J	0.75 U	0.8 J
Total organic carbon (TOC) (mg/l)	1.9	1.5	NA	1.2	NA	1.2	0.7 J	0.76 J	2	2	0.56 J	0.64 J	1.4	1.3

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 4-3

Constituents Detected in Groundwater

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

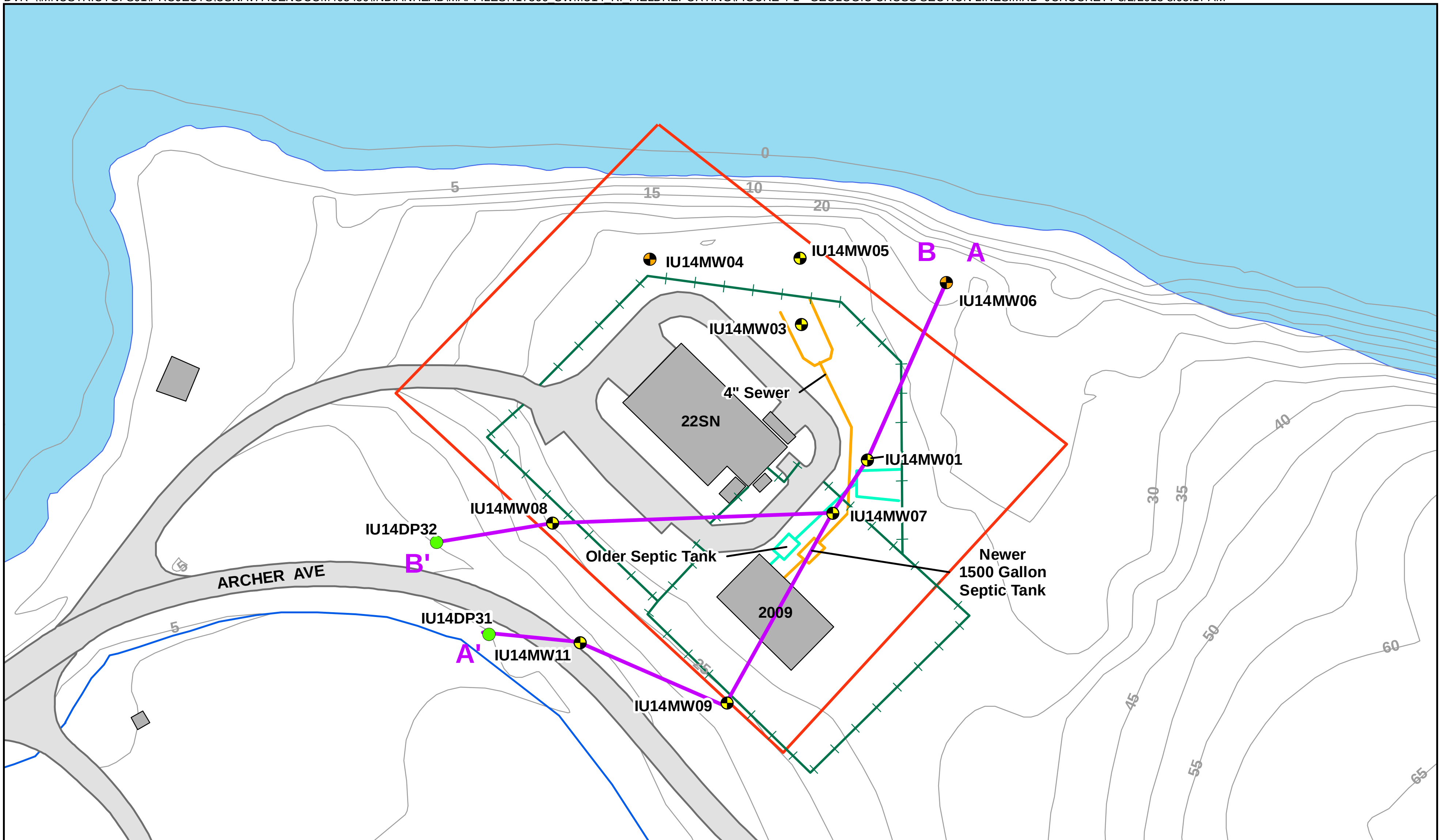
Station ID	IU14MW08		IU14MW09		IU14MW11
Sample ID	IU14GW08-0911	IU14GW080712	IU14GW09-0911	IU14GW090712	IU14GW110712
Sample Date	09/09/11	07/11/12	09/07/11	07/11/12	07/11/12
Chemical Name					
Total Metals (UG/L)					
Aluminum	84.5 B	65.6 B	199 B	43.3 B	876
Antimony	0.12 B	0.09 B	0.5 U	0.1 B	0.24 B
Arsenic	4 U	4 U	4 U	4 U	3 J
Barium	110	85.4	30.3	26.7	24.9 B
Beryllium	0.44 J	0.5 J	0.62 J	0.39 J	0.06 J
Cadmium	0.2 J	0.34 J	0.15 J	0.12 B	0.24 J
Calcium	8,200	6,400	1,400	1,030	4,870
Cobalt	54.1	47.4	90.6	66.8	6.3
Copper	0.61 J	1.1 B	4.3	5.7	4.1 B
Iron	47.1 J	30.1 B	60 U	27.8 B	1,150
Lead	0.22 B	0.24 B	0.66 J	0.07 B	0.95 B
Magnesium	3,990	3,260	2,020	1,570	2,800
Manganese	682	504	20.2	12.9	247
Mercury	0.08 J	0.19 J	0.1 U	0.02 J	0.01 J
Nickel	10.9	8.4	44.5	32	5.8
Potassium	3,630	2,530	1,850	1,640	2,390
Selenium	1.3 B	3 U	1 B	3 U	0.58 J
Sodium	37,600	33,300	9,870	10,200	89,400
Thallium	0.4 U	0.4 U	0.35 J	0.26 J	0.09 J
Vanadium	1.2 B	3.2 B	0.7 J	2.9 B	5.5 B
Zinc	23.9 B	14.8	124	73.6	5.5 J
Dissolved Metals (UG/L)					
Aluminum, Dissolved	73.6 B	41.6 B	61.6 B	38 B	61.5 B
Antimony, Dissolved	0.1 B	0.1 B	0.09 B	0.11 B	0.24 B
Arsenic, Dissolved	4 U	4 U	4 U	4 U	4 U
Barium, Dissolved	112	79.1	27.8	27.1	23.4
Beryllium, Dissolved	0.47 J	0.42 J	0.54 J	0.4 J	0.2 U
Cadmium, Dissolved	0.21 J	0.3 J	0.23 J	0.1 J	0.13 J
Calcium, Dissolved	8,580	6,000	1,490	1,090	5,100
Chromium, Dissolved	3.2 B	2.8 B	1.8 B	2.9 B	3.1 B
Cobalt, Dissolved	55	42.4	82.6	70.1	4.2
Copper, Dissolved	0.98 J	2.2 B	3.8	3.2 B	6.1
Iron, Dissolved	40.1 J	17.6 B	60 U	27.7 B	180
Lead, Dissolved	0.22 B	0.19 B	0.59 J	0.07 B	0.24 B
Magnesium, Dissolved	4,180	2,930	1,930	1,670	2,930
Manganese, Dissolved	698	465	18.7	13.6	218
Mercury, Dissolved	0.06 B	0.12 B	0.1 U	0.05 B	0.06 B
Nickel, Dissolved	11	7.8	40.5	34	4.8
Potassium, Dissolved	3,670	2,490	1,820	1,710	2,300
Sodium, Dissolved	38,200	31,300	9,930	10,700	92,500
Thallium, Dissolved	0.4 U	0.4 U	0.31 J	0.26 J	0.07 J
Vanadium, Dissolved	0.99 B	4 B	0.56 J	3.2 B	3.7 B
Zinc, Dissolved	23	15.9	93.4	72	4.5 J
Wet Chemistry					
Ferrous iron (mg/l)	0.028 J	0.09 J	0.083 J	0.29	0.52
Hardness (mg/l)	38	24	12	4.1 J	20
pH (ph)	4.8	5.1	5.2	4.7	6.2
Sulfate (mg/l)	14	12	12	12	3.7
Sulfide (mg/l)	0.75 U	1.2	0.75 U	0.8 J	1.6
Total organic carbon (TOC) (mg/l)	1.4	1	2.2	0.84 J	9

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
L - Analyte present, value may be biased low, actual value may be high
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 4-1 - GEOLOGIC CROSS SECTION LINES.MXD JCROCKETT 5/2/2013 8:05:17 AM



Legend

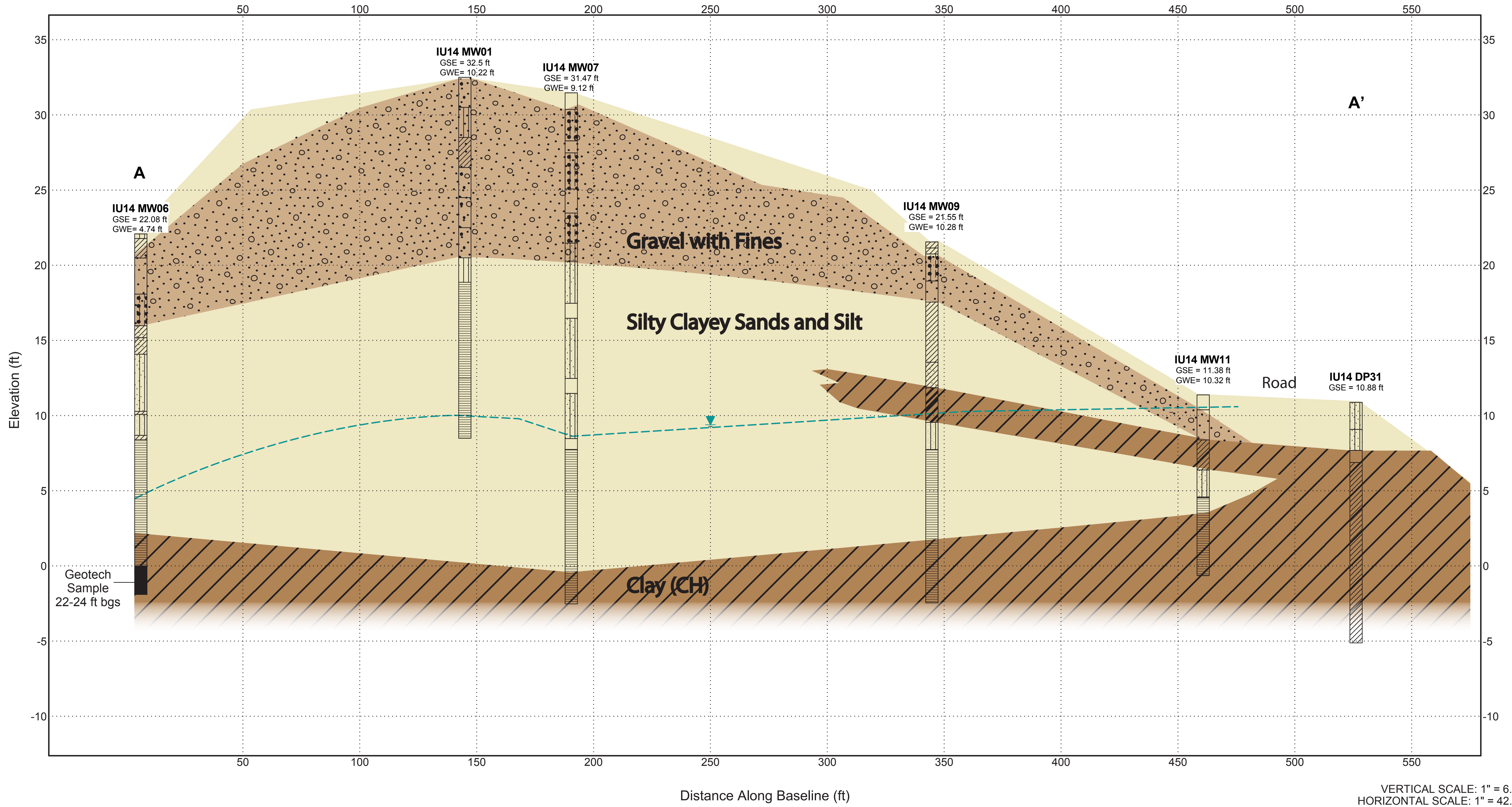
- Direct Push Boring Location
- Monitoring Well Location
- Monitoring Well and Geotech Sample Location
- Approximate Site Boundary
- Elevation Contour (5 foot interval)
- Fence Line
- Streams
- Buildings
- Roads and Paved Areas

N

0 50 100 Feet

Figure 4-1
Geologic Cross Section Lines
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

CH2MHILL.

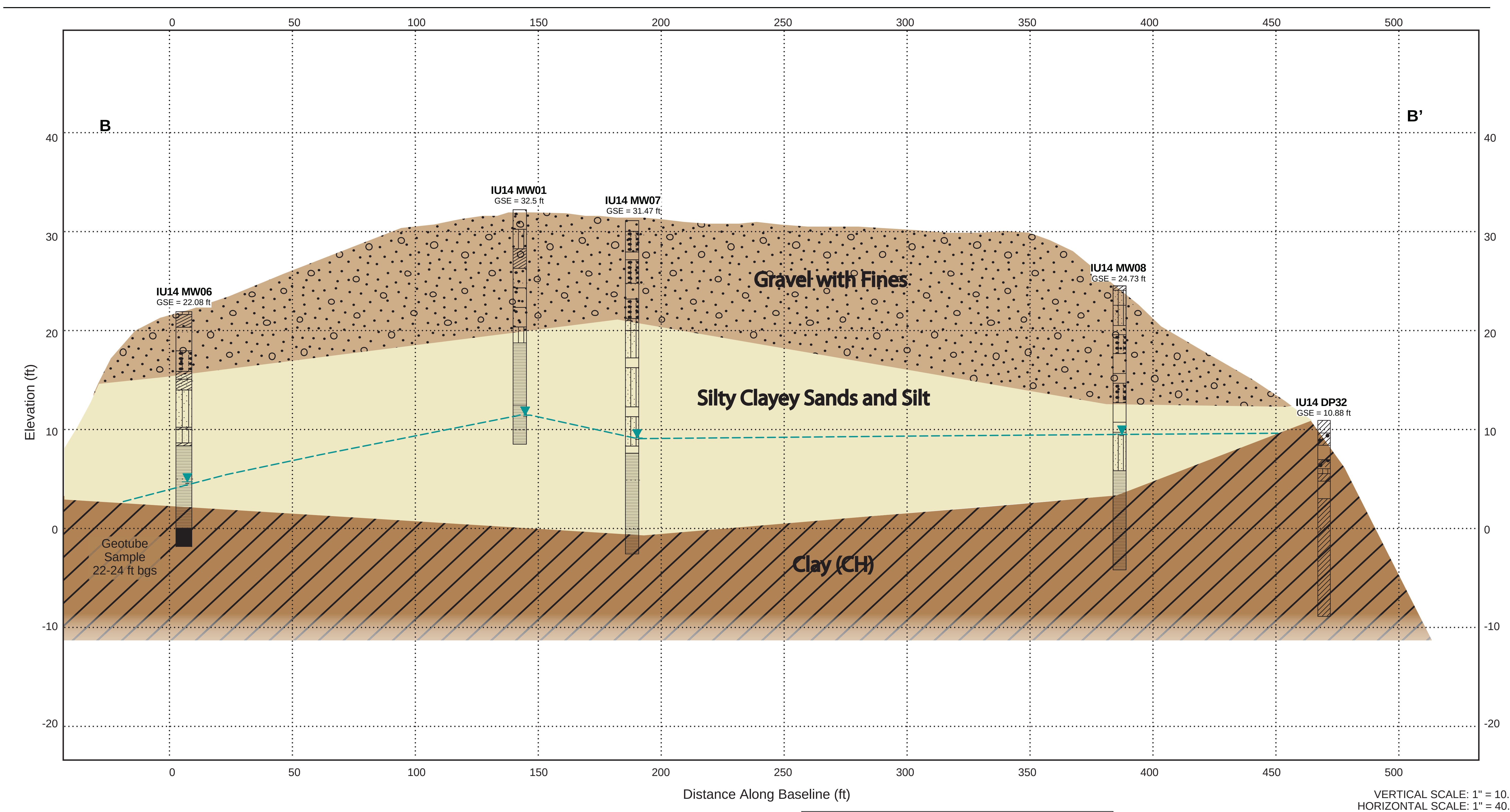


LITHOLOGY GRAPHICS

GSE - Ground Surface Elevation

GWE - Groundwater Elevation

FIGURE 4-2
Geologic Cross Section
Remedial Investigation Report - Stump Neck Annex - SWMU 14
NSF-IH, Indian Head, Maryland



LITHOLOGY GRAPHICS

Silty Sand
Lean Clay
Poorly Graded Gravel
Silt
GSE - Ground Surface Elevation
Well-Graded Gravel with Silt
Clayey Sand
Fat Clay
Organic Clay or Silt
GWE - Groundwater Elevation

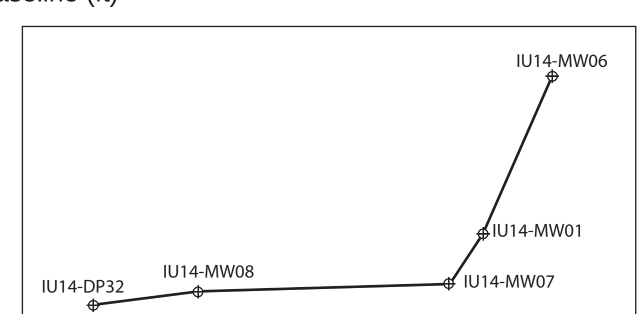
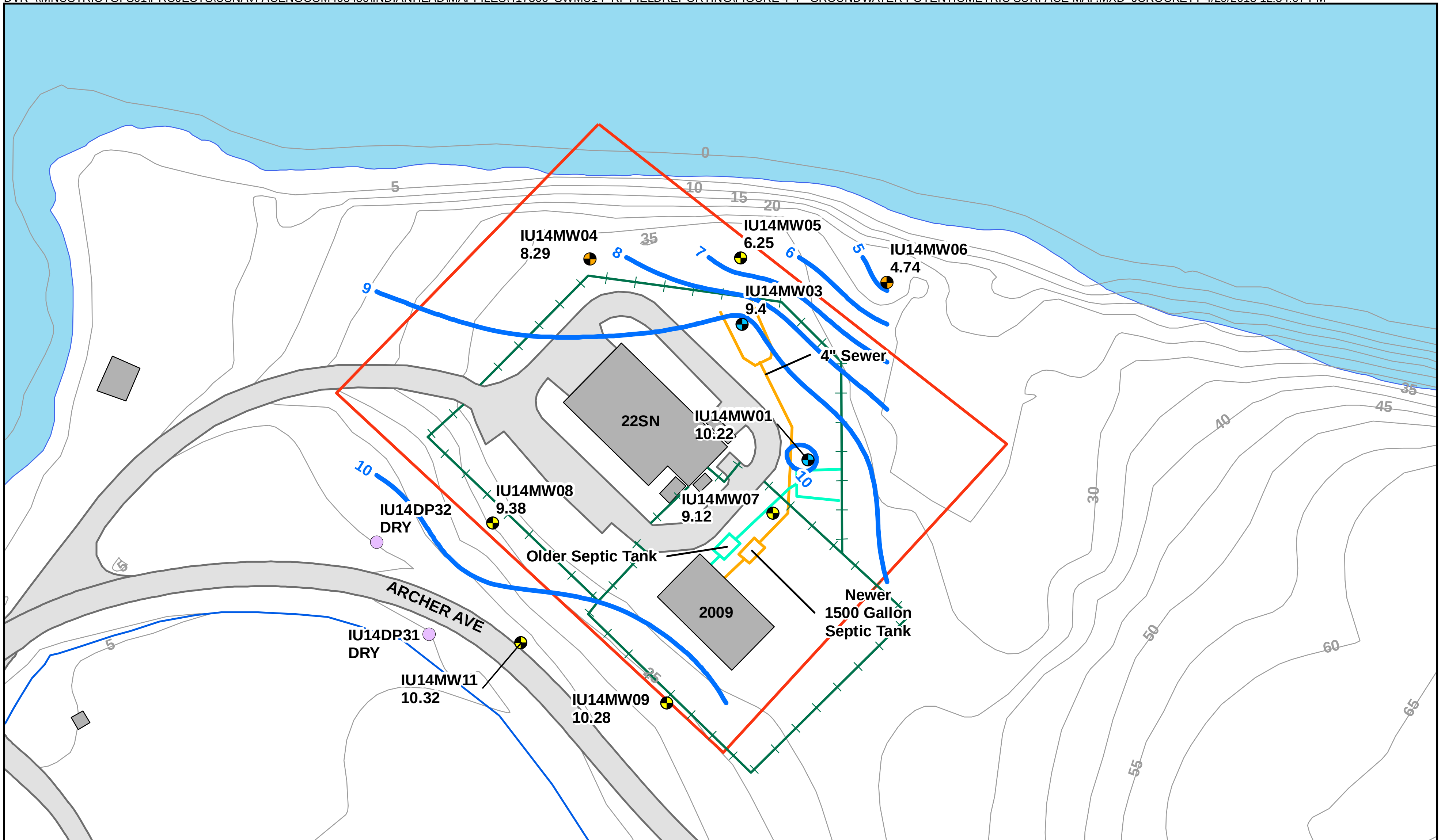


Figure 4-3
Geologic Cross Section
Remedial Investigation Report - Stump Neck Annex - SWMU 14
NSF-IH, Indian Head, Maryland

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 4-4 - GROUNDWATER POTENTIOMETRIC SURFACE MAP.MXD JCROCKETT 4/29/2013 12:54:07 PM



Legend

- DPT Groundwater Location
- Monitoring Well Location
- Monitoring Well and Geotech Sample Location
- Existing Monitoring Well Location
- Potentiometric Contour
- Approximate Site Boundary
- Elevation Contour (5 foot interval)
- Fence Line
- Streams
- Buildings
- Roads and Paved Areas

N

0 50 100 Feet

Figure 4-4
Groundwater Potentiometric Surface Map
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

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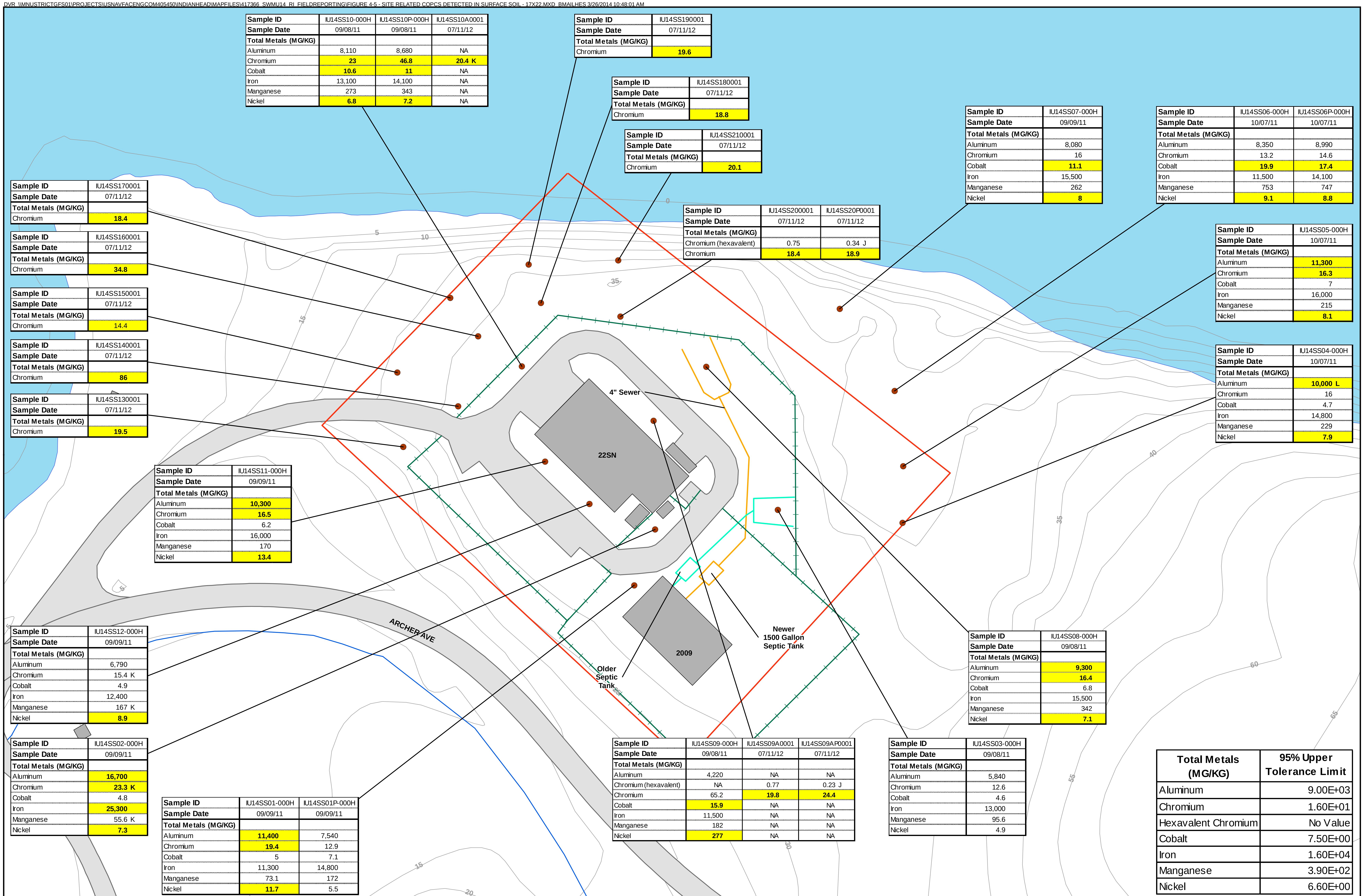
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 4-5 - SITE RELATED COPCS DETECTED IN SURFACE SOIL - 17X22.MXD BMAILHES 3/26/2014 10:48:01 AM



Sample ID	IU14SS10-000H	IU14SS10P-000H	IU14SS10A0001
Sample Date	09/08/11	09/08/11	07/11/12
Total Metals (MG/KG)			
Aluminum	8,110	8,680	NA
Chromium	**23**	**46.8**	**20.4 K**
Cobalt	**10.6**	**11**	NA
Iron	13,100	14,100	NA
Manganese	273	343	NA
Nickel	**6.8**	**7.2**	NA

Sample ID	IU14SS190001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**19.6**

Sample ID	IU14SS180001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**18.8**

Sample ID	IU14SS210001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**20.1**

Sample ID	IU14SS07-000H
Sample Date	09/09/11
Total Metals (MG/KG)	
Aluminum	8,080
Chromium	16
Cobalt	**11.1**
Iron	15,500
Manganese	262
Nickel	**8**

Sample ID	IU14SS06-000H	IU14SS06P-000H
Sample Date	10/07/11	10/07/11
Total Metals (MG/KG)		
Aluminum	8,350	8,990
Chromium	13.2	14.6
Cobalt	**19.9**	**17.4**
Iron	11,500	14,100
Manganese	753	747
Nickel	**9.1**	**8.8**

Sample ID	IU14SS170001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**18.4**

Sample ID	IU14SS200001	IU14SS20P0001
Sample Date	07/11/12	07/11/12
Total Metals (MG/KG)		
Chromium (hexavalent)	0.75	0.34 J
Chromium	**18.4**	**18.9**

Sample ID	IU14SS05-000H
Sample Date	10/07/11
Total Metals (MG/KG)	
Aluminum	**11,300**
Chromium	**16.3**
Cobalt	7
Iron	16,000
Manganese	215
Nickel	**8.1**

Sample ID	IU14SS160001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**34.8**

Sample ID	IU14SS150001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**14.4**

Sample ID	IU14SS140001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**86**

Sample ID	IU14SS04-000H
Sample Date	10/07/11
Total Metals (MG/KG)	
Aluminum	**10,000 L**
Chromium	16
Cobalt	4.7
Iron	14,800
Manganese	229
Nickel	**7.9**

Sample ID	IU14SS130001
Sample Date	07/11/12
Total Metals (MG/KG)	
Chromium	**19.5**

Sample ID	IU14SS11-000H
Sample Date	09/09/11
Total Metals (MG/KG)	
Aluminum	**10,300**
Chromium	**16.5**
Cobalt	6.2
Iron	16,000
Manganese	170
Nickel	**13.4**

Sample ID	IU14SS12-000H
Sample Date	09/09/11
Total Metals (MG/KG)	
Aluminum	6,790
Chromium	15.4 K
Cobalt	4.9
Iron	12,400
Manganese	167 K
Nickel	**8.9**

Sample ID	IU14SS08-000H
Sample Date	09/08/11
Total Metals (MG/KG)	
Aluminum	**9,300**
Chromium	**16.4**
Cobalt	6.8
Iron	15,500
Manganese	342
Nickel	**7.1**

Sample ID	IU14SS02-000H
Sample Date	09/09/11
Total Metals (MG/KG)	
Aluminum	**16,700**
Chromium	**23.3 K**
Cobalt	4.8
Iron	**25,300**
Manganese	55.6 K
Nickel	**7.3**

Sample ID	IU14SS01-000H	IU14SS01P-000H
Sample Date	09/09/11	09/09/11
Total Metals (MG/KG)		
Aluminum	**11,400**	7,540
Chromium	**19.4**	12.9
Cobalt	5	7.1
Iron	11,300	14,800
Manganese	73.1	172
Nickel	**11.7**	5.5

Sample ID	IU14SS09-000H	IU14SS09A0001	IU14SS09AP0001
Sample Date	09/08/11	07/11/12	07/11/12
Total Metals (MG/KG)			
Aluminum	4,220	NA	NA
Chromium (hexavalent)	NA	0.77	0.23 J
Chromium	65.2	**19.8**	**24.4**
Cobalt	**15.9**	NA	NA
Iron	11,500	NA	NA
Manganese	182	NA	NA
Nickel	**277**	NA	NA

Sample ID	IU14SS03-000H
Sample Date	09/08/11
Total Metals (MG/KG)	
Aluminum	5,840
Chromium	12.6
Cobalt	4.6
Iron	13,000
Manganese	95.6
Nickel	4.9

Total Metals (MG/KG)	95% Upper Tolerance Limit
Aluminum	9.00E+03
Chromium	1.60E+01
Hexavalent Chromium	No Value
Cobalt	7.50E+00
Iron	1.60E+04
Manganese	3.90E+02
Nickel	6.60E+00

Legend

- Surface Soil Sample Location
- Approximate Site Boundary
- Elevation Contour (5 foot interval)
- Streams
- Fence Line
- Buildings
- Roads and Paved Areas

Notes:

Exceeds 95% Upper Tolerance Limit Values for Background Surface Soil

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram

N

0 25 50 Feet

Figure 4-5
Site Related COPCs Detected in Surface Soil
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

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DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 4-6 - SITE RELATED COPCS IN GW - 22X34.MXD JCROCKETT 4/29/2013 12:29:47 PM

Sample ID	IU14GP262428	IU14GP262428P
Sample Date	08/04/08	08/04/08
Unfiltered Metals (UG/L)		
Cobalt	**360 K**	**361 K**
Filtered Metals (UG/L)		
Cobalt	**377**	**370**

Sample ID	IU14GP272428
Sample Date	09/17/08
Unfiltered Metals (UG/L)	
Cobalt	**67.9**
Filtered Metals (UG/L)	
Cobalt	**68.1**

Sample ID	IU14GP072528
Sample Date	07/18/07
Unfiltered Metals (UG/L)	
Barium	**97.9 J**
Cobalt	**266**
Nickel	**20.7 J**
Filtered Metals (UG/L)	
Barium	**88.1 J**
Cobalt	**254**
Nickel	**18.4 J**

Sample ID	IU14GW05-0911	IU14GW050712
Sample Date	09/06/11	07/10/12
Unfiltered Metals (UG/L)		
Barium	**61.1**	**49.4**
Cobalt	**221**	**301**
Nickel	**9.5**	**9.2**
Filtered Metals (UG/L)		
Barium	**57**	**49.2**
Cobalt	**214**	**298**
Nickel	**9.5**	**9.6**

Sample ID	IU14GP052630	IU14GP05P2630
Sample Date	07/11/07	07/11/07
Unfiltered Metals (UG/L)		
Barium	**123 J**	**131 J**
Cobalt	**325**	**321**
Nickel	**36.5 J**	**37.8 J**
Filtered Metals (UG/L)		
Barium	**111 J**	**115 J**
Cobalt	**322**	**330**
Nickel	**33.9 J**	**34.3 J**

Sample ID	IU14GP222428
Sample Date	07/31/08
Unfiltered Metals (UG/L)	
Cobalt	**233 K**
Filtered Metals (UG/L)	
Cobalt	**259**

Sample ID	IU14GP232428
Sample Date	08/01/08
Unfiltered Metals (UG/L)	
Cobalt	**442 K**
Filtered Metals (UG/L)	
Cobalt	**459**

Sample ID	IU14GW04-0911	IU14GW040712
Sample Date	09/09/11	07/11/12
Unfiltered Metals (UG/L)		
Barium	**158**	**197**
Cobalt	**8.6**	**12.7**
Nickel	**34.6**	**47.7**
Filtered Metals (UG/L)		
Barium	**154**	**194**
Cobalt	**8.1**	**11.3**
Nickel	**37.8**	**47**

Sample ID	IU14GW06-0911	IU14GW060712
Sample Date	09/06/11	07/10/12
Unfiltered Metals (UG/L)		
Barium	**66.8**	**61**
Cobalt	**37.4**	**39.6**
Nickel	**17.8**	**31.8**
Filtered Metals (UG/L)		
Barium	**70.9**	**62.2**
Cobalt	**21.8**	**40.8**
Nickel	**31**	**31.2**

Sample ID	IU14GP042832
Sample Date	07/11/07
Unfiltered Metals (UG/L)	
Barium	**294**
Cobalt	**560**
Nickel	**88.8**
Filtered Metals (UG/L)	
Barium	**63 J**
Cobalt	**510**
Nickel	**14.5 J**

Sample ID	IU14GP062428
Sample Date	07/18/07
Unfiltered Metals (UG/L)	
Barium	**95.8 J**
Cobalt	**533**
Nickel	**17.9 J**
Filtered Metals (UG/L)	
Barium	**58.6 J**
Cobalt	**530**
Nickel	**9.9 J**

Sample ID	IU14GP282428
Sample Date	08/01/08
Unfiltered Metals (UG/L)	
Cobalt	**44.8 K**
Filtered Metals (UG/L)	
Cobalt	**21.6**

Sample ID	IU14GP182428
Sample Date	09/17/08
Unfiltered Metals (UG/L)	
Cobalt	**304**
Filtered Metals (UG/L)	
Cobalt	**312**

Sample ID	IU14GP172428
Sample Date	08/01/08
Unfiltered Metals (UG/L)	
Cobalt	**390 K**
Filtered Metals (UG/L)	
Cobalt	**393**

Sample ID	IU14GP030919
Sample Date	07/11/07
Unfiltered Metals (UG/L)	
Barium	**183 J**
Cobalt	**503**
Nickel	**50.7**
Filtered Metals (UG/L)	
Barium	**113 J**
Cobalt	**469**
Nickel	**40.7**

Sample ID	IU14GP190011
Sample Date	09/17/08
Unfiltered Metals (UG/L)	
Cobalt	**73.8**
Filtered Metals (UG/L)	
Cobalt	**53.5**

Sample ID	IU14GW030807	IU14GW03P0807	IU14GW03-0911	IU14GW03P-0911	IU14GW030712
Sample Date	08/28/07	08/28/07	09/08/11	09/08/11	07/10/12
Unfiltered Metals (UG/L)					
Barium	**84 J**	**82.9 J**	**68**	**71**	**68.7**
Cobalt	**389**	**386**	**238**	**234**	**280**
Nickel	**18.4 J**	**18.4 J**	**9.5**	**8.8**	**13**
Filtered Metals (UG/L)					
Barium	**81.9 J**	**83.2 J**	**70**	**70.9**	**67.6**
Cobalt	**389**	**393**	**247**	**242**	**280**
Nickel	**18.3 J**	**18.9 J**	**9.9**	**9.8**	**13.2**

Sample ID	IU14GP150012
Sample Date	09/16/08
Unfiltered Metals (UG/L)	
Cobalt	**71.4**
Filtered Metals (UG/L)	
Cobalt	**23.1**

Sample ID	IU14GP292428
Sample Date	08/04/08
Unfiltered Metals (UG/L)	
Cobalt	**24.8 K**
Filtered Metals (UG/L)	
Cobalt	**24.1**

Sample ID	IU14GP252428	IU14GP252428P
Sample Date	07/31/08	07/31/08
Unfiltered Metals (UG/L)		
Cobalt	**71.6 K**	**75.7 K**
Filtered Metals (UG/L)		
Cobalt	**42.4**	**43.8**

Sample ID	IU14MW01-1105	IU14GW010707	IU14GW01-0911	IU14GW010712	IU14GW01P0712
Sample Date	11/02/05	07/10/07	09/08/11	07/10/12	07/10/12
Unfiltered Metals (UG/L)					
Barium	**58.3 J**	**45.2 J**	**40.2**	**43.8**	**43**
Cobalt	**1,110**	**834**	**595 L**	**554**	**550**
Nickel	11.7 U	**8.7 J**	**5.4**	**5.6**	**4.8**
Filtered Metals (UG/L)					
Barium	**56.4 J**	**44.2 J**	**41.3**	**51.8**	**52.4**
Cobalt	**1,080**	**830**	**632**	**534**	**535**
Nickel	11.7 U	**8.2 J**	**5.4**	**4.9**	**4.9**

Sample ID	IU14GP302428
Sample Date	08/04/08
Unfiltered Metals (UG/L)	
Cobalt	**35.3 K**
Filtered Metals (UG/L)	
Cobalt	**22.2**

Sample ID	IU14GP242428
Sample Date	08/04/08
Unfiltered Metals (UG/L)	
Cobalt	**172 K**
Filtered Metals (UG/L)	
Cobalt	**147**

Sample ID	IU14GW08-0911	IU14GW080712
Sample Date	09/09/11	07/11/12
Unfiltered Metals (UG/L)		
Barium	**110**	**85.4**
Cobalt	**54.1**	**47.4**
Nickel	**10.9**	**8.4**
Filtered Metals (UG/L)		
Barium	**112**	**79.1**
Cobalt	**55**	**42.4**
Nickel	**11**	**7.8**

Sample ID	IU14GP202428
Sample Date	08/04/08
Unfiltered Metals (UG/L)	
Cobalt	**51.7 K**
Filtered Metals (UG/L)	
Cobalt	**49.3**

Sample ID	IU14GP022428
Sample Date	07/12/07
Unfiltered Metals (UG/L)	
Barium	**339**
Cobalt	**267**
Nickel	**47.9**
Filtered Metals (UG/L)	
Barium	**84.7 J**
Cobalt	**233**
Nickel	**14.9 J**

Sample ID	IU14GW110712
Sample Date	07/11/12
Unfiltered Metals (UG/L)	
Cobalt	**6.3**
Nickel	**5.8**
Filtered Metals (UG/L)	
Barium	**23.4**
Cobalt	**4.2**
Nickel	**4.8**

Sample ID	IU14GP140023	IU14GP140023P
Sample Date	09/17/08	09/17/08
Unfiltered Metals (UG/L)		
Cobalt	**89.1**	**88.3**
Filtered Metals (UG/L)		
Cobalt	**89.5**	**89.7**

Sample ID	IU14GP092428
Sample Date	09/16/08
Unfiltered Metals (UG/L)	
Cobalt	**112**
Filtered Metals (UG/L)	
Cobalt	**86.1**

Sample ID	IU14GP080408
Sample Date	09/18/08
Unfiltered Metals (UG/L)	
Cobalt	**44.8**
Filtered Metals (UG/L)	
Cobalt	**27.3**

Sample ID	IU14GP162428
Sample Date	08/01/08
Unfiltered Metals (UG/L)	
Cobalt	**534 K**
Filtered Metals (UG/L)	
Cobalt	**575**

Sample ID	IU14GP132428
Sample Date	08/05/08
Unfiltered Metals (UG/L)	
Cobalt	**48.9 K**
Filtered Metals (UG/L)	
Cobalt	**46.4**

Metals (UG/L)	95 % UTL Unfiltered Non-Turbid	95% UTL Filtered
Barium	254	114
Cobalt	39.6	13
Nickel	39	41.4

Sample ID	IU14GW09-0911	IU14GW090712
Sample Date	09/07/11	07/11/12
Unfiltered Metals (UG/L)		
Barium	**30.3**	**26.7**
Cobalt	**90.6**	**66.8**
Nickel	**44.5**	**32**
Filtered Metals (UG/L)		
Barium	**27.8**	**27.1**
Cobalt	**82.6**	**70.1**
Nickel	**40.5**	**34**

Sample ID	IU14GP012832
Sample Date	07/12/07
Unfiltered Metals (UG/L)	
Barium	**191 J**
Cobalt	**85.2 K**
Nickel	**45.4**
Filtered Metals (UG/L)	
Barium	**67.5 J**
Cobalt	**23.5 K**
Nickel	**11.8 J**

Sample ID	IU14GW07-0911	IU14GW070712
Sample Date	09/08/11	07/10/12
Unfiltered Metals (UG/L)		
Barium	**82.3**	**81.8**
Cobalt	**433**	**554**
Nickel	**37**	**42.1**
Filtered Metals (UG/L)		
Barium	**84.8**	**78.2**
Cobalt	**456**	**529**
Nickel	**37.9**	**38.4**

Sample ID	IU14GP102428
Sample Date	08/05/08
Unfiltered Metals (UG/L)	
Cobalt	**654 K**
Filtered Metals (UG/L)	
Cobalt	**26.8**

Sample ID	IU14GP112832
Sample Date	09/18/08
Unfiltered Metals (UG/L)	
Cobalt	**30**

Sample ID	IU14GP122630
Sample Date	08/05/08
Unfiltered Metals (UG/L)	
Cobalt	**38.1 K**
Filtered Metals (UG/L)	
Cobalt	**6.1**

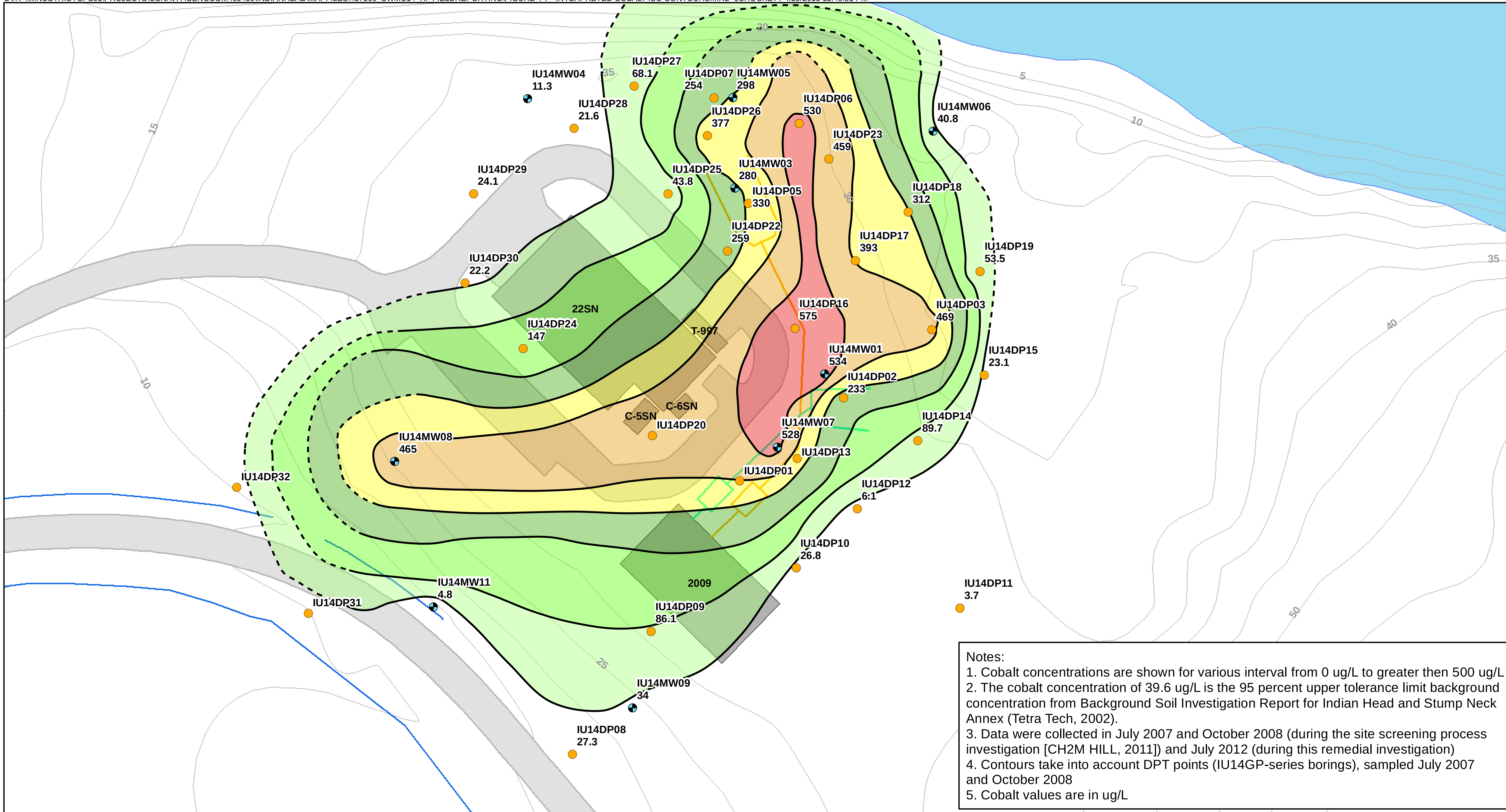
Legend

- SSP Direct Push Boring Groundwater Sample Location
- Monitoring Well Location
- Monitoring Well and Geotech Sample Location
- Approximate Site Boundary
- Elevation Contour (5 foot interval)
- Streams
- Fence Line
- Buildings
- Roads and Paved Areas

Notes:
Exceeds 95% Upper Tolerance Limit Values for Unfiltered, Non-Turbid or Filtered Background Groundwater
Bold indicates detections
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter

Figure 4-6
Site Related COPCs Detected in Groundwater
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\417366_SWMU14_RI_FIELDREPORTING\FIGURE 4-7 - INTERPRETED COBALT ISO CONTOURS.MXD JCROCKETT 4/29/2013 12:49:51 PM



Notes:
1. Cobalt concentrations are shown for various interval from 0 ug/L to greater then 500 ug/L
2. The cobalt concentration of 39.6 ug/L is the 95 percent upper tolerance limit background concentration from Background Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).
3. Data were collected in July 2007 and October 2008 (during the site screening process investigation [CH2M HILL, 2011]) and July 2012 (during this remedial investigation)
4. Contours take into account DPT points (IU14GP-series borings), sampled July 2007 and October 2008
5. Cobalt values are in ug/L

Legend

- DPT Groundwater Sample Locations
- Monitoring Well Location
- Streams
- Elevation Contour (5 foot interval)
- Older 4-inch Sewer Line
- Newer 4-inch Sewer Line
- Cobalt Isoconcentration Line (dashed where inferred)
- Buildings
- Roads and Paved Areas

Cobalt Isoconcentrations (ug/L)

- 39.7 - 100
- 100.1 - 200
- 200.1 - 300
- 300.1 - 400
- 400.1 - 500
- > 500.1

N

0 25 50 Feet

Figure 4-7
Interpreted Cobalt Isoconcentration Contour Map
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

CH2MHILL.

SECTION 5

Contaminant Fate and Transport

The fate and transport of individual chemical constituents depends on how the constituents interact with the physical, geochemical, and biological conditions that are encountered in the environment. This section describes the general processes controlling the fate and transport of contaminants in the environment and discusses how select constituents detected in specific environmental media at SWMU 14 tend to react to these processes.

Metals were detected in the surface soil and groundwater at the site. Discussion of every metal COPC is not practical in the scope of this report; therefore, the discussion of environmental fate and transport is limited to cobalt, which is the human health risk driver at SWMU 14.

5.1 Fate and Transport of Cobalt in Groundwater

Cobalt is a naturally occurring element in soil. Elevated concentrations of cobalt in soil and groundwater may result from anthropogenic activities such as the application of cobalt-containing sludge or phosphate fertilizers to soil, the disposal of cobalt-containing wastes, and atmospheric deposition from activities such as burning fossil fuels and smelting and refining metals. Cobalt adsorbs rapidly and strongly to soil and sediment in which it is retained by metal oxides, crystalline minerals, and natural organic matter. The mobility of cobalt depends on the nature of the soil or sediment; it increases with decreasing pH and redox potential and in the presence of chelating/complexing agents. Cobalt in water will sorb to particles and may settle into the sediment or be sorbed directly by sediment, or may precipitate out as carbonates and hydroxides or with mineral oxides (Agency for Toxic Substances and Disease Registry, 2004).

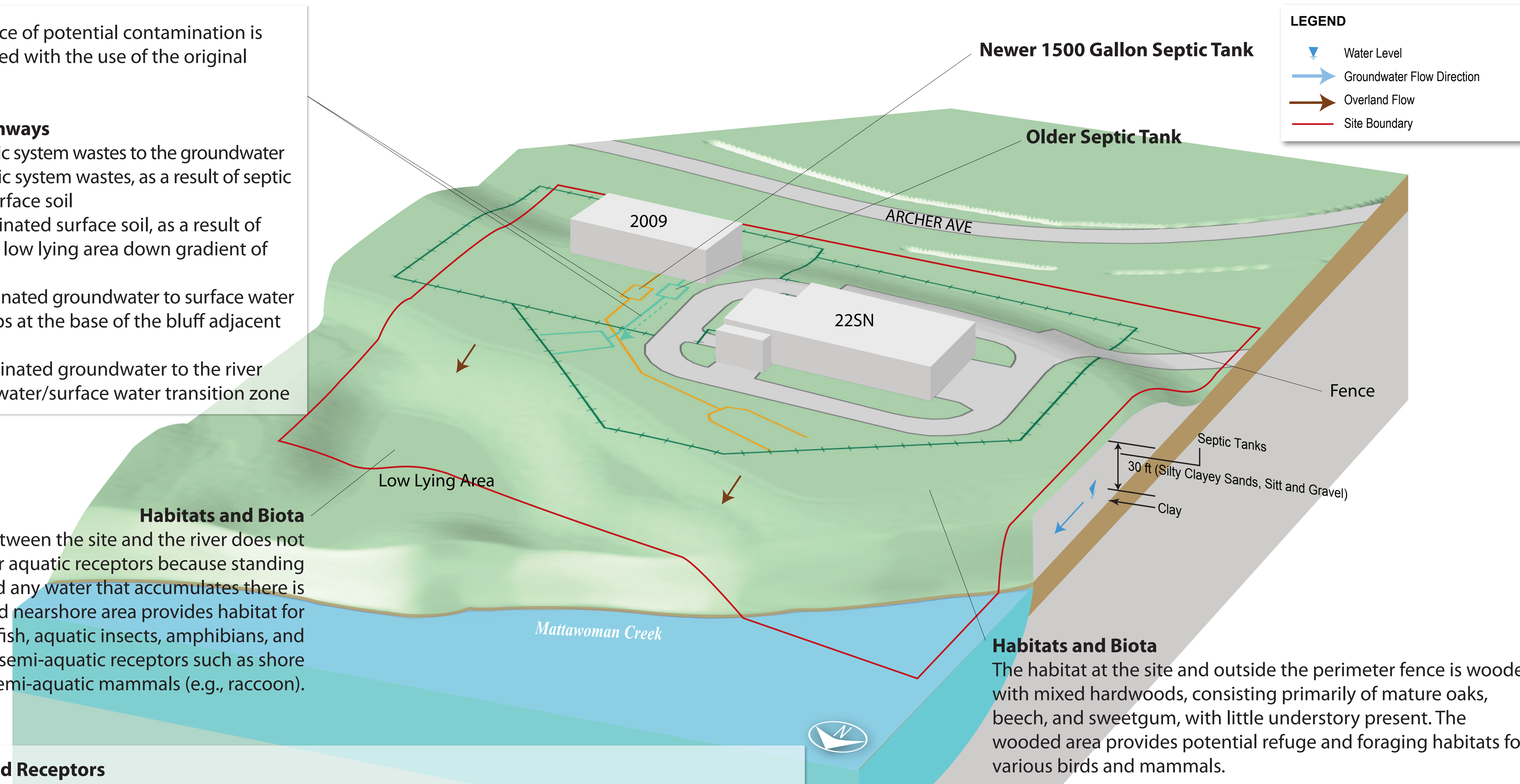
5.2 Conceptual Site Model

A conceptual site model (CSM) for SWMU 14 was developed to present a three-dimensional representation of the septic drain fields (i.e., source area), potential migration pathways, exposure routes, and receptors (Figure 5-1). The primary transport mechanisms from sources at SWMU 14 appear to be infiltration of the septic system wastes to the groundwater and subsequent discharge to the Potomac River, migration of the septic system wastes, as a result of septic tank overflows, to surface soil, and potential migration of surface soil as a result of overland flow to the low-lying area downgradient of the site boundary. The potential receptors for current human health exposure scenarios are described in Section 6.3. The potential receptors for ecological exposure are described in Section 7.2.

Source: The primary source of potential contamination is considered to be associated with the use of the original septic system.

Potential Migration Pathways

- Infiltration of the septic system wastes to the groundwater
- Migration of the septic system wastes, as a result of septic tank overflows, to surface soil
- Migration of contaminated surface soil, as a result of overland flow, to the low lying area down gradient of the site boundary
- Discharge of contaminated groundwater to surface water through surface seeps at the base of the bluff adjacent to the river
- Discharge of contaminated groundwater to the river through the groundwater/surface water transition zone



Habitats and Biota

The low lying area between the site and the river does not provide viable habitat for aquatic receptors because standing water is not present and any water that accumulates there is transitory. The shoreline and nearshore area provides habitat for aquatic biota, such as fish, aquatic insects, amphibians, and reptiles and habitat for semi-aquatic receptors such as shore birds and semi-aquatic mammals (e.g., raccoon).

Habitats and Biota

The habitat at the site and outside the perimeter fence is wooded with mixed hardwoods, consisting primarily of mature oaks, beech, and sweetgum, with little understory present. The wooded area provides potential refuge and foraging habitats for various birds and mammals.

Ecological Exposures and Receptors

A potential exposure pathway for aquatic organisms exists if groundwater discharges directly to the Potomac River. However, apparent groundwater seeps are present at the base of the bluff adjacent to the river; therefore, groundwater may not be upwelling through the near shore sediments, but rather discharging at these seep locations. Alternatively, groundwater may discharge via seeps and direct discharge to the river. These seeps are a likely exposure pathway for ecological receptors to site groundwater at the point of discharge. No fine grained sediment is present along the immediate shoreline of the site, but organisms inhabiting the sand and cobble habitat may be exposed to contaminants in pore water if groundwater is upwelling through the gravel and cobble.

Organisms might be exposed to chemicals present at the site through the following routes:

- Direct contact with soil
- Direct contact with seep water
- Direct contact with sediment pore water in the groundwater/surface water transition zone
- Ingestion of soil
- Ingestion of surface water
- Root uptake (plants)
- Ingestion of biota that have may have accumulated chemicals in their tissue from contaminated soil or surface water

Human Health Exposures and Receptors

Features	Receptors
Surface soil throughout the site (in the industrial area of the site and the low-lying area)	Current/future industrial workers and adult/adolescent trespasser/visitor exposed through incidental ingestion, dermal contact, and inhalation of particulate emissions from soil.
Groundwater	Hypothetical future resident using groundwater as a potable water supply exposed via ingestion and dermal contact; and future construction worker exposed via dermal contact.
Surface soil throughout the site (in the industrial area of the site and the low-lying area)	Future industrial workers, construction workers and adult/adolescent trespasser/visitor exposed through incidental ingestion, dermal contact, and inhalation of particulate emissions from soil.

FIGURE 5-1
Conceptual Site Model
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head, Maryland

SECTION 6
Baseline Human Health Risk Assessment

The baseline HHRA for SWMU 14 was conducted to evaluate the potential human health risks associated with exposure to surface soil and groundwater. Suburface soil was investigated as part of the SSP (CH2M HILL, 2009) and was not evaluated quantitatively in the HHRA. The risk screening evaluation in the SSP showed that exposure to subsurface soil was not expected to pose an unacceptable risk above background levels to human health. Therefore, further evaluation and assessment of risk associated with subsurface soil were not necessary. Groundwater was also investigated during the SSP, and it was concluded that there were potentially unacceptable risks associated with exposure to the groundwater, primarily associated with cobalt. Therefore, groundwater was further evaluated in the HHRA, using only the monitoring well groundwater samples collected during the RI. Surface soil, which had not been investigated during previous site investigations, was also sampled, and risks associated with exposure to the surface soil were evaluated in the HHRA.

6.1 Scope of Risk Assessment

The HHRA for SWMU 14 comprised the following components:

- **Identification of COPCs**—identifies and characterizes the distribution of COPCs found on the site. COPCs were the focus of the subsequent evaluation in the risk assessment.
- **Exposure Assessment**—identifies potential pathways by which exposure could occur, characterizes the potentially exposed populations (for example, residents), and estimates the magnitude, frequency, and duration of exposures to the COPCs.
- **Toxicity Assessment**—identifies the types of adverse health effects associated with exposure to COPCs and summarizes the relationship between magnitude of exposure and occurrence of adverse health effects (toxicity factors).
- **Risk Characterization**—integrates the results of the exposure assessment and toxicity assessment to estimate the potential risks to human health. Both cancer and non-cancer human health effects were evaluated.
- **Uncertainty Assessment**—identifies sources of uncertainty associated with the data, methodology, and the values used in the risk assessment.

These components are described in the following sections. The spreadsheets used to screen for COPCs and calculate estimated exposures and health risks associated with the COPCs are presented in Appendix G.

6.2 Identification of Chemicals of Potential Concern

The identification of COPCs includes data collection, data evaluation, and data screening steps. The data collection and evaluation steps involve gathering and reviewing the available site data and identifying a set of data that is of acceptable quality for the risk assessment. This data set is then further screened against concentrations that are protective of human health to reduce the data set to those chemicals and media of potential concern (the COPCs).

6.2.1 Data Selection and Evaluation

Section 2.2.2 summarizes the previous investigations at SWMU 14, and Section 3.1 summarizes the investigation activities conducted as part of this RI. Only the data collected during the RI were evaluated in the risk assessment. All analytical results evaluated in the HHRA were fully validated (see Section 4.2 and Appendix F). The following bullets discuss how validated, qualified results were evaluated in the risk assessment:

- Data qualified with a J (estimated) were treated as detected concentrations.
- Data qualified with a K or an L (value biased high or low, respectively) were treated as detected concentrations.
- Data qualified with a B (blank contamination) was used in the risk assessment as if they were not detected.
- For duplicate samples, the higher of the two concentrations was used.

Analytes for which no detected results are reported for a particular medium were not considered COPCs for that medium.

6.2.2 Data Summary

All of the data used in the risk assessment have been fully validated and are assumed to represent current conditions. Soil and groundwater data that were used in the HHRA are described in this section.

6.2.2.1 Surface Soil

Twelve surface soil samples were collected in September and October 2011 during the RI from from the unpaved areas within and surrounding the old and new septic system drain fields and from locations spaced across the low-lying wet area downgradient of the industrial area at the site. Sample locations were biased toward areas where runoff containing site contaminant(s) may have accumulated. The samples were analyzed for TAL metals (including mercury and cyanide). Eleven additional surface soil samples were collected in July 2012 and analyzed for total chromium and hexavalent chromium to further characterize the chromium detected in the 2011 surface soil samples. The surface soil samples were collected from a depth interval of 0 to 0.5 feet bgs. Soil sample locations are shown on Figure 3-1.

Table 6-1 summarizes each surface soil sample and the corresponding analysis. Analytical results for the samples are summarized in Table 4-2 and Appendix F.

6.2.2.2 Groundwater

Seven monitoring wells were installed during the RI within the shallow water-bearing unit throughout SWMU 14; six of the monitoring wells were installed in August 2011, and an additional monitoring well was installed in June 2012. Monitoring well locations were based on site hydrogeology and *in situ* groundwater analytical results from the SSP (CH2M HILL, 2009). As part of the SSP, two permanent monitoring wells were previously installed at SWMU 14, one within the older septic system drain field and one in the newer drain field. During the September 2011 RI field event, groundwater samples were collected from eight wells total, six newly installed monitoring wells (IU14MW04 through IU14MW09) and two previously installed monitoring wells (IU14MW01 and IU14MW03). Following the installation of the additional monitoring well in June 2011, samples were collected from nine wells total, seven new monitoring wells (IU14MW04 through IU14MW09 and IU14MW11) and two existing monitoring wells (IU14MW01 and IU14MW03) in July 2012. All groundwater samples collected during the September 2011 and July 2012 sampling event were analyzed for total and dissolved TAL metals (including mercury and cyanide). Monitoring well locations are shown on Figure 3-2. Unfiltered groundwater samples were evaluated in the HHRA because there was no significant difference between the filtered and unfiltered results, as demonstrated by no significant differences in aluminum, iron, and manganese concentrations in mutual samples filtered and unfiltered samples (EPA, 1992).

Table 6-1 summarizes the groundwater samples evaluated in the risk assessment and the corresponding laboratory analysis. Analytical results for the groundwater samples are summarized in Table 4-3 and Appendix F.

6.2.3 Selection of Chemicals of Potential Concern

All of the detected constituents were screened following the procedures described below. The selection of COPCs was based on the criteria presented in the EPA *Region III Technical Guidance Manual, Selection of*

Exposure Routes and Contaminants of Concern by Risk-Based Screening (EPA, 1993b), and Risk Assessment Guidance for Superfund (RAGS) Part D (EPA, 2001).

The maximum detected concentration of each constituent for each medium was compared to the criteria discussed below to select the COPCs. If the maximum concentration exceeded the criteria, the constituent was identified as a COPC. Constituents that were not detected in any of the samples or were detected at concentrations less than the criteria were not retained as COPCs.

Detection limits for constituents that were not detected were also compared to the screening levels discussed in Section 6.6.1, the uncertainty assessment.

- **Comparison with Health-based Criteria for Surface Soil:** The maximum detected constituent concentrations in surface soil were compared to EPA residential soil regional screening levels (RSLs) (EPA, 2012a). RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents that affect the same target organ (for example, kidney). RSLs based on carcinogenic effects were used as presented in the RSL table. Lead concentrations in soil were compared to the EPA residential child lead soil screening value of 400 milligrams per kilogram (mg/kg) (EPA, 1994).
- **Comparison with Health-Based Criteria for Groundwater:** Groundwater data were compared to the EPA tap water RSLs (EPA, 2012a). RSLs that are based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table. Lead concentrations in groundwater were compared to the federal action level for drinking water of 15 micrograms per liter (μg/L) (EPA, 2009).
- **Essential Human Nutrients:** Constituents that are considered essential nutrients, present at low concentrations (only slightly elevated above naturally occurring levels) and toxic only at very high doses, were eliminated from the quantitative risk analysis. These constituents are calcium, magnesium, potassium, and sodium. Although iron and manganese are also considered essential nutrients and are only toxic at very high doses, they were included in the HHRA because toxicity values are available.

6.2.4 COPCs

Table 6-2 identifies the constituents that were selected as COPCs based on the screening methodology described above for surface soil and groundwater. Details of the screening process are shown in the screening tables, Tables 2.1 through 2.3, in Appendix G. Eight metals (aluminum, arsenic, hexavalent chromium, cobalt, iron, manganese, nickel, and thallium) in surface soil exceeded the RSLs and were identified as COPCs. No constituents were retained as COPCs for the fugitive emissions from the surface soil pathway. For groundwater, seven metals (arsenic, cadmium, cobalt, iron, manganese, nickel, and thallium) exceeded the RSLs and were selected as COPCs.

6.3 Exposure Assessment

Exposure refers to the potential contact of an individual with a chemical. The exposure assessment identifies pathways and routes by which an individual may be exposed to the COPCs and estimates the magnitude, frequency, and duration of potential exposure. Contaminant fate and transport was discussed in Section 5, which described the potential release mechanisms at the site. A conceptual exposure model showing potential exposure scenarios identified under current and potential future conditions is presented in Figure 6-1. The following subsections discuss the three components of exposure assessment:

- Characterization of exposure setting
- Identification of exposure pathways
- Quantification of exposure

6.3.1 Characterization of Exposure Setting

Characterizing an exposure setting consists of two parts: (1) identifying the physical characteristics of the site as they relate to exposure, and (2) characterizing human populations on or near the site.

Basic facility characteristics such as physical setting, climate, and groundwater hydrology were summarized in Section 2. Potentially exposed populations are identified based on their locations relative to the site, their activity patterns, and the presence of potentially sensitive subpopulations.

6.3.1.1 Current Land Use

SWMU 14 is on the north side of the Stump Neck Annex portion of NSF-IH, approximately 300 feet south of the Potomac River (Figure 2-2). In general, SWMU 14 is a topographically flat area atop a small hill and covers approximately 2.4 acres. The site is within an industrial area and is currently used for industrial activities. The low- lying area downgradient of the site is not used as an industrial area. The site contains a photographic laboratory (Building 22SN), x-ray facility (Building 2009), and two associated septic tanks, discharge lines, and drain fields (Figure 2-2). The x-ray facility is currently in use. The photographic laboratory is vacant. Currently, neither of the septic systems at the site is in use.

The current industrial workers at the site could contact the surface soil across the site. Because access to SWMU 14 is not restricted, adult and adolescent trespassers/visitors could access the site and contact the surface soil across the site.

6.3.1.2 Potential Future Land Use

The site is currently used for industrial activities and potential future site use is expected to stay the same. It is unlikely that the site will be developed for additional future industrial use or residential use. However, for a conservative evaluation of potential future risks, residential use was evaluated as a potential future site use.

The future industrial workers at the site could be exposed to the surface soil. It was assumed a future trespasser (adult and adolescent) might be exposed to this soil. And although unlikely, it was assumed the site could be used for future residential development, and future residents could contact site surface soil. Future excavation or construction activities at the site may also expose construction workers to the surface soil.

Groundwater is not anticipated to be used as a future potable water supply at the Annex. However, the groundwater data from the site were used as a conservative assessment of groundwater quality for the future residential exposure scenario and industrial worker scenario. Also, future construction or excavation activities at the site could result in construction worker exposure to the groundwater.

6.3.2 Identification of Exposure Pathways

An exposure pathway can be described as a mechanism that moves a COPC from its source to an exposed population or individual, referred to as a receptor. An exposure pathway must be complete or exposure cannot occur. A complete exposure pathway has five elements:

- Source (for example, chemical residues in soil)
- Mechanism for release and migration of chemical (for example, runoff, leaching)
- Environmental transport medium (for example, soil, groundwater)
- Point or site of potential human contact (exposure point—for example, contact with soil)
- Route of intake (for example, incidental ingestion of soil)

All five elements must be present for a pathway to be considered complete. If one or more elements are not present, then the pathway is incomplete and there is no possibility of exposure. The following subsections discuss the elements as they pertain to SWMU 14.

6.3.2.1 Contaminant Sources

Sources at SWMU 14 include the site septic systems. For an unknown time period (not continuously), photographic development chemicals, containing metals, were discharged to the original site septic system. Silver-contaminated waste fixer from the x-ray facility is now treated onsite for silver recovery before being released to the sanitary line with the wash water and developer. Discharges from the septic systems may have contaminated the soil and/or groundwater in the vicinity of the drain fields.

6.3.2.2 Release and Transport Mechanisms

The fate and transport of chemicals in soil and groundwater are determined by physical characteristics of the site as well as by the chemical and physical properties of the constituents. A detailed description of the fate and transport of contaminants is presented in Section 5.

The primary transport mechanisms from sources at SWMU 14 appear to be infiltration of the septic system wastes to the groundwater, migration of the septic system wastes, as a result of septic tank overflows, to surface soil, and migration of contaminated surface soil, as a result of overland flow, to the low-lying area downgradient of the site boundary.

6.3.2.3 Potential Exposure Points and Exposure Routes

Exposure points are locations where humans could come in contact with contamination. Onsite exposure points include surface soil and groundwater.

Potential exposure routes were evaluated for potential current and future site use. Existing and potential exposure pathways are illustrated in the CSM (Figure 6-1). Exposure scenarios and potentially complete pathways of exposure evaluated in this risk assessment are identified in Table 1, Appendix G.

Current Exposure Routes

The only contaminated medium currently accessible at the site is surface soil. Based on current site use, potential receptors for this medium are:

- **Industrial Worker —** Incidental ingestion of and dermal contact with surface soil.
- **Trespasser/Visitor (adult and youth) —** Incidental ingestion of and dermal contact with surface soil.

Future Exposure Routes

The potential future use of the site was discussed in Section 6.3.1.2. The future land use exposure routes include current exposure routes and the following receptors:

- **Resident (adult and child) —** Incidental ingestion of and dermal contact with surface soil, ingestion of groundwater, and dermal contact with groundwater while showering/bathing.
- **Construction Worker —** Incidental ingestion of and dermal contact with surface soil, and dermal contact with groundwater while in an excavation.
- **Industrial Worker —** Incidental ingestion of and dermal contact with surface soil, and ingestion of groundwater.

6.3.3 Quantification of Exposure

Exposure is quantified by estimating the exposure point concentrations (EPCs) and chemical intake by the receptors for both reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios. CTE scenarios were only evaluated when the RME scenario hazards and/or risks exceeded EPA acceptable risk levels (see Section 6.5).

6.3.3.1 Exposure Point Concentrations

EPCs are estimated constituent concentrations that a receptor may contact and are specific to each exposure medium. EPCs may be directly measured or estimated using environmental fate and transport models. Constituent concentrations in surface soil and groundwater were measured for this assessment. Fate and transport modeling conducted for the risk assessment included estimating fugitive dust from soil for the COPC screening process following the methods in EPA's soil screening guidance document (EPA, 2002), as shown in Table 2.2 in Appendix G.

The RME EPCs were calculated as the 95 percent upper confidence limit (95 percent UCL) of the arithmetic mean concentration. ProUCL software Version 4.1.0.1 (EPA, 2011) was used to determine the distribution that the data fit and to calculate the 95 percent UCLs used as the RME and CTE EPCs. ProUCL identifies three possible data distributions: normal distribution, log-normal distribution, and gamma distribution. The 95 percent UCL calculation method is then selected based on the data distribution (normal, log-normal, gamma, or nonparametric if the data do not fit any of the distributions). The recommendations outlined in the ProUCL software documentation were followed to select the appropriate 95 percent UCL to use as the EPC (EPA, 2010). The maximum detected concentration was used as the EPC in cases where the estimated 95 percent UCL was greater than the maximum detected concentration.

The data qualifiers were handled as discussed in Section 6.2.1. The EPCs are included in Appendix G, Tables 3.1 and 3.2.

6.3.3.2 Estimation of Chemical Intakes for Individual Pathways

Chemical intake is the amount of a chemical contaminant entering the receptor's body. Chemical intakes for the ingestion and dermal pathways are generally expressed as follows:

$$I = \frac{C\ x\ CR\ x\ EF\ x\ ED}{BW\ x\ AT}\ (mg/kg/day)$$

Where:

I = intake (mg/kg-day)

C = chemical concentration at exposure point (mg/L, mg/kg)

CR= contact rate, or amount of contaminated medium contacted per unit time or event (L/day, mg/event)

EF= exposure frequency (days/year)

ED= exposure duration (years)

BW= body weight of exposed individual (kg)

AT= averaging time, or period over which exposure is averaged (days)

For the dermal pathway, the contact rate usually incorporates the skin surface area in contact with the exposure medium, and an absorption factor. The intake equation for the dermal exposure pathway is shown in the Appendix G, Table 4 series.

The intake and exposure equations require exposure parameters that are specific to each exposure pathway. Many of the exposure parameters have default values, which were used for this assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and duration, are provided in EPA guidance (1989, 1991, 1997a, 2002, and 2004a).Other assumptions (for example, for the visitor/trespasser scenarios) require consideration of location-specific information and were determined using professional judgment. Appendix G, Tables 4.1.RME through 4.3.RME, present the RME exposure factors that were used for the exposure scenarios that were evaluated in the risk assessment. RME scenario exposure parameters were compiled for all scenarios; CTE parameters (presented in Appendix G, Tables 4.1.CTE and 4.2.CTE) were compiled only for scenarios where the RME risk for an environmental medium was greater than EPA's noncarcinogenic hazard or carcinogenic risk target levels (target organ-specific hazard index (HI) >1, and excess lifetime cancer risk (ELCR) >1 × 10^{-4}).

For residential exposure, lifetime age-adjusted intakes were calculated for carcinogenic COPCs. Age-adjusted exposure factors were calculated using the equations presented in the EPA RSLs (EPA, 2011a) and shown in Tables 4.2.RME, 4.3.RME, 4.1.CTE, and 4.2.CTE in Appendix G.

The dermal exposure model presented in EPA's dermal exposure assessment guidance (EPA, 2004a) was used to estimate dermal exposure to groundwater. The values for parameters used in this model were obtained from this guidance document and are included in the RAGS Part D Table 7 series (for example, chemical specific permeability constant) and RAGS Part D Table 4 series (for example, event time) (EPA, 2001) in Appendix G. The dermal exposure method presented in the EPA guidance for soil (EPA2004a) was used to estimate dermal exposure to soil. This method includes the use of a chemical-specific dermal absorption factor (DABS). The DABS values used in the risk calculations were obtained from this guidance and resulted in a DABS of 0.03 for arsenic, and a DABS of 0.01 for other metals.

6.4 Toxicity Assessment

Toxicity assessment defines the relationship between the magnitude of exposure and possible severity of adverse effects, and weighs the quality of available toxicological evidence. Toxicity assessment generally consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of evaluating the potential adverse effects from exposure to the chemical along with the type of health effect involved. 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. Toxicity criteria (for example, reference doses [RfDs] and cancer slope factors [CSFs]) used in the risk assessment were derived from the dose-response relationship.

EPA recommends that a tiered approach be used to obtain the toxicity values (RfDs and CSFs) that are used to estimate noncarcinogenic and carcinogenic risks (EPA, 2003a). The hierarchy of toxicity value sources is the following:

1. Integrated Risk Information System (EPA, 2012b)
2. Provisional Peer-Reviewed Toxicity Values (PPRTV)
3. Other EPA and non-EPA sources, including the National Center for Environmental Assessment , Agency for Toxic Substances and Disease Registry, Health Effects Assessment Summary Tables (EPA 1997b), California EPA , and EPA's Office of Water, New Jersey Department of Environmental Protection chromium workgroup (2009)

The use in an HHRA of toxicity values from sources other than the Integrated Risk Information System increases the uncertainty of the quantitative risk estimates. Some of the COPCs elicit both systemic (noncarcinogenic) toxic effects and cancer (carcinogenic) effects. Because of this, these constituents are evaluated as both noncarcinogens and carcinogens. The health risks for carcinogenic and noncarcinogenic effects were estimated separately based on different toxicity values.

6.4.1 Toxicity Information for Noncarcinogenic Effects

Noncarcinogenic health effects include a variety of toxic effects on body systems, ranging from toxicity to the kidneys to central nervous system disorders. Noncarcinogenic health effects are grouped into two basic categories: acute toxicity and chronic toxicity. Acute toxicity can occur after a single exposure (usually at high doses), and the effect is most often seen immediately. Chronic toxicity generally occurs after repeated exposure (usually at low doses) and is seen weeks, months, or years after the initial exposure. The toxicity of a chemical is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations.

EPA (1989) defines the chronic RfD as a dose that is likely to be without appreciable risk of deleterious effects during a lifetime of exposure. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (for example, 7 years to a lifetime), and consider uncertainty in the toxicological data base and sensitive receptors. Chronic RfDs may be overly protective if used to evaluate the potential for adverse health effects resulting from short-term exposure. EPA's National Center for Environmental Assessment develops subchronic RfDs for short-term exposure (2 weeks to 7 years). Subchronic RfDs have been peer-reviewed by EPA and outside reviewers, but they have not undergone verification by an intra-agency workgroup, and as a result are considered interim rather than verified toxicity values. Subchronic RfDs were used for the construction worker scenario because the exposure duration is 1 year. Chronic RfDs were used to evaluate the noncarcinogenic risks to all other receptors evaluated in the risk assessment.

In the development of RfDs, all available studies examining the toxicity of a chemical following exposure are considered based on their scientific merit. The lowest dose level at which an observed toxic effect is occurring is identified as the lowest observed adverse effect level (LOAEL) and the dose at which no effect is observed is identified as the no observed adverse effect level (NOAEL). Several uncertainty factors (UFs) may be applied to account for uncertainties such as limited data, extrapolation of data from animal studies to human exposures, or the use of subchronic studies to develop chronic criteria. These UFs range between 1 and 3,000 and are based on professional judgment. Therefore, there are varying degrees of uncertainty in the toxicity criteria.

EPA-derived oral RfDs and associated UFs and modifying factors for the COPCs are listed in Table 5.1 in Appendix G.

Following EPA guidance, oral RfDs were adjusted from administered doses to absorbed doses (dermal) to evaluate dermal toxicity. When appropriate, the RfDs were adjusted using oral absorption factors (EPA, 2004a). The oral RfDs were converted to dermal RfDs by multiplying by the gastrointestinal (GI) absorption factor. If a chemical-specific GI absorption factor was not available or was greater than 50 percent, a GI absorption factor of 100 percent was assumed. The dermal RfDs are included in Table 5.1, Appendix G.

6.4.2 Toxicity Information for Carcinogenic Effects

Potential carcinogenic effects are quantified using oral CSFs that convert estimated exposure directly to incremental lifetime carcinogenic risks.

CSFs may be derived from the results of chronic animal bioassays, human epidemiological studies, or both. Animal bioassays are usually conducted at dose levels that are much higher than are likely to be encountered in the environment. This study design detects possible adverse effects in the relatively small test populations used in the studies. The actual risks from exposure to a potential carcinogen are not likely to exceed the estimated risks and are probably much lower or even zero. EPA-derived CSFs are listed in Table 6.1 in Appendix G. In accordance with EPA guidance, oral CSFs were adjusted from administered doses to absorbed doses to evaluate dermal toxicity. When appropriate, the CSFs were adjusted using oral absorption factors from EPA (2004a). The oral CSFs were converted to dermal CSFs by dividing by the GI absorption factor. If a chemical-specific GI absorption factor was not available or was greater than 50 percent, a GI absorption factor of 100 percent was assumed. The dermal CSFs are presented in Table 6.1, Appendix G.

6.4.3 Approach for Potential Mutagenic Effects

For COPCs that act via a mutagenic mode of action (MMOA), cancer risks were estimated using age-dependent adjustment factors (ADAFs), consistent with cancer guidelines and supplemental guidance (EPA, 2005a, 2005b). In the HHRA, hexavalent chromium was the only analyte categorized as a chemical with a MMOA (McCarrol, et al., 2010). The calculation of cancer risk using ADAFs is presented in Table 7.6.RME Supplement A in Appendix G. Because chemical-specific data are not available for hexavalent chromium, default ADAFs, as included in the EPA Region III memorandum *Derivation of RBCs for Carcinogens That Act via a Mutagenic Mode of Action and Incorporate Default ADAFs* (EPA, 2006), were used for the MMOA evaluation. The default ADAFs used to adjust the CSFs are 10 for infants to 2-year-olds, 3 for 2- to 6-year-olds, 3 for 6- to 12-year-olds, and 1 for 16- to 30-year-olds. The CSF was multiplied by the appropriate ADAF to derive the age-specific CSF for a receptor to calculate the total carcinogenic risk. Additionally, the exposure factors for children 0–2 years old and 2–6 years old were assumed to be the same as the parameters for a child 0–6 years old, with the exception of the exposure duration, which was instead 2 years and 4 years, respectively. The exposure factors for the adult residential receptor were used for residents 6–16 years old and 16–30 years old, with the exception of the exposure durations, which were 10 years and 14 years, respectively.

6.5 Risk Characterization

Risk characterization combines the results of the previous elements of the risk assessment to evaluate the potential health risks associated with exposure to the COPCs. The calculated risk is then used as an integral component in remedial decision making.

6.5.1 Risk Estimation Methods

Potential human health risks are discussed independently for carcinogenic and noncarcinogenic effects because of the different toxicological endpoints, relevant exposure duration, and methods used to characterize risk.

6.5.1.1 Noncarcinogenic Risk Estimation

Noncarcinogenic health risks are estimated by comparing the calculated exposures to RfDs. The calculated intake divided by the RfD is equal to the hazard quotient (HQ):

$$HQ = Intake / RfD$$

The intake and RfD represent the same exposure period (chronic or subchronic) and the same exposure route (oral intakes are divided by oral RfDs; dermal intakes are divided by dermal RfDs). An HQ that exceeds one (intake exceeds the RfD) indicates that there is a potential for adverse health effects associated with exposure to that constituent.

To assess the potential for noncarcinogenic health effects posed by exposure to multiple chemicals and multiple exposure pathways, an HI approach is used (EPA, 1986). This approach assumes that noncarcinogenic hazards associated with exposure to more than one chemical and pathway are additive (HI = sum of the HQs). Synergistic or antagonistic interactions between chemicals are not considered. The HI may exceed one even if all of the individual HQs are less than one. If the HI is greater than 1, separate HIs are estimated for each target organ to assess whether the HI for a specific target organ is greater than 1. A target-organ-specific HI greater than 1 indicates that there is some potential for adverse noncarcinogenic health effects associated with exposure to the COPCs, possibly warranting remedial action. If the HI for each target organ does not exceed 1, noncarcinogenic hazards are not expected.

6.5.1.2 Carcinogenic Risk Estimation

The potential for carcinogenic effects due to exposure to site-related contamination is evaluated by estimating the ELCR, which is the incremental increase in the probability of developing cancer during one's lifetime in addition to the background probability of developing cancer associated with exposure to all non-site-related carcinogens.

The carcinogenic risk is calculated by multiplying the intake by the CSF:

$$ELCR = Intake \times CSF$$

The combined risk from exposure to multiple chemicals at a site was evaluated by adding the risks from individual chemicals. Risks were also added across the pathways if an individual would be exposed through multiple pathways.

When a cumulative carcinogenic risk to an individual receptor under the assumed RME exposure conditions at a site exceeds 100 in a million (10^{-4} excess cancer risk), CERCLA generally requires remedial action to reduce risks at the site (EPA, 1991). If the cumulative risk is less than 10^{-4}, action generally is not required, but may be warranted if a risk-based chemical-specific standard, for example, maximum contaminant level, is exceeded. A risk-based remedial decision could be superseded by the presence of an environmental impact requiring action at the site.

6.5.2 Risk Assessment Results

The results of the risk characterization are presented below by receptor group. A summary of the RME results is shown in Table 6-3 and a summary of the CTE results is shown in Table 6-4. CTE risks were calculated when the RME hazards exceeded 1 or the cancer risks exceeded 10^{-4}.

The noncarcinogenic hazards and carcinogenic risks are calculated in Appendix G, Tables 7.1.RME through 7.8.RME, and 7.1.CTE through 7.3.CTE. Tables 9.1.RME through 9.8.RME in Appendix G summarize the RME total potential risks to each receptor. Tables 9.1.CTE through 9.3.CTE in Appendix G summarize the CTE total potential risks to each receptor that had risks that exceeded an HI of 1 or exceeded a carcinogenic risk of 1×10^{-4}. Tables 10.1.RME through 10.3.RME and Tables 10.1.CTE through 10.3.CTE in Appendix G summarize only the constituents of concern (COCs), the chemicals that contribute an HI above 0.1 to a total target organ HI greater than 1, or a cancer risk greater than 1×10^{-6} to a total carcinogenic risk greater than 1×10^{-4}.

The risk estimates for each receptor group are summarized below and compared to EPA's target HI of 1 and target ELCR range of 1×10^{-6} to 1×10^{-4}. Noncarcinogenic hazards less than 1 are below EPA's noncarcinogenic goal of protection of an HI of 1. Carcinogenic risks between or below 1×10^{-6} to 1×10^{-4} are within EPA's acceptable carcinogenic risk levels.

Noncarcinogenic hazards and carcinogenic risks were calculated for each of the receptors. However, carcinogenic risks were calculated for the combined adult and child resident (not individual for the adult and child resident) to estimate the lifetime carcinogenic risks to the resident.

6.5.2.1 Current Industrial Worker (Table 9.1.RME, Appendix G)

The risk assessment assumed that a current industrial worker could be exposed to surface soil at SWMU 14 through incidental ingestion and dermal contact.

The RME noncarcinogenic hazard associated with exposure to the surface soil (HI = 0.1) is less than EPA's target HI of 1. The RME carcinogenic risk associated with exposure to the surface soil (ELCR = $3x10^{-6}$) is within EPA's target risk range of $1×10^{-6}$ to $1×10^{-4}$.

6.5.2.2 Current/Future Adult Trespasser/Visitor (Table 9.2.RME, Appendix G)

The risk assessment assumed that a current/future adult trespasser/visitor could be exposed to surface soil at SWMU 14 through incidental ingestion and dermal contact.

The RME noncarcinogenic hazard associated with exposure to the surface soil (HI = 0.03) is less than EPA's target HI of 1. The RME carcinogenic risk associated with exposure to the surface soil (ELCR = $5x10^{-7}$) is below EPA's target risk range of $1×10^{-6}$ to $1×10^{-4}$.

6.5.2.3 Current/Future Adolescent Trespasser/Visitor (Table 9.3.RME, Appendix G)

The risk assessment assumed that a current/future adolescent trespasser/visitor could be exposed to surface soil at SWMU 14 through incidental ingestion and dermal contact.

The RME noncarcinogenic hazard associated with exposure to the surface soil (HI = 0.04) is less than EPA's target HI of 1. The RME carcinogenic risk associated with exposure to the surface soil (ELCR = $4x10^{-7}$) is below EPA's target risk range of $1×10^{-6}$ to $1×10^{-4}$.

6.5.2.4 Future Resident Adult (Tables 9.4.RME and 9.1.CTE, Appendix G)

The risk assessment assumed that potential future adult residents living onsite would be exposed to surface soil through incidental ingestion and dermal contact, and to groundwater through ingestion and dermal contact while showering.

The total RME noncarcinogenic hazard associated with exposure to the surface soil and groundwater (HI = 35) exceeds EPA's target HI of 1. The hazard is associated with exposure to groundwater (HI = 35), and primarily with cobalt, the only COPC with an HI greater than 1, detected in the groundwater. The only COC for groundwater (the COPCs which contribute an HI > 0.1 to a total target organ HI > 1) is cobalt. The HI associated with exposure to soil (HI = 0.2) is less than the target HI.

The CTE noncarcinogenic hazard associated with exposure to the soil and groundwater (HI = 16) also exceeds EPA's target HI of 1. Again, the hazard is associated with exposure to groundwater (HI =16), and primarily cobalt.

6.5.2.5 Future Resident Child (Tables 9.5.RME and 9.2.CTE, Appendix G)

The risk assessment assumed that potential future child residents living onsite would be exposed to surface soil through incidental ingestion and dermal contact, and to groundwater through ingestion and dermal contact while showering.

The total RME noncarcinogenic hazard associated with exposure to the surface soil and groundwater (HI = 83) exceeds EPA's target HI of 1. The hazard is primarily associated with exposure to groundwater (HI = 81), and primarily with cobalt (HI = 78, the only COPC with an HI greater than 1. The only COC for groundwater (a COPC which contribute an HI > 0.1 to a total target organ HI > 1) is cobalt. The HI associated with exposure to soil (HI = 2) exceeds the target HI; however, no individual target organ HIs exceeded 1 associated with exposure to surface soil alone.

The CTE noncarcinogenic hazard associated with exposure to the soil and groundwater (HI = 55) also exceeds EPA's target HI of 1. Again, the hazard is associated with exposure to cobalt in groundwater (HI =52).

6.5.2.6 Future Lifetime Resident (Table 9.6.RME, Appendix G)

The risk assessment assumed that a potential future lifetime resident living onsite could be exposed to surface soil at SWMU 14 through incidental ingestion and dermal contact, and to groundwater through ingestion and dermal contact.

The total RME carcinogenic risk associated with exposure to the surface soil and groundwater (ELCR = $8x10^{-5}$) is within EPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$.

6.5.2.7 Future Construction Worker (Table 9.7.RME, Appendix G)

The risk assessment assumed that a future construction worker could be exposed to surface soil through incidental ingestion and dermal contact and to groundwater through dermal contact with water in an excavation pit.

The total RME noncarcinogenic hazard associated with exposure to the soil and groundwater (HI = 0.3) is less than EPA's target HI of 1. The total RME carcinogenic risk associated with exposure to the soil and groundwater (ELCR = $2x10^{-7}$) is below EPA's target risk range of 1×10^{-6} to 1×10^{-4}.

6.5.2.8 Future Industrial Worker (Tables 9.8.RME and 9.3.CTE, Appendix G)

The risk assessment assumed that a future industrial worker could be exposed to surface soil through incidental ingestion and dermal contact and to groundwater through ingestion.

The total RME noncarcinogenic hazard associated with exposure to the soil and groundwater (HI = 13) exceeds EPA's target HI of 1. The hazard is primarily associated with exposure to groundwater (HI = 12), and primarily with cobalt, the only COPC with an HI greater than 1, which was identified as a COC. The HI associated with exposure to soil (HI = 0.2) is less than the target HI. The total RME carcinogenic risk associated with exposure to the soil and groundwater (ELCR = $7x10^{-5}$) is within EPA's target risk range of 1×10^{-6} to 1×10^{-4}.

The CTE noncarcinogenic hazard associated with exposure to the soil and groundwater (HI = 11) also exceeds EPA's target HI of 1. Again, the hazard is associated with exposure to cobalt in groundwater (HI =10).

6.6 Uncertainty Associated with HHRA

The risk measures used in HHRAs are not fully probabilistic estimates of risk, but are conditional estimates given that a set of assumptions about exposure and toxicity are realized. Therefore it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective (EPA, 1989).

6.6.1 General Uncertainty in COPC Selection

The sampling conducted at SWMU 14 generally focused on areas of known or suspected impact from past site use, based on previous sampling information and past use of the site. Therefore, the uncertainty in sampling and the possibility of missing a location affected by site constituents are expected to be minimal. The uncertainty associated with the data analysis is minimal because the data were fully validated before use in the risk assessment.

The general assumptions used in the COPC selection process were conservative to ensure that true COPCs were not eliminated from the quantitative risk assessment and that the highest possible risk was estimated. RSLs based on residential assumptions were used to select the COPCs for all of the scenarios, including non-residential scenarios.

A comparison of site concentrations to background concentrations was not used to select the COPCs, in accordance with EPA Region III guidance. This may result in the inclusion of risks that may be associated with background conditions and are not necessarily site-related. For instance, aluminum, arsenic, cobalt, iron, manganese, and thallium were selected as COPCs in surface soil, and iron and manganese were selected as COPCs in groundwater; however, all detected concentrations of these constituents were less than the 95 percent UTL background concentration.

Constituents that were not detected in any of the samples within an environmental medium were not selected as COPCs. Reporting limits for constituents that were not detected were compared to the screening levels. In soil, cyanide was the only constituent not detected; the maximum reporting limit was less than the screening level. In groundwater, three constituents were not detected (chromium, cyanide, and silver). Of these, chromium and cyanide had reporting limits greater than the screening limits.

6.6.2 Uncertainty Associated with Exposure Assessment

The most significant source of uncertainty associated with the exposure assessment is the underlying assumption that contact with affected media would occur under current land use conditions, and that the land use and human activity patterns assumed for the hypothetical future scenarios would occur. There is no information to suggest that trespassers/visitors currently at NSF-IH routinely come into contact with affected media in the course of their daily activities (or will in the future); therefore, the generic exposure assumptions used to evaluate exposure are likely to overestimate current (and future) exposure.

Most of the exposure pathways analyzed were assumed, and exposure factors used for quantification of exposure are conservative and reflect worst-case or upper-bound assumptions on the exposure. Most of the exposure pathways evaluated for SWMU 14 are hypothetical and are not likely to occur in the future. SWMU 14 is not expected to be used for residential use, so the inclusion of this receptor in the assessment is conservative.

The percent of a chemical absorbed through the skin is likely to be affected by many parameters. Some of the parameters include soil loading, soil moisture content, organic content, pH, and presence of other constituents. The availability of a chemical depends on site-specific fate and transport properties of the chemical species available for eventual absorption of skin. Chemical concentrations, specific properties of the chemical, and soil release kinetics all affect the amount of a chemical that is absorbed. These factors contribute to the uncertainty associated with these estimates and make quantification of the amount of certain chemicals absorbed from soil difficult.

6.6.3 Uncertainty Associated with Toxicity Assessment

Uncertainty associated with the noncarcinogenic toxicity factors is included in the toxicity tables (Appendix G, Tables 5.1 and 6.1). EPA applies several UFs to extrapolate dose points from animal studies to humans, ranging between 1 and 3,000. Additional modification factors are used on the basis of EPA's professional judgment. Therefore, there is a high degree of uncertainty in the noncarcinogenic toxicity criteria based on the available scientific data for each constituent. The noncarcinogenic toxicity factors used in the HHRA are expected to be overestimates of actual toxicity.

CSFs developed by EPA represent upper-bound estimates. Carcinogenic risks generated in this assessment should be regarded as an upper-bound estimate on the potential carcinogenic risks. The true ELCR is likely to be less than the predicted value (EPA, 1989). Uncertainty is also associated with the application of the MMOA for chromium; this may overestimate or underestimate risks. Generic ADAFs were used in the MMOA calculations because there are no chromium-specific ADAFs available.

Use of provisional or withdrawn toxicity factors increases the uncertainty of the quantitative hazard and risk estimates. Provisional toxicity values (New Jersey and PPRTV) were used in the HHRA. A provisional RfD from PPRTV was used to estimate the noncarcinogenic risks associated with cobalt in groundwater, the only COC identified in the HHRA. The provisional values were used to provide a quantitative estimate rather than a merely qualitative risk discussion; however, EPA has not fully promulgated these toxicity values.

There is uncertainty associated with the oral–to-dermal adjustment factors (based on constituent-specific GI absorption factors) used to transform the oral RfDs and CSFs based on administered doses to dermal RfDs and CSFs based on absorbed doses. It is not known if the adjustment factor results in an underestimation or overestimation of the actual toxicity associated with dermal exposure.

6.6.4 Uncertainty in Risk Characterization

The uncertainties identified in each component of risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and constituents contributes to uncertainty based on chemical interactions such as additivity, synergism, potentiation, and susceptibility of exposed receptors.

6.7 Summary

The HHRA was conducted to evaluate the potential human health risks associated with the presence of site-related constituents in surface soil and groundwater at SWMU 14. Potential risks were calculated for a current and future industrial worker and adult and adolescent trespasser, and future adult resident, child resident, lifetime resident, and construction worker.

Appendix G, Tables 9.1.RME through 9.8.RME and Tables 9.1.CTE through 9.3.CTE summarize the RME and CTE potential hazards and risks to each receptor. Appendix G, Tables 10.1.RME through 10.3.RME, and 10.1.CTE through 10.3.CTE show only the constituents that contributed HIs greater than 0.1 to total HIs greater than 1, or carcinogenic risks greater than $1x10^{-6}$ to total carcinogenic risks greater than $1x10^{-4}$.

There are no risks or hazards that exceed EPA acceptable risk levels for the current industrial worker and the current or future adult and adolescent trespasser/visitor exposed to site surface soil, or the future lifetime resident or future construction worker exposed to surface soil and groundwater. There are non-carcinogenic hazards for future industrial and hypothetical residential use of the site associated with exposure to groundwater.

The following receptors had total RME noncarcinogenic hazards and/or carcinogenic risks that exceeded EPA's target levels:

- Future adult resident exposed to surface soil and groundwater (noncarcinogenic hazard exceeds EPA's target HI, associated with groundwater)
- Future child resident exposed to surface soil and groundwater (noncarcinogenic hazard exceeds EPA's target HI, associated with groundwater)
- Future industrial worker exposed to surface soil and groundwater (carcinogenic risk exceeds EPA's target HI, associated with groundwater).

The COCs (the risk drivers) associated with each medium are presented in Table 6.3. The COCs are COPCs that pose an HI greater than 0.1 to a scenario with total target organ HI greater than 1, or pose a carcinogenic risk greater than $1x10^{-6}$ to a scenario with a total carcinogenic risk greater than $1x10^{-4}$. The COCs are summarized below:

- Surface soil
  - Noncarcinogenic COCs - none
  - Carcinogenic COCs – none
- Groundwater
  - Noncarcinogenic COCs – cobalt (HI>1)
  - Carcinogenic COCs - none

TABLE 6-1
Summary of Data Used in Baseline Human Health Risk Assessment
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Sample Location	SampleID	Date of Sampling	Parameters
Surface Soil			
IU14SS01	IU14SS01-000H	09/09/11	Total Metals
IU14SS01	IU14SS01P-000H[1]	09/09/11	Total Metals
IU14SS02	IU14SS02-000H	09/09/11	Total Metals
IU14SS03	IU14SS03-000H	09/08/11	Total Metals
IU14SS04	IU14SS04-000H	10/07/11	Total Metals
IU14SS05	IU14SS05-000H	10/07/11	Total Metals
IU14SS06	IU14SS06-000H	10/07/11	Total Metals
IU14SS06	IU14SS06P-000H[1]	10/07/11	Total Metals
IU14SS07	IU14SS07-000H	09/09/11	Total Metals
IU14SS08	IU14SS08-000H	09/08/11	Total Metals
IU14SS09	IU14SS09-000H	09/08/11	Total Metals
IU14SS09	IU14SS09A0001	07/11/12	Hexavalent and Total Chromium
IU14SS09	IU14SS09AP0001[1]	07/11/12	Hexavalent and Total Chromium
IU14SS10	IU14SS10-000H	09/08/11	Total Metals
IU14SS10	IU14SS10P-000H[1]	09/08/11	Total Metals
IU14SS10	IU14SS10A0001	07/11/12	Hexavalent and Total Chromium
IU14SS11	IU14SS11-000H	09/09/11	Total Metals
IU14SS12	IU14SS12-000H	09/09/11	Total Metals
IU14SS13	IU14SS130001	07/11/12	Hexavalent and Total Chromium
IU14SS14	IU14SS140001	07/11/12	Hexavalent and Total Chromium
IU14SS15	IU14SS150001	07/11/12	Hexavalent and Total Chromium
IU14SS16	IU14SS160001	07/11/12	Hexavalent and Total Chromium
IU14SS17	IU14SS170001	07/11/12	Hexavalent and Total Chromium
IU14SS18	IU14SS180001	07/11/12	Hexavalent and Total Chromium
IU14SS19	IU14SS190001	07/11/12	Hexavalent and Total Chromium
IU14SS20	IU14SS200001	07/11/12	Hexavalent and Total Chromium
IU14SS20	IU14SS20P0001[1]	07/11/12	Hexavalent and Total Chromium
IU14SS21	IU14SS210001	07/11/12	Hexavalent and Total Chromium
Groundwater			
IU14MW01	IU14GW01-0911	09/08/11	Total Metals, Dissolved Metals
IU14MW01	IU14GW01P-0911[1]	09/08/11	Total Metals, Dissolved Metals
IU14MW01	IU14GW010712	07/10/12	Total Metals, Dissolved Metals
IU14MW01	IU14GW01P0712[1]	07/10/12	Total Metals, Dissolved Metals
IU14MW03	IU14GW03-0911	09/08/11	Total Metals, Dissolved Metals
IU14MW03	IU14GW030712	07/10/12	Total Metals, Dissolved Metals
IU14MW04	IU14GW04-0911	09/09/11	Total Metals, Dissolved Metals
IU14MW04	IU14GW040712	07/11/12	Total Metals, Dissolved Metals

TABLE 6-1
Summary of Data Used in Baseline Human Health Risk Assessment
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Sample Location	SampleID	Date of Sampling	Parameters
Groundwater (cont'd)			
IU14MW05	IU14GW05-0911	09/06/11	Total Metals, Dissolved Metals
IU14MW05	IU14GW050712	07/10/12	Total Metals, Dissolved Metals
IU14MW06	IU14GW06-0911	09/06/11	Total Metals, Dissolved Metals
IU14MW06	IU14GW060712	07/10/12	Total Metals, Dissolved Metals
IU14MW07	IU14GW07-0911	09/08/11	Total Metals, Dissolved Metals
IU14MW07	IU14GW070712	07/10/12	Total Metals, Dissolved Metals
IU14MW08	IU14GW08-0911	09/09/11	Total Metals, Dissolved Metals
IU14MW08	IU14GW080712	07/11/12	Total Metals, Dissolved Metals
IU14MW09	IU14GW09-0911	09/07/11	Total Metals, Dissolved Metals
IU14MW09	IU14GW090712	07/11/12	Total Metals, Dissolved Metals
IU14MW11	IU14GW110712	07/11/12	Total Metals, Dissolved Metals

Notes:

[1]Duplicate of preceeding sample.

TABLE 6-2
Summary of COPCs
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Surface Soil
Aluminum
Arsenic
Chromium (VI)
Cobalt
Iron
Manganese
Nickel
Thallium
Groundwater
Arsenic
Cadmium
Cobalt
Iron
Manganese
Nickel
Thallium

TABLE 6-3

Summary of RME Cancer Risks and Hazard Indices

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1	COCs[1]
Current Industrial Worker	Surface Soil	Ingestion	2E-06			Arsenic	0.1		None
		Dermal Contact	8E-07				0.02		
		Inhalation	N/A				N/A		
		Total	3E-06			Arsenic	0.1		
	All Media	Total	3E-06			Arsenic	0.1		
Current/Future Trespasser/Visitor Adult	Surface Soil	Ingestion	4E-07				0.03		None
		Dermal Contact	9E-08				0.003		
		Inhalation	N/A				N/A		
		Total	5E-07				0.03		
	All Media	Total	5E-07				0.03		
Current/Future Trespasser/Visitor Adolescent	Surface Soil	Ingestion	2E-07				0.03		None
		Dermal Contact	1E-07				0.01		
		Inhalation	N/A				N/A		
		Total	4E-07				0.04		
	All Media	Total	4E-07				0.04		
Future Resident Adult	Surface Soil	Ingestion	N/A				0.2		None
		Dermal Contact	N/A				0.02		
		Inhalation	N/A				N/A		
		Total	N/A				0.2		
	Groundwater	Ingestion	N/A				35	Cobalt	Cobalt
		Dermal Contact	N/A				0.1		
		Inhalation	N/A				N/A		
		Total	N/A				35	Cobalt	
	All Media	Total	N/A				35	Cobalt	Cobalt
Future Resident Child	Surface Soil	Ingestion	N/A				2		None
		Dermal Contact	N/A				0.1		
		Inhalation	N/A				N/A		
		Total	N/A				2		
	Groundwater	Ingestion	N/A				81	Cobalt	Cobalt
		Dermal Contact	N/A				0.4		
		Inhalation	N/A				N/A		
		Total	N/A				81	Cobalt	
	All Media	Total	N/A				83	Cobalt	Cobalt
Future Resident Child/Adult	Surface Soil	Ingestion	1E-05			Arsenic, Chromium (VI)	N/A		None
		Dermal Contact	4E-06			Chromium (VI)	N/A		
		Inhalation	N/A				N/A		
		Total	2E-05			Arsenic, Chromium (VI)	N/A		
	Groundwater	Ingestion	7E-05		Arsenic	Arsenic	N/A		None
		Dermal Contact	4E-07				N/A		
		Inhalation	N/A				N/A		
		Total	7E-05		Arsenic		N/A		
	All Media	Total	8E-05		Arsenic	Chromium (VI)	N/A		None

TABLE 6-3

Summary of RME Cancer Risks and Hazard Indices

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1	COCs[1]
Future Construction Worker	Surface Soil	Ingestion	1E-07				0.1		None
		Dermal Contact	2E-08				0.03		
		Inhalation	N/A				N/A		
		Total	2E-07				0.2		
	Groundwater	Ingestion	N/A				N/A		None
		Dermal Contact	1E-08		Arsenic		0.1		
		Inhalation	N/A				N/A		
		Total	1E-08		Arsenic		0.1		
	All Media	Total	2E-07		Arsenic		0.3		None
Future Industrial Worker	Surface Soil	Ingestion	2E-06			Arsenic	0.1		None
		Dermal Contact	5E-05		Arsenic, Chromium (VI)		0.09		
		Inhalation	N/A				N/A		
		Total	6E-05		Arsenic, Chromium (VI)		0.2		
	Groundwater	Ingestion	2E-05		Arsenic		12	Cobalt	Cobalt
		Dermal Contact	N/A				N/A		
		Inhalation	N/A				N/A		
		Total	2E-05		Arsenic		12	Cobalt	
	All Media	Total	7E-05		Arsenic		13	Cobalt	Cobalt

Notes:

[1] Includes analytes with an ELCR greater than 1E-06 that contribute to a total risk greater than 1E-04 and/or analytes with HI greater than 0.1 that contribute to a target organ HI greater than 1.

COC = Contaminants of concern

ELCR = Excess Lifetime Cancer Risk

N/A = Not available/not applicable

TABLE 6-4

Summary of CTE Cancer Risks and Hazard Indices

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Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1	COCs[1]
Future Resident Adult	Surface Soil	Ingestion	N/A				0.06		None
		Dermal Contact	N/A				0.0016		
		Inhalation	N/A				N/A		
		Total	N/A				0.06		
	Groundwater	Ingestion	N/A				16	Cobalt	Cobalt
		Dermal Contact	N/A				0.04		
		Inhalation	N/A				N/A		
		Total	N/A				16	Cobalt	
	All Media	Total	N/A				16	Cobalt	Cobalt
Future Resident Child	Surface Soil	Ingestion	N/A				0.5		None
		Dermal Contact	N/A				0.01		
		Inhalation	N/A				N/A		
		Total	N/A				0.5		
	Groundwater	Ingestion	N/A				54	Cobalt	Cobalt
		Dermal Contact	N/A				0.1		
		Inhalation	N/A				N/A		
		Total	N/A				54	Cobalt	
	All Media	Total	N/A				55	Cobalt	Cobalt
Future Industrial Worker	Surface Soil	Ingestion	3E-07				0.05		None
		Dermal Contact	2E-06				8E-03		
		Inhalation	N/A				N/A		
		Total	2E-06				0.06		
	Groundwater	Ingestion	5E-06				11	Cobalt	Cobalt
		Dermal Contact	N/A				N/A		
		Inhalation	N/A				N/A		
		Total	5E-06				11	Cobalt	
	All Media	Total	7E-06				11	Cobalt	Cobalt

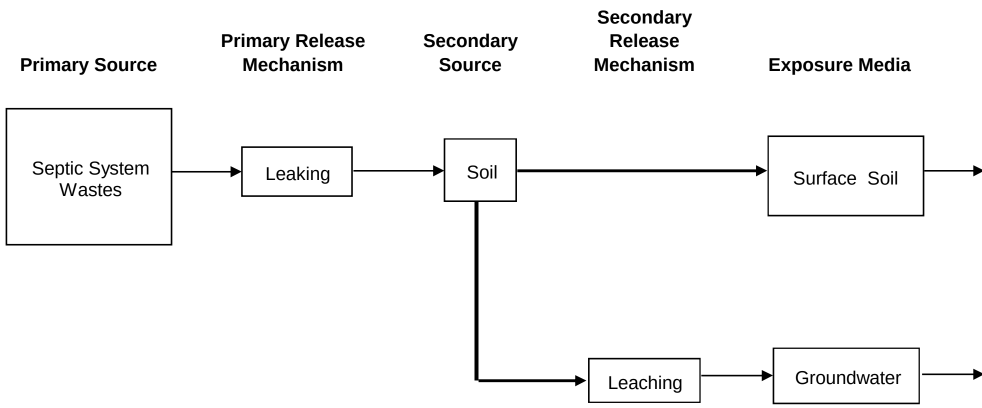
Notes:

[1] Includes analytes with an ELCR greater than 1E-06 that contribute to a total risk greater than 1E-04 and/or analytes with HI greater than 0.1 that contribute to a target organ HI greater than 1.

COC = Contaminants of concern

ELCR = Excess Lifetime Cancer Risk

N/A = Not available/not applicable



Potential Human Receptors

Exposure Media	Exposure Route	Current/Future: Industrial Worker	Current/Future: Trespasser/ Visitor Adult	Current/Future: Trespasser/ Visitor Adolescent	Future: Construction Worker	Future: Resident Adult	Future: Resident Child
Surface Soil	Ingestion	X	X	X	X	X	X
Surface Soil	Dermal Contact	X	X	X	X	X	X
Surface Soil	Inhalation	X	X	X	X	X	X
Groundwater	Ingestion	X[1]	NA	NA	NA	X	X
Groundwater	Dermal Contact	NA	NA	NA	X	X	X
Groundwater	Inhalation	NA	NA	NA	NA	NA	NA

[1] Groundwater evaluated for future use only.
NA - Not Applicable or pathway is incomplete
X - Potentially complete exposure pathways

FIGURE 6-1
Conceptual Site Model for HHRA
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SECTION 7

Ecological Risk Assessment (Steps 1–3A)

7.1 Introduction

This section discusses the SERA, which included Steps 1 and 2 of the ecological risk assessment (ERA) process, and the first step (Step 3A) of a baseline ecological risk assessment (BERA) for SWMU-14.

7.1.1 Ecological Risk Assessment Process

The ERA was conducted in accordance with the *Navy Policy for Conducting Ecological Risk Assessments* (Chief of Naval Operations [CNO], 1999) and the Navy guidance for implementing this policy (NAVFAC, 2012). The Navy ERA policy and guidance, which describe a process consisting of eight steps organized into three tiers, are conceptually similar to the 8-step ERA process outlined in EPA ERA guidance for the Superfund program (EPA, 1997c). For both sets of guidance, Steps 1 and 2 involve conducting a SERA using very conservative assumptions. The BERA represents Steps 3 through 7. The BERA uses more-realistic assumptions and site-specific data to refine the risk estimates from the SERA for components that fail the initial screen. Step 8 addresses risk management issues. The major differences between the Navy ERA policy/guidance and the EPA ERA guidance are: (1) the Navy policy/guidance provides clearly defined criteria for exiting the ERA process at specific points; (2) the Navy policy/guidance divides Step 3 (the first step of the BERA) into two distinct sub-steps (Steps 3A and 3B), with a potential exit point after Step 3A; and (3) the Navy policy/guidance incorporates risk management considerations throughout all tiers of the ERA process.

ERAs are conducted using a tiered, step-wise approach and are punctuated with Scientific Management Decision Points (SMDPs). SMDPs represent points in the ERA process where agreement on conclusions, actions, or methodologies is needed so that the ERA process can continue (or terminate) in a technically defensible manner. The results of the ERA at a particular SMDP are used to decide how the ERA process should proceed— for example, to the next step in the process or directly to a later step. The process continues until a final decision has been reached (for example, remedial action if unacceptable risks are identified, or no further action if risks are acceptable). The process can also be iterative if data needs are identified at any step; the needed data are collected and the process starts again at the point appropriate to the type of data collected.

The screening problem formulation is the first step of an ERA and establishes the goals, scope, and focus of the SERA. Step 1 of the ERA process is intended to answer two main questions: (1) do complete exposure pathways exist?; and (2) are sufficient data available to conduct the SERA? If no complete exposure pathways exist, the ERA process terminates at Step 1 with a conclusion of negligible (acceptable) risk because exposure, and therefore potential risk, can only occur if complete exposure pathways exist. If one or more complete exposure pathways are known to exist, or are likely to exist, the ERA process continues to Step 2 but only evaluates those pathways that have been determined to be “critical” (ecologically important)—that is, they represent exposures to sensitive receptors associated with the predominant fate and transport mechanisms at the site (EPA, 1997c). Available data are then evaluated to determine if they are adequate to support the SERA. If not, additional data are collected before the ERA process continues. The second step of the ERA process involves conducting a screening exposure assessment, a screening effects assessment, and a screening risk calculation (risk characterization).

The results of the SERA are used to evaluate the potential for unacceptable ecological risks based on conservative assumptions. If the results of the SERA suggest that further ecological risk evaluation is warranted, the ERA process proceeds to the BERA (Steps 3 through 7), which is a more-detailed phase of the ERA process, for the pathways, chemicals, receptors, and areas identified in the SERA. As indicated above, the first step of the BERA (Step 3) is divided into two distinct sub-steps (3A and 3B) in Navy ERA guidance.

Step 3 of the EPA ERA guidance consists of the following activities (EPA, 1997c):

1. Refinement of the COPCs from the SERA.
2. Further characterizing the potential ecological effects of contaminants.
3. Refining information on contaminant fate and transport, complete exposure pathways, and receptors potentially at risk.
4. Selecting assessment endpoints.
5. Refining the CSM and risk hypotheses from the SERA.

Step 3A of the Navy policy/guidance corresponds to the first activity listed above for the EPA ERA guidance. In Step 3A, a refined evaluation of exposure estimates is conducted using more-realistic assumptions and additional methodologies relative to those used in the SERA, which is intended to be a very conservative assessment. Examples of more-realistic exposure assumptions include using central tendency (that is, mean) estimates (rather than maximums) for media concentrations, bioaccumulation factors, and exposure parameters. Examples of additional methodologies include the consideration of background concentrations, bioavailability, and detection frequency (CNO, 1999; NAVFAC, 2001).

If risk estimates (and their associated uncertainty) are acceptable following Step 3A, the site will meet the conditions of the exit criterion specified in the Navy policy/guidance. If the Step 3A evaluation does not support a determination of acceptable risk within acceptable uncertainty, evaluation of the site continues to Step 3B.

Step 3B of the Navy policy/guidance corresponds conceptually to the last four activities listed above for Step 3 of the EPA ERA guidance. In Step 3B, the preliminary CSM from the SERA is refined based on the results of the Step 3A evaluation to develop a revised list of key receptors, critical exposure pathways, key COPCs, assessment endpoints, measurement endpoints, and risk hypotheses. Based upon the refined CSM, the lines of evidence to be used in characterizing risk are determined. Agreement on the refined conceptual model, COPCs, exposure pathways, endpoints, and risk hypotheses constitutes the SMDP at the end of Step 3 in both Navy and EPA ERA guidance.

Following the completion of Step 3, a decision point is reached, with two potential outcomes. If the refined risk estimates are acceptable for each selected assessment endpoint, the investigation proceeds to risk characterization (Step 7) to document this conclusion, and the ERA process terminates. If the uncertainties associated with the refined risk estimates are unacceptable and/or the risk estimates indicate that unacceptable risks may exist, site-specific studies might be required and the ERA process continues (Steps 4 through 6). Step 4 is a work planning step in which additional site-specific studies are scoped and designed. Step 5 consists of the verification of the field sampling design developed in Step 4, and Step 6 constitutes the site investigation and data analysis phase of the process. The scope (for example, spatial extent of sampling) and components (for example, collection of biological data, such as tissue samples, toxicity testing, etc.) of any site-specific studies are determined by the conclusions of Step 3 and the pathways/endpoints associated with the potential unacceptable risks.

Step 7 consists of the documentation and synthesis of the information and data identified in Steps 1 through 3 (no additional study) or Steps 1 through 6 (additional study). In this step, risk is evaluated and characterized using both quantitative and qualitative methods. Conclusions are made as to whether there is a reasonable potential for unacceptable ecological risk, and if there is a potential for unacceptable ecological risk, the magnitude of that risk. The results of the completed BERA (Step 7) are used to make any necessary risk management decisions (Step 8) related to current or future risks. Possible decisions include:

- Adequate information is available to conclude that no unacceptable ecological risks exist. The assessment should stop at Step 7.

- Adequate information is available to conclude that unacceptable ecological risks exist for which remedial actions or controls are warranted. Whether remedial actions or controls are taken, and the specific actions or controls taken, will depend upon a number of risk management factors such as the results of HHRAs (if applicable) and the potential impact of the remedial action or control itself on the habitats and biota present. This analysis would occur as part of Step 8.
- Adequate information is not available to estimate risk or the risk estimate is believed to be too conservative or uncertain to recommend remediation. The assessment should be refined.

7.2 Screening-level Problem Formulation

The products of screening level problem formulation are the preliminary CSM and the preliminary assessment and measurement endpoints. The purpose of the CSM is to describe how ecological receptors may be exposed to chemical constituents present at the site. Development of the CSM requires the identification and description of major habitats and potential ecological receptors, media of concern, and potential contaminant sources. These elements (sources and receptors) and an understanding of how chemicals move through the local environment (transport mechanisms and exposure routes) are used to build the CSM.

7.2.1 Environmental Setting

Stump Neck SWMU 14 encompasses 2.4 acres and consists of a photographic laboratory (Building 22SN), x-ray facility (Building 2009), and two associated septic tanks, discharge lines, and drain fields, as shown in Figure 2-2. The original septic tank system was constructed in approximately 1968. The potential source of contamination is believed to be associated with use of the original septic tank system. Photographic development chemicals containing metals were discharged for an unknown period to the original septic system. The septic effluent from the original septic tank was chlorinated before discharging to the Potomac River. The original septic tank was documented as being abandoned in place.

The new septic system eliminated surface discharges to the Potomac River and handled sanitary wastewater from Building 22SN. Waste fixer from the x-ray facility, which contained silver, was treated onsite for silver recovery and then released to the septic system with the wash water and developer. In 1998, the drain field became clogged by an overload of sewage into the system, causing floating solids to rise through the tank and clog the downstream drainpipes. This resulted in periodic backups of sewage from the septic tank into Building 22SN. Since 2002, Buildings 22SN and 2009 have been connected to a pipeline that conveys sanitary and process wastewater from each building to the NSF-IH wastewater treatment plant; therefore, neither of the septic systems has been in use since 2002.

The habitat at the site and outside the perimeter fence is wooded with mixed hardwoods, consisting primarily of mature oaks, beech, and sweetgum, with little understory present (Photograph 7- 1). The wooded area provides potential refuge and foraging habitats for various birds and mammals. The low-lying area between the site and the river does not provide viable habitat for aquatic receptors because standing water is not present and any water that accumulates there is transitory. The shoreline and near-shore area provide habitat for aquatic biota such as fish, aquatic insects, amphibians, and reptiles, and habitat for receptors such as shore birds and semi-aquatic mammals (for example, raccoon).

7.2.2 Data Used in the ERA

The groundwater and surface soil data collected to support this RI (in 2011 and 2012) were quantitatively evaluated in the ERA. Because ecological exposures are generally confined to the top 2 feet of the soil column, available soil data were generally confined to this depth range as surface samples (typically 0 to 6 inches). Ecological receptors are generally not exposed to subsurface soil deeper than 5 feet. Historical subsurface soil data from deeper depths were available but were not considered in this ERA.

Although ecological receptors do not typically have direct exposure to groundwater, groundwater data collected as part of the RI were also evaluated in the ERA to provide a conservative evaluation of the potential for significant contaminant transport via groundwater to downgradient receiving water bodies, in this case the Potomac River.

The samples used in the ERA are shown on Figures 3-1 and 3-2. The raw analytical data for these samples can be found in Appendix F.

7.2.2.1 Preliminary CSM

The ecological CSM relates potentially exposed receptor populations with potential source areas based on physical site characteristics and complete exposure pathways. Important components of the CSM are the identification of potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptors. Actual or potential exposures of ecological receptors associated with a site are determined by identifying the most likely, and most important, mechanisms and pathways of contaminant release and transport. A complete exposure pathway requires the following: a source or sources of contamination that result in a release to the environment; a pathway and mechanism of chemical transport through an environmental medium; and an exposure or contact point for ecological receptors where the contamination can be taken up via one or more exposure routes. Key components of this model are discussed in the following subsections.

Contaminant Source Areas

The sources of potential contamination at SWMU 14 are the two septic systems shown on Figure 2-2. These potential source areas are discussed in more detail in Section 2.

Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby site-related chemicals, once released, may be transported from a source to ecologically relevant media (such as surface soil) where exposures may occur. These transport pathways are shown on Figure 7-1.

The primary release mechanisms and transport pathways at the site are:

- Infiltration of septic system wastes to groundwater and subsequent discharge to surface seeps at the base of the bluff adjacent to the river and to the surface water of the Potomac River
- Possible migration of the septic system wastes, as a result of septic tank overflows, to surface soil
- Possible migration of contaminated surface soil, as a result of overland flow, to the low-lying area downgradient of the site boundary
- Uptake from the surface soil and accumulation in the tissues of terrestrial biota
- Uptake from surface water and accumulation in the tissues of aquatic biota

Exposure media for ecological receptors are typically limited to surface water, surface sediment, and surface soil. Surface water and sediment were not evaluated in this ERA because the site does not contain water bodies or wetlands with standing water and the shoreline along the Potomac River is composed of cobble and gravel substrate with no fine sediment present (Photograph 7-2). Subsurface soils (deeper than 5 feet bgs) were not evaluated because ecological receptors are not exposed to soils at these depths. Groundwater is generally considered only as a transport medium because there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep. In the ERA, groundwater was evaluated as a potential transport medium to the Potomac River.

Exposure Pathways and Routes

An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure routes. Exposure, and therefore potential risk, can only occur if complete exposure pathways exist. Figure 7-1 shows the potentially complete exposure pathways to ecological receptors associated with SWMU 14, which include:

- Direct contact with site-related chemicals in surface soil for lower-trophic-level receptors (for example, plants and soil invertebrates)
- Potential ingestion of site-related chemicals via the food chain by avian and mammalian terrestrial receptors
- Potential direct contact with site-related chemicals in seep or surface water resulting from discharge of groundwater
- Potential ingestion of site-related chemicals via the food chain by avian and mammalian semi-aquatic receptors

There are no complete exposure pathways for aquatic receptors on the site due to the lack of aquatic habitats on the actual site. However, groundwater was evaluated as a potential transport medium to the Potomac River and receptors were evaluated for possible exposure to site-related chemicals in surface water at the point of groundwater discharge. There is no fine-grained sediment present along the immediate shoreline of the site, but organisms inhabiting the gravel and cobble habitat may be exposed to contaminants in pore water if groundwater is upwelling through the gravel and cobble. However, based on the site stratigraphy (Figure 4-3) this transport pathway is not complete because the confining clay layer prevents upwelling of groundwater directly to the riverbed. The silty clayey sand and silt unit represents a limited groundwater-bearing zone within the hill that discharges to the seeps near the base of the bluff several feet above the river water surface elevation. Although groundwater is discharging to the river through the seeps, there is no direct groundwater/surface water interface at the point of discharge. Therefore, aquatic organisms are potentially exposed to chemicals in site groundwater after the seep water mixes with the river water.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are dermal contact, direct uptake, ingestion, and inhalation. Terrestrial plants may be exposed to chemicals present in surface soils through their root surfaces during water and nutrient uptake. Terrestrial invertebrates may be exposed to chemicals in surface soil through dermal contact and ingestion.

Animals may be exposed to chemicals through the: (1) inhalation of gaseous chemicals or of chemicals adhered to airborne particulate matter; (2) incidental ingestion of contaminated abiotic media (soil) during feeding or preening activities; (3) ingestion of contaminated water; (4) ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These routes, where applicable, are depicted on Figure 7-1.

Incidental ingestion of soil and sediment and exposure via food webs are the primary exposure routes for upper-trophic-level receptors (birds and mammals). The contribution to the total dose from the inhalation route is generally insignificant for upper-trophic-level ecological receptors relative to ingestion pathways. Therefore, the air pathway is not generally considered for ecological receptors. Exposure to chemicals present in surface soil via dermal contact may occur but is unlikely to represent a major exposure pathway for most upper-trophic-level receptors because fur or feathers minimize transfer of chemicals across dermal tissue. Incidental ingestion of surface soil during feeding, preening, or grooming activities is, however, considered in the risk estimates. Direct contact is considered for lower-trophic-level receptors (soil invertebrates).

Direct ingestion of groundwater is only considered when a permanent or semi-permanent source of water with salinity below 15 parts per thousand exists on a site. There are no permanent or semi-permanent sources of surface water on the site. Therefore, exposure via direct ingestion of drinking water was not included in this ERA.

Receptors

Because of the complexity of natural systems, it is generally not practical to directly assess the potential impacts to all ecological receptors present at a site. Therefore, specific receptor species (for example, red-tailed hawk) or species groups (for example, plants) are selected as surrogates to evaluate potential risks to larger components of the ecological community (guilds; such as carnivorous birds) used to represent the assessment endpoints (for example, survival and reproduction of carnivorous birds). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site
- Have a particular ecological, economic, or aesthetic value
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present for which complete exposure pathways are likely to exist
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations

The following upper-trophic-level receptor species were selected for exposure modeling based on the criteria listed above:

- Mourning dove (*Zenaida macroura*) - terrestrial avian herbivore
- American robin (*Turdus migratorius*) - terrestrial avian omnivore
- Red-tailed hawk (*Buteo jamaicensis*) - terrestrial avian carnivore
- Spotted sandpiper (*Actitis macularia*) - semi-aquatic avian insectivore
- Meadow vole (*Microtus pennsylvanicus*) - terrestrial mammalian herbivore
- Short-tailed shrew (*Blarina brevicauda*) - terrestrial mammalian vermivore
- Red fox (*Vulpes vulpes*) - terrestrial mammalian carnivore
- Raccoon (*Procyon lotor*) – semi-aquatic mammalian omnivore

Upper-trophic-level receptor species quantitatively evaluated in the ERA were limited to birds and mammals, the taxonomic groups with the most available information regarding exposure and toxicological effects. Lower-trophic-level receptor species were evaluated based on those taxonomic groupings for which soil screening values have been developed. As such, specific species of plants or soil invertebrates in terrestrial habitats were not chosen as receptors because of the limited information available for specific species and because these receptors were evaluated on a community level via a comparison of chemical concentrations in soil-to-soil screening values.

Soil invertebrates may be exposed to contaminants in the soil through dermal contact and ingestion. Because these organisms are the prey base for other animals, they also represent an exposure source through the bioaccumulation of contaminants in their bodies. Similarly, small mammals, amphibians, fish, and reptiles may accumulate contaminants in their tissue, becoming a possible exposure source for upper-trophic-level receptors (carnivorous birds and mammals).

Amphibians and reptiles are an applicable receptor group. Individual species of amphibians and reptiles were not, however, selected for evaluation because of the general lack of available toxicological information for this taxonomic group for direct effects and effects from exposures via food webs. Potential risks to amphibians and reptiles from food web exposures were evaluated using other fauna (birds and mammals) as surrogates. Similarly, potential risks to this group from direct exposures to surface soil were evaluated using soil screening values developed for other taxonomic groups (described above). This is discussed further in Section 7.6 (uncertainties).

Assessment and Measurement Endpoints

The conclusion of the problem formulation includes the selection of ecological endpoints and risk hypotheses, which are based on the CSM. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process (EPA, 1997c). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in EPA (1997c) and discussed in detail in Suter (1989, 1990, and 1993). Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses when exposed to contaminants.

Endpoints define ecological attributes that are to be protected (assessment endpoints) and measurable characteristics of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has occurred or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to a site (EPA, 1997c). Assessment endpoints contain an entity (for example, shrew population) and an attribute of that entity (for example, survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself. Effects on individual organisms are important for some receptors, such as rare and endangered species; population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. Therefore, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. As a result, receptor species (for example, American robin) or species groups are often selected as surrogates to evaluate potential risks to larger components of the ecological community (feeding guilds; for example, omnivorous birds) represented in the assessment endpoints (for example, survival and reproduction of carnivorous birds). However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values designed to protect the majority of the components of a community (for example, ambient water quality criteria for the protection of aquatic life) can be useful in evaluating potential community- and/or population-level effects.

Table 7-1 shows the assessment endpoints, risk hypotheses, and measurement endpoints used in the ERA.

7.2.3 Screening-level Effects Evaluation

The effects assessment defines the methods and data used to define an adverse ecological effect. For the ERA, effects data were available from multiple lines of evidence:

- **Ecological Screening Values (ESVs) for Surface Soil** - Analytical surface soil data were compared to the literature-based surface soil screening values described in Section 7.3.1. Two sets of surface soil screening values were used —one set used to assess potential risk for direct contact lower-trophic-level receptors (soil invertebrates and terrestrial plants) and one set used in a preliminary screening step for upper-trophic-level receptors. The screening methodology is described in Section 7.5.

- **ESVs for Surface Water** - Analytical groundwater data were compared to literature-based surface water screening values described in Section 7.3.1.

- **Toxicity Reference Values (TRVs) for Ingestion Exposures** - Food web exposure estimates were compared to ingestion-based TRVs described in Section 7.3.2.

7.2.4 Medium-specific Screening Values

The effects assessment defines the methods and data used to define an adverse ecological effect. For the ERA, effects data were available from multiple lines of evidence:

- **ESVs for Surface Soil** - Analytical surface soil data were compared to the literature-based surface soil screening values described in Section 7.3.1. Two sets of surface soil screening values were used—one to assess potential risk for direct contact lower-trophic-level receptors (soil invertebrates and terrestrial plants) and one set in a preliminary screening step for upper-trophic-level receptors. The screening methodology is described in Section 7.5.
- **ESVs for Surface Water** - Analytical groundwater data were compared to literature-based surface water screening values described in Section 7.3.1.
- **TRVs for Ingestion Exposures** - Food web exposure estimates were compared to ingestion-based TRVs described in Section 7.3.2.

7.2.5 Ingestion Screening Values

TRVs based on ingestion were derived for dietary exposures to the bioaccumulative chemicals at the site. Bioaccumulative chemicals were identified based on EPA guidance (EPA, 2000). Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (for example, laboratory mice) where necessary. The ingestion screening values are expressed as milligrams of the chemical per kilogram body weight of the receptor per day (Table 7-2 for mammals and Table 7-3 for birds).

Allometric scaling, as discussed in Sample et al. (1996), was not used to adjust TRVs obtained from the literature for the following reasons. Allometric scaling factors discussed in Sample et al. (1996) are all based on acute toxicity (that is, the median lethal dose [LD_{50}]). These factors are derived by regressing the body weight of the test animal against the amount of chemical given in a single dose that resulted in mortality. In application, however, these acute relationships are used to estimate variation in chronic effects. However, the mode of action for an acute exposure is likely to be dramatically different from what would be expected for a chronic exposure. The acute effects are attributable to comparatively large doses, causing severe toxic responses that result in fairly rapid mortality. Chronic exposures/effects are comparatively more subtle, and multiple types of effects could result (for example, affecting reproduction, growth, organ systems, etc.). Each type of chronic effect could have different scaling factors depending on the detoxification and sensitivity characteristics of the animal. Because there is insufficient information pertaining to the relationship between acute and chronic effects for different chemicals across different taxa, the use of acute data-based allometric scaling factors may actually increase the level of uncertainty in the TRVs, rather than decreasing it. For these reasons, the TRVs used in this risk assessment were not adjusted for body weight differences between test species and surrogate receptor species.

Growth and reproduction were emphasized within the assessment endpoints because they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicity studies were available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. Longer-duration studies were selected over shorter ones, and preference was given to studies using reproduction endpoints, and studies with tests species most similar to receptor species were selected where possible. NOAELs based on growth and reproductions were used, where available, as the screening values. When chronic NOAEL values were unavailable, estimates were derived or extrapolated from chronic LOAELs or acute values as follows:

- A UF of 5 was used to convert a reported LOAEL to a NOAEL because Dourson and Stara (1983) conducted a data review of toxicity values and found that 96 percent of the chemicals reviewed had a LOAEL/NOAEL ratio of 5 or less.

- When values for chronic toxicity were not available, the LD_{50} was used. a UF of 100 was used to convert the acute LD_{50} to a chronic NOAEL (the LD_{50} was multiplied by 0.01 to obtain the chronic NOAEL).

7.3 Screening-level Exposure Estimate

For the initial screening-level risk estimates, maximum concentrations in environmental media were used to conservatively estimate potential chemical exposures to ecological receptors. For conservatism, the maximum detection limit for chemicals that were analyzed for but not detected were also be compared to medium-specific screening values. This was done so that detection limits were similar to or less than chemical concentrations at which potential adverse effects to ecological receptors might occur. For samples with duplicate analyses, the higher of the two concentrations was used in the screening (that is, when both values were detects or both were nondetects). In cases where one result was detected and the other was a nondetect, the detected value was used in the assessment.

Validated analytical data were used in the SERA based on the following criteria. Data with rejected (R) values were not used. Unqualified data and data qualified as J, L, or K were treated as detected. Data qualified as U or B were treated as nondetected.

Upper-trophic-level receptor exposures to chemicals in site media were calculated by estimating the concentration of each chemical in each relevant dietary component. Incidental ingestion of soil or sediment was included when calculating the total exposure, where appropriate.

Body weights, ingestion rates, and dietary composition for each receptor are presented in Table 7-4. Conservative body weights (minimum weights) and ingestion rates (maximum rates) were used in calculating food web exposures for the initial assessment (Step 2 of the ERA).

Dietary items for which tissue concentrations were modeled included terrestrial plants, soil invertebrates (earthworms), small mammals, aquatic plants, aquatic invertebrates, and fish/frogs. The methodologies used for these tissue calculations are outlined in the following subsection. For the screening-level exposure estimation, the uptake of chemicals from abiotic media into these food items was conservatively estimated based on maximum or "high-end" (90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature (Tables 7-5 through 7-7). Default factors of 1.0 were used only where data for a chemical were unavailable in the literature. More-detailed information regarding development of EPCs and ingestion exposure calculations is provided below.

7.3.1 Food Web EPCs

Maximum measured media concentrations were used as EPCs for the screening-level exposure estimation and food web modeling. EPCs for terrestrial and aquatic prey items (plants, soil invertebrates, small mammals, fish/frogs, and aquatic invertebrates) were estimated using bioaccumulation models and maximum measured media concentrations. The models used to derive these estimates are described below.

For the screening (SERA) exposure estimates, the uptake of chemicals from the abiotic medium (surface soil) into food items was based on conservative (90th percentile) BCFs or BAFs from the literature, where available. The 90th percentile is generally recommended to provide for a conservative screening assessment (Sample et al., 1998a; 1998b; Bechtel Jacobs, 1998). If 90th percentile values were not available in the cited reference, the maximum value was used, if available. If only central tendency (median) values were reported, they were used for both the Step 2 and Step 3A. Where an individual study (as opposed to a compilation of multiple studies) was cited, the best available value was sometimes a single value or the derivation was not specified. Default (assumed) factors of 1.0 were used only when data for a chemical were not readily available in the literature. In some cases, chemical concentrations in food items were directly estimated from maximum surface soil concentrations using available literature-based regression models (Table 7-5).

Terrestrial Plants. Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated by multiplying the maximum measured surface soil concentration for each chemical by chemical-specific soil-to-plant BCFs obtained from the literature (Table 7-6). The BCF values used are based on root uptake from soil and on the ratio between dry-weight soil and dry-weight plant tissue. Literature values based on the ratio between dry-weight soil and wet-weight plant tissue were converted to a dry-weight basis by dividing the wet-weight BCF by the estimated solids content for terrestrial plants (15 percent [0.15]; Sample et al., 1997c).

For inorganic chemicals without literature-based BCFs, a soil-to-plant BCF of 1.0 was assumed. For organic chemicals without literature based BCFs, soil-to-plant BCFs were estimated using the algorithm provided in Travis and Arms (1988):

$$\log B_v = 1.588 - (0.578)\ (\log K_{ow})$$

where:

B_v	=	Soil-to-plant BCF (unitless; dry weight basis)
K_{ow}	=	Octanol-water partitioning coefficient (unitless)

The log K_{ow} values used in the calculations were obtained mostly from EPA (1996).

Earthworms. Tissue concentrations in soil invertebrates (earthworms) were estimated by multiplying the maximum measured surface soil concentration for each chemical by chemical-specific BCFs or BAFs obtained from the literature (Table 7-7). BCFs were calculated by dividing the concentration of a chemical in the tissues of an organism by the concentration of that same chemical in the surrounding environmental medium (in this case, soil) without accounting for uptake via the diet. BAFs consider both direct exposure to soil and exposure via the diet. Because earthworms consume soil, BAFs are more appropriate values and are used in the food web models when available. BAFs based on depurated analyses (soil was purged from the gut of the earthworm before analysis) are given preference over undepurated analyses when selecting BAF values because direct ingestion of soil is accounted for separately in the food web model.

The BCF/BAF values are based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BCF/BAF by the estimated solids content for earthworms (16 percent [0.16]; EPA 1993c). For inorganic chemicals without available measured BAFs or BCFs, an earthworm BAF of 1.0 was assumed.

Small Mammals. Whole-body tissue concentrations in small mammals (shrews, voles, and/or mice) were estimated using one of two methodologies. For chemicals with literature-based soil-to-small mammal BCFs, the small mammal tissue concentration were obtained by multiplying the maximum measured surface soil concentration for each chemical by a chemical-specific soil-to-small mammal BCF obtained from the literature. The BCF values used are based on the ratio between dry-weight soil and whole-body dry-weight tissue. Literature values based on the ratio between dry-weight soil and wet-weight tissue were converted to a dry-weight basis by dividing the wet-weight BCF by the estimated solids content for small mammals (32 percent [0.32]; EPA 1993d). BCFs for shrews are those reported in Sample et al. (1998) for insectivores (or for general small mammals if insectivore values were unavailable), for voles are those reported for herbivores, and for mice are those reported for omnivores. The soil-to-small mammal BAFs used are shown in Table 7-8.

For chemicals without soil-to-small mammal BCF values, an alternate approach was used to estimate whole-body tissue concentrations. Because most chemical exposure for these small mammal species is via the diet, it was assumed that the concentration of each chemical in the small mammal's tissues is equal to the chemical concentration in its diet, that is, a diet to whole-body BAF (wet-weight basis) of 1.0 was assumed. The use of a diet to whole-body BAF of 1.0 is likely to result in a conservative estimate of chemical concentrations for chemicals that are not known to biomagnify in terrestrial food chains (for example, aluminum). For chemicals that are known to biomagnify (for example, polychlorinated biphenyls), a diet to whole-body BAF value of 1.0 likely results in a realistic estimate of tissue concentrations based on reported literature values.

Aquatic Plants. Tissue concentrations in the aboveground vegetative portion of aquatic plants were estimated using the same methodologies as described above for terrestrial plants except that maximum groundwater concentrations was used in the calculation. A conservative BCF of 1.0 was used to model uptake from groundwater to aquatic plants.

Aquatic Invertebrates. Tissue concentrations in aquatic invertebrates were estimated by multiplying the maximum measured groundwater concentration for each chemical by a conservative BCF of 1.0.

Aquatic Vertebrates. Tissue concentrations in whole-body fish were estimated by multiplying the maximum measured groundwater concentration for each chemical by a conservative BCF of 1.0.

Dietary Intakes

Dietary intakes for each receptor species were calculated using the following formula (modified from EPA [1993d]):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

where:	DI_x	=	Dietary intake for chemical x (mg chemical/kg body weight/day)
	FIR	=	Food ingestion rate (kg/day, dry-weight)
	FC_{xi}	=	Concentration of chemical x in food item i (mg/kg, dry weight)
	PDF_i	=	Proportion of diet composed of food item i (dry weight basis)
	SC_x	=	Concentration of chemical x in soil/sediment (mg/kg, dry weight)
	PDS	=	Proportion of diet composed of soil/sediment (dry weight basis)
	WIR	=	Water ingestion rate (L/day)
	WC_x	=	Concentration of chemical x in water (mg/L)
	BW	=	Body weight (kg, wet weight)

For conservatism, the model assumes that chemicals are 100 percent bioavailable to the receptor and that each receptor spends 100 percent of its time within the boundaries of the site.

7.4 Screening-level Risk Estimation

The screening-level risk calculation is the final step in the SERA (Step 2). In this step, the maximum exposure concentrations for abiotic media (surface soil and groundwater) or exposure doses for upper trophic-level receptor species are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of COPCs for each media-pathway-receptor combination.

COPCs are selected using the HQ method. HQs are calculated by dividing the chemical concentration in the medium being evaluated by the corresponding medium-specific screening value or by dividing the exposure dose by the corresponding ingestion screening value. For nondetected chemicals, the maximum reporting limit is used as the sample concentration (direct exposure) and as the basis for exposure doses (food web models). Chemicals with HQs greater than or equal to 1 are considered COPCs in the SERA.

HQs exceeding 1 indicate the potential for risk because the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to 1 do not necessarily indicate that impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation. HQs that are less than 1 indicate that risks are unlikely (EPA, 1997c), enabling a conclusion of no unacceptable risk to be reached with high confidence.

7.4.1 Surface Soil

Maximum surface soil concentrations were compared to soil screening values to identify preliminary COPCs (Table 7-9). Based on maximum detected concentrations, 10 metals were identified as preliminary COPCs for lower-trophic-level receptors (terrestrial plants and soil-dwelling invertebrates).

The direct exposure screening values for aluminum and iron were based on soil pH rather than the detected concentrations of those chemicals in soil. The aluminum soil screening level (SSL) states that aluminum is identified as a COPC only at sites where the soil pH is less than 5.5 (EPA, 2003b). Similarly, the iron SSL states that iron is not expected to be toxic to plants when the soil pH is between 5 and 8 (EPA, 2003c). Based on these criteria, both aluminum and iron were not identified as preliminary COPCs because the average pH of the soil was 5.7.

7.4.2 Groundwater

Maximum dissolved groundwater concentrations were compared to screening values for surface water in Table 7-10. Based on maximum dissolved concentrations, nine inorganics were detected that exceeded screening values and therefore were identified as preliminary COPCs for aquatic receptors. Selenium was also retained as preliminary COPCs because although not detected, the maximum reporting limit for selenium exceeded the screening value.

7.4.3 Food Web Exposure Screening

Before the dose of detected bioaccumulative chemicals was estimated, the maximum detected soil concentrations were first compared to the avian and mammalian ecological SSLs (Eco-SSLs; EPA, 2003b). This comparison was used as an initial screening step for food web exposure for the identification of food web COPCs following the methodology recommended by EPA Region III. Chemicals that are present in surface soils at concentrations below the Eco-SSL values are unlikely to pose unacceptable risk to upper-trophic-level receptors and therefore site-specific food web modeling was not conducted for them.

7.4.3.1 Eco-SSL Screening

Step 2 food web COPCs were selected by first comparing maximum surface soil concentrations with the lower of the available bird and mammal Eco-SSLs for the chemicals listed on Table 7-11. Chemicals that exceeded the Eco-SSLs based on the maximum surface soil concentration were retained for site-specific food web modeling. Those that did not were not evaluated further for terrestrial food web exposures. The final Step 2 food web COPCs were selected based upon a comparison of maximum exposure doses from site-specific food web modeling with the NOAEL-based ingestion TRV. Those chemicals with an exposure dose exceeding the NOAEL-based ingestion TRV were identified as Step 2 preliminary COPCs. For Step 3A, ingestion-based (food web) COPCs were based upon a comparison of mean exposure doses with ingestion TRVs based on the NOAEL, Maximum Acceptable Toxicant Concentration (MATC), and LOAEL. An exceedance of the mean-based MATC was considered an unacceptable effect at Step 3A, although chemicals that exceeded the MATC, but not the LOAEL, are discussed for possible risk management considerations.

Chromium, copper, lead, nickel, silver, vanadium, and zinc exceeded Eco-SSLs based on maximum detected concentrations (Table 7-11). However, the magnitude of the maximum HQs for copper (1.2) and nickel (2.1) were low and there were no exceedances based upon the mean soil concentrations for these metals. Also, the concentrations exceeded the Eco- SSLs in only 1 of the 12 samples. Lead, vanadium, and zinc exceeded either the bird or mammal Eco-SSLs based on the maximum and mean concentrations. No Eco-SSL is available for mercury. Therefore, for terrestrial receptors exposed to primarily surface soil, site-specific food web modeling was conducted for the following inorganics: chromium, lead, mercury, silver, vanadium, and zinc.

7.4.3.2 Site-specific Food Web Modeling

The HQs resulting from comparison of maximum exposure doses of bioaccumulative chemicals (EPA, 2000) for each upper-trophic-level receptor species to ingestion screening values are presented in Table 7-12. Site-specific food web modeling calculations for individual receptors are presented in Appendix H.

Terrestrial Receptors

The estimated maximum exposure doses of chromium lead, mercury, silver, and vanadium exceeded the NOAEL-based screening values for one or more terrestrial receptors. Therefore, each of these chemicals was retained as a preliminary COPC for terrestrial upper-trophic-level receptors.

Semi-Aquatic Receptors

None of the maximum exposure does for semi-aquatic receptors exceeded the NOAEL-based screening values. Therefore, no preliminary COPCs were identified for semi-aquatic upper-trophic-level receptors.

7.5 Step 3A—Refinement of Conservative Exposure Assumptions

According to Superfund guidance (EPA, 1997c), Step 3 initiates the problem formulation phase of the BERA. Under Navy guidance (CNO, 1999), the BERA is defined as Tier 2, and the first activity under Tier 2 is Step 3A. In Step 3A, the conservative assumptions employed in Tier 1 are refined and risk estimates are recalculated using the same CSM for the site. The refined risk calculations are described in the following subsections. This step is conducted to assist with the identification of risk drivers (that is, the chemicals that may pose the greatest risk). In some cases, additional information is presented that has bearing on whether a constituent is identified as a potential risk driver.

If re-evaluation of the conservative exposure assumptions supports an acceptable risk finding, then a site may exit the ERA process (CNO, 1999). However, if it is concluded that unacceptable risk exists, the site moves forward in the process and Step 3B is conducted, where the BERA problem formulation is completed based on the conclusions from Step 3A.

7.5.1 Assumptions and Approach

Assumptions and methods that were modified for the calculation of media-specific and food web HQs are listed below, along with justification for each modification. These refinements were used to weigh the evidence of potential risk for each preliminary COPC identified for each medium to assess whether they warrant further evaluation or action. For Step 3A, the following additional factors were also considered, as appropriate:

- Average chemical concentrations were used instead of maximum concentrations as the EPC for direct exposure (lower-trophic-level receptors) and for estimating dietary doses to upper-trophic-level receptors. Average chemical concentrations provide a more realistic estimate of the likely level of chemical exposure such receptors would encounter. Because some of these receptors are relatively immobile or have a limited home range, individuals are more likely to be affected by locations with maximum concentrations. However, the evaluation of an average exposure scenario is more instructive with regard to the level of potential impact that might be expected at the population level.

- Midpoints of the receptor body weight and food ingestion rate presented in Table 7-13 were used to develop exposure estimates for higher-trophic-level receptors, rather than minimum body weights and maximum ingestion rates. Because these represent the characteristics of a greater proportion of the individuals in a population, midpoint exposure parameters are often more realistic.

- CTEs were used to develop exposure estimates for BAFs used in the food web exposure estimation. Soil-to-plant, soil-to-invertebrate, and soil-to-small mammal BCFs/BAFs used in Step 3A are presented in Table 7-6, Table 7-7, and Table 7-8, respectively.

- Ingestion-based (food web) COPCs were based on a comparison of mean exposure doses with ingestion TRVs based upon the NOAEL, the MATC, and the LOAEL. The MATC is the geometric mean of the NOAEL and LOAEL. An exceedance of the MATC was generally considered an unacceptable effect at the refined screening step although chemicals that exceed the MATC, but not the LOAEL, were discussed for possible risk management considerations.

- Chemicals that were not detected but were retained as preliminary COPCs because the maximum reporting limit exceeded the screening value were dropped from further consideration in Step 3A because it is unlikely that the concentrations of these chemicals are present at environmentally significant levels.

- Additional information considered in the more-realistic evaluations also included the size of the site, the type and quality of the habitat present on the site and the surrounding area, the potential receptors likely to be present, and the frequency and magnitude of screening value exceedances.
- It is unlikely that infrequently detected chemicals represent an unacceptable risk to receptors at the population level, due to limited spatial exposure. However, a qualitative evaluation was conducted to ensure that "hot spot" areas were not eliminated from consideration based on this screening criterion before a chemical was eliminated from further consideration.
- Facility-specific background concentrations were also considered in the reevaluation for soil and groundwater. The background evaluation consisted of a direct comparison of site concentrations to the UTLs developed for inorganics in the background study in a manner analogous to the comparison to ESVs. The background UTLs are facility-specific values derived for NSF-IH.

7.5.2 Refined Risk Calculations

7.5.2.1 Surface Soil

The refined risk calculations for surface soil are presented in Table 7-14. Three inorganics (chromium, manganese, and vanadium) exceeded screening values based on detected mean concentrations and were identified as refined COPCs. No screening value was available for hexavalent chromium; therefore, it was retained a COPC even though it was detected in only 3 of 11 samples. No other inorganics in the surface soil exceeded the screening values based on mean detected concentrations.

7.5.2.2 Groundwater

Four inorganics (barium, cadmium, cobalt, and manganese) exceeded screening values based on detected mean dissolved concentrations (Table 7-15). These metals were considered refined COPCs; however, there is no direct exposure to groundwater and dilution occurs upon groundwater discharge to surface water. To account for the dilution expected during migration and upon discharges of groundwater to surface water, the Coastal Protection and Restoration Division of the National Oceanic and Atmospheric Administration recommends multiplying surface water screening values by 10 if site-specific dilution factors are not available (Buchman, 1999). This approach was used to further evaluate the potential risk posed by the COPCs identified for groundwater. Using the dilution-adjusted screening value approach described above, the HQs for the COPCs are as presented in Table 7-16.

Based on this comparison, it is unlikely that these metals pose a significant risk to ecological receptors because it is likely that the actual dilution rate upon discharge to the Potomac River is much greater than a factor of 10.

7.5.2.3 Site-specific Food Web Modeling

The HQs resulting from comparison of mean exposure doses of bioaccumulative chemicals for upper-trophic-level receptor species to ingestion screening values are presented in Table 7-17. Results are presented only for those receptors for which preliminary COPCs were identified after Step 2 (short-tailed shrew, American robin, and mourning dove). None of the estimated doses exceeded the NOAEL-based screening values. Therefore, no refined COPCs were identified for upper-trophic-level receptors.

7.5.3 Comparison to Background Data

7.5.3.1 Surface Soil

Concentrations of the three inorganic COPCs that were measured above soil screening values were compared to the background concentrations for these metals reported in the *Background Soil Investigation Report for Indian Head and Stump Neck Annex* (Tetra Tech NUS, 2002b). The comparison is presented in Table 7-18.

The mean site concentrations of manganese and vanadium were slightly greater than the mean background concentrations for these inorganics. However, the maximum concentrations of both metals were substantially less than the 95 percent UTL background concentrations, suggesting that the site concentrations are consistent with background conditions. Therefore, it is unlikely that their concentrations are site-related and as such manganese and vanadium are not considered risk-driving COPCs.

The maximum and mean chromium concentrations at the site exceeded both the 95 percent UTL and mean background concentrations, suggesting that chromium concentrations at the site are not consistent with background conditions. Therefore, chromium was retained as a potential risk-driving COPC for soil invertebrates.

7.5.3.2 Groundwater

The site maximum and mean concentrations of barium were compared to background barium concentrations reported in the *Appendix A*, *Background Investigation Report for Groundwater, Freshwater Sediments, and Biota*, provided in the background soil investigation report (Tetra Tech NUS, 2002b). The comparison is presented in Table 7-19.

The maximum and mean filtered barium concentrations in groundwater exceeded both the 95 percent UTL and mean background concentrations; however, the maximum unfiltered barium concentration did not exceed the background 95 percent UTL for unfiltered groundwater, and the mean unfiltered site mean concentration is only 10 percent higher than the mean unfiltered background concentration. Therefore, although barium is a potential risk-driving COPC for aquatic receptors, the concentrations in site groundwater may be reflective of background conditions.

7.6 Uncertainty

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. Because very conservative assumptions were used in the exposure and effects assessments, these uncertainties are more likely to result in an overestimation of the likelihood and magnitude of risks to ecological receptors rather than an underestimation. The uncertainty in this risk assessment is mainly attributable to the following factors:

- **Detection Limits:** Detection limits for some analytes exceeded applicable screening values in some media. Although these analytes were not detected, they were retained as preliminary COPCs for conservatism. This likely overstates the number of actual COPCs.

- **Selection of COPCs:** Chemicals without available screening values were retained as preliminary COPCs. This likely overstates the number of actual COPCs.

- **Receptor Species Selection:** Amphibian and reptilian species were not selected as potential receptors in the ERA, although exposure pathways to these organisms were likely to be complete. This represents an uncertainty in the risk assessment, although the other assessment endpoints are assumed to be protective of these receptor groups.

- **Food Web Exposure Modeling:** Chemical concentrations in terrestrial food items (plants and earthworms) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and BAFs introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a conservative estimate of potential food web exposure concentrations.

  Another source of uncertainty is the use of default assumptions for exposure parameters such as BCFs/BAFs. Although BCFs or BAFs for many bioaccumulative chemicals were readily available from the literature and were used in the SERA, the use of a default factor of 1.0 to estimate the concentration of some chemicals in receptor prey items is a source of uncertainty. However, for most chemicals, the assumption that the chemical body burden in the prey item is at the same concentration as in soil or surface water is conservative and would overestimate risk.

The exposure parameters used for the receptors were unrealistically conservative. The use of maximum ingestion rates and minimum body weights resulted in a conservative estimate of exposure. In addition, area use factors were assumed to equal 1. This is a conservative assumption because a significant percentage of each upper-trophic-level receptor species' time could be spent foraging offsite in unaffected areas or areas where chemical concentrations are expected to be significantly lower.

- **Chemical Mixtures:** Information on the ecotoxicological effects of chemical interactions is generally lacking, which required (as is standard for ecological risk assessments) that the chemicals be evaluated on a compound-by-compound basis during the comparison to screening value. This could result in an underestimation of risk (if there are additive or synergistic effects among chemicals) or an overestimation of risks (if there are antagonistic effects among chemicals).
- **Mean Versus Maximum Media Concentrations:** As is typical in a SERA, a finite number of samples was used to develop the exposure estimates. The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based on the mean constituent concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the *Wildlife Exposure Factors Handbook* (EPA, 1993e), which specifies the use of average media concentrations.
- **Evaluation of Groundwater:** Although ecological receptors are not directly exposed to groundwater, groundwater concentrations were compared directly to surface water screening values with a generic dilution factor of 10. Because significant dilution is likely to occur upon discharge to a surface water body, this procedure results in a conservative assessment.

7.7 Ecological Risk Assessment Conclusions and Considerations

7.7.1 Surface Soil

Chromium in surface soil poses a potential risk to soil invertebrates and/or terrestrial plants. Toxicity testing of surface soil at Site 47 and the lab area as part of baseline ERAs for these sites (CH2M HILL, 2006a and 2006b) provides additional information that can be used to assess the potential risk posed by chromium. No adverse effects (survival or growth) were observed in the bioassay samples from these sites (28-day tests with the earthworm *Eisenia foetida*). The maximum concentrations of the chromium in the surface soils from these sites used in the toxicity tests were 28.5 mg/kg and 19.4 mg/kg, respectively. The mean concentration in surface soil at SWMU 14 is 24.9 mg/kg. In addition, two studies deemed acceptable for use in deriving an Eco-SSL for soil invertebrates (EPA, 2008), derived an MATC concentration for chromium of 57 mg/kg in toxicity tests with earthworms. Therefore, it is likely that risk is overestimated for chromium over most of the site, with the possible exception of the area where samples IU14SS09, IU14SS10, IU14SS14, and IU14SS16 were collected. These samples were the only ones that exceeded 28.5 mg/kg, with concentrations of 34.8 to 86.0 mg/kg. However, both of these sample locations are located close to Building 22SN and the paved driveway and provide limited habitat. These factors should be considered with regard to risk management decisions for surface soil.

7.7.2 Groundwater

Barium in groundwater poses a potential risk to aquatic receptors at the point of groundwater discharge. This conclusion is based on using a generic dilution factor of 10 to account for dilution of groundwater upon discharge, in lieu of a site-specific dilution factor. Therefore, this risk may be overestimated because the actual dilution factor is likely much higher than 10 upon discharge to the Potomac River. Although barium is a potential risk-driving COPC for aquatic receptors, the concentrations in site groundwater may be reflective of background conditions.

TABLE 7-1

Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Risk Hypothesis	**Measurement Endpoint**	**Receptor**
Survival, growth, and reproduction of terrestrial soil invertebrate communities	Are site-related chemical concentrations in surface soil sufficient to adversely effect soil invertebrate communities?	Comparison of maximum (Step 2) and mean (Step 3) chemical concentrations in surface soil with soil screening values	Soil invertebrates
Survival, growth, and reproduction of terrestrial plant communities	Are site-related chemical concentrations in surface soil sufficient to adversely effect terrestrial plant communities?	Comparison of maximum (Step 2) and mean (Step 3) chemical concentrations in surface soil with soil screening values	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial herbivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume terrestrial plants (seeds) from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Mourning dove
Survival, growth, and reproduction of avian terrestrial invertivore/omnivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume terrestrial plants and soil invertebrates from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	American robin
Survival, growth, and reproduction of avian terrestrial carnivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume small mammals from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Red-tailed hawk
Survival, growth, and reproduction of avian semi-aquatic invertivore populations	Are site-related chemical concentrations in groundwater sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume benthic invertebrates from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) groundwater concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Spotted sandpiper
Survival, growth, and reproduction of mammalian terrestrial herbivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume plants from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Meadow vole

TABLE 7-1

Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Risk Hypothesis	Measurement Endpoint	Receptor
Survival, growth, and reproduction of mammalian terrestrial invertivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume soil invertebrates from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Short-tailed shrew
Survival, growth, and reproduction of mammalian terrestrial carnivore populations	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume small mammals from the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Red fox
Survival, growth, and reproduction of mammalian semi-aquatic omnivore populations	Are site-related chemical concentrations in groundwater and surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to semi-aquatic mammalian receptor populations that may consume aquatic plants, invertebrates, and fish fom the site?	Comparison of modeled dietary intakes using maximum (Step 2) and mean (Step 3) groundwater and surface soil concentrations with literature-based ingestion TRVs; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Raccoon

TABLE 7-2

Toxicity Reference Values for Mammals

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Test Organism	Duration	Critical Life Stage?	Exposure Route	Effect/Endpoint	NOAEL (mg/kg/d)	MATC (mg/kg/d)	LOAEL (mg/kg/d)	Reference
Inorganics									
Chromium	multiple	chronic	--	oral	--	2.40	5.37	12.0	USEPA 2008 (SSL)
Lead	rat	chronic	--	oral	--	4.70	6.47	8.90	USEPA 2005 (SSL)
Mercury (vole and shrew)	rat	3 generations	Yes	oral in diet	reproduction	0.032	0.072	0.160	Sample et al. 1996
Mercury (raccoon and fox)	mink	93 days	No	oral in diet	survival/weight loss/ataxia	0.150	0.192	0.247	Sample et al. 1996
Vandium	mouse	chronic	--	oral	--	4.160	5.880	8.31	USEPA 2005 (SSL)
Zinc	multiple	chronic	--	oral	--	75.4	169	377	USEPA 2007 (SSL)

TABLE 7-3

Toxicity Reference Values for Birds

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Chemical Form	Test Organism	Duration	Critical Life Stage?	Exposure Route	Effect/Endpoint	NOAEL (mg/kg/d)	MATC (mg/kg/d)	LOAEL (mg/kg/d)	Reference
Inorganics										
Chromium	Cr+3	multiple	chronic	--	oral	--	2.66	5.95	13.3	USEPA 2008 (SSL)
Lead	--	chicken	chronic	--	oral	--	1.63	2.31	3.3	USEPA 2005 (SSL)
Mercury	Mercuric chloride	Japanese quail	1 year	Yes	oral in diet	reproduction	0.45	0.64	0.90	Sample et al. 1996
Vanadium		chicken	chronic	--	oral	--	0.34	0.49	0.69	USEPA 2005 (SSL)
Zinc	--	multiple	chronic	--	oral	--	66.1	148	331	USEPA 2007 (SSL)

TABLE 7-4

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 2

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Minimum Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)									Soil/ Sediment Ingestion (percent)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Value**	**Reference**	**Terr Plants**	**Terr Inv**	**Mouse**	**Vole**	**Shrew**	**Aq Plants**	**Aq Inv**	**Fish**	**Reference**	**Value**	**Reference**
Mammals																	
Meadow vole	0.0300	Silva and Downing 1995	0.01334	USEPA 1993a	0.00310	USEPA 1993a	95.6	2.0	0.0	0.0	0.0	0.0	0.0	0.0	USEPA 1993a	2.4	Beyer et al. 1994
Raccoon	4.2300	Silva and Downing 1995	0.60919	allometric equation	0.13067	Conover 1989	0.0	0.0	0.0	0.0	0.0	40.0	43.6	7.0	USEPA 1993a	9.4	Beyer et al. 1994
Red fox	3.1700	Silva and Downing 1995	0.41154	allometric equation	0.14763	Sample and Suter 1994	7.0	2.8	29.2	29.1	29.1	0.0	0.0	0.0	USEPA 1993a	2.8	Beyer et al. 1994
Short-tailed shrew	0.0133	USEPA 1993a	0.00475	USEPA 1993a	0.00189	USEPA 1993a	4.7	82.3	0.0	0.0	0.0	0.0	0.0	0.0	USEPA 1993a; Sample and Suter 1994	13.0	Sample and Suter 1994
Birds																	
American robin	0.0635	USEPA 1993a	0.01287	allometric equation	0.00736	Levey and Karasov 1989	51.9	43.5	0.0	0.0	0.0	0.0	0.0	0.0	Martin et al. 1951	4.6	Sample and Suter 1994
Mourning dove	0.1050	Tomlinson et al. 1994	0.01750	allometric equation	0.02090	allometric equation	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Tomlinson et al. 1994	5.0	Assumed based on diet
Red-tailed hawk	0.9570	USEPA 1993a	0.06796	allometric equation	0.03952	Sample and Suter 1994	0.0	0.0	34.0	33.0	33.0	0.0	0.0	0.0	USEPA 1993a; Sample and Suter 1994	0.0	Sample and Suter 1994
Spotted sandpiper	0.0294	Dunning 1993	0.00894	allometric equation	0.01052	allometric equation	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	USEPA 1993a	0.0	Assumed based on site characteristics

TABLE 7-5

Bioconcentration/Bioaccumulation Factor Models (Dry Weight)

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Plants[1]	Reference	Soil Invertebrates[2]	Reference	Small Mammal Herbivores[3]	Reference	Small Mammal Insectivores[3]	Reference
Metals								
Chromium	--	--	--	--	$C_m = e^{(-1.4599 + 0.7338(\ln Cs))}$	Sample et al. 1998b; USEPA 2007j	$C_m = e^{(-1.4599 + 0.7338(\ln Cs))}$	Sample et al. 1998b; USEPA 2007j
Lead	$C_p = e^{(-1.328 + 0.561(\ln Cs))}$	Bechtel Jacobs 1998a; USEPA 2007j	$C_w = e^{(-0.218 + 0.807(\ln Cs))}$	Sample et al. 1998a; USEPA 2007j	$C_m = e^{(-0.6114 + 0.5181(\ln Cs))}$	Sample et al. 1998b	$C_m = e^{(0.4819 + 0.4869(\ln Cs))}$	Sample et al. 1998b
Mercury	$C_p = e^{(-0.996 + 0.544(\ln Cs))}$	Bechtel Jacobs 1998a	--	--	--	--	--	--
Zinc	$C_p = e^{(1.575 + 0.555(\ln Cs))}$	Bechtel Jacobs 1998a; USEPA 2007j	$C_w = e^{(4.449 + 0.328(\ln Cs))}$	Sample et al. 1998a; USEPA 2007j	$C_m = e^{(4.3632 + 0.0706(\ln Cs))}$	Sample et al. 1998b; USEPA 2007j	$C_m = e^{(4.2479 + 0.1324(\ln Cs))}$	Sample et al. 1998b

Notes:

1 Where C_p = Concentration in aboveground portion of plant (mg/kg dry wt) and C_s = Concentration in sc

2 Where C_w = Concentration in earthworm (mg/kg dry wt) and C_s = Concentration in soil (mg/kg dry wt)

3 Where C_m = Concentration in whole-body small mammal (mg/kg dry wt) and C_s = Concentration in soil (mg/kg dry wt)

TABLE 7-6

Soil Bioaccumulation Factors for Terrestrial Plants

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Step 2			Step 3A			Regression		
	Soil-Plant BAF (dry weight)			Soil-Plant BAF (dry weight)					
	Value	Basis	Reference	Value	Basis	Reference	B0	B1	Reference
Inorganics									
Chromium	0.084	90th percentile	Bechtel Jacobs 1998a	0.041	Median	Bechtel Jacobs 1998a	--	--	--
Lead	0.468	90th percentile	Bechtel Jacobs 1998a	0.039	Median	Bechtel Jacobs 1998a	-1.328	0.561	Bechtel Jacobs 1998a
Mercury	5.000	90th percentile	Bechtel Jacobs 1998a	0.652	Median	Bechtel Jacobs 1998a	-0.996	0.544	Bechtel Jacobs 1998a
Vandium	0.010	90th percentile	Bechtel Jacobs 1998a	0.005	Geometric mean	Bechtel Jacobs 1998a	--	--	--
Zinc	1.820	90th percentile	Bechtel Jacobs 1998a	0.358	Geometric mean	Bechtel Jacobs 1998a	1.575	0.555	Bechtel Jacobs 1998a

TABLE 7-7

Soil Bioaccumulation Factors For Soil Invertebrates

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Step 2			Step 3A			Regression		
	Soil-Invertebrate BAF (dry weight)			Soil-Invertebrate BAF (dry weight)					
Chemical	**Value**	**Basis**	**Reference**	**Value**	**Basis**	**Reference**	**B0**	**B1**	**Reference**
Inorganics									
Chromium	3.162	90th percentile	Sample et al. 1998a	0.320	Geometric mean	Sample et al. 1998a	--	--	--
Lead	1.522	90th percentile	Sample et al. 1998a	0.307	Geometric mean	Sample et al. 1998a	-0.218	0.807	Sample et al. 1998a
Mercury	20.625	90th percentile	Sample et al. 1998a	1.186	Geometric mean	Sample et al. 1998a	--	--	--
Vanadium	0.088	90th percentile	Sample et al. 1998a	0.039	Arithmetic mean	Sample et al. 1998a	--	--	--
Zinc	12.885	90th percentile	Sample et al. 1998a	2.482	Geometric mean	Sample et al. 1998a	4.449	0.328	Sample et al. 1998a

TABLE 7-8

Soil Bioaccumulation Factors for Small Mammals

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Omnivores								
	Step 2			Step 3A			Regression		
	Soil-Mammal BAF (dry weight)			Soil-Mammal BAF (dry weight)					
	Value	Basis	Reference	Value	Basis	Reference	B0	B1	Reference
Inorganics									
Chromium	0.349	90th percentile	Sample et al. 1998b	0.070	Median	Sample et al. 1998b	-1.495	0.733	Sample et al. 1998b
Lead	0.286	90th percentile	Sample et al. 1998b	0.055	Geometric mean	Sample et al. 1998b	0.076	0.442	Sample et al. 1998b
Mercury	0.130	90th percentile	Sample et al. 1998b	0.054	Median	Sample et al. 1998b	--	--	--
Vandium	0.013	90th percentile	Sample et al. 1998b	0.010	Median	Sample et al. 1998b	--	--	--
Zinc	2.782	90th percentile	Sample et al. 1998b	0.509	Geometric mean	Sample et al. 1998b	4.471	0.074	Sample et al. 1998b

TABLE 7-8

Soil Bioaccumulation Factors for Small Mammals

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Herbivores								
	Step 2			Step 3A			Regression		
	Soil-Mammal BAF (dry weight)			Soil-Mammal BAF (dry weight)					
	Value	Basis	Reference	Value	Basis	Reference	B0	B1	Reference
Inorganics									
Chromium	0.309	90th percentile	Sample et al. 1998b	0.088	Median	Sample et al. 1998b	-1.460	0.734	Sample et al. 1998b
Lead	0.187	90th percentile	Sample et al. 1998b	0.041	Geometric mean	Sample et al. 1998b	-0.611	0.518	Sample et al. 1998b
Mercury	0.192	90th percentile	Sample et al. 1998b	0.067	Geometric mean	Sample et al. 1998b	--	--	--
Vandium	0.019	90th percentile	Sample et al. 1998b	0.013	Median	Sample et al. 1998b	--	--	--
Zinc	2.317	90th percentile	Sample et al. 1998b	0.293	Geometric mean	Sample et al. 1998b	4.363	0.071	Sample et al. 1998b

TABLE 7-8

Soil Bioaccumulation Factors for Small Mammals

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Insectivores								
	Step 2			Step 3A			Regression		
	Soil-Mammal BAF (dry weight)			Soil-Mammal BAF (dry weight)					
Chemical	**Value**	**Basis**	**Reference**	**Value**	**Basis**	**Reference**	**B0**	**B1**	**Reference**
Inorganics									
Chromium	0.333	90th percentile	Sample et al. 1998b	0.085	Median	Sample et al. 1998b	-1.460	0.734	Sample et al. 1998b
Lead	0.339	90th percentile	Sample et al. 1998b	0.160	Median	Sample et al. 1998b	0.482	0.487	Sample et al. 1998b
Mercury	0.192	90th percentile	Sample et al. 1998b	0.067	Geometric mean	Sample et al. 1998b	--	--	--
Vandium	0.018	90th percentile	Sample et al. 1998b	0.012	Median	Sample et al. 1998b	--	--	--
Zinc	2.901	90th percentile	Sample et al. 1998b	0.862	Geometric mean	Sample et al. 1998b	4.248	0.132	Sample et al. 1998b

TABLE 7-9

Screening Statistics - SWMU 14 Surface Soil - Step 2

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Frequency of Detection	Maximum Non-Detect	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Preliminary COPC?
Inorganics (MG/KG)								
Aluminum	12 / 12	--	16,700	IU14SS02-000H	5.5 < pH	12 / 12	See text	NO
Antimony	12 / 12	--	0.48	IU14SS10-000H	78 [a]	0 / 12	0.0062	NO
Arsenic	12 / 12	--	4.40	IU14SS02-000H	18 [b]	0 / 12	0.24	NO
Barium	12 / 12	--	240	IU14SS08-000H	330 [a]	0 / 12	0.73	NO
Beryllium	12 / 12	--	0.71	IU14SS06-000H	40 [a]	0 / 12	0.018	NO
Cadmium	12 / 12	--	0.26	IU14SS08-000H	32 [b]	0 / 12	0.0081	NO
Calcium [1]	12 / 12	--	3,880	IU14SS01-000H	NSV	-- / --	NSV	NO
Chromium (hexavalent)	3 / 11	0.24	0.77	IU14SS09A0001	NSV	-- / --	NSV	**YES**
Chromium	23 / 23	--	86.0	IU14SS140001	1.0 [b]	23 / 23	86.0	**YES**
Cobalt	12 / 12	--	19.9	IU14SS06-000H	13 [b]	2 / 12	1.53	**YES**
Copper	12 / 12	--	32.3	IU14SS01-000H	70 [b]	0 / 12	0.46	NO
Cyanide	0 / 12	0.56	--	--	5 [c]	-- / --	0.11	NO
Iron	12 / 12	--	25,300	IU14SS02-000H	5 < pH < 8	12 / 12	See text	NO
Lead	12 / 12	--	181	IU14SS10-000H	120 [b]	1 / 12	1.51	**YES**
Magnesium [1]	12 / 12	--	12,800	IU14SS09-000H	NSV	-- / --	NSV	NO
Manganese	12 / 12	--	753	IU14SS06-000H	220 [b]	5 / 12	3.42	**YES**
Mercury	12 / 12	--	0.23	IU14SS11-000H	0.1 [a]	2 / 12	2.30	**YES**
Nickel	12 / 12	--	277	IU14SS09-000H	38 [b]	1 / 12	7.29	**YES**
Potassium [1]	12 / 12	--	678	IU14SS02-000H	NSV	-- / --	NSV	NO
Selenium	6 / 12	0.39	0.63	IU14SS06-000H	0.52 [b]	3 / 12	1.21	**YES**
Silver	12 / 12	--	25.0	IU14SS08-000H	560 [b]	0 / 12	0.045	NO
Sodium [1]	3 / 12	45.8	572	IU14SS01-000H	NSV	-- / --	NSV	NO
Thallium	12 / 12	--	0.19	IU14SS02-000H	1.0 [a]	0 / 12	0.19	NO
Vanadium	12 / 12	--	36.8	IU14SS05-000H	2.0 [b]	12 / 12	18.4	**YES**
Zinc	12 / 12	--	136	IU14SS10-000H	120 [a]	1 / 12	1.13	**YES**

NSV - no screening value

1 - macronutrient, not considered a COPC

a - soil invertebrate based value

b - terrestrial plant based value

c - Region IV background value

TABLE 7-10

Screening Statistics - SWMU 14 Groundwater - Step 2

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Frequency of Detection	Maximum Non-Detect	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]	Preliminary COPC?
Inorganics (UG/L)								
Aluminum	2 / 17	199	876	IU14GW110712	87.0	2 / 17	10.1	**YES**
Antimony	1 / 17	0.50	0.070	IU14GW010712	30.0	0 / 17	0.0023	NO
Arsenic	2 / 17	4.00	3.00	IU14GW010712	5.00	0 / 17	0.60	NO
Barium	16 / 17	24.9	197	IU14GW040712	4.00	16 / 17	49.3	**YES**
Beryllium	17 / 17	--	1.10	IU14GW070712	0.66	2 / 17	1.67	**YES**
Cadmium	16 / 17	0.12	3.50	IU14GW060712	0.14	12 / 17	24.3	**YES**
Calcium [2]	17 / 17	--	16,400	IU14GW05-0911	NSV	-- / --	NSV	NO
Chromium	0 / 17	6.90	--	--	43.0	-- / --	0.16	NO
Cobalt	17 / 17	--	595	IU14GW03-0911	23.0	14 / 17	25.9	**YES**
Copper	9 / 17	8.90	9.60	IU14GW030712	4.51	4 / 17	2.13	**YES**
Cyanide	0 / 17	8.00	--	--	5.00	-- / --	1.60	**YES**
Iron	7 / 17	60.0	1,150	IU14GW110712	300	1 / 17	3.83	**YES**
Lead	4 / 17	0.95	0.66	IU14GW09-0911	1.08	0 / 17	0.61	NO
Magnesium [2]	17 / 17	--	9,640	IU14GW040712	NSV	-- / --	NSV	NO
Manganese	17 / 17	--	682	IU14GW08-0911	120	13 / 17	5.68	**YES**
Mercury	7 / 17	0.10	0.19	IU14GW080712	0.026	3 / 17	7.31	**YES**
Nickel	17 / 17	--	47.7	IU14GW040712	25.4	7 / 17	1.88	**YES**
Potassium [2]	17 / 17	--	20,300	IU14GW05-0911	NSV	-- / --	NSV	NO
Selenium	2 / 17	3.00	0.61	IU14GW040712	1.00	0 / 17	0.61	NO
Silver	0 / 17	0.40	--	--	0.88	-- / --	0.46	NO
Sodium [2]	17 / 17	--	89,400	IU14GW110712	NSV	-- / --	NSV	NO
Thallium	6 / 17	0.40	0.35	IU14GW09-0911	0.80	0 / 17	0.44	NO
Vanadium	1 / 17	5.50	0.70	IU14GW09-0911	20.0	0 / 17	0.035	NO
Zinc	5 / 17	96.4	124	IU14GW09-0911	58.3	3 / 17	2.13	**YES**

Notes:

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Macronutrient - Not considered to be a COPC

TABLE 7-10

Screening Statistics - SWMU 14 Groundwater - Step 2

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Frequency of Detection	Maximum Non-Detect	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]	Preliminary COPC?
Dissolved Metals (UG/L)								
Aluminum	2 / 17	105	113	IU14GW04-0911	87.0	1 / 17	1.30	**YES**
Antimony	5 / 17	0.24	0.12	IU14GW070712	30.0	0 / 17	0.0040	NO
Arsenic	1 / 17	4.00	2.40	IU14GW070712	5.00	0 / 17	0.48	NO
Barium	17 / 17	--	194	IU14GW040712	4.00	17 / 17	48.5	**YES**
Beryllium	16 / 17	0.20	1.00	IU14GW040712	0.66	2 / 17	1.52	**YES**
Cadmium	16 / 17	0.20	1.30	IU14GW040712	0.14	11 / 17	9.55	**YES**
Calcium [2]	17 / 17	--	15,800	IU14GW040712	NSV	-- / --	NSV	NO
Chromium	1 / 17	4.10	3.20	IU14GW060712	37.0	0 / 17	0.087	NO
Cobalt	17 / 17	--	632	IU14GW03-0911	23.0	13 / 17	27.5	**YES**
Copper	8 / 17	9.90	8.20	IU14GW05-0911	4.33	4 / 17	1.89	**YES**
Iron	7 / 17	60.0	256	IU14GW06-0911	300	0 / 17	0.85	NO
Lead	2 / 17	0.61	0.59	IU14GW09-0911	0.99	0 / 17	0.60	NO
Magnesium [2]	17 / 17	--	9,600	IU14GW040712	NSV	-- / --	NSV	NO
Manganese	17 / 17	--	698	IU14GW08-0911	120	13 / 17	5.82	**YES**
Mercury	1 / 17	0.12	0.020	IU14GW010712	0.026	0 / 17	0.77	NO
Nickel	17 / 17	--	47.0	IU14GW040712	25.3	8 / 17	1.85	**YES**
Potassium [2]	17 / 17	--	19,200	IU14GW05-0911	NSV	-- / --	NSV	NO
Selenium	0 / 17	3.00	--	--	1.00	-- / --	3.00	**YES**
Silver	0 / 17	0.40	--	--	0.75	-- / --	0.54	NO
Sodium [2]	17 / 17	--	92,500	IU14GW110712	NSV	-- / --	NSV	NO
Thallium	6 / 17	0.40	0.31	IU14GW09-0911	0.80	0 / 17	0.39	NO
Vanadium	6 / 17	4.00	5.10	IU14GW060712	20.0	0 / 17	0.26	NO
Zinc	12 / 17	75.9	93.4	IU14GW09-0911	57.5	4 / 17	1.62	**YES**

Notes:

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Macronutrient - Not considered to be a COPC

TABLE 7-11

Surface Soil Screening - SWMU 14 - Mammal/Bird Eco-SSLs

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Maximum Concentration Detected	Arithmetic Mean	Mammal Eco-SSL	Frequency of Exceedance	Maximum Hazard Quotient	Mean Hazard Quotient	Bird Eco-SSL	Frequency of Exceedance	Maximum Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)										
Arsenic	4.4	3.73	46	0 / 12	0.1	0.1	43	0 / 12	0.1	0.1
Barium	240	60.5	2,000	0 / 12	0.1	0.0	--	0 / 12	--	--
Beryllium	0.71	0.45	21	0 / 12	0.0	0.0	--	0 / 12	--	--
Cadmium	0.26	0.13	0.36	0 / 12	0.7	0.4	0.77	0 / 12	0.3	0.2
Chromium (hexavalent)	0.77	0.29	130	0 / 11	0.0	0.0	--	-- / --	--	--
Chromium	86.0	24.9	34	4 / 23	**2.5**	0.7	26	4 / 23	**3.3**	1.0
Cobalt	19.9	8.7	230	0 / 12	0.1	0.0	120	0 / 12	0.2	0.1
Copper	32.3	13.1	49	0 / 12	0.7	0.3	28	1 / 12	**1.2**	0.5
Lead	181	39.2	56	1 / 12	**3.2**	0.7	11	11 / 12	**16.5**	**3.6**
Manganese	753	249	4,000	0 / 12	0.2	0.1	4,300	0 / 12	0.2	0.1
Nickel	277	30.9	130	1 / 12	**2.1**	0.2	210	1 / 12	**1.3**	0.1
Selenium	0.63	0.3	0.63	0 / 12	1.0	0.5	1.2	0 / 12	0.5	0.3
Silver	25	3.51	14	1 / 12	**1.8**	0.3	4	3 / 12	**6.0**	0.8
Vanadium	36.8	27.3	280	0 / 12	0.1	0.1	7.8	12 / 12	**4.7**	**3.5**
Zinc	136	49.9	79	1 / 12	**1.7**	0.6	46	6 / 12	**3.0**	**1.1**

Notes:

Bold text indicates concentration exceeds the Eco-SSL resulting in an HQ > 1.

TABLE 7-12

Foodweb Exposure Estimates (Step 2) - SWMU 14

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Short-tailed shrew			Meadow vole			Red fox			Raccoon		
	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL
Inorganics												
Chromium	**13.9**	**6.2**	**2.8**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	**2.0**	**1.5**	**1.1**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	**17.5**	**7.8**	**3.5**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	**3.8**	**1.7**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

TABLE 7-12

Foodweb Exposure Estimates (Step 2) - SWMU 14

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	American robin			Mourning dove			Red-tailed hawk			Spotted sandpiper		
	NOAEL	**MATC**	**LOAEL**	**NOAEL**	**MATC**	**LOAEL**	**NOAEL**	**MATC**	**LOAEL**	**NOAEL**	**MATC**	**LOAEL**
Inorganics												
Chromium	**5.5**	**2.5**	**1.1**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	**2.4**	**1.7**	**1.2**	**1.7**	**1.2**	<1	<1	<1	<1	<1	<1	<1
Mercury	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	**1.1**	<1	<1	**1.3**	<1	<1	<1	<1	<1	<1	<1	<1
Silver	**4.8**	**2.2**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

TABLE 7-13

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 3A

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)									Soil/ Sediment Ingestion (percent)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Value**	**Reference**	**Terr Plants**	**Terr Inv**	**Mouse**	**Vole**	**Shrew**	**Aq Plants**	**Aq Inv**	**Fish**	**Reference**	**Value**	**Reference**
Mammals																	
Meadow vole	0.0428	Silva and Downing 1995	0.00899	USEPA 1993a	0.00209	USEPA 1993a	95.6	2.0	0.0	0.0	0.0	0.0	0.0	0.0	USEPA 1993a	2.4	Beyer et al. 1994
Raccoon	5.9400	Silva and Downing 1995	0.49209	allometric equation	0.10308	Conover 1989	0.0	0.0	0.0	0.0	0.0	40.0	43.6	7.0	USEPA 1993a	9.4	Beyer et al. 1994
Red fox	4.0600	Silva and Downing 1995	0.34939	allometric equation	0.12308	Sample and Suter 1994	7.0	2.8	29.2	29.1	29.1	0.0	0.0	0.0	USEPA 1993a	2.8	Beyer et al. 1994
Short-tailed shrew	0.0169	USEPA 1993a	0.00376	USEPA 1993a	0.00149	USEPA 1993a	4.7	82.3	0.0	0.0	0.0	0.0	0.0	0.0	USEPA 1993a; Sample and Suter 1994	13.0	Sample and Suter 1994
Birds																	
American robin	0.0773	USEPA 1993a	0.01062	allometric equation	0.00552	Levey and Karasov 1989	51.9	43.5	0.0	0.0	0.0	0.0	0.0	0.0	Martin et al. 1951	4.6	Sample and Suter 1994
Mourning dove	0.1265	Tomlinson et al. 1994	0.01477	allometric equation	0.01757	allometric equation	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Tomlinson et al. 1994	5.0	Assumed based on diet
Red-tailed hawk	1.1260	Sample and Suter 1994	0.06388	allometric equation	0.03603	Sample and Suter 1994	0.0	0.0	34.0	33.0	33.0	0.0	0.0	0.0	USEPA 1993a; Sample and Suter 1994	0.0	Sample and Suter 1994
Spotted sandpiper	0.0404	`	0.00687	allometric equation	0.00804	allometric equation	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	USEPA 1993a	0.0	Assumed based on site characteristics

TABLE 7-14

Screening Statistics - SWMU 14 Surface Soil - Step 3

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Frequency of Detection	Maximum Non-Detect	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Screening Value	Frequency of Exceedance	Mean Hazard Quotient	COPC?
Inorganics (MG/KG)									
Chromium (hexavalent)	3 / 11	0.24	0.77	IU14SS09A0001	0.29	NSV	-- / --	NSV	**YES**
Chromium	23 / 23	--	86.0	IU14SS140001	24.9	1.0 [b]	23 / 23	24.9	**YES**
Cobalt	12 / 12	--	19.9	IU14SS06-000H	8.67	13 [b]	2 / 12	0.67	NO
Lead	12 / 12	--	181	IU14SS10-000H	39.2	120 [b]	1 / 12	0.33	NO
Manganese	12 / 12	--	753	IU14SS06-000H	249	220 [b]	5 / 12	1.13	**YES**
Mercury	12 / 12	--	0.23	IU14SS11-000H	0.074	0.1 [a]	2 / 12	0.74	NO
Nickel	12 / 12	--	277	IU14SS09-000H	30.9	38 [b]	1 / 12	0.81	NO
Selenium	6 / 12	0.39	0.63	IU14SS06-000H	0.33	0.52 [b]	3 / 12	0.64	NO
Vanadium	12 / 12	--	36.8	IU14SS05-000H	27.3	2.0 [b]	12 / 12	13.6	**YES**
Zinc	12 / 12	--	136	IU14SS10-000H	49.9	120 [a]	1 / 12	0.42	NO

Notes:

a - soil invertebrate based value

b - terrestrial plant based value

TABLE 7-15

Screening Statistics - SWMU 14 Groundwater - Step 3

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

AnalyteName	Frequency of Detection	Maximum Non-Detect	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Screening Value	Frequency of Exceedance	Mean Hazard Quotient[1]	COPC?
Inorganics (UG/L)									
Aluminum	2 / 17	199	876	IU14GW110712	94.3	87.0	2 / 17	1.08	**YES**
Barium	16 / 17	24.9	197	IU14GW040712	73.3	4.00	16 / 17	18.3	**YES**
Beryllium	17 / 17	--	1.10	IU14GW070712	0.45	0.66	2 / 17	0.68	NO
Cadmium	16 / 17	0.12	3.50	IU14GW060712	0.57	0.14	12 / 17	3.96	**YES**
Cobalt	17 / 17	--	595	IU14GW03-0911	208	23.0	14 / 17	9.05	**YES**
Copper	9 / 17	8.90	9.60	IU14GW030712	2.88	4.51	4 / 17	0.64	NO
Cyanide	0 / 17	8.00	--	--	4.00	5.00	-- / --	0.80	NO
Iron	7 / 17	60.0	1,150	IU14GW110712	135	300	1 / 17	0.45	NO
Manganese	17 / 17	--	682	IU14GW08-0911	221	120	13 / 17	1.84	**YES**
Mercury	7 / 17	0.10	0.19	IU14GW080712	0.049	0.026	3 / 17	1.90	**YES**
Nickel	17 / 17	--	47.7	IU14GW040712	21.5	25.4	7 / 17	0.84	NO
Zinc	5 / 17	96.4	124	IU14GW09-0911	29.7	58.3	3 / 17	0.51	NO
Dissolved Metals (UG/L)									
Aluminum	2 / 17	105	113	IU14GW04-0911	34.8	87.0	1 / 17	0.40	NO
Barium	17 / 17	--	194	IU14GW040712	73.6	4.00	17 / 17	18.4	**YES**
Beryllium	16 / 17	0.20	1.00	IU14GW040712	0.43	0.66	2 / 17	0.65	NO
Cadmium	16 / 17	0.20	1.30	IU14GW040712	0.39	0.14	11 / 17	2.86	**YES**
Cobalt	17 / 17	--	632	IU14GW03-0911	207	23.0	13 / 17	9.02	**YES**
Copper	8 / 17	9.90	8.20	IU14GW05-0911	3.06	4.33	4 / 17	0.71	NO
Manganese	17 / 17	--	698	IU14GW08-0911	217	120	13 / 17	1.81	**YES**
Nickel	17 / 17	--	47.0	IU14GW040712	22.0	25.3	8 / 17	0.87	NO
Selenium	0 / 17	3.00	--	--	0.83	1.00	-- / --	0.83	NO
Zinc	12 / 17	75.9	93.4	IU14GW09-0911	30.7	57.5	4 / 17	0.53	NO

Notes:

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

TABLE 7-16

Foodweb Exposure Estimates (Step 3A) - SWMU 14

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Short-tailed shrew			American robin			Mourning dove		
	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL
Inorganics									
Chromium	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	<1	<1	<1	<1	<1	<1	<1	<1	<1

TABLE 7-17

Dilution-Adjusted HQS for Groundwater COPCS Using Dilution-Adjusted Screening Values

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

	Mean Concentration (μg/L)	Dilution Adjusted Screening Value (SV x10)	Dilution Adjusted HQ
Barium	**73.6**	**40**	**1.8**
Cadmium	**0.39**	**1.4**	**0.3**
Cobalt	**207**	**230**	**0.9**
Manganese	**217**	**1,200**	**0.2**

TABLE 7-18

Comparison of Surface Soil COPCS Concentrations With Background Concentrations

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Maximum Site Concentration (mg/kg)	Background 95% UTL (mg/kg)	Mean Site Concentration (mg/kg)	Mean Background Concentration (mg/kg)	Mean Concentration Ratio (Site/ Background)
Chromium	**65.2**	**33.4**	**24.9**	**13.6**	**1.8**
Manganese	**753**	**1,390**	**249**	**227**	**1.1**
Vanadium	**36.8**	**53.3**	**27.3**	**23.3**	**1.2**

TABLE 7-19

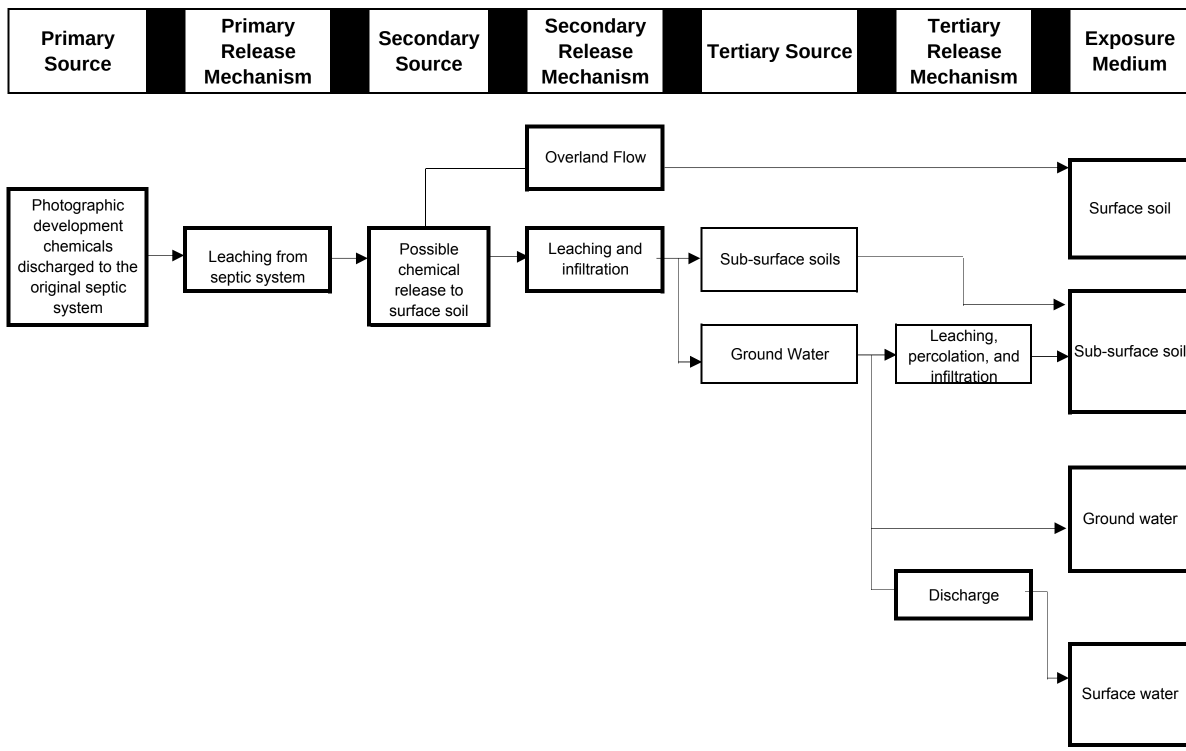
Comparison of Barium Concentrations in Groundwater with Background Concentrations

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-IH, Indian Head, Maryland

Chemical	Maximum Site Concentration (µg/L)	Background 95% UTL (µg/L)	Mean Site Concentration (µg/L)	Mean Background Concentration (µg/L)	Mean Concentration Ratio (Site/ Background)
Barium, filtered	194	114	73.6	40	1.8
Barium, unfiltered	197	254	73.3	64	1.1

Figure 7-1. Conceptual Site Model for the Ecological Risk Assessment - SWMU 14



Ecological Receptors

Exposure Medium	Exposure Route	Plants: Terrestrial Plants	Plants: Aquatic Plants	Invertebrates: Soil	Invertebrates: Aquatic	Fish	Amphibians/Reptiles: Amphibians	Amphibians/Reptiles: Reptiles	Birds: Terrestrical Avian Predator (Red-tailed Hawk)	Birds: Terrestrial Avian Herbivore (Mourning Dove)	Birds: Semi-aquatic Avian Insectivore (Spotted Sandpiper)	Birds: Terrestrial Avian Omnivore (American Robin)	Mammals: Terrestrial Mammalian Vermivore (Short-tailed shrew)	Mammals: Terrestrial Mammalian Herbivore (Meadow Vole)	Mammals: Terrestrial Mammalian Carnivore (Red Fox)	Mammals: Semi-aquatic omnivore (Racoon)
Surface soil	Ingestion	x	x	●	x	x	i	i	i	i	x	○	○	○	i	i
	Dermal contact or root uptake	●	x	i	x	x	i	i	i	i	x	i	○	○	i	i
	Dietary*	x	x	○	x	x	x	x	●	●	x	●	●	i	●	i
Sub-surface soil	Ingestion	x	x	x	x	x	x	x	x	x	x	x	x	x	i	x
	Dermal contact or root uptake	●	x	x	x	x	x	x	x	x	x	x	x	x	i	x
	Dietary[4]	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ground water	Ingestion	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Dermal contact or root uptake	○	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Dietary*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Surface water	Ingestion	x	x	x	i	i	i	i	i	i	i	i	i	i	i	i
	Dermal contact or root uptake	x	i	x	●	●	●	i	i	i	i	i	i	i	i	i
	Dietary*	x	x	x	i	i	i	i	i	i	●	i	i	i	i	●

Legend

- ● = Complete and significant pathway
- ○ = Complete and significance unknown
- **i** = Complete and insignificant pathway
- **x** = Incomplete pathway

Note

*Dietary = Dietary means any tissue that is consumed by the species of interest within the exposure medium, and it includes trophic transfer.

Definitions

A **Complete** pathway means there is a potential for a contaminant to reach a receptor via the proposed route.

An **Incomplete** pathway means there is no potential for a contaminant to reach a receptor via the proposed route.

A **Significant** pathway means there is a high potential that the receptor will receive a significant proportion of the contaminant dose via the proposed route.

An **Insignificant** pathway means there is a low potential that the receptor will receive a significant proportion of the contaminant dose via the proposed route.

Significance Unknown means that it is unknown if the receptor will receive a significant proportion of the contaminant dose via the proposed route alone. However, the receptor could receive a significant proportion of the contaminant dose when combined with other pathways or other contaminants.

Photograph 7-1
Representative Habitat
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head Maryland

Photograph 7-2
SWMU 14 Shoreline
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-IH, Indian Head Maryland

SECTION 8

Conclusions and Recommendations

8.1 Conclusions

8.1.1 Site Characterization

Through characterization and sampling activities performed at the site during both the SSP and RI, the nature and extent of contamination in surface soil and groundwater have been adequately characterized to develop human health and ecological risk assessments for the site. In general the site-related constituent concentrations within the surface soil in the vicinity of the septic drain fields and low-lying area were no higher than elsewhere within the site. Within groundwater, the highest concentrations of cobalt were detected in the vicinity of the original (circa 1968) septic drain field, indicating that cobalt within groundwater at the site is likely a result of releases from the original septic system.

Clay soil was observed at depth during installation of the monitoring wells at the site, suggesting that the clay observed at the base of the bluff is continuous across the site. Geotechnical analysis indicated that the clay layer is of sufficiently low hydraulic conductivity to limit downward migration of potential contamination. Observation of dry borings west and south west of the site at the proposed IU14MW10 location (renamed DP-32) and IU14DP31, indicate that the shallow water bearing zone beneath the site is of limited extent and does not extend across Archer Avenue. There does not appear to be a groundwater divide within the boundary of the site; however, the shallow groundwater is limited to the area beneath the site and not hydraulically connected to the local shallow aquifer. Groundwater flows from the site northeast towards Mattawoman Creek.

8.1.2 HHRA

The HHRA was conducted to assess the potential human health risks, as a result of exposure to surface soil and/or groundwater at SWMU 14. The potential risks were assessed for a current industrial worker and adult and youth trespasser/visitor, as well as future adult and child residents, and construction and industrial workers. The assessment indicated that there are no unacceptable risks that exceed EPA acceptable risk levels for the current or future industrial worker, the current or future adult and adolescent trespasser/visitor, or future adult and child resident exposed to site surface soil, or the future construction worker exposed to surface soil and groundwater.

Future industrial use of the site could result in potential unacceptable RME noncarcinogenic hazard associated with exposure to groundwater due to the presence of cobalt. Also, future residential use of the site could result in potential unacceptable noncarcinogenic hazards to adult and child residents using the groundwater as a potable water supply due to the presence of cobalt.

8.1.3 ERA

Chromium in surface soil was identified as posing a potential risk to invertebrates and/or terrestrial plants due to the concentrations detected within the fenced area near Building 22SN. This is an industrial area with mowed grass and pavement that does not possess significant natural habitat to support native plant or invertebrate communities. Also, chromium does not pose unacceptable risk to birds and mammals that may use the SWMU 14 area.

Barium in groundwater poses a potential risk to aquatic receptors at the point of groundwater discharge. This conclusion is based on using a generic dilution factor of 10 to account for dilution of groundwater upon discharge, in lieu of a site-specific dilution factor. However, the actual dilution factor for this site is likely much greater, considering the volume of the water in the Potomac River in the vicinity of the site. Additionally, although barium is a potential risk-driving COPC for aquatic receptors, the concentrations in site groundwater may be reflective of background conditions because the maximum unfiltered concentration of barium is below the 95 percent UTL background concentration.

8.2 Recommendations

Based on the results of the site characterization and risk assessments, a Feasibility Study is recommended to evaluate remedial alternatives to address cobalt in groundwater at SWMU 14. Because there is limited habitat for ecological receptors and there were no human health risks associated with surface soil, no further action is recommended for the surface soil.

SECTION 9

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Appendix A
Boring Logs

PROJECT NUMBER: **417366**

BORING NUMBER: **IU14-MW04** SHEET 1 OF 2

CH2MHILL

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation

LOCATION : Indian Head, MD (323729.6 N, 1250887.6 E)

ELEVATION : 31.95 ft amsl

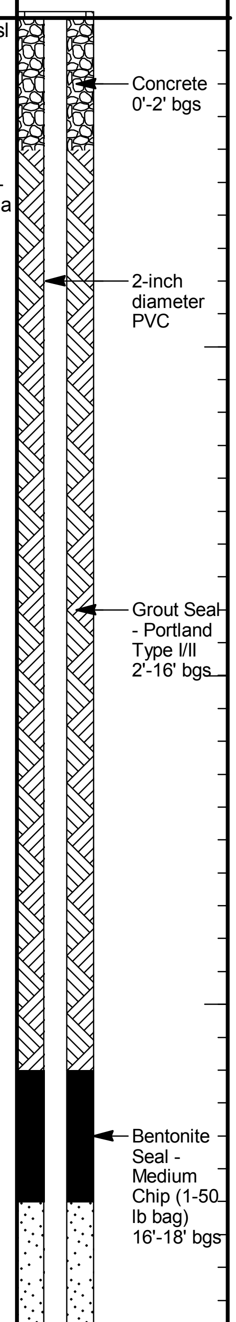
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 23.7 ft bgs | START : 8/9/11 08:05 | END : 8/9/11 14:15 | LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS
		4.0		**TOPSOIL/ORGANIC SILT (OL)** 0.0-0.7'- yellowish red, (5 YR 4/6), dry, loose, roots, trace pebbles	Water level: 8.29 ft. amsl (potentiometric - 08/09/2011)
	4.0			**CLAY WITH SILT (CL)** 0.7-4.5'- light yellowish brown grading to brownish yellow at 2.5', (10 YR 6/4-6/6), dry, very soft, roots	Stick-up style surface completion, with a water-tight expansion cap and a lockable, protective steel cover
5		4.0		**SILT (ML)** 4.5-6.7'- strong brown, (7.5 YR 5/6), dry, loose, few fine to coarse black granules	
				SILT (ML) 6.7-7.5'- very pale brown, (10 YR 8/3), dry, very loose, trace very fine sand	
	8.0			**SILT (ML)** 7.5-8.8'- Same as 4.5-6.7 except no black granules	
10		4.0		**CLAY WITH SAND (CL)** 8.8-10.9'- light gray, (2.5 Y 7/1), dry, medium soft, low to medium plasticity, very fine strong brown sand stringers, trace pebbles (rounded, up to 1/2" in size)	
				SILTY SAND (SM) 10.9-16.0'- strong brown, (7.5 YR 5/8), dry, very loose, fine to medium grained, trace rounded pebbles to 1" in size	
15		4.0			
		4.0		**SILTY SAND (SM)** 16.0-18.2'- Same as 10.9-16.0	
				COBBLES 18.2-18.4'- angular to subrounded 2" diameter	
20	20.0				

WELL DIAGRAM



CH2MHILL

PROJECT NUMBER: 417366

BORING NUMBER: IU14-MW04 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (323729.6 N, 1250887.6 E)

ELEVATION : 31.95 ft amsl
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 23.7 ft bgs
START : 8/9/11 08:05
END : 8/9/11 14:15
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
		4.0		**SILTY SAND (SM)** 18.4-19.2'- reddish yellow, (7.5 YR 6/6), moist, loose, low plasticity, fine grain brownish black Silty Sand (SM) lense 1/2" **CLAY (CL)** 19.2-23.5'- light brownish gray, (10 YR 6/2), dry to moist, stiff, medium to high plasticity, 30% up to 3/4" rounded pebbles throughout, trace silt sand lenses (<2") at 22.5' and 23.1', grades to brown (7.5 YR 5/2) at 23.1-23.5', sand rich		19.2-25.5' Interval considered "Marley" and should correlate to historic borings at SWMU14	
25		4.0		**SILTY SAND (SM)** 23.5-24.0'- light gray, (10 YR 7/2), moist, loose, low plasticity, fine to medium grains **CLAYEY SAND (SC)** 24.0-25.5'- light gray, (10 YR 7/2), moist, dense, high plasticity, trace pebbles (rounded, <1/2") **SILTY SAND WITH GRAVEL (SM-GW)** 25.5-27.8'- light gray and pale yellow grading to strong brown at 26.5', wet, loose to medium dense, fine to coarse sand, ~30% fine to coarse gravel, gravel is subangular, up to 1 1/2" in size			Sand Pack (7.5 bags/~375 lbs) 18'-30' bgs 10' 0.01 slotted screen 2-inch diameter PVC - set at base of borehole (30' bgs) 20'-30'
30	30.0	2.0		**CLAY (CL)** 27.8-28.0'- gray, (7.5 YR 6/1), dry, very stiff, high plasticity, trace fine to medium sand		Shelby Tube Sample collected from 28.0-30.0' bgs	8.25" borehole
				Bottom of Boring at 30.0 ft below ground surface on 8/9/11 14:15			

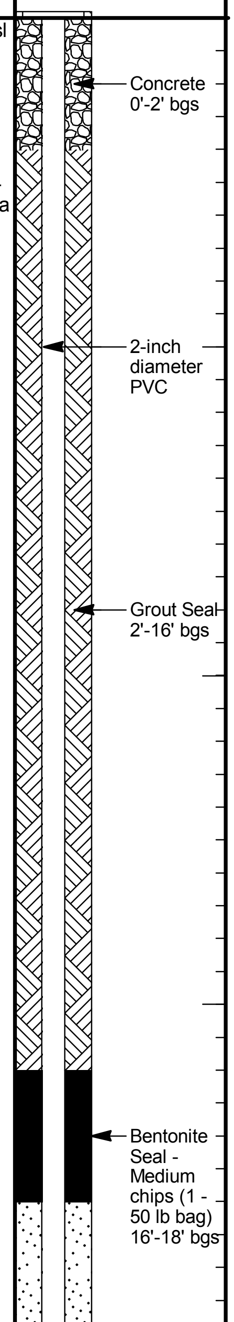
PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW05 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (323730.2 N, 1250994.5 E)
ELEVATION : 31.87 ft amsl
DRILLING CONTRACTOR : Parratt Wolff, Inc.
DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA
WATER LEVELS: 25.6 ft bgs
START : 8/9/11 15:30
END : 8/9/11 17:00
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS
	4.0	4.0		**TOPSOIL/ORGANIC SILT (OL)** 0.0-0.4'- yellowish red, dry, very loose, root matting, pebbles **CLAY WITH SILT (CL)** 0.4-3.1'- light yellowish brown grading to brownish yellow at 2.6' bgs, (10 Yr 6/4 to 6/6), dry, soft, friable, trace roots throughout **SILT (ML)** 3.1-8.0'- dry, loose, fine sand throughout, 3.1' to 5.1' is strong brown in color (7.5 YR 5/6), 5.5' to 8.0' is very pale brown (10 YR 8/3), trace rounded pebbles throughout		Water level: 6.25 ft. amsl (potentiometric - 08/09/2011) Stick-up style surface completion, with a water-tight expansion cap and a lockable, protective steel cover
5		4.0				
10		0.0		**NOT SAMPLED** 8.0-15.0' - see IU14-MW04 for lithology, encounter coarse gravel and cobble at ~10' bgs		
15	16.0	4.0		**SILTY SAND (SM)** 150-16.5'- varigated brownish yellow, yellowish brown, and strong brown, dry, loose to medium dense, low plasticity, fine grain		
20	20.0	3.0		**CLAYEY SAND (SC)** 16.5-16.7'- greenish gray and yellowish red, (GLEY 1 6/56Y and 5 Y 5/8), dry, medium plasticity, laminated, fine sands **SILTY SAND (SM)** 16.7-19.0'- light gray, (2.5 Y 7/2), dry, very loose to loose, low to medium plasticity, banded 15% brownish yellow (10 YR 6/8), fine grain		

WELL DIAGRAM



PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW05 SHEET 2 OF 2

CH2MHILL

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation

LOCATION : Indian Head, MD (323730.2 N, 1250994.5 E)

ELEVATION : 31.87 ft amsl

DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 25.6 ft bgs

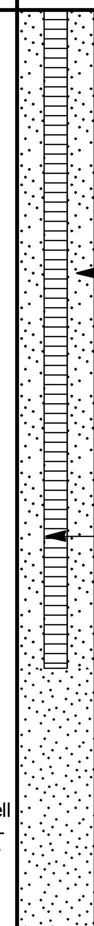
START : 8/9/11 15:30

END : 8/9/11 17:00

LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS
				NOT SAMPLED 19.0-20.0'		
		0.0		**NO RECOVERY** 20.0-24.0' - >2" dia cobble blocking shoe collar		
25				**NOT SAMPLED** 24.0-25.0'		
		3.0		**SILTY SAND (SM)** 25.0-25.5'- light gray, (2.5 Y 7/2), moist, loose to medium dense, medium plasticity, fine grain		
				SILTY SAND (SM) 25.5-27.5'- light gray, (2.5 Y 7/2), wet, very loose, nonplastic, medium grain, angular sands		
	28.0			**NO RECOVERY** 27.5-29.0'		
30		0.0		**NO RECOVERY** 29.0-30.0'		Outside of sample barrel contains soil consistent with Clay (CL) layer found at IU14-MW04. Geologist stops further advancement of any augers or samplers. Well screen to be set from 20-30' bgs with the sampler pilot hole backfilled with sand to 30' bgs (sanded 30-34' 2" diameter hole)
				NO RECOVERY 30.0-34.0' - all slough from above		
		0.0				
	34.0			Bottom of Boring at 34.0 ft below ground surface on 8/9/11 17:00		

WELL DIAGRAM



PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW06 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation   LOCATION : Indian Head, MD (323712.7 N, 1251099.0 E)

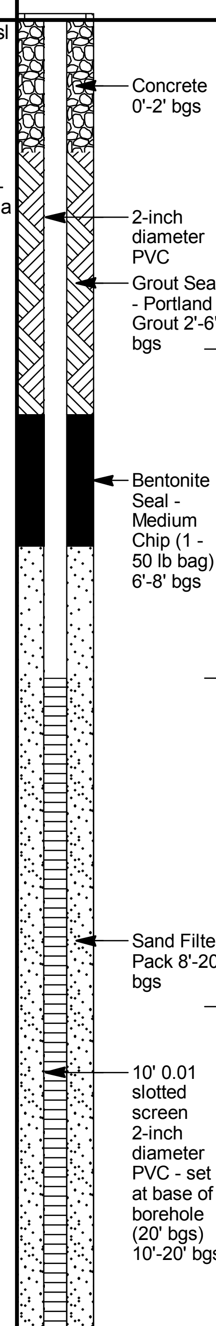
ELEVATION : 22.08 ft amsl   DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 17.3 ft bgs   START : 8/10/11 11:55   END : 8/10/11 05:25   LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS
		1.6		**SILTY WITH SAND (ML)** 0.0-0.3'- brown, (10 YR 5/3), dry, very loose, fine sand, roots, trace large (> 1") pebble gravel **CLAY WITH SILT (CL)** 0.3-1.6'- light yellowish brown, (10 YR 6/4), dry, very soft, 30-35% fine to coarse pebble gravel (up to 1 1/2") **NO RECOVERY** 1.6-4.0'	Water level: 4.74 ft. amsl (potentiometric - 08/10/2011) Stick-up style surface completion, with a water-tight expansion cap and a lockable, protective steel cover
5		4.0		**GRAVEL WITH SILT AND SAND (GW-GM)** 4.0-6.1'- yellowish brown, (10 YR 5/4), dry, very loose, nonplastic, cobbles greater than 1 1/2", medium sand yellowish red in color, 15% medium to coarse block particles from 4.8' to 6.1' **SILTY SAND/CLAYEY SAND (SC)** 6.1-6.9'- laminated yellowish red and light yellowish brown, (5 YR 5/8 and 2.5 Y 6/4), dry, stiff to very stiff, low plasticity, varied mineral assemblage **SILTY SAND/CLAYEY SAND (SC)** 6.9-8.0'- Same as 6.1-6.9 except light yellowish brown homogeneous	
10		4.0		**SILTY SAND (SM)** 8.0-11.8'- pale yellow, (2.5 Y 7/3), moist, medium dense, fine grain, organics in lense at 8.4', strong brown laminations at 8.0-8.2', 9.0', and 11.3-11.5', fine to medium black particles at 11.3-11.5' **CLAY (CL)** 11.8-12.0'- dark grayish brown, (10 YR 4/2), moist, stiff, medium plasticity	
15		4.0		**SILTY SAND (SM)** 12.0-19.7'- light gray, (2.5 Y 7/2), moist to wet, loose, nonplastic, banded strong brown and brownish black throughout, Clay (CL) lense (as above) at 12.8' and 13.3', laminated strong brown from 16.0-16.4', pale yellow (2.5 Y 7/3) sand from 16.0-18.0', with intensified oxidation staining from 18' to 19.3', 19.3-19.7' is gray (5 Y 5/1), wet, with black laminations and 30% medium to coarse black particles (friable, organics), at 19.7' there is a 1/2" lense of fine subrounded clear to translucent gravel (<1/4")	
20		4.0			

WELL DIAGRAM



PROJECT NUMBER:	BORING NUMBER:
417366	**IU14-MW06** SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation LOCATION : Indian Head, MD (323712.7 N, 1251099.0 E)

ELEVATION : 22.08 ft amsl DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 17.3 ft bgs START : 8/10/11 11:55 END : 8/10/11 05:25 LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
		4.0		**CLAY (CL/CH)** 19.7-20.0'- gray, (5 Y 5/1), moist, very stiff, medium to high plasticity, some fine to medium sand, trace fine gravel/coarse subrounded sands (as above)		Shelby Tube Sample collected from 22.0-24.0' bgs	
	24.0			Bottom of Boring at 24.0 ft below ground surface on 8/10/11 17:25			8.25" borehole

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW07 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation LOCATION : Indian Head, MD (323548.1 N, 1251017.7 E)

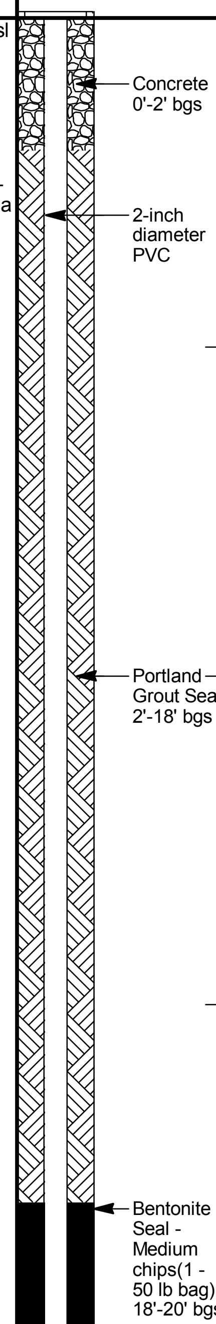
ELEVATION : 31.47 ft asml DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 22.4 ft bgs START : 8/15/11 12:30 END : 8/15/2011 LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS
0–4		3.2		**SILT WITH GRAVEL** 0.0-1.1'- light yellowish brown, (2.5 Y 6/4), dry, loose to medium dense, trace roots at surface, gravel up to 3/4", angular	Water level: 9.12 ft. amsl (potentiometric - 08/15/2011)
				GRAVEL WITH SAND (GW-GM) 1.1-3.2'- strong brown, (7.5 YR 4/6), dry to moist, nonplastic to low plasticity, coarse gravel few >2", angular, medium to coarse sand	Stick-up style surface completion, with a water-tight expansion cap and a lockable, protective steel cover
				NO RECOVERY 3.2-4.0'	
4–8 (5)		2.4		**GRAVEL WITH SAND (GW-GM)** 4.0-6.4'- Same as 1.0-3.2	
				NO RECOVERY 6.4-8.0'	
8–12 (10)		4.0		**GRAVEL WITH SAND (GW-GM)** 8.0-10.0'- Same as 4.0-6.4 except yellowish brown, (10 YR 5/6 - 5/8), moist, fine to medium sand	
				SILTY SAND WITH GRAVEL (SM) 10.0-11.2'- strong brown, (7.5 YR 5/8), dry, medium dense, low plasticity, fine to medium sand, gravel up to 1", angular	10.0-12.0' Driller refusal with sampler at 10' bgs, instructed to run augers to 10' to collect macrocore at 10.0-14.0'
				SILTY SAND (SM) 11.2-14.0'- moist, medium dense, medium plasticity, mica rich, 11.2-13.0' strong brown and yellowish brown (7.5 YR 5/8 and 10 YR 5/6), grades to light yellowish brown (2.5 Y 6/3) at 13' bgs fine to medium stands, low to non plastic below 13', vertical light gray (2.5 Y 7/1) seams 11.2-12.5'	
12–16 (15)		3.0		**NOT SAMPLED** 14.0-15.0'	
				SILTY SAND (SM) 15.0-19.0'- pale yellow, (2.5 Y 7/3), moist, medium dense to loose, low plasticity, banded strong brown at 16.3', 17.8' and 18.3', grades to medium grain sand with brown (10 YR 4/3) laminations at 18.8'	
16–20 (20)		3.0		**NOT SAMPLED** 19.0-20.0'	

WELL DIAGRAM



PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW07 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation   LOCATION : Indian Head, MD (323548.1 N, 1251017.7 E)

ELEVATION : 31.47 ft asml   DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 22.4 ft bgs   START : 8/15/11 12:30   END : 8/15/2011   LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
		3.0		**SILTY SAND (SM)** 20.0-23.0'- light gray to pale yellow, (2.5 Y 7/2 - 7/3), moist to wet at 22.5' bgs, low to non plasticity, medium grain sands, trace yellow banding/laminations throughout			
				NO RECOVERY 23.0-24.0'			
25		3.0		**SILTY SAND (SM)** 24.0-29.0'- light gray to pale yellow, (2.5Y 7/2 - 7/3), wet, loose, medium grain, trace pebbles at 28.5', grades to coarse sand (SP-SM) 28.5-29', yellowish red banding at 29.9' bgs			Sand Filter Pack (12 - 50 lb bags) 20'-32' bgs
							10' 0.01 slotted screen 2-inch diameter PVC, set at base of borehole (32' bgs) 22'-32' bgs
				NOT SAMPLED 29.0-30.0'			
30		3.0		**SILTY SAND (SM)** 30.0-32.0'- pale yellow, (2.5 Y 7/3 -7/4), wet, very loose, nonplastic, discolored yellowish red (especially 31.5-32.0'), coarse sands 31.5-32.0' yellowish red (5 YR 5/8)			
	34.0	2.0		**CLAY (CL/CH)** 32.0-34.0'- yellowish brown, (10 YR 5/4), dry, very stiff to hard, medium plasticity, some dark reddish brown concretions at 32-32.8', discolored reddish yellow from 32-32.8', grades to greenish gray (GLEY 1 6/5GY) at 33.9' bgs, interval from 33-34' white fine sand throughout			Macro core sample; 8.25" borehole
				Bottom of Boring at 34.0 ft below ground surface on 8/15/2011			

PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW08 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation LOCATION : Indian Head, MD (323540.7 N, 1250818.3 E)

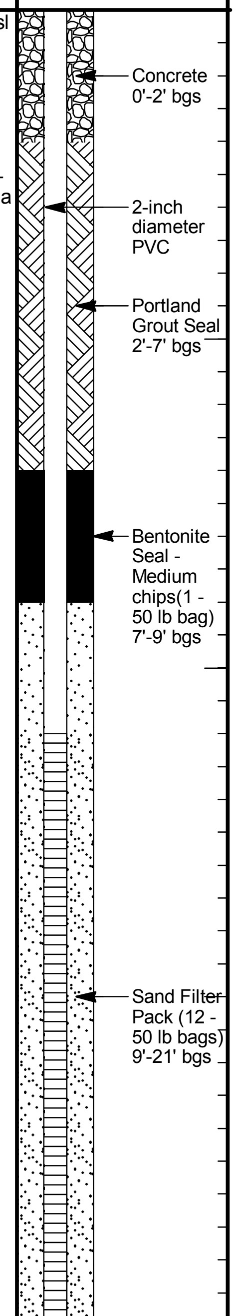
ELEVATION : 24.73 ft asml DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 15.4 ft bgs START : 8/11/2011 END : 8/11/2011 LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS
		4.0		**CLAY WITH SILT (CL)** 0.0-0.5'- light yellowish brown, (10 YR 6/4), dry, very soft, grass roots upper 2", trace pebbles **SILTY SAND (SM)** 0.5-2.0'- strong brown, (7.5 YR 5/6), dry, very loose, nonplastic, very fine to fine grains, 0.2' of coarse subangular gravel up to 3/4" in size **SILTY SAND (SM)** 2.0-4.0'- pale yellow, (2.5 Y 8/3), dry to moist, medium dense, low plasticity, mottled 40 % yellow throughout, trace coarse rounded sand/fine pebble gravel		Water level: 9.38 ft. amsl (potentiometric - 08/11/2011) Flush-mounted surface completion, with a water-tight expansion cap and a lockable, protective steel cover
5		2.0		**NOT SAMPLED** 4.0-5.0' **POORLY GRADED GRAVELLY SAND (GP-GM)** 5.0-7.0'- variegated, dry, very loose, gravel up to 2", angular, some non-native mineral fragments **NO RECOVERY** 7.0-9.0'		
10		2.0		**NOT SAMPLED** 9.0-10.0' **POORLY GRADED GRAVELLY SAND (GP-GM)** 10.0-12.0'- Same as 5.0-7.0 except yellowish red, (5 YR 5/8) **NO RECOVERY** 12.0-14.0'		
15	16.0	1.0		**NOT SAMPLED** 14.0-15.0' **CLAYEY SAND (SC)** 15.0-15.2'- pale yellow, (2.5 Y 7/4), moist, medium dense, medium to high plasticity, fine grain		
20		3.0		**SILTY SAND (SM)** 15.2-19.0'- wet at 15.9', loose, nonplastic to low plasticity, medium grain, discolored yellowish red (5 YR 5/8) with up to 1.5" gravel from 15.2-15.6', interval is predominately pale yellow (2.5 Y 7/4) with up to 40% strong brown and reddish yellow banding/lamination, wet from 15.9-19.0' 19.0-20.0'		

WELL DIAGRAM



PROJECT NUMBER: 417366	BORING NUMBER: IU14-MW08 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (323540.7 N, 1250818.3 E)
ELEVATION : 24.73 ft asml
DRILLING CONTRACTOR : Parratt Wolff, Inc.
DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA
WATER LEVELS: 15.4 ft bgs
START : 8/11/2011
END : 8/11/2011
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
		4.0		**SILTY SAND (SP-SM)** 20.0-21.2'- light gray, (2.5 Y 7/1), wet, very loose, nonplastic, medium to coarse grain, varied mineral assemblage in sand grains, <1" thick coarse sand, fine pebble gravel at 21.2', rounded <3/8" **SILT (ML)** 21.2-21.6'- yellowish red, (5 YR 4/6), dry, medium soft, slightly layered, friable, trace brownish black **CLAY (CL/CH)** 21.6-24.0'- light yellowish brown, (2.5 Y 6/3), dry to moist, very stiff, high plasticity, mottled yellowish red (5 YR 4/6), thinly bedded brownish black and dark reddish brown (2.5 YR 3/4			10' 0.01 slotted screen 2-inch diameter PVC - set at base of borehole (21' bgs) 11'-21' bgs
25		3.0		**NOT SAMPLED** 24.0-25.0' **CLAYEY SAND (SC)** 25.0-29.0'- greenish gray, (GLEY 1 6/5GY - 10GY), dry, hard, medium plasticity, very fine sand 25.0-27.0' is vertically mottled light yellowish brown up to 40% with trace weak red vertical mottling			Macro core sample
	29.0	1.0					8.25" borehole
				Bottom of Boring at 29.0 ft below ground surface on 8/11/2011			

PROJECT NUMBER: 417366	BORING NUMBER: IU14-MW09	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (323412.4 N, 1250942.3 E)

ELEVATION : 21.55 ft asml
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 11.3 ft bgs
START : 8/11/2011
END : 8/11/2011
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS	WELL DIAGRAM
	4.0	2.6		**TOPSOIL/CLAY WITH SILT (CL)** 0.0-0.4'- light yellowish brown, dry, soft, roots, black coarse sized organics **CLAY (CL)** 0.4-0.8'- very pale brown, (10 YR 7/3), dry, soft, trace very fine sand **GRAVEL WITH SAND (GW-GM)** 0.8-2.6'- yellowish brown, (10 YR 5/6), dry, loose, angular fine to coarse gravel, fine to medium sand, gravel > 1 1/2"		Water level: 10.28 ft. amsl (potentiometric - 08/11/2011) Flush-mounted style surface completion, with a water-tight expansion cap and a lockable, protective steel cover	Concrete 0'-2' bgs 2-inch diameter PVC Portland Grout Seal 2'-6' bgs
5	8.0	4.0		**NO RECOVERY** 2.6-4.0' **CLAY (CL)** 4.0-8.0'- brownish yellow and yellowish brown, (10 YR 6/8 - 5/8), dry, very stiff, high plasticity, grades to light gray (10 YR 7/2) at 3.2' bgs, gray sand lenses at 7.6' and 7.8'			Bentonite Seal - Medium chip (1 - 50 lb bag) 6'-8' bgs
10	12.0	4.0		**CLAYEY SAND (SC)** 8.0-9.7'- light brownish gray, (2.5 Y 6/2), moist, stiff, medium to high plasticity, fine to medium sands, trace course black (organics) particles **CLAY WITH SAND/SANDY FAT CLAY (CH)** 9.7-12.0'- gray to dark gray, (5 Y 5/1 - 4/1), moist to wet, medium to high plasticity, fine to medium sands, large (~ 1") organic fragments, fine to medium black organics up to 15%			
15		4.0		**SILTY SAND (SM)** 12.0-20.0'- light gray, (2.5 Y 7/2), wet, low plasticity, fine to medium grain, reddish yellow bands at 13.9', 15.3' and 15.9' bgs, discolored reddish yellow from 16-20' bgs			Sand Filter Pack (7 - 50 lb bags) 8'-20' bgs
20		4.0					10' 0.01 slotted screen 2-inch diameter PVC - set at base of borehole (20' bgs) 10'-20' bgs

PROJECT NUMBER:	BORING NUMBER:
417366	IU14-MW09 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation LOCATION : Indian Head, MD (323412.4 N, 1250942.3 E)

ELEVATION : 21.55 ft asml DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : CME 45, 4 ¼ ID 8 ¾ O.D. HSA

WATER LEVELS: 11.3 ft bgs START : 8/11/2011 END : 8/11/2011 LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
	24.0	4.0		**CLAYEY SAND (SC)** 20.0-20.7'- dark greenish gray, (GLEY 1 4/10Y), moist, medium dense, medium plasticity, medium to coarse sands, clear to translucent, angular, (smokey quartz grains?), iredescent shimmer to mineral grains **CLAY WITH SILT (CL)** 20.7-24.0'- dark greenish gray, (GLEY 1 4/10Y), dry, very stiff, medium plasticity, silt stringers throughout, trace very fine sands			Macro core sample
				Bottom of Boring at 24.0 ft below ground surface on 8/11/2011			8.25" borehole

PROJECT NUMBER: 417366	BORING NUMBER: IU14-DP32 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (1250735.6 N, 323528.6 E)

ELEVATION : 10.88 ft amsl
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT :

WATER LEVELS: N/A
START : 6/27/2012
END : 6/27/2012
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
				CLAY (CL) 0.0-1.3'- brown grading to brownish yellow, (10YR 4/3 to 10YR 6/8), at 0.95' bgs, moist, medium stiff, low to medium plasticity, trace coarse pebbles of 1.1-1.3' bgs			
				GRAVEL WITH CLAYEY SAND (GC-GM) 1.3-2.5'- brownish yellow and light brownish gray, (10YR 6/8 and 10YR 6/2), wet at 1.3' bgs around coarse pebble gravel (rounded to subrounded), low plastic fines, very fine grained to fie grained sands			
				NO RECOVERY 2.5-4.0'			
5				**GRAVEL WITH CLAYEY SAND (GC-GM)** 4.0-4.95'- Same as 1.3-2.5' except coarse sands, angular well graded gravel, dusky red mottling at 4.7' bgs			
				SAND WITH PEBBLE GRAVEL (SM-SP) 4.95-5.4'- brownish yellow and yellowish red mottling, wet, loose to medium dense, trace rounded pebbles up to 1/2", trace clay stringer at 5.1-5.2' bgs, seam of coarse grain black particles at 5.4' bgs (1/2" thick)			
				CLAY (CL) 5.4-6.2'- light yellowish brown, (2.5Y 6/4), mottled 20-30% strong brown, dry, very stiff, medium plasticity, trace very fine sand throughout			
10				**NO RECOVERY** 6.2-8.0'			
				CLAY (CL/CH) 8.0-20.0'- light yellowish brown and strong brown mottled, (2.5Y 6/4 and 7.5YR 5/6), dry, very stiff to hard			
				trace greenish gray mottling at 9.2-10.4' bgs (1/4" lamination)			
				12.0-16.0' bgs is predominately olive gray (5Y 5/2) with 30% strong brown mottling, up to 15% fine grained sand throughout material mostly 12.0-16.0' bgs			
15							
				16.0-20.0' bgs is greenish gray (5GY 5/1) with 30-35% strong brown mottling,		very difficult hammering from 16.0-20.0' bgs interval	
						no well installed	
20	20.0						
				Bottom of Boring at 20.0 ft below ground surface on 6/27/2012			

PROJECT NUMBER: 417366	BORING NUMBER: IU14-MW11	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (323465.0 N, 1250838.5 E)

ELEVATION : 11.38 ft asml
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT :

WATER LEVELS: N/A
START : 6/27/2012
END : 6/27/2012
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
				0.0-1.0'- hand augered (grass and topsoil cover)			Concrete 0'-2' bgs
				GRAVELLY SAND 1.0-3.0'- cobble up to 3" in size			Bentonite Seal - Medium Chip 2'-4' bgs
				CLAY WITH SAND (CL) 3.0-5.0'- yellowish brown, (10YR 5/4), dry to moist, soft, medium plasticity, up to 10% fine sand throughout grades to Clayey Sand (SC) from 4.0-5.0' bgs			Sand Filter Pack 4'-10' bgs
5				**SILTY SAND (SM)** 5.0-7.8'- laminated yellowish red (5YR 5/8) from 5.0-5.8' bgs, medium dense, nonplastic fines, cohesive, trace strong brown mottling throughout wet at 5.6' bgs yellowish brown (10YR 5/6) and gray (2.5Y 6/1) from 5.8-7.8' bgs			0.01 Slotted, 2" Diameter, PVC
				CLAY WITH CONCRETIONS (CL) 7.8-7.9'- dark brown to very dark gray, (10YR 3/3 to 10YR 3/1), dry, brittle to very stiff, up to 20% concretion, up to 5 mm in size			
10				**CLAY (CL)** 7.9-10.75'- light yellowish brown, (2.5Y 6/4), mottled 20% strong brown (7.5yr 5/6), dry, stiff to very stiff, low to medium plasticity mottled weak to dusky red from 9.4-9.9' bgs			
	12.0			**CLAY (CL/CH)** 10.75-12.0'- olive gray grading to greenish gray, (5Y 5/2 to 5GY 5/1), 15% mottled brown to dark brown, dry, very stiff, high plasticity			
				Bottom of Boring at 12.0 ft below ground surface on 6/27/2012			

PROJECT NUMBER: 417366	BORING NUMBER: IU14-DP31 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation
LOCATION : Indian Head, MD (1250773.0 N, 323461.6 E)

ELEVATION : 10.88 ft amsl
DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT :

WATER LEVELS: N/A
START : 6/26/2012
END : 6/26/2012
LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS	WELL DIAGRAM
				SILTY SAND WITH GRAVEL (SM) 0.0-2.8'- brown, (7.5YR 4/3), dry, loose to medium dense, medium to coarse grained, nonplastic, rounded to subangular, gravel up to 2", trace roots			
				SILTY SAND (SM) 2.8-3.0'- yellow to reddish yellow, (7.5YR 6/8), dry, very loose			Concrete 0'-6' bgs
				2.4'- wet			
5				3.0-3.2'- dark yellowish brown, (10YR 4/6), dry, dense, medium grained, low plasticity, becomes clayey at 3.0' bgs			
				NO RECOVERY 3.2-4.0'			
				CLAY (CL) 4.0-12.0'- brownish yellow, yellowish brown, strong brown, dry, very stiff to hard, medium plasticity, trace very fine sand and silt throughout, iron nodules throughout			
10				3" thick Clayey Sand (SC) at 8.0-8.25' bgs, reddish yellow, medium to coarse grained, medium dense to loose, low plastic fines, 3-6% fine rounded mineral pebbles			0.01 Slotted, 2" Diameter, PVC
				clay is predominately gray with transition to greenish gray at 11.8-12.0' bgs, banded yellowish brown			
15	16.0						
				Bottom of Boring at 16.0 ft below ground surface on 6/26/2012			

PROJECT NUMBER:	BORING NUMBER:
417366	IU14-DP32 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Stump Neck Annex SWMU14 Remedial Investigation LOCATION : Indian Head, MD (1250735.6 N, 323528.6 E)

ELEVATION : 10.88 ft amsl DRILLING CONTRACTOR : Parratt Wolff, Inc.

DRILLING METHOD AND EQUIPMENT :

WATER LEVELS: N/A START : 6/27/2012 END : 6/27/2012 LOGGER : T. Stewart/VBO

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	SAMPLE ID (TIME)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS	WELL DIAGRAM
				CLAY (CL) 0.0-1.3'- brown grading to brownish yellow, (10YR 4/3 to 10YR 6/8), at 0.95' bgs, moist, medium stiff, low to medium plasticity, trace coarse pebbles of 1.1-1.3' bgs			
				GRAVEL WITH CLAYEY SAND (GC-GM) 1.3-2.5'- brownish yellow and light brownish gray, (10YR 6/8 and 10YR 6/2), wet at 1.3' bgs around coarse pebble gravel (rounded to subrounded), low plastic fines, very fine grained to fie grained sands			
				NO RECOVERY 2.5-4.0'			
				GRAVEL WITH CLAYEY SAND (GC-GM) 4.0-4.95'- Same as 1.3-2.5' except coarse sands, angular well graded gravel, dusky red mottling at 4.7' bgs			
5				**SAND WITH PEBBLE GRAVEL (SM-SP)** 4.95-5.4'- brownish yellow and yellowish red mottling, wet, loose to medium dense, trace rounded pebbles up to 1/2", trace clay stringer at 5.1-5.2' bgs, seam of coarse grain black particles at 5.4' bgs (1/2" thick)			
				CLAY (CL) 5.4-6.2'- light yellowish brown, (2.5Y 6/4), mottled 20-30% strong brown, dry, very stiff, medium plasticity, trace very fine sand throughout			
10				**NO RECOVERY** 6.2-8.0'			
				CLAY (CL/CH) 8.0-20.0'- light yellowish brown and strong brown mottled, (2.5Y 6/4 and 7.5YR 5/6), dry, very stiff to hard			
				trace greenish gray mottling at 9.2-10.4' bgs (1/4" lamination)			
				12.0-16.0' bgs is predominately olive gray (5Y 5/2) with 30% strong brown mottling, up to 15% fine grained sand throughout material mostly 12.0-16.0' bgs			
15							
				16.0-20.0' bgs is greenish gray (5GY 5/1) with 30-35% strong brown mottling,		very difficult hammering from 16.0-20.0' bgs interval	
						no well installed	
20	20.0						
				Bottom of Boring at 20.0 ft below ground surface on 6/27/2012			

Appendix B
Well Completion Reports

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

C1 4964 — SEQUENCE NO. (MDE USE ONLY)
1 2 3 6 (THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER Charles

ST/CO USE ONLY
DATE Received MM DD YY (8–13)

DATE WELL COMPLETED MM DD YY: 06 09 11 (15–20)

Depth of Well (22–26): 30 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 95 - 1659 (28–37)

OWNER US Navy
last name first name
WELL SITE ADDRESS NSF Indian Head Division
TOWN Indian Head
SUBDIVISION
SECTION
LOT IU14-MW04

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med silt little f/sand	0	18	
Brown wet med silt, some f/m sand trace clay	18	30	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED: yes Y / no N — N

CIRCLE APPROPRIATE LETTER
- **A** A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- **E** ELECTRIC LOG OBTAINED
- **P** TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M 6 D 0 1 7

DRILLERS SIGNATURE
(MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. __ __ D __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box): yes Y / no N (44) — Y

TYPE OF GROUTING MATERIAL (Circle one)
CEMENT CM (45 46) — circled; BENTONITE CLAY BC (45 46)

NO. OF BAGS 3 NO. OF POUNDS 15

GALLONS OF WATER 20

DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. (48 TOP 52) to 18 ft. (54 BOTTOM 58)
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
ST STEEL; CO CONCRETE; PL PLASTIC; OT OTHER

MAIN CASING TYPE (60 61)	Nominal diameter top (main) casing (nearest inch) (63 64)	Total depth of main casing (nearest foot) (66–70)
PL	2	20

EACH CASING — OTHER CASING (if used)

diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole insert appropriate code below
ST STEEL; BR BRASS BRONZE; HO OPEN HOLE; PL PLASTIC; OT OTHER

C2 — EACH SCREEN — DEPTH (nearest ft.)

	type	from	to
1 (8 9, 11–15, 17–21)	PL	20	30
2 (23 24, 26–30, 32–36)			
3 (38 39, 41–45, 47–51)			

SLOT SIZE 1 .010 2 ___ 3 ___

DIAMETER OF SCREEN (56–60): 2 (NEAREST INCH)

GRAVEL PACK from 18 to 30
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 TELESCOPE CASING; 72 LOG INDICATOR; 74 75 76 OTHER DATA

C3
PUMPING TEST
HOURS PUMPED (nearest hour) (8 9): /

PUMPING RATE (gal. per min.) (11–15): /

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)
BEFORE PUMPING (17–20): / ft.
WHEN PUMPING (22–25): / ft.

TYPE OF PUMP USED (for test) (27)
A air; P piston; T turbine; C centrifugal; R rotary; O other (describe below); J jet; S submersible

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO): YES / NO — NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29.

CAPACITY: GALLONS PER MINUTE (to nearest gallon) (31–35)

PUMP HORSE POWER (37–41)

PUMP COLUMN LENGTH (nearest ft.) (43–47)

CASING HEIGHT (circle appropriate box and enter casing height)
+ above (49) — circled; – below (49) LAND SURFACE
3 (50 51) (nearest) foot)

LATITUDE 38.33329
LONGITUDE 77.12882
(DEFAULT COORD. WGS 84)

NOTES:
see map

MW-04

MDE/WMA/PER.071

DRILLER

C 1 4965

SEQUENCE NO. (MDE USE ONLY)

1 2 3 6 (THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER Charles

ST/CO USE ONLY DATE Received MM DD YY 8 13

DATE WELL COMPLETED MM DD YY 08 09 11 15 20

Depth of Well 22 30 26 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 95 - 1660 28 29 30 31 32 33 34 35 36 37

OWNER US Navy

WELL SITE ADDRESS last name NSF Indian Head Division first name TOWN Indian Head

SUBDIVISION SECTION LOT IU14-MW05

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med. silt little F/sand	0	18	
Brown wet med silt little F/sand trace clay	18	30	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED yes Y no N

CIRCLE APPROPRIATE LETTER
- A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E ELECTRIC LOG OBTAINED
- P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M CD 017

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. __ __ D __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y 44 no N 44

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT CM 45 46 BENTONITE CLAY BC 45 46

NO. OF BAGS 3 NO. OF POUNDS 15

GALLONS OF WATER 20

DEPTH OF GROUT SEAL (to nearest foot) from 0 ft. to 18 ft. 48 TOP 52 54 BOTTOM 56 (enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below

ST STEEL CO CONCRETE PL PLASTIC OT OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)!	Total depth of main casing (nearest foot)
PL (60 61)	2 (63 64)	20 (66 70)

EACH CASING — OTHER CASING (if used) diameter inch, depth (feet) from to

SCREEN RECORD
screen type or open hole insert appropriate code below

ST STEEL BR BRASS BRONZE HO OPEN HOLE PL PLASTIC OT OTHER

C 2

EACH SCREEN — DEPTH (nearest ft.)

	Type		
1	PL (8 9)	20 (11 15)	30 (17 21)
2	(23 24)	(26 30)	(32 36)
3	(38 39)	(41 45)	(47 51)

SLOT SIZE 1 .010 2 ____ 3 ____

DIAMETER OF SCREEN 2 (NEAREST INCH) 56 60

GRAVEL PACK from 18 to 30

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)

T (E.R.O.S.) W Q

70 TELESCOPE CASING 72 LOG INDICATOR 74 75 76 OTHER DATA

C 3

PUMPING TEST
HOURS PUMPED (nearest hour) 1 8 9

PUMPING RATE (gal. per min.) 1 . 11 15

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING 1 ft. 17 20

WHEN PUMPING 1 ft. 22 25

TYPE OF PUMP USED (for test)

A air, P piston, T turbine, C centrifugal, R rotary, O other (describe below), J jet, S submersible (27)

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. 29

CAPACITY: GALLONS PER MINUTE (to nearest gallon) 31 35

PUMP HORSE POWER 37 41

PUMP COLUMN LENGTH (nearest ft.) 43 47

CASING HEIGHT (circle appropriate box and enter casing height)

+ above 49 LAND SURFACE − below 49 3 (nearest) foot) 50 51

LATITUDE 38.33311

LONGITUDE 77.12836

(DEFAULT COORD. WGS 84)

NOTES:

See map

MW-05

MDE/WMA/PER.071

DRILLER

C 1 4966
1 2 3 6
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

SEQUENCE NO. (MDE USE ONLY)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER Charles

ST/CO USE ONLY
DATE Received MM DD YY (8–13)

DATE WELL COMPLETED MM DD YY: 08 10 11 (15–20)

Depth of Well: 22 (TO NEAREST FOOT) (22–26)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 05 - 1661 (28–37)

OWNER US Navy
WELL SITE ADDRESS NSF Indian Head Division TOWN Indian Head
SUBDIVISION ______ SECTION ______ LOT IU14-MW06

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med silt little F/sand	0	16	
Brown wet med silt, little F/m sand Trace clay	16	22	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED yes Y no N (N circled)

CIRCLE APPROPRIATE LETTER
A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
E ELECTRIC LOG OBTAINED
P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M G D 0 1 7

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. __ __ D __ __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y no N (44)
TYPE OF GROUTING MATERIAL (Circle one)
CEMENT CM (45 46) BENTONITE CLAY BC (45 46)
NO. OF BAGS 2 NO. OF POUNDS 10
GALLONS OF WATER 15
DEPTH OF GROUT SEAL (to nearest foot)
from 0 TOP (48–52) ft. to 10 BOTTOM (54–58) ft.
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
ST STEEL, CO CONCRETE, PL PLASTIC, OT OTHER

MAIN CASING TYPE (60 61)	Nominal diameter top (main) casing (nearest inch)! (63 64)	Total depth of main casing (nearest foot) (66–70)
PL	2	12

OTHER CASING (if used)

EACH CASING

	diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole insert appropriate code below
ST STEEL, BR BRASS BRONZE, HO OPEN HOLE, PL PLASTIC, OT OTHER

C 2
1 2

DEPTH (nearest ft.)

EACH SCREEN

	Type	from	to
1	PL (8 9)	12 (11–15)	22 (17–21)
2	(23 24)	(26–30)	(32–36)
3	(38 39)	(41–45)	(47–51)

SLOT SIZE 1 .010 2 ____ 3 ____

DIAMETER OF SCREEN 2 (56–60) (NEAREST INCH)

	from	to
GRAVEL PACK	10	22

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 TELESCOPE CASING; 72 LOG INDICATOR; 74 75 76 OTHER DATA

C 3
1 2

PUMPING TEST
HOURS PUMPED (nearest hour) 1 (8 9)
PUMPING RATE (gal. per min.) 1 . (11–15)
METHOD USED TO MEASURE PUMPING RATE ______
WATER LEVEL (distance from land surface)
BEFORE PUMPING 1 (17–20) ft.
WHEN PUMPING 1 (22–25) ft.
TYPE OF PUMP USED (for test)
A air, P piston, T turbine, C centrifugal, R rotary, O other (describe below), J jet, S submersible (27)

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO (NO circled)
IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.
TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. ___ (29)
CAPACITY: GALLONS PER MINUTE (to nearest gallon) (31–35)
PUMP HORSE POWER (37–41)
PUMP COLUMN LENGTH (nearest ft.) (43–47)
CASING HEIGHT (circle appropriate box and enter casing height)
+ above (49) / − below (49) LAND SURFACE 3 (50 51) (nearest foot) (+ circled)

LATITUDE 38.33293
LONGITUDE 77.12799
(DEFAULT COORD. WGS 84)
NOTES:
See map

MW-06

MDE/WMA/PER.071

DRILLER

C 1 4967

SEQUENCE NO. (MDE USE ONLY)

1 2 3 6 (THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER Charles

ST/CO USE ONLY DATE Received MM DD YY 8 13

DATE WELL COMPLETED MM DD YY 08 15 11 (15–20)

Depth of Well 22 32 26 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 95 - 1662 (28–37)

OWNER US Navy
WELL SITE ADDRESS NSF Indina Head Division TOWN Indian Head
SUBDIVISION ______ SECTION ______ LOT IU14-MW07

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med Silt Little F/m sand	0	24	
Brown wet med Silt Little F/m sand Trace clay	24	32	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED yes Y no N (circled: N)

CIRCLE APPROPRIATE LETTER
- A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E ELECTRIC LOG OBTAINED
- P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M 6D 017

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. ___ D ___

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y (circled) no N (44)

TYPE OF GROUTING MATERIAL (Circle one)
CEMENT CM (circled) 45 46 BENTONITE CLAY BC 45 46

NO. OF BAGS 3 NO. OF POUNDS 15

GALLONS OF WATER 20

DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. (48 TOP 52) to 20 ft. (54 BOTTOM 58)
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below: ST STEEL; CO CONCRETE; PL PLASTIC; OT OTHER

MAIN CASING TYPE (60 61)	Nominal diameter top (main) casing (nearest inch) (63 64)	Total depth of main casing (nearest foot) (66 70)
PL	2	22

EACH CASING — OTHER CASING (if used)

diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole insert appropriate code below: ST STEEL; BR BRASS BRONZE; HO OPEN HOLE; PL PLASTIC; OT OTHER

C 2 1 2

EACH SCREEN — DEPTH (nearest ft.)

	type	from	to
1	PL (8 9)	22 (11 15)	32 (17 21)
2	(23 24)	(26 30)	(32 36)
3	(38 39)	(41 45)	(47 51)

SLOT SIZE 1 .010 2 ___ 3 ___

DIAMETER OF SCREEN 2 (56 60) (NEAREST INCH)

GRAVEL PACK from 20 to 32
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 72 74 75 76
TELESCOPE CASING LOG INDICATOR OTHER DATA

C 3 1 2

PUMPING TEST
HOURS PUMPED (nearest hour) 1 (8 9)

PUMPING RATE (gal. per min.) 1 (11 15)

METHOD USED TO MEASURE PUMPING RATE ______

WATER LEVEL (distance from land surface)
BEFORE PUMPING 1 ft. (17 20)
WHEN PUMPING 1 ft. (22 25)

TYPE OF PUMP USED (for test) (27)
- A air
- P piston
- T turbine
- C centrifugal
- R rotary
- O other (describe below)
- J jet
- S submersible

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO (circled: NO)

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. ___ 29

CAPACITY: GALLONS PER MINUTE (to nearest gallon) (31 35)

PUMP HORSE POWER (37 41)

PUMP COLUMN LENGTH (nearest ft.) (43 47)

CASING HEIGHT (circle appropriate box and enter casing height)
+ above (49) (circled) / – below (49) LAND SURFACE 3 (50 51) (nearest foot)

LATITUDE 38.33265
LONGITUDE 77.12819
(DEFAULT COORD. WGS 84)
NOTES:

See map

MW-07

MDE/WMA/PER.071

DRILLER

STATE OF MARYLAND
WELL COMPLETION REPORT

C 1 4968 — SEQUENCE NO. (MDE USE ONLY)
1 2 3 6 (THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER: Charles

ST/CO USE ONLY — DATE Received MM DD YY (8–13)

DATE WELL COMPLETED MM DD YY: 08 12 11 (15–20)

Depth of Well: 21 (22–26) (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 95 - 1663 (28–37)

OWNER: US Navy (last name / first name)

WELL SITE ADDRESS: NSF Indian Head Division TOWN: Indina Head

SUBDIVISION: SECTION: LOT: IU14-MW08

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med silt, little F/sand	0	13	
Brown wet med silt, little F/sand, trace clay	13	21	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED: yes Y / no N (N circled)

CIRCLE APPROPRIATE LETTER
- A — A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E — ELECTRIC LOG OBTAINED
- P — TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M G-D 017

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION): [signature]

LIC. NO. __ __ D __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box): yes Y / no N (44)

TYPE OF GROUTING MATERIAL (Circle one): CEMENT CM (45 46) BENTONITE CLAY BC (45 46)

NO. OF BAGS: 2 NO. OF POUNDS: 10

GALLONS OF WATER: 15

DEPTH OF GROUT SEAL (to nearest foot) from 0 ft. (TOP 48–52) to 9 ft. (BOTTOM 54–58) (enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below: ST STEEL, CO CONCRETE, PL PLASTIC, OT OTHER

MAIN CASING TYPE (60 61)	Nominal diameter top (main) casing (nearest inch)! (63 64)	Total depth of main casing (nearest foot) (66–70)
PL	2	11

OTHER CASING (if used) — EACH CASING: diameter inch / depth (feet) from / to

SCREEN RECORD
screen type or open hole insert appropriate code below: ST STEEL, BR BRASS BRONZE, HO OPEN HOLE, PL PLASTIC, OT OTHER

C 2 — DEPTH (nearest ft.)

EACH SCREEN	type	from	to
1	PL (8 9)	11 (11–15)	21 (17–21)
2	(23 24)	(26–30)	(32–36)
3	(38 39)	(41–45)	(47–51)

SLOT SIZE 1 .010 2 ___ 3 ___

DIAMETER OF SCREEN: 2 (56–60) (NEAREST INCH)

GRAVEL PACK from 9 to 21

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 TELESCOPE CASING — 72 LOG INDICATOR — 74 75 76 OTHER DATA

C 3 PUMPING TEST
HOURS PUMPED (nearest hour): 1 (8 9)

PUMPING RATE (gal. per min.): 1 (11–15)

METHOD USED TO MEASURE PUMPING RATE:

WATER LEVEL (distance from land surface)
- BEFORE PUMPING: 1 ft. (17–20)
- WHEN PUMPING: 1 ft. (22–25)

TYPE OF PUMP USED (for test) (27): A air, P piston, T turbine, C centrifugal, R rotary, O other (describe below), J jet, S submersible

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO): YES NO (NO circled)

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29.

CAPACITY: GALLONS PER MINUTE (to nearest gallon) (31–35)

PUMP HORSE POWER (37–41)

PUMP COLUMN LENGTH (nearest ft.) (43–47)

CASING HEIGHT (circle appropriate box and enter casing height): + above / − below (49) LAND SURFACE: 3 (50 51) (nearest foot) — above (+) circled

LATITUDE 38.33275
LONGITUDE 77.12878
(DEFAULT COORD. WGS 84)

NOTES:

See map

MW-08

MDE/WMA/PER.071

DRILLER

C 1 4969

SEQUENCE NO. (MDE USE ONLY)

1 2 3 6 (THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER Charles

ST/CO USE ONLY DATE Received MM DD YY 8 13

DATE WELL COMPLETED MM DD YY 08 11 11 15 20

Depth of Well 22 20 26 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 95 - 1664 28 29 30 31 32 33 34 35 36 37

OWNER US Navy

WELL SITE ADDRESS last name NSF Indian Head Division first name TOWN Indian Head

SUBDIVISION SECTION LOT IU14-MW09

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist med Silt little F/m Sand	0	12	
Brown wet med Silt, little F/m Sand Trace clay	12	20	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED yes Y no N

CIRCLE APPROPRIATE LETTER
- A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E ELECTRIC LOG OBTAINED
- P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M C-D 017

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. __ __ D __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y no N 44 44

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT C M 45 46 BENTONITE CLAY B C 45 46

NO. OF BAGS 2 NO. OF POUNDS 18

GALLONS OF WATER 15

DEPTH OF GROUT SEAL (to nearest foot) from 0 ft. to 8 ft. 48 TOP 52 54 BOTTOM 58 (enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below

S T STEEL C O CONCRETE P L PLASTIC O T OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)!	Total depth of main casing (nearest foot)
PL (60 61)	2 (63 64)	10 (66 70)

EACH CASING — OTHER CASING (if used) diameter inch, depth (feet) from to

SCREEN RECORD
screen type or open hole insert appropriate code below

S T STEEL B R BRASS BRONZE H O OPEN HOLE P L PLASTIC O T OTHER

C 2 1 2

DEPTH (nearest ft.)

EACH SCREEN	type	from	to
1	PL (8 9)	10 (11 15)	20 (17 21)
2	(23 24)	(26 30)	(32 36)
3	(38 39)	(41 45)	(47 51)

SLOT SIZE 1 .010 2 ___ 3 ___

DIAMETER OF SCREEN 2 (NEAREST INCH) 56 60

GRAVEL PACK from 8 to 20

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)

T (E.R.O.S.) W Q

70 TELESCOPE CASING 72 LOG INDICATOR 74 75 76 OTHER DATA

C 3 1 2

PUMPING TEST
HOURS PUMPED (nearest hour) 1 8 9

PUMPING RATE (gal. per min.) 1 . 11 15

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING 1 ft. 17 20

WHEN PUMPING 1 ft. 22 25

TYPE OF PUMP USED (for test)

A air, P piston, T turbine, C centrifugal, R rotary, O other (describe below), J jet, S submersible (27)

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. 29

CAPACITY: GALLONS PER MINUTE (to nearest gallon) 31 35

PUMP HORSE POWER 37 41

PUMP COLUMN LENGTH (nearest ft.) 43 47

CASING HEIGHT (circle appropriate box and enter casing height) + above 49 LAND SURFACE – below 49 3 (nearest) foot 50 51

LATITUDE 38.33247

LONGITUDE 77.12836

(DEFAULT COORD. WGS 84)

NOTES:

See map

MW-09

MDE/WMA/PER.071

DRILLER

10379

SEQUENCE NO. (MDE USE ONLY)

THIS NUMBER IS TO BE PUNCHED COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER: Charles

ST/CO USE ONLY DATE Received MM DD YY

DATE WELL COMPLETED MM DD YY: 06 27 12

Depth of Well: 10 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 12 - 0058

OWNER: US Navy

WELL SITE ADDRESS: Archer Ave   TOWN: Indian Head

SUBDIVISION: NSF Indian Head Division   SECTION: ____   LOT: ____

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Brown moist loose F/m sand little silt	0	2	
Brown wet loose F/m sand little silt trace clay	2	10	✓

NUMBER OF UNSUCCESSFUL WELLS: 0

WELL HYDROFRACTURED: yes Y / no N (circled: N)

CIRCLE APPROPRIATE LETTER
- A — A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E — ELECTRIC LOG OBTAINED
- P — TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO.: MGD017

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: __ __ D __ __ __

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box): yes Y (circled) / no N

TYPE OF GROUTING MATERIAL (Circle one): CEMENT CM (circled) / BENTONITE CLAY BC

NO. OF BAGS: 1   NO. OF POUNDS: 5

GALLONS OF WATER: 8

DEPTH OF GROUT SEAL (to nearest foot): from 0 ft. (TOP) to 4 ft. (BOTTOM) (enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below: ST STEEL, CO CONCRETE, PL PLASTIC, OT OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	5

OTHER CASING (if used): diameter inch; depth (feet) from / to

SCREEN RECORD
screen type or open hole, insert appropriate code below: ST STEEL, BR BRASS BRONZE, HO OPEN HOLE, PL PLASTIC, OT OTHER

C 2 — DEPTH (nearest ft.)

	Type	From	To
1	PL	5	10
2			
3			

SLOT SIZE 1 .010 2 ____ 3 ____

DIAMETER OF SCREEN: 2 (NEAREST INCH)

GRAVEL PACK: from 4 to 10

IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER): T (E.R.O.S.) W Q; TELESCOPE CASING; LOG INDICATOR; OTHER DATA

C 3 — PUMPING TEST
HOURS PUMPED (nearest hour): 1

PUMPING RATE (gal. per min.): 1

METHOD USED TO MEASURE PUMPING RATE: ____

WATER LEVEL (distance from land surface)

BEFORE PUMPING: 1 ft.

WHEN PUMPING: 1 ft.

TYPE OF PUMP USED (for test): A air, P piston, T turbine, C centrifugal, R rotary, O other (describe below), J jet, S submersible

PUMP INSTALLED
DRILLER INSTALLED PUMP (CIRCLE) (YES or NO): NO (circled)

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29.

CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height): + above (circled) / − below LAND SURFACE: 3 (nearest foot)

LATITUDE 3_.______

LONGITUDE 7_.______

(DEFAULT COORD. WGS 84)

NOTES:

See map

IU14-MW11

MDE/WMA/PER.071

DRILLER

Appendix C
Survey Report

610 W. Cumberland St. Dunn, NC 28334
A Veteran Owned Company

ECLS
Serving the East Coast
•Engineering
•Construction Staking
•Land Surveying
•Subsurface Utility Locating
910.897.3257

CH2MHILL SURVEYOR REPORT

Surveying of SWMU 14 Monitoring Wells

A Naval Support Facility Indian Head Stump Neck Annex, Indian Head, Maryland

CLEAN N62470-08-D-1000 - CTO-JU40

Date of Survey: 08-07-2012

Name(s) of crew: Don Williams and Danny McCready

Weather Conditions: Sunny - 80°F

Barometric Pressure: 30.2

Survey Control Stations:

The Horizontal values shown in this report are Maryland Coordinates System (MDCS) of 1983 North Zone. The Vertical values shown in this report are in NAVD 88 Datum current adjustment.

All coordinates shown in U.S. Survey Foot.

EXISTING CONTROL	ELEV.	NORTHING	EASTING
PT1: IRS	32.37	323,658.87	1,250,978.17
PT2: IRS	32.03	323,684.73	1,250,870.41
PT3: IRS	24.86	323,532.11	1,250,821.36

Control Points 1-3 were established on a field survey done by ECLS, Inc. on 09-12-2011 with receiver Trimble R8 GPS using 45 minute OPUS Static GPS sessions. Existing Control Points 1-3 were recovered and then monitoring well was then tied to MDCS. The following checks were made throughout the survey.

CONTROL CHECKS	ELEV.	NORTHING	EASTING
PT1 CHECK	32.37	323,658.88	1,250,978.16
PT3 CHECK	24.87	323,532.10	1,250,821.35
PT2 CHECK	32.03	323,684.72	1,250,870.41

Monitoring Well Locations:

WELL NUMBER	TOP OF WELL	TOP OF CASING	CONCRETE PAD	GROUND	NORTHING	EASTING
	(ft msl)	(ft msl)	(ft msl)	(ft msl)		
IU14-MW11	14.40	14.47	11.64	11.38	323,464.96	1,250,838.49

WELL NUMBER	TOP OF WELL	TOP OF CASING	CONCRETE PAD	GROUND	NORTHING	EASTING
	(ft msl)	(ft msl)	(ft msl)	(ft msl)		
IU14-MW04	35.43	34.97	31.94	31.95	323,729.58	1,250,887.64
IU14-MW05	35.64	35.35	32.18	31.87	323,730.15	1,250,994.52
IU14-MW06	25.80	25.52	22.56	22.08	323,712.70	1,251,098.95
IU14-MW07	35.43	34.98	32.02	31.47	323,548.07	1,251,017.74
IU14-MW08	24.78	24.47	24.80	24.73	323,540.68	1,250,818.33
IU14-MW09	21.64	21.41	21.65	21.55	323,412.41	1,250,942.33

CONTROL USED	ELEV.	NORTHING	EASTING
PT1: IRS	32.37	323,658.87	1,250,978.17
PT2: IRS	32.03	323,684.73	1,250,870.41
PT3: IRS	24.86	323,532.11	1,250,821.36

CONTROL CHECKS	ELEV.	NORTHING	EASTING
PT2 CHECK	32.03	323,684.73	1,250,870.41
PT2 CHECK	32.03	323,684.72	1,250,870.41
PT1 CHECK	32.36	323,658.87	1,250,978.17
PT2 CHECK	32.04	323,684.71	1,250,870.41
PT2 CHECK	32.04	323,684.71	1,250,870.41

ECLS, Inc. ACTIVITY HAZARD ANALYSIS **Activity:** Land Surveying of monitoring wells **Job Name: CTO-WE15**

Date: 12/26/11 **Description of Services:** Land Surveying

Lab Row, Allegany Ballistics Lab, Rocket Center, WV

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization to site	Adverse Weather Road Conditions Other Drivers Fatigue	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. • Frequently observe the horizon for developing storms systems. • Bring clothing suitable for anticipated daily weather conditions. • Observe proper driving techniques, employ defensive driving skills, wear seat belts, pre-job vehicle inspections. • Abstain from using cell phone while driving • Obtain proper amount of sleep, follow fatigue management regulations. • Shut down operations during heavy rain, lightning events or high wind conditions. For storms producing lightning, seek safe haven in vehicles, enclosed buildings or low ground. • Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events.	Standard Level D PPE per APP/SSHP
Pre-survey of job site	Biological	• Observe ground surfaces, enclosed structures, and surrounding vegetation for hazardous plants, insects, snakes, and spiders. Identification of common hazards provided in APP/SSHP. • Prior to starting field activities, notify supervisors of known allergies to stinging insects and location and quantity of antidote in the event the employee becomes incapacitated as a result of an insect bite • If exposed, follow first aid procedures provided in APP/SSHP • Tick prevention measures: – Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into/taped to boots; – Spray only outside of clothing with permethrin or permanone and spray skin with DEET or other appropriate repellant. – Check yourself frequently for ticks. • Where exposure to ticks is verified, personnel shall consider wearing "bug-out" suits to minimize potential exposures to ticks or other biting insects (i.e., chiggers). • Frequently check body and clothing for ticks, chiggers, spiders • First aid kits and a Bloodborne Pathogens Protection Kit shall be immediately available at the site. • Use universal precautions when dealing with materials or situations where there is a potential for bloodborne pathogens.	Standard Level D PPE per APP/SSHP
Land Surveying	Fire Prevention	• One fire extinguisher is located in each vehicle.	Standard Level D PPE per APP/SSHP

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ECLS, Inc. ACTIVITY HAZARD ANALYSIS **Activity:** Land Surveying of monitoring wells **Job Name: CTO-WE15**

Date: 12/26/11 **Description of Services:** Land Surveying

Lab Row, Allegany Ballistics Lab, Rocket Center, WV

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Land Surveying	Heat/Cold Stress	**Heat Stress** • Become familiar with signs and symptoms of heat stress (see APP/SSHP) • Drink 16 oz. of water prior to beginning work. • Acclimate by slowly increasing workloads (e.g., do not begin with extremely demanding activities). • Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency. • Conduct strenuous field activities in the early morning or evening and rotate shifts of workers, if possible. • Whenever possible, avoid direct sun, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods. • Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal). • Maintain good hygiene standards by frequently changing clothing and showering. • Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSHO to avoid progression of heat-related illness. • To counteract the onset of heat stress symptoms, a work-break regimen must be established during the executed work. **Cold Stress** • Be aware of the symptoms of cold-related disorders. • Wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather. • Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SHSO to avoid progression of cold-related illness. • Implement work/rest regimen as necessary. • Observe one another for initial signs of cold-related disorders. • Obtain and review weather forecast— be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.	Standard Level D PPE per APP/SSHP
Land Surveying	Manual Lifting	• Personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • Plan storage and staging to minimize lifting or carrying distances. • Split heavy loads into smaller loads. • Barricade off work area if possible. • Have someone assist with the lift— especially for heavy (>40 lbs.) or awkward loads. • Make sure the path of travel is clear prior to the lift. • Employ correct lifting procedures. Bending at waist and lifting with your lower body.	Standard Level D PPE per APP/SSHP

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ECLS, Inc. ACTIVITY HAZARD ANALYSIS **Activity:** Land Surveying of monitoring wells **Job Name: CTO-WE15**

Date: 12/26/11 **Description of Services:** Land Surveying

Lab Row, Allegany Ballistics Lab, Rocket Center, WV

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Land Surveying	Utility Strikes	• Assess overall job site prior to completion • Two person induction scan to ensure safety over areas of concern • GPR scan as precaution over areas of concern	
Land Surveying	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions (well casings). • Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). • Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices: Clean Work Areas as activities proceed. Clear/removed materials and debris from pathways and commonly traveled areas. • Three points of contact when enter/exiting equipment or when using stairways/ladders.	Standard Level D PPE per APP/SSHP
Land Surveying	Vehicular Traffic	• Shut off and secure Site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting traveled way or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working in high-traffic areas must wear reflective/high-visibility safety vests and make eye contact before passing in front of other vehicles.	Standard Level D PPE per APP/SSHP

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Equipment Preferred but not Inclusive	Inspection Requirements	Training Requirements
• Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid Kit • Fire Extinguisher • Communication devices (Cell Phone/Marine Radio) • Land Survey equipment (as applicable -Electromagnetic Locators -Metal Locator • Bush Axe / Machete	• Visual Inspections of designated work areas identify and address hazardous conditions. • Emergency Response equipment Inspections • (Fire Extinguishers, Eye wash First Aid/CPR etc.) • Calibration of Survey equipment • Vehicle Inspection checklists • Ensure that it is properly sheathed. Check it for sharpness. Check it for a cracked handle.	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new Site personnel. • Qualified/competent line locator • Use caution operating a Woodsman's Pal or brush axe blade. Whenever holding a brush axe that is out of the sheath, use full PPE, including Kevlar leg chaps that completely enclose your legs, safety glasses or face shield, hard hat if cutting large brush or small trees. This full PPE is to be worn, whether it is to sharpen the blade or to cut vegetation with it. • Swing the blade so the path is not in line with any body parts. Swing at a downward angle, so that the end of the strike is well away from your legs. Swing the blade so it hits the intended target with a sawing motion so that the blade is drawn across the item to be cut, allowing the edge to penetrate and not bounce or veer off. Never swing toward a hand holding back vegetation unless the hand is a full two arm's length away from where you are intending to strike. This technique is intended to pull trees down to cut. Keep a firm grip on the handle, and make sure handle is not slippery (use clean grip gloves) to keep from accidently throwing brush blade, use lanyard to make sure blade does not get thrown. Make sure to keep a safe distance from other people swinging blades. Safe distance is twice the distance of a person's both arms at full reach with the blade in hand. Have one person watch the cutting to observe for signs of heat stress, persons getting too close or potential incidents. Know who is around you and where they are. Watch out for branches snapping back when cut. Wear safety glasses or face shields to protect from thorns and vegetation hazards. Wear sturdy gloves with good grip to protect your hands. Keep your brush axe moderately sharp. It does not have to be extremely sharp, just reasonably sharp (don't hone the blade to a very sharp edge). To sharpen a brush axe, the preferred way is to have the brush axe in a vise and run a drill with a sharpening stone bit over the edges to sharpen it. Keep a fire extinguisher handy, and keep flammable materials away because of sparks. Alternately a medium metal round file can be used to create and maintain a sharp edge. Make sure to stroke the file away from the blade, and use cut proof gloves and caution. Carry the blade sheathed or backwards with the blade side toward the ground. Always carry the blade sheathed when going over steep or rugged terrain. Never swing the blade back behind your head. Employees must be trained on the correct use and handling of a brush axe, (which handles differently than a machete) prior to their being allowed to use one. Review brush cutting safety every day that brush cutting is ongoing. • Anyone who uses machete and bush axe are trained to always be aware of surrounding areas and people in close proximity. Also, to use gloves so that slippage is minimized.

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PRINT SIGNATURE

Supervisor Name: ______________________ ____ Date/Time: ______________

Safety Officer Name: ______________________ ____ Date/Time:_______________

Site Personnel: ______________________ ____ Date/Time:_______________

____ ____ Date/Time:_______________

____ ____ Date/Time:_______________

____ ____ Date/Time:_______________

____ ____ Date/Time:_______________

____ ____ Date/Time:_______________

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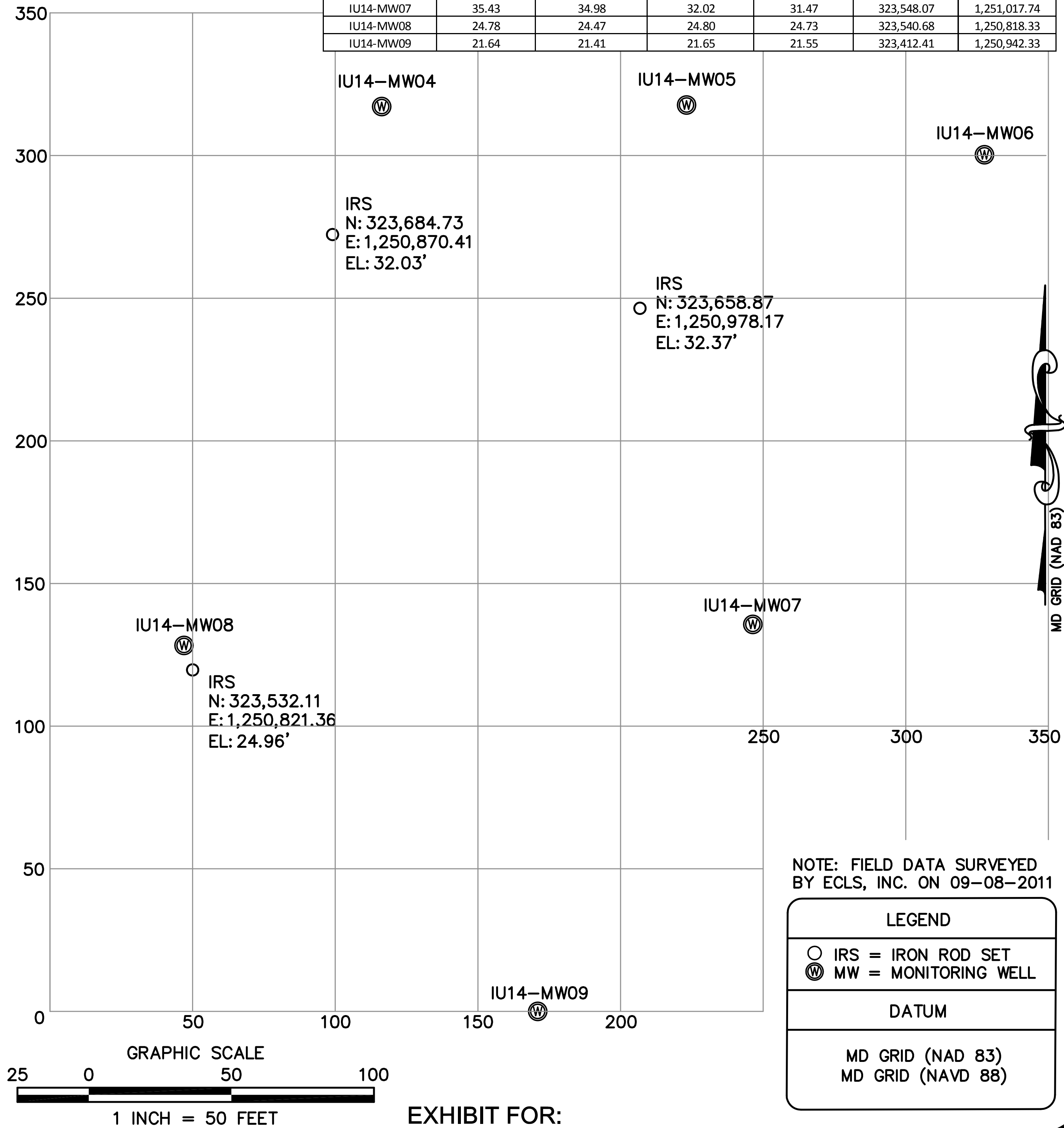
____ ____ Date/Time:_______________

WELL NUMBER	TOP OF WELL	TOP OF CASING	CONCRETE PAD	GROUND	NORTHING	EASTING
	(ft msl)	(ft msl)	(ft msl)	(ft msl)		
IU14-MW04	35.43	34.97	31.94	31.95	323,729.58	1,250,887.64
IU14-MW05	35.64	35.35	32.18	31.87	323,730.15	1,250,994.52
IU14-MW06	25.80	25.52	22.56	22.08	323,712.70	1,251,098.95
IU14-MW07	35.43	34.98	32.02	31.47	323,548.07	1,251,017.74
IU14-MW08	24.78	24.47	24.80	24.73	323,540.68	1,250,818.33
IU14-MW09	21.64	21.41	21.65	21.55	323,412.41	1,250,942.33



NOTE: FIELD DATA SURVEYED BY ECLS, INC. ON 09–08–2011

LEGEND
○ IRS = IRON ROD SET Ⓦ MW = MONITORING WELL
DATUM
MD GRID (NAD 83) MD GRID (NAVD 88)

EXHIBIT FOR:

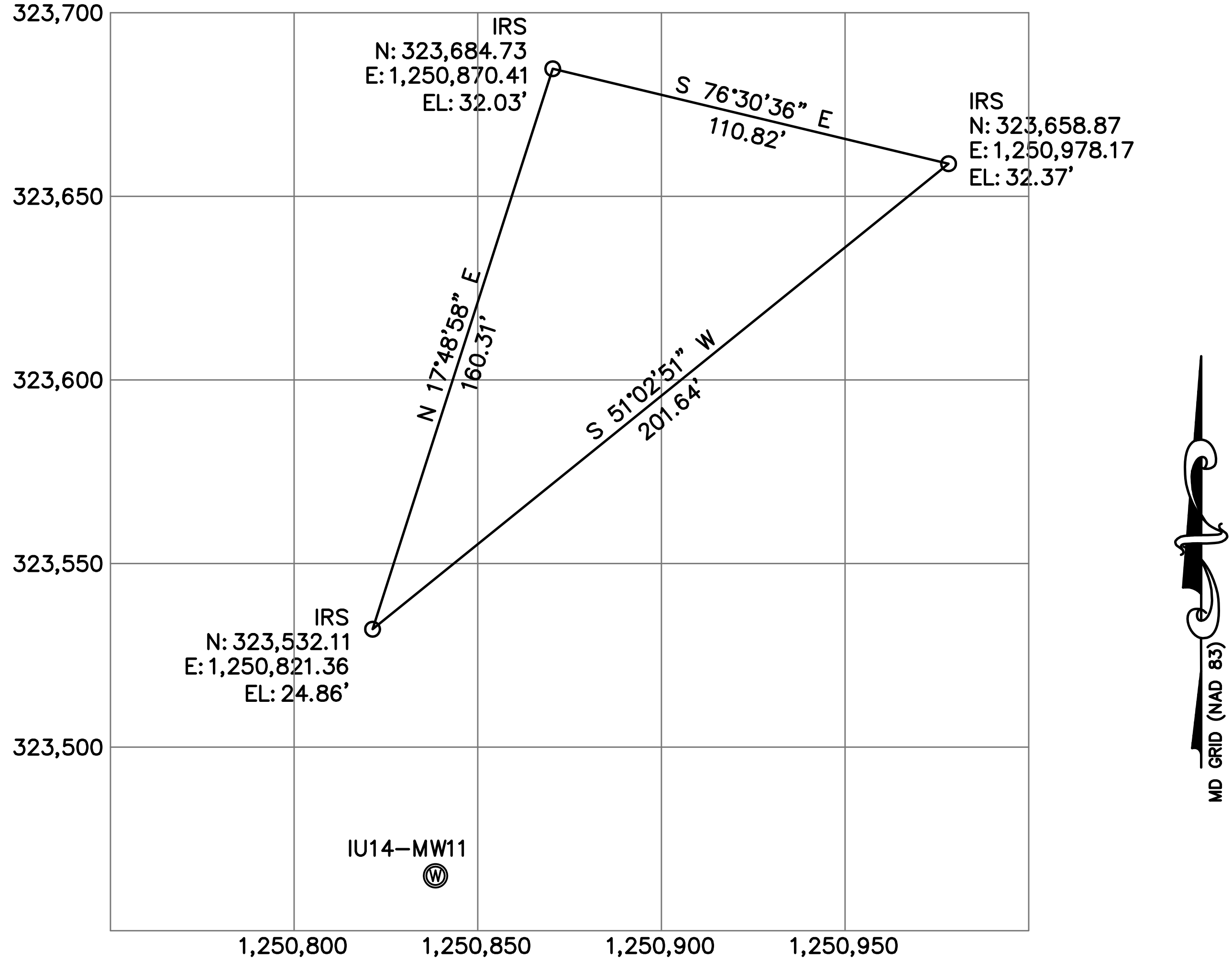
ECLS

PROJ. NO.:	CTO–JU40
FILENAME:	INDIAN HEAD
DRAWN BY:	DWS
SCALE:	1"=50'
DATE:	01–04–2012

CH2MHILL
CLEAN N62470-08-D-1000 - CTO-JU40
NAVAL SUPPORT FACILITY HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

ECLS
SURVEYING THE EAST COAST
610 W. CUMBERLAND ST.
DUNN, NC 28334
910.897.3257
910.897.2329 FAX

WELL NUMBER	TOP OF WELL	TOP OF CASING	CONCRETE PAD	GROUND	NORTHING	EASTING
	(ft msl)	(ft msl)	(ft msl)	(ft msl)		
IU14-MW11	14.40	14.47	11.64	11.38	323,464.96	1,250,838.49



NOTE: FIELD DATA SURVEYED BY ECLS, INC. ON 08-01-2012

LEGEND
○ IRS = IRON ROD SET Ⓦ MW = MONITORING WELL
DATUM
MD GRID (NAD 83) MD GRID (NAVD 88)

GRAPHIC SCALE

25 0 50 100

1 INCH = 50 FEET

EXHIBIT FOR:

ECLS

PROJ. NO.:	CTO—JU40
FILENAME:	INDIAN HEAD
DRAWN BY:	DWS
SCALE:	1"=50'
DATE:	08—07—2012

CH2MHILL
CLEAN N62470-08-D-1000 - CTO-JU40
NAVAL SUPPORT FACILITY HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

ECLS
SURVEYING THE EAST COAST
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DUNN, NC 28334
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Appendix D
Data Validation Report

MEMORANDUM CH2MHILL

Data Validation Summary

Indian Head CTO-JU04, SWMU 14

TO:	Juan Acaron/GNV
	Anita Dodson/WDC
FROM:	Tiffany McGlynn/GNV
CC:	Herb Kelly/GNV
DATE:	December 9, 2011

Introduction

The following data validation report discusses the data validation process and findings for Katahdin Laboratories, Inc. for SDG CTO0012-2.

Samples were analyzed using the following analytical methods:

- SW6020 Metals, total and filtered
- SW7471A/7470A Mercury
- SW9012 Cyanide

The samples included in this SDG are listed in the table below.

Sample Name	Matrix
IU14GW05-0911	Water
IU14GW06-0911	Water
IU14-EB-090711-SS	Water
IU14-EB-090711-GW	Water
IU14-GW09-0911	Water
IU14GW04-0911	Water
IU14GW08-0911	Water
IU14SS11-000H	Soil
IU14SS12-000H	Soil
IU14SS01P-000H	Soil

Sample Name	Matrix
IU14SS02-000H	Soil
IU14SS07-000H	Soil
IU14SS01-000H	Soil
IU14GW01-0911	Water
IU14GW01P-0911	Water
IU14GW03-0911	Water
IU14SS03-000H	Soil
IU14GW07-0911	Water
IU14SS08-000H	Soil
IU14SS09-000H	Soil
IU14SS10-000H	Soil
IU14SS10P-000H	Soil

Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: Uniform Federal Policy-Sampling and Analysis Plan for Stump Neck SWMU 14 Remedial Investigation, Naval Support Facility Indian Head (May 2011), National Functional Guidelines for Inorganic Methods Data Review (EPA 2010), and Region III Modifications for Inorganic Data Review (EPA 1993) as applicable. The samples were evaluated based on the following criteria:

- Data Completeness
- Technical Holding Times
- Initial/Continuing Calibrations
- Blanks
- Internal Standards
- Serial Dilutions
- Laboratory Control Samples
- Matrix Spike Recoveries
- Field Duplicate Precision
- Identification/Quantitation
- Reporting Limits

Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to the chain of custody records, sampling was performed on 9/6/11 through 9/9/11. Samples were received at the laboratory on 9/7/11 through 9/10/11. All sample preparation analysis was performed within holding time requirements.

Blanks

Detects were found in the equipment blanks, method blanks, and ICB/CCB blanks as listed in the table below. Affected data are summarized in **Attachment 1**.

Blank ID	Total or Filtered	Analyte	Conc.	Units
IU14-EB-090711-GW	Total	Aluminum	7.9	ug/l
IU14-EB-090711-GW	Total	Calcium	30.4	ug/l
IU14-EB-090711-GW	Total	Chromium	1.9	ug/l
IU14-EB-090711-GW	Total	Lead	0.05	ug/l
IU14-EB-090711-GW	Total	MAGNESIUM	11.0	ug/l
IU14-EB-090711-GW	Total	Manganese	1.1	ug/l
IU14-EB-090711-GW	Total	Mercury	0.03	ug/l
IU14-EB-090711-GW	Total	Selenium	0.84	ug/l
IU14-EB-090711-GW	Total	Sodium	24.0	ug/l
IU14-EB-090711-GW	Total	Vanadium	0.54	ug/l
IU14-EB-090711-GW	Total	Zinc	22.5	ug/l
IU14-EB-090711-GW	Filtered	Aluminum	8.9	ug/l
IU14-EB-090711-GW	Filtered	Calcium	23.2	ug/l
IU14-EB-090711-GW	Filtered	Chromium	1.5	ug/l
IU14-EB-090711-GW	Filtered	MAGNESIUM	10.1	ug/l
IU14-EB-090711-GW	Filtered	Manganese	0.38	ug/l
IU14-EB-090711-GW	Filtered	Mercury	0.02	ug/l
IU14-EB-090711-GW	Filtered	Selenium	0.71	ug/l
IU14-EB-090711-GW	Filtered	Sodium	37.0	ug/l
IU14-EB-090711-SS	Total	Aluminum	10.8	ug/l

Blank ID	Total or Filtered	Analyte	Conc.	Units
IU14-EB-090711-SS	Total	Antimony	0.06	ug/l
IU14-EB-090711-SS	Total	Calcium	56.8	ug/l
IU14-EB-090711-SS	Total	Chromium	2.1	ug/l
IU14-EB-090711-SS	Total	Copper	0.31	ug/l
IU14-EB-090711-SS	Total	Lead	0.11	ug/l
IU14-EB-090711-SS	Total	MAGNESIUM	12.5	ug/l
IU14-EB-090711-SS	Total	Manganese	2.2	ug/l
IU14-EB-090711-SS	Total	Mercury	0.01	ug/l
IU14-EB-090711-SS	Total	Nickel	0.18	ug/l
IU14-EB-090711-SS	Total	Selenium	0.81	ug/l
IU14-EB-090711-SS	Total	Sodium	38.6	ug/l
IU14-EB-090711-SS	Total	Zinc	22.2	ug/l
CCB	All	Mercury	0.057	ug/l
PBSBI22IMS1	All	Aluminum	1.122	MG_KG
PBSBI22IMS1	All	Arsenic	0.205	MG_KG
PBSBI22IMS1	All	Barium	0.096	MG_KG
PBSBI22IMS1	All	Calcium	17.370	MG_KG
PBSBI22IMS1	All	Chromium	0.378	MG_KG
PBSBI22IMS1	All	Copper	0.123	MG_KG
PBSBI22IMS1	All	Lead	0.027	MG_KG
PBSBI22IMS1	All	MAGNESIUM	5.725	MG_KG
PBSBI22IMS1	All	Manganese	0.275	MG_KG
PBSBI22IMS1	All	Nickel	0.129	MG_KG
PBSBI22IMS1	All	Selenium	0.094	MG_KG
PBSBI22IMS1	All	Sodium	11.530	MG_KG
PBSBI22IMS1	All	Zinc	0.517	MG_KG
PBSBI28IMS1	All	Aluminum	1.725	MG_KG
PBSBI28IMS1	All	Barium	0.063	MG_KG
PBSBI28IMS1	All	Cadmium	-0.019	MG_KG
PBSBI28IMS1	All	Calcium	11.945	MG_KG
PBSBI28IMS1	All	Chromium	0.171	MG_KG
PBSBI28IMS1	All	Lead	0.037	MG_KG
PBSBI28IMS1	All	MAGNESIUM	3.636	MG_KG
PBSBI28IMS1	All	Manganese	1.054	MG_KG
PBSBI28IMS1	All	Nickel	0.084	MG_KG
PBSBI28IMS1	All	Selenium	0.049	MG_KG
PBSBI28IMS1	All	Sodium	5.595	MG_KG
PBSBJ05HGS1	All	Mercury	-0.007	MG_KG
PBWBI27IMW1	All	Aluminum	14.060	UG_L
PBWBI27IMW1	All	Antimony	0.068	UG_L

Blank ID	Total or Filtered	Analyte	Conc.	Units
PBWBI27IMW1	All	Calcium	28.545	UG_L
PBWBI27IMW1	All	Chromium	1.025	UG_L
PBWBI27IMW1	All	Copper	0.261	UG_L
PBWBI27IMW1	All	Iron	-15.105	UG_L
PBWBI27IMW1	All	MAGNESIUM	11.200	UG_L
PBWBI27IMW1	All	Manganese	0.591	UG_L
PBWBI27IMW1	All	Selenium	0.658	UG_L
PBWBI27IMW1	All	Sodium	32.500	UG_L
PBWBI27IMW2	All	Aluminum	9.070	UG_L
PBWBI27IMW2	All	Antimony	0.061	UG_L
PBWBI27IMW2	All	Calcium	25.500	UG_L
PBWBI27IMW2	All	Chromium	1.320	UG_L
PBWBI27IMW2	All	Lead	0.189	UG_L
PBWBI27IMW2	All	MAGNESIUM	10.405	UG_L
PBWBI27IMW2	All	Manganese	5.125	UG_L
PBWBI27IMW2	All	Nickel	0.179	UG_L
PBWBI27IMW2	All	Selenium	0.761	UG_L
PBWBI27IMW2	All	Sodium	23.460	UG_L
PBWBI27IMW2	All	Vanadium	0.701	UG_L
PBWBI28HGW2	All	Mercury	-0.018	UG_L
PBWBI28IMW1	All	Aluminum	14.855	UG_L
PBWBI28IMW1	All	Antimony	0.077	UG_L
PBWBI28IMW1	All	Chromium	1.149	UG_L
PBWBI28IMW1	All	Iron	29.240	UG_L
PBWBI28IMW1	All	MAGNESIUM	12.880	UG_L
PBWBI28IMW1	All	Manganese	1.000	UG_L
PBWBI28IMW1	All	Selenium	0.349	UG_L
PBWBI28IMW1	All	Sodium	29.340	UG_L
PBWBI28IMW1	All	Vanadium	0.692	UG_L
ICB/CCB	All	Aluminum	20.52	UG_L
ICB/CCB	All	Barium	0.248	UG_L
ICB/CCB	All	Cadmium	0.02	UG_L
ICB/CCB	All	Cobalt	0.04	UG_L
ICB/CCB	All	Iron	19.3	UG_L
ICB/CCB	All	Lead	0.059	UG_L
ICB/CCB	All	MAGNESIUM	2.952	UG_L
ICB/CCB	All	Manganese	0.171	UG_L
ICB/CCB	All	Nickel	0.059	UG_L
ICB/CCB	All	Zinc	0.177	UG_L
ICB/CCB	All	Calcium	4.632	UG_L

Blank ID	Total or Filtered	Analyte	Conc.	Units
ICB/CCB	All	Chromium	0.118	UG_L
ICB/CCB	All	Copper	0.063	UG_L
ICB/CCB	All	Thallium	0.02	UG_L
ICB/CCB	All	Antimony	0.01	UG_L

Matrix Spike/Spike Duplicate

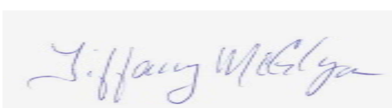
Various compounds for total metals exhibited either high or low recoveries in the MS/MSDs. Affected data are summarized in **Attachment 1**.

Conclusion

These data, as qualified, are available to be evaluated by the project team for use in decision-making purposes.

Please do not hesitate to contact us about this validation report.

Sincerely,



Tiffany McGlynn

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation

Value	Description
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Indian Head CTO-JU04, SWMU 14
Attachment 1 Change Qual. Table
SDG CTO0012-2

Sample ID	Total/Filtered	Compound	Q Flag	Qual Code
IU14GW05-0911	TOTAL	Aluminum	B	CCBL
IU14GW05-0911	TOTAL	Antimony	B	MBL
IU14GW05-0911	TOTAL	Chromium	B	MBL
IU14GW05-0911	TOTAL	Lead	B	CCBL
IU14GW05-0911	TOTAL	Selenium	B	MBL
IU14GW05-0911	TOTAL	Thallium	B	CCBL
IU14GW05-0911	TOTAL	Zinc	B	EBL
IU14GW05-0911	FILT	Aluminum	B	CCBL
IU14GW05-0911	FILT	Antimony	B	MBL
IU14GW05-0911	FILT	Chromium	B	MBL
IU14GW05-0911	FILT	Lead	B	CCBL
IU14GW05-0911	FILT	Selenium	B	MBL
IU14GW05-0911	FILT	Thallium	B	CCBL
IU14GW06-0911	TOTAL	Aluminum	B	CCBL
IU14GW06-0911	TOTAL	Antimony	B	MBL
IU14GW06-0911	TOTAL	Chromium	B	MBL
IU14GW06-0911	TOTAL	Copper	B	MBL
IU14GW06-0911	TOTAL	Mercury	B	CCBL
IU14GW06-0911	TOTAL	Selenium	B	MBL
IU14GW06-0911	TOTAL	Thallium	B	CCBL
IU14GW06-0911	TOTAL	Vanadium	B	EBL
IU14GW06-0911	TOTAL	Zinc	B	EBL
IU14GW06-0911	FILT	Aluminum	B	CCBL
IU14GW06-0911	FILT	Antimony	B	MBL
IU14GW06-0911	FILT	Chromium	B	MBL
IU14GW06-0911	FILT	Copper	B	MBL
IU14GW06-0911	FILT	Lead	B	CCBL
IU14GW06-0911	FILT	Selenium	B	MBL
IU14GW06-0911	FILT	Thallium	B	CCBL
IU14-EB-090711-SS	TOTAL	Aluminum	B	CCBL
IU14-EB-090711-SS	TOTAL	Antimony	B	MBL
IU14-EB-090711-SS	TOTAL	Calcium	B	MBL
IU14-EB-090711-SS	TOTAL	Chromium	B	MBL
IU14-EB-090711-SS	TOTAL	Copper	B	MBL
IU14-EB-090711-SS	TOTAL	Lead	B	CCBL
IU14-EB-090711-SS	TOTAL	MAGNESIUM	B	MBL
IU14-EB-090711-SS	TOTAL	Manganese	B	MBL
IU14-EB-090711-SS	TOTAL	Mercury	B	CCBL
IU14-EB-090711-SS	TOTAL	Selenium	B	MBL
IU14-EB-090711-SS	TOTAL	Sodium	B	MBL
IU14-EB-090711-GW	TOTAL	Aluminum	B	CCBL
IU14-EB-090711-GW	TOTAL	Calcium	B	MBL
IU14-EB-090711-GW	TOTAL	Chromium	B	MBL

Indian Head CTO-JU04, SWMU 14
Attachment 1 Change Qual. Table
SDG CTO0012-2

Sample ID	Total/Filtered	Compound	Q Flag	Qual Code
IU14-EB-090711-GW	TOTAL	Lead	B	CCBL
IU14-EB-090711-GW	TOTAL	MAGNESIUM	B	MBL
IU14-EB-090711-GW	TOTAL	Manganese	B	MBL
IU14-EB-090711-GW	TOTAL	Mercury	B	CCBL
IU14-EB-090711-GW	TOTAL	Selenium	B	MBL
IU14-EB-090711-GW	TOTAL	Sodium	B	MBL
IU14-EB-090711-GW	FILT	Aluminum	B	CCBL
IU14-EB-090711-GW	FILT	Calcium	B	MBL
IU14-EB-090711-GW	FILT	Chromium	B	MBL
IU14-EB-090711-GW	FILT	MAGNESIUM	B	MBL
IU14-EB-090711-GW	FILT	Manganese	B	MBL
IU14-EB-090711-GW	FILT	Mercury	B	CCBL
IU14-EB-090711-GW	FILT	Selenium	B	MBL
IU14-EB-090711-GW	FILT	Sodium	B	CCBL
IU14-GW09-0911	TOTAL	Aluminum	B	CCBL
IU14-GW09-0911	TOTAL	Chromium	B	MBL
IU14-GW09-0911	TOTAL	Selenium	B	MBL
IU14-GW09-0911	FILT	Aluminum	B	CCBL
IU14-GW09-0911	FILT	Antimony	B	MBL
IU14-GW09-0911	FILT	Chromium	B	MBL
IU14-GW09-0911	FILT	Selenium	B	MBL
IU14GW04-0911	TOTAL	Antimony	B	MBL
IU14GW04-0911	TOTAL	Chromium	B	MBL
IU14GW04-0911	TOTAL	Selenium	B	MBL
IU14GW04-0911	TOTAL	Vanadium	B	MBL
IU14GW04-0911	TOTAL	Zinc	B	EBL
IU14GW04-0911	FILT	Antimony	B	MBL
IU14GW04-0911	FILT	Chromium	B	MBL
IU14GW04-0911	FILT	Lead	B	CCBL
IU14GW04-0911	FILT	Selenium	B	MBL
IU14GW04-0911	FILT	Vanadium	B	MBL
IU14GW08-0911	TOTAL	Aluminum	B	CCBL
IU14GW08-0911	TOTAL	Antimony	B	MBL
IU14GW08-0911	TOTAL	Chromium	B	MBL
IU14GW08-0911	TOTAL	Lead	B	CCBL
IU14GW08-0911	TOTAL	Selenium	B	MBL
IU14GW08-0911	TOTAL	Vanadium	B	MBL
IU14GW08-0911	TOTAL	Zinc	B	EBL
IU14GW08-0911	FILT	Aluminum	B	CCBL
IU14GW08-0911	FILT	Antimony	B	MBL
IU14GW08-0911	FILT	Chromium	B	MBL
IU14GW08-0911	FILT	Lead	B	CCBL
IU14GW08-0911	FILT	Mercury	B	CCBL

Indian Head CTO-JU04, SWMU 14
Attachment 1 Change Qual. Table
SDG CTO0012-2

Sample ID	Total/Filtered	Compound	Q Flag	Qual Code
IU14GW08-0911	FILT	Selenium	B	MBL
IU14GW08-0911	FILT	Vanadium	B	MBL
IU14SS11-000H	TOTAL	Selenium	B	MBL
IU14SS11-000H	TOTAL	Sodium	B	MBL
IU14SS12-000H	TOTAL	Antimony	L	MSL
IU14SS12-000H	TOTAL	Chromium	K	MSH
IU14SS12-000H	TOTAL	Copper	K	MSH
IU14SS12-000H	TOTAL	Lead	K	MSH
IU14SS12-000H	TOTAL	MAGNESIUM	K	MSH
IU14SS12-000H	TOTAL	Manganese	K	MSH
IU14SS12-000H	TOTAL	Potassium	K	MSH
IU14SS12-000H	TOTAL	Selenium	B	MBL
IU14SS12-000H	TOTAL	Sodium	B	MBL
IU14SS12-000H	TOTAL	Vanadium	K	MSH
IU14SS12-000H	TOTAL	Zinc	K	MSH
IU14SS01P-000H	TOTAL	Selenium	B	MBL
IU14SS01P-000H	TOTAL	Sodium	B	MBL
IU14SS02-000H	TOTAL	Antimony	L	MSL
IU14SS02-000H	TOTAL	Chromium	K	MSH
IU14SS02-000H	TOTAL	Lead	K	MSH
IU14SS02-000H	TOTAL	MAGNESIUM	K	MSH
IU14SS02-000H	TOTAL	Manganese	K	MSH
IU14SS02-000H	TOTAL	Potassium	K	MSH
IU14SS02-000H	TOTAL	Vanadium	K	MSH
IU14SS02-000H	TOTAL	Zinc	K	MSH
IU14SS07-000H	TOTAL	Sodium	B	MBL
IU14SS01-000H	TOTAL	Selenium	B	MBL
IU14GW01-0911	TOTAL	Aluminum	B	CCBL
IU14GW01-0911	TOTAL	Antimony	B	MBL
IU14GW01-0911	TOTAL	Chromium	B	MBL
IU14GW01-0911	TOTAL	Iron	B	CCBL
IU14GW01-0911	TOTAL	Lead	B	CCBL
IU14GW01-0911	TOTAL	Selenium	B	MBL
IU14GW01-0911	TOTAL	Thallium	B	CCBL
IU14GW01-0911	TOTAL	Zinc	B	EBL
IU14GW01-0911	FILT	Aluminum	B	CCBL
IU14GW01-0911	FILT	Antimony	B	MBL
IU14GW01-0911	FILT	Chromium	B	MBL
IU14GW01-0911	FILT	Iron	B	CCBL
IU14GW01-0911	FILT	Lead	B	CCBL
IU14GW01-0911	FILT	Mercury	B	CCBL
IU14GW01-0911	FILT	Selenium	B	MBL
IU14GW01-0911	FILT	Thallium	B	CCBL

Indian Head CTO-JU04, SWMU 14 Attachment 1 Change Qual. Table SDG CTO0012-2				
Sample ID	**Total/Filtered**	**Compound**	**Q Flag**	**Qual Code**
IU14GW01P-0911	TOTAL	Aluminum	B	CCBL
IU14GW01P-0911	TOTAL	Antimony	B	MBL
IU14GW01P-0911	TOTAL	Chromium	B	MBL
IU14GW01P-0911	TOTAL	Iron	B	CCBL
IU14GW01P-0911	TOTAL	Lead	B	CCBL
IU14GW01P-0911	TOTAL	Mercury	B	CCBL
IU14GW01P-0911	TOTAL	Selenium	B	MBL
IU14GW01P-0911	TOTAL	Thallium	B	CCBL
IU14GW01P-0911	TOTAL	Zinc	B	EBL
IU14GW01P-0911	FILT	Aluminum	B	CCBL
IU14GW01P-0911	FILT	Antimony	B	MBL
IU14GW01P-0911	FILT	Chromium	B	MBL
IU14GW01P-0911	FILT	Iron	B	CCBL
IU14GW01P-0911	FILT	Lead	B	CCBL
IU14GW01P-0911	FILT	Selenium	B	MBL
IU14GW01P-0911	FILT	Thallium	B	CCBL
IU14GW03-0911	TOTAL	Aluminum	B	CCBL
IU14GW03-0911	TOTAL	Calcium	L	MSL
IU14GW03-0911	TOTAL	Chromium	B	MBL
IU14GW03-0911	TOTAL	Cobalt	L	MSL
IU14GW03-0911	TOTAL	Copper	B	MBL
IU14GW03-0911	TOTAL	Selenium	B	MBL
IU14GW03-0911	TOTAL	Sodium	L	MSL
IU14GW03-0911	TOTAL	Vanadium	B	EBL
IU14GW03-0911	TOTAL	Zinc	B	EBL
IU14GW03-0911	FILT	Aluminum	B	CCBL
IU14GW03-0911	FILT	Antimony	B	MBL
IU14GW03-0911	FILT	Chromium	B	MBL
IU14GW03-0911	FILT	Copper	B	MBL
IU14GW03-0911	FILT	Lead	B	CCBL
IU14GW03-0911	FILT	Selenium	B	MBL
IU14SS03-000H	TOTAL	Selenium	B	MBL
IU14SS03-000H	TOTAL	Sodium	B	MBL
IU14GW07-0911	TOTAL	Aluminum	B	CCBL
IU14GW07-0911	TOTAL	Antimony	B	MBL
IU14GW07-0911	TOTAL	Chromium	B	MBL
IU14GW07-0911	TOTAL	Iron	B	CCBL
IU14GW07-0911	TOTAL	Lead	B	CCBL
IU14GW07-0911	TOTAL	Selenium	B	MBL
IU14GW07-0911	TOTAL	Vanadium	B	EBL
IU14GW07-0911	TOTAL	Zinc	B	EBL
IU14GW07-0911	FILT	Aluminum	B	CCBL
IU14GW07-0911	FILT	Antimony	B	MBL

Indian Head CTO-JU04, SWMU 14
Attachment 1 Change Qual. Table
SDG CTO0012-2

Sample ID	Total/Filtered	Compound	Q Flag	Qual Code
IU14GW07-0911	FILT	Chromium	B	MBL
IU14GW07-0911	FILT	Iron	B	CCBL
IU14GW07-0911	FILT	Lead	B	CCBL
IU14GW07-0911	FILT	Mercury	B	CCBL
IU14GW07-0911	FILT	Selenium	B	MBL
IU14SS08-000H	TOTAL	Selenium	B	MBL
IU14SS08-000H	TOTAL	Sodium	B	MBL
IU14SS09-000H	TOTAL	Selenium	B	MBL
IU14SS09-000H	TOTAL	Sodium	B	MBL
IU14SS10-000H	TOTAL	Selenium	B	MBL

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW05-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5636-001

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 75.9	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL 0.08	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	61.1			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.33	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.18	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	16400		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 1.4	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	221		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	8.0			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	252			MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL 0.21	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	6420			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	324			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	9.5			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	20300			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 0.78	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	45000		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	B-CCBL 0.08	~~J~~		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 33.0			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW05-0911

Matrix: WATER | **SDG Name:** CTO0012-2

Percent Solids: 0.00 | **Lab Sample ID:** SE5636-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 57.8	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.10	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	57.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.28	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.11	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	14800		N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 1.1	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	214		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	8.2			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	223			MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.15	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	5970			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	299			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	9.5			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	19200			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 0.61	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	42900		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	B-CCBL 0.06	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	14.9			MS	5	10	3.90	8.0

Comments:

12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW06-0911

Matrix: WATER | **SDG Name:** CTO0012-2

Percent Solids: 0.00 | **Lab Sample ID:** SE5636-003

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 96.6	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-mBL 0.08	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	66.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.18	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.06	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	9230		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-mBL 2.5	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	37.4		~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	B-mBL 0.72	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	114			MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	0.52	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	4540			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	149			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	B-CCBL 0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	17.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	3880			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-mBL 2.4	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	11600		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	B-CCBL 0.06	~~J~~		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	B-FBL 1.2	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 22.0			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW06-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5636-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 59.6	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.09	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	70.9			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.19	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	9830		N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 2.7	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	21.8		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	B-MBL 1.0	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	256			MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.35	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	5100			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	186			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	31.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	4090			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 2.6	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	10100		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	B-CCBL 0.06	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	2.7	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	7.2	J		MS	5	10	3.90	8.0

Comments:

12/7/11

FORM I - IN

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-EB-090711-SS

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5697-001

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 10.8	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL 0.06	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	B-MBL 56.8	~~J~~	~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 2.1	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	0.30	U	~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	B-MBL 0.31	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL 0.11	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	B-MBL 12.5	~~J~~		MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	B-MBL 2.2			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	B-CCBL 0.01	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	0.18	J		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 0.81	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	B-MBL 38.6	~~J~~	~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	22.2			MS	5	10	3.90	8.0

Comments:

ydd
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-EB-090711-GW

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5697-002

Concentration Units : ug/L

										ADJUSTED	
CAS No.	**Analyte**		**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL	7.9	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL		0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL		1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL		0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL		0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	B-MBL	30.4	~~J~~	N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL	1.9	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL		0.30	U	~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL		2.0	U		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL		60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL	0.05	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	B-MBL	11.0	~~J~~		MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	B-MBL	1.1	~~J~~		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	B-CCBL	0.03	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL		1.2	U		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL		400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL	0.84	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	B-MBL	24.0	~~J~~	~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL		0.54	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL		22.5			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-EB-090711-GW

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5697-003

Concentration Units : ug/L

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 8.9	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	B-MBL 23.2	~~J~~	~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 1.5	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	0.30	U	~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	2.0	U		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	0.50	U		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	B-MBL 10.1	~~J~~		MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	B-MBL 0.38	~~J~~		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	B-CCBL 0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	1.2	U		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 0.71	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	B-CCBL 37.0	~~J~~	~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	8.0	U		MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14-GW09-0911

SDG Name: CTO0012-2

Lab Sample ID: SE5697-004

Concentration Units : ug/L

								ADJUSTED		
CAS No.	**Analyte**		**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL	199	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL		0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL		30.3			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL		0.62	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL		0.15	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL		1400		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL	2.4	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL		90.6		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL		4.3			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL		60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL		0.66	~~J~~ J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL		2020			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL		20.2			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL		0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL		44.5			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL		1850			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL	1.0	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL		9870		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL		0.35	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL		0.70	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL		124			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-GW09-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5697-005

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 61.6	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.09	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	27.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.54	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.23	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	1490		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 1.8	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	82.6		~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	3.8			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	0.59	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	1930			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	18.7			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	40.5			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	1820			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B MBL 1.4	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	9930		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.31	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	0.56	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	93.4			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14GW04-0911
Matrix: WATER
SDG Name: CTO0012-2
Percent Solids: 0.00
Lab Sample ID: SE5737-001

Concentration Units : ug/L

									ADJUSTED	
CAS No.	**Analyte**		**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL		136	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL	0.08	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL		158			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL		0.49	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL		0.84	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL		14100			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL	2.8	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL		8.6			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL		1.0	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL		60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL		0.51	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL		8660			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL		319			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL		0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL		34.6			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL		3120			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL	1.5	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL		68700			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	B-MBL	0.54	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL	64.1			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW04-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5737-002

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	113	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.12	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	154			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.49	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.74	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	13500			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 3.2	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	8.1			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	4.8			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.61	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	8300			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	303			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	37.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	2970			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 2.4	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	66800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	B-MBL 0.71	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	51.8			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Matrix: WATER
Percent Solids: 0.00

Client Field ID: IU14GW08-0911
SDG Name: CTO0012-2
Lab Sample ID: SE5737-003

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 84.5	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL 0.12	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	110			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.44	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.20	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	8200			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 2.6	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	54.1			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	0.61	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	47.1	J		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL 0.22	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	3990			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	682			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.08	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	10.9			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	3630			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 1.3	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	37600			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	B-MBL 1.2	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 23.9			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: **Katahdin Analytical Services** **Client Field ID:** IU14GW08-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5737-004

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 73.6	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.10	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	112			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.47	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.21	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	8580			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 3.2	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	55.0			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	0.98	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	40.1	J		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.22	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	4180			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	698			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	B-CCBL 0.06	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	11.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	3670			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 1.3	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	38200			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	B-MBL 0.99	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	23.0			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS11-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 73.0 **Lab Sample ID:** SE5737-005

Concentration Units : mg/Kgdrywt

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	10300			MS	5	33	0.57	4.4
7440-36-0	ANTIMONY, TOTAL	0.26		~~N~~	MS	5	0.11	0.02	0.056
7440-38-2	ARSENIC, TOTAL	3.8			MS	5	0.56	0.17	0.44
7440-39-3	BARIUM, TOTAL	54.1			MS	5	0.22	0.04	0.11
7440-41-7	BERYLLIUM, TOTAL	0.52			MS	5	0.11	0.004	0.022
7440-43-9	CADMIUM, TOTAL	0.15			MS	5	0.11	0.01	0.022
7440-70-2	CALCIUM, TOTAL	1770			MS	5	11	4.26	8.9
7440-47-3	CHROMIUM, TOTAL	16.5		~~N*~~	MS	5	0.56	0.06	0.44
7440-48-4	COBALT, TOTAL	6.2			MS	5	0.11	0.006	0.033
7440-50-8	COPPER, TOTAL	11.9		~~N~~	MS	5	0.33	0.08	0.22
7439-89-6	IRON, TOTAL	16000		~~*~~	MS	5	11	2.67	6.7
7439-92-1	LEAD, TOTAL	35.2		~~N~~	MS	5	0.11	0.006	0.056
7439-95-4	MAGNESIUM, TOTAL	1540		~~N~~	MS	5	11	1.52	8.9
7439-96-5	MANGANESE, TOTAL	170		~~NE~~	MS	5	0.22	0.04	0.11
7439-97-6	MERCURY, TOTAL	0.23			CV	1	0.036	0.005	0.018
7440-02-0	NICKEL, TOTAL	13.4			MS	5	0.22	0.03	0.13
7440-09-7	POTASSIUM, TOTAL	642		N	MS	5	110	5.08	44
7782-49-2	SELENIUM, TOTAL	B-MBL 0.39	~~J~~		MS	5	0.56	0.04	0.33
7440-22-4	SILVER, TOTAL	0.19			MS	5	0.11	0.006	0.044
7440-23-5	SODIUM, TOTAL	B-MBL 45.8	~~J~~		MS	5	110	2.86	44
7440-28-0	THALLIUM, TOTAL	0.14			MS	5	0.11	0.01	0.044
7440-62-2	VANADIUM, TOTAL	28.5		~~N~~	MS	5	0.56	0.12	0.44
7440-66-6	ZINC, TOTAL	77.2		~~N*~~	MS	5	1.1	0.14	0.89

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14SS12-000H

Matrix: SOIL | **SDG Name:** CTO0012-2

Percent Solids: 80.2 | **Lab Sample ID:** SE5737-006

Concentration Units : mg/Kgdrywt

									ADJUSTED	
CAS No.	**Analyte**		**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL		6790			MS	5	35	0.59	4.6
7440-36-0	ANTIMONY, TOTAL	L-MSL	0.26		~~N~~	MS	5	0.12	0.02	0.058
7440-38-2	ARSENIC, TOTAL		3.0			MS	5	0.58	0.17	0.46
7440-39-3	BARIUM, TOTAL		35.4			MS	5	0.23	0.04	0.12
7440-41-7	BERYLLIUM, TOTAL		0.43			MS	5	0.12	0.005	0.023
7440-43-9	CADMIUM, TOTAL		0.14			MS	5	0.12	0.01	0.023
7440-70-2	CALCIUM, TOTAL		1320			MS	5	12	4.45	9.3
7440-47-3	CHROMIUM, TOTAL	K-MSH	15.4		~~N*~~	MS	5	0.58	0.06	0.46
7440-48-4	COBALT, TOTAL		4.9			MS	5	0.12	0.006	0.035
7440-50-8	COPPER, TOTAL	K-MSH	13.4		~~N~~	MS	5	0.35	0.08	0.23
7439-89-6	IRON, TOTAL		12400		~~*~~	MS	5	12	2.79	7.0
7439-92-1	LEAD, TOTAL	K-MSH	43.5		~~N~~	MS	5	0.12	0.006	0.058
7439-95-4	MAGNESIUM, TOTAL	K-MSH	1340		~~N~~	MS	5	12	1.59	9.3
7439-96-5	MANGANESE, TOTAL	K-MSH	167		~~NE~~	MS	5	0.23	0.05	0.12
7439-97-6	MERCURY, TOTAL		0.1			CV	1	0.042	0.006	0.021
7440-02-0	NICKEL, TOTAL		8.9			MS	5	0.23	0.03	0.14
7440-09-7	POTASSIUM, TOTAL	K-MSH	592		~~N~~	MS	5	120	5.31	46
7782-49-2	SELENIUM, TOTAL	B-MBL	0.34	~~J~~		MS	5	0.58	0.05	0.35
7440-22-4	SILVER, TOTAL		0.13			MS	5	0.12	0.006	0.046
7440-23-5	SODIUM, TOTAL	B-MBL	36.8	~~J~~		MS	5	120	2.99	46
7440-28-0	THALLIUM, TOTAL		0.09	J		MS	5	0.12	0.01	0.046
7440-62-2	VANADIUM, TOTAL	K-MSH	21.6		~~N~~	MS	5	0.58	0.13	0.46
7440-66-6	ZINC, TOTAL	K-MSH	61.0		~~N*~~	MS	5	1.2	0.15	0.93

Comments:

[illegible] 12/7/11

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14SS01P-000H

Matrix: SOIL | **SDG Name:** CTO0012-2

Percent Solids: 87.3 | **Lab Sample ID:** SE5737-007

Concentration Units : mg/Kgdrywt

								ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	7540			MS	5	18	0.30	2.3
7440-36-0	ANTIMONY, TOTAL	0.12		N	MS	5	0.058	0.01	0.029
7440-38-2	ARSENIC, TOTAL	4.0			MS	5	0.29	0.09	0.23
7440-39-3	BARIUM, TOTAL	32.3			MS	5	0.12	0.02	0.058
7440-41-7	BERYLLIUM, TOTAL	0.43			MS	5	0.058	0.002	0.012
7440-43-9	CADMIUM, TOTAL	0.06			MS	5	0.058	0.006	0.012
7440-70-2	CALCIUM, TOTAL	485			MS	5	5.8	2.24	4.7
7440-47-3	CHROMIUM, TOTAL	12.9		N*	MS	5	0.29	0.03	0.23
7440-48-4	COBALT, TOTAL	7.1			MS	5	0.058	0.003	0.018
7440-50-8	COPPER, TOTAL	6.4		N	MS	5	0.18	0.04	0.12
7439-89-6	IRON, TOTAL	14800		*	MS	5	5.8	1.40	3.5
7439-92-1	LEAD, TOTAL	11.0		N	MS	5	0.058	0.003	0.029
7439-95-4	MAGNESIUM, TOTAL	578		N	MS	5	5.8	0.80	4.7
7439-96-5	MANGANESE, TOTAL	172		NE	MS	5	0.12	0.02	0.058
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.030	0.004	0.015
7440-02-0	NICKEL, TOTAL	5.5			MS	5	0.12	0.01	0.070
7440-09-7	POTASSIUM, TOTAL	546		N	MS	5	58	2.66	23
7782-49-2	SELENIUM, TOTAL	B-mBL 0.30			MS	5	0.29	0.02	0.18
7440-22-4	SILVER, TOTAL	1.5			MS	5	0.058	0.003	0.023
7440-23-5	SODIUM, TOTAL	B-mBL 15.4	J		MS	5	58	1.50	23
7440-28-0	THALLIUM, TOTAL	0.09			MS	5	0.058	0.006	0.023
7440-62-2	VANADIUM, TOTAL	20.5		N	MS	5	0.29	0.06	0.23
7440-66-6	ZINC, TOTAL	23.3		N*	MS	5	0.58	0.08	0.47

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14SS02-000H

Matrix: SOIL

SDG Name: CTO0012-2

Percent Solids: 82.2

Lab Sample ID: SE5737-008

Concentration Units : mg/Kgdrywt

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	16700			MS	5	25	0.42	3.3
7440-36-0	ANTIMONY, TOTAL	L-MSL 0.21		~~N~~	MS	5	0.083	0.02	0.041
7440-38-2	ARSENIC, TOTAL	4.4			MS	5	0.41	0.12	0.33
7440-39-3	BARIUM, TOTAL	74.4			MS	5	0.16	0.03	0.083
7440-41-7	BERYLLIUM, TOTAL	0.46			MS	5	0.083	0.003	0.016
7440-43-9	CADMIUM, TOTAL	0.12			MS	5	0.083	0.008	0.016
7440-70-2	CALCIUM, TOTAL	2390			MS	5	8.3	3.17	6.6
7440-47-3	CHROMIUM, TOTAL	K-MSH 23.3		~~N*~~	MS	5	0.41	0.04	0.33
7440-48-4	COBALT, TOTAL	4.8			MS	5	0.083	0.004	0.025
7440-50-8	COPPER, TOTAL	12.1		N	MS	5	0.25	0.06	0.16
7439-89-6	IRON, TOTAL	25300		~~*~~	MS	5	8.3	1.99	5.0
7439-92-1	LEAD, TOTAL	K-MSH 18.3		~~N~~	MS	5	0.083	0.004	0.041
7439-95-4	MAGNESIUM, TOTAL	1120		~~N~~	MS	5	8.3	1.13	6.6
7439-96-5	MANGANESE, TOTAL	55.6		~~NE~~	MS	5	0.16	0.03	0.083
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.037	0.006	0.019
7440-02-0	NICKEL, TOTAL	7.3			MS	5	0.16	0.02	0.099
7440-09-7	POTASSIUM, TOTAL	K-MSH 678		~~N~~	MS	5	83	3.77	33
7782-49-2	SELENIUM, TOTAL	0.55			MS	5	0.41	0.03	0.25
7440-22-4	SILVER, TOTAL	0.03	J		MS	5	0.083	0.004	0.033
7440-23-5	SODIUM, TOTAL	69.7	J		MS	5	83	2.12	33
7440-28-0	THALLIUM, TOTAL	0.19			MS	5	0.083	0.008	0.033
7440-62-2	VANADIUM, TOTAL	K-MSH 32.4		~~N~~	MS	5	0.41	0.09	0.33
7440-66-6	ZINC, TOTAL	K-MSH 32.7		~~N*~~	MS	5	0.83	0.11	0.66

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS07-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 73.9 **Lab Sample ID:** SE5737-009

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	8080			MS	5	29	0.49	3.8
7440-36-0	ANTIMONY, TOTAL	0.20		~~N~~	MS	5	0.096	0.02	0.048
7440-38-2	ARSENIC, TOTAL	3.4			MS	5	0.48	0.14	0.38
7440-39-3	BARIUM, TOTAL	35.4			MS	5	0.19	0.03	0.096
7440-41-7	BERYLLIUM, TOTAL	0.49			MS	5	0.096	0.004	0.019
7440-43-9	CADMIUM, TOTAL	0.06	J		MS	5	0.096	0.010	0.019
7440-70-2	CALCIUM, TOTAL	363			MS	5	9.6	3.67	7.7
7440-47-3	CHROMIUM, TOTAL	16.0		~~N*~~	MS	5	0.48	0.05	0.38
7440-48-4	COBALT, TOTAL	11.1			MS	5	0.096	0.005	0.029
7440-50-8	COPPER, TOTAL	7.8		~~N~~	MS	5	0.29	0.07	0.19
7439-89-6	IRON, TOTAL	15500		~~*~~	MS	5	9.6	2.30	5.8
7439-92-1	LEAD, TOTAL	28.3		~~N~~	MS	5	0.096	0.005	0.048
7439-95-4	MAGNESIUM, TOTAL	720		~~N~~	MS	5	9.6	1.31	7.7
7439-96-5	MANGANESE, TOTAL	262		~~NE~~	MS	5	0.19	0.04	0.096
7439-97-6	MERCURY, TOTAL	0.09			CV	1	0.036	0.005	0.018
7440-02-0	NICKEL, TOTAL	8.0			MS	5	0.19	0.02	0.12
7440-09-7	POTASSIUM, TOTAL	394		~~N~~	MS	5	96	4.38	38
7782-49-2	SELENIUM, TOTAL	0.52			MS	5	0.48	0.04	0.29
7440-22-4	SILVER, TOTAL	0.12			MS	5	0.096	0.005	0.038
7440-23-5	SODIUM, TOTAL	B-MBL 24.4	J		MS	5	96	2.46	38
7440-28-0	THALLIUM, TOTAL	0.14			MS	5	0.096	0.010	0.038
7440-62-2	VANADIUM, TOTAL	27.3		~~N~~	MS	5	0.48	0.11	0.38
7440-66-6	ZINC, TOTAL	27.5		~~N*~~	MS	5	0.96	0.12	0.77

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS01-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 85.6 **Lab Sample ID:** SE5737-010

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	11400			MS	5	28	0.48	3.8
7440-36-0	ANTIMONY, TOTAL	0.11		~~N~~	MS	5	0.095	0.02	0.048
7440-38-2	ARSENIC, TOTAL	2.0			MS	5	0.48	0.14	0.38
7440-39-3	BARIUM, TOTAL	35.1			MS	5	0.19	0.03	0.095
7440-41-7	BERYLLIUM, TOTAL	0.25			MS	5	0.095	0.004	0.019
7440-43-9	CADMIUM, TOTAL	0.16			MS	5	0.095	0.010	0.019
7440-70-2	CALCIUM, TOTAL	3880			MS	5	9.5	3.63	7.6
7440-47-3	CHROMIUM, TOTAL	19.4		~~N*~~	MS	5	0.48	0.05	0.38
7440-48-4	COBALT, TOTAL	5.0			MS	5	0.095	0.005	0.028
7440-50-8	COPPER, TOTAL	32.3		~~N~~	MS	5	0.28	0.07	0.19
7439-89-6	IRON, TOTAL	11300		~~*~~	MS	5	9.5	2.28	5.7
7439-92-1	LEAD, TOTAL	14.2		~~N~~	MS	5	0.095	0.005	0.048
7439-95-4	MAGNESIUM, TOTAL	3140		~~N~~	MS	5	9.5	1.30	7.6
7439-96-5	MANGANESE, TOTAL	73.1		~~NE~~	MS	5	0.19	0.04	0.095
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.039	0.006	0.020
7440-02-0	NICKEL, TOTAL	11.7			MS	5	0.19	0.02	0.11
7440-09-7	POTASSIUM, TOTAL	410		~~N~~	MS	5	95	4.33	38
7782-49-2	SELENIUM, TOTAL	B-MBL 0.22	J		MS	5	0.48	0.04	0.28
7440-22-4	SILVER, TOTAL	0.32			MS	5	0.095	0.005	0.038
7440-23-5	SODIUM, TOTAL	572			MS	5	95	2.44	38
7440-28-0	THALLIUM, TOTAL	0.10			MS	5	0.095	0.010	0.038
7440-62-2	VANADIUM, TOTAL	25.6		~~N~~	MS	5	0.48	0.10	0.38
7440-66-6	ZINC, TOTAL	62.0		~~N*~~	MS	5	0.95	0.12	0.76

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW01-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5738-001

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 45.8	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL 0.06	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	68.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.30	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.07	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	11900		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 1.9	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	238		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	5.8			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	B-CCBL 23.5	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL 0.16	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	5440			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	133			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.05	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	9.5			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	10700			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 1.3	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	48500		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	B-CCBL 0.06	~~J~~		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 29.2			MS	5	10	3.90	8.0

JH
12/7/11

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: **Katahdin Analytical Services** **Client Field ID:** IU14GW01-0911
Matrix: WATER **SDG Name:** CTO0012-2
Percent Solids: 0.00 **Lab Sample ID:** SE5738-002

Concentration Units : ug/L

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 51.4	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.07	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	70.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.26	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.05	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	12100		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 2.2	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	247		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	6.7			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	B-CCBL 18.9	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.13	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	5460			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	131			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	B-CCBL 0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	9.9			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	10900			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 1.7	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	48400		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	B-CCBL 0.06	~~J~~		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	1.0	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	9.9	J		MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW01P-0911

Matrix: WATER | **SDG Name:** CTO0012-2

Percent Solids: 0.00 | **Lab Sample ID:** SE5738-003

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 81.5	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL 0.07	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	71.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.31	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.04	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	12100		N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 1.9	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	234		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	5.6			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	B-CCBL 26.1	J		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL 0.15	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	5400			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	129			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	B-CCBL 0.03	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	8.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	10000			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 1.9	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	46800		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	B-CCBL 0.06	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 24.1			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14GW01P-0911
Matrix: WATER
SDG Name: CTO0012-2
Percent Solids: 0.00
Lab Sample ID: SE5738-004

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL 54.9	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL 0.08	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	70.9			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.27	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.06	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	12300		N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL 2.0	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	242		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	6.3			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	B-CCBL 35.7	J		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL 0.10	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	5400			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	129			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	9.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	11000			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL 1.5	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	48200		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	B-CCBL 0.07	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	0.65	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	18.1			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW03-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5738-005

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	B-CCBL 22.2	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	40.2			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.33	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.05	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	L-MSL 6210		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL 3.1	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	L-MSL 595		~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	B-MBL 0.89	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	0.50	U		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	2640			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	37.4			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.01	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	5.4			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	2740			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL 1.2	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	L-MSL 25500		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	B-EBL 0.64	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL 35.7			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW03-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5738-006

Concentration Units : ug/L

CAS No.	Analyte		Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL	21.2	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL	0.1	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED		41.3			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED		0.34	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED		0.03	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED		6470		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL	3.1	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED		632		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	B-MBL	0.68	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED		60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL	0.11	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED		2790			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED		38.5			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED		0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED		5.4			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED		2900			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL	1.1	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED		27100		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED		0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED		0.65	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED		14.4			MS	5	10	3.90	8.0

JH
12/7/11

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS03-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 82.0 **Lab Sample ID:** SE5738-007

Concentration Units : mg/Kgdrywt

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	5840			MS	5	27	0.47	3.7
7440-36-0	ANTIMONY, TOTAL	0.09	J	~~N~~	MS	5	0.092	0.02	0.046
7440-38-2	ARSENIC, TOTAL	3.6			MS	5	0.46	0.14	0.37
7440-39-3	BARIUM, TOTAL	23.7			MS	5	0.18	0.03	0.092
7440-41-7	BERYLLIUM, TOTAL	0.37			MS	5	0.092	0.004	0.018
7440-43-9	CADMIUM, TOTAL	0.04	J		MS	5	0.092	0.009	0.018
7440-70-2	CALCIUM, TOTAL	347			MS	5	9.2	3.51	7.3
7440-47-3	CHROMIUM, TOTAL	12.6		~~N*~~	MS	5	0.46	0.05	0.37
7440-48-4	COBALT, TOTAL	4.6			MS	5	0.092	0.005	0.027
7440-50-8	COPPER, TOTAL	5.0		~~N~~	MS	5	0.27	0.06	0.18
7439-89-6	IRON, TOTAL	13000		~~*~~	MS	5	9.2	2.20	5.5
7439-92-1	LEAD, TOTAL	7.2		~~N~~	MS	5	0.092	0.005	0.046
7439-95-4	MAGNESIUM, TOTAL	415		~~N~~	MS	5	9.2	1.25	7.3
7439-96-5	MANGANESE, TOTAL	95.6		~~NE~~	MS	5	0.18	0.04	0.092
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.038	0.006	0.019
7440-02-0	NICKEL, TOTAL	4.9			MS	5	0.18	0.02	0.11
7440-09-7	POTASSIUM, TOTAL	434		~~N~~	MS	5	92	4.18	37
7782-49-2	SELENIUM, TOTAL	B-MBL 0.31	~~J~~		MS	5	0.46	0.04	0.27
7440-22-4	SILVER, TOTAL	1.1			MS	5	0.092	0.005	0.037
7440-23-5	SODIUM, TOTAL	B-MBL 17.7	~~J~~		MS	5	92	2.35	37
7440-28-0	THALLIUM, TOTAL	0.08	J		MS	5	0.092	0.009	0.037
7440-62-2	VANADIUM, TOTAL	16.0		~~N~~	MS	5	0.46	0.10	0.37
7440-66-6	ZINC, TOTAL	16.8		~~N*~~	MS	5	0.92	0.12	0.73

Comments:

YH 12/7/11

INORGANIC ANALYSIS DATA SHEET

Lab Name: **Katahdin Analytical Services** | **Client Field ID:** IU14GW07-0911

Matrix: WATER | **SDG Name:** CTO0012-2

Percent Solids: 0.00 | **Lab Sample ID:** SE5738-008

Concentration Units : ug/L

CAS No.	Analyte		Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, TOTAL	B-CCBL	90.4	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	B-MBL	0.10	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL		82.3			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL		0.55	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL		0.41	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL		8660		N*	MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	B-MBL	3.6	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL		433		N*	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL		2.1	J J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	B-CCBL	21.4	J		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	B-CCBL	0.17	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL		4630			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL		288			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL		0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL		37.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL		4690			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	B-MBL	2.2	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL		25200		N*	MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL		0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	B-EBL	0.69	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	B-EBL	96.4			MS	5	10	3.90	8.0

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW07-0911

Matrix: WATER **SDG Name:** CTO0012-2

Percent Solids: 0.00 **Lab Sample ID:** SE5738-009

Concentration Units : ug/L

CAS No.	Analyte		Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, DISSOLVED	B-CCBL	71.6	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	B-MBL	0.11	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED		4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED		84.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED		0.55	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED		0.38	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED		9060		~~N*~~	MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	B-MBL	3.6	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED		456		~~N*~~	MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED		2.8	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	B-CCBL	17.5	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	B-CCBL	0.15	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED		4910			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED		301			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	B-CCBL	0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED		37.9			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED		4970			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	B-MBL	2.0	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED		0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED		26300		~~N*~~	MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED		0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED		0.51	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED		75.5			MS	5	10	3.90	8.0

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS08-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 76.8 **Lab Sample ID:** SE5738-010

Concentration Units : mg/Kgdrywt

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	9300			MS	5	31	0.53	4.2
7440-36-0	ANTIMONY, TOTAL	0.36		~~N~~	MS	5	0.10	0.02	0.052
7440-38-2	ARSENIC, TOTAL	3.7			MS	5	0.52	0.16	0.42
7440-39-3	BARIUM, TOTAL	240			MS	5	0.21	0.04	0.10
7440-41-7	BERYLLIUM, TOTAL	0.35			MS	5	0.10	0.004	0.021
7440-43-9	CADMIUM, TOTAL	0.26			MS	5	0.10	0.01	0.021
7440-70-2	CALCIUM, TOTAL	597			MS	5	10	3.99	8.3
7440-47-3	CHROMIUM, TOTAL	16.4		~~N*~~	MS	5	0.52	0.05	0.42
7440-48-4	COBALT, TOTAL	6.8			MS	5	0.10	0.005	0.031
7440-50-8	COPPER, TOTAL	7.5		~~N~~	MS	5	0.31	0.07	0.21
7439-89-6	IRON, TOTAL	15500		~~*~~	MS	5	10	2.50	6.2
7439-92-1	LEAD, TOTAL	36.6		~~N~~	MS	5	0.10	0.005	0.052
7439-95-4	MAGNESIUM, TOTAL	696		~~N~~	MS	5	10	1.42	8.3
7439-96-5	MANGANESE, TOTAL	342		~~NE~~	MS	5	0.21	0.04	0.10
7439-97-6	MERCURY, TOTAL	0.08			CV	1	0.040	0.006	0.020
7440-02-0	NICKEL, TOTAL	7.1			MS	5	0.21	0.03	0.12
7440-09-7	POTASSIUM, TOTAL	506		~~N~~	MS	5	100	4.75	42
7782-49-2	SELENIUM, TOTAL	B-MBL 0.38	~~J~~		MS	5	0.52	0.04	0.31
7440-22-4	SILVER, TOTAL	25.0			MS	5	0.10	0.005	0.042
7440-23-5	SODIUM, TOTAL	B-MBL 32.8	~~J~~		MS	5	100	2.67	42
7440-28-0	THALLIUM, TOTAL	0.11			MS	5	0.10	0.01	0.042
7440-62-2	VANADIUM, TOTAL	31.0		~~N~~	MS	5	0.52	0.11	0.42
7440-66-6	ZINC, TOTAL	50.7		~~N*~~	MS	5	1.0	0.14	0.83

Comments:

JH
12/7/11

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INORGANIC ANALYSIS DATA SHEET

Lab Name: **Katahdin Analytical Services** **Client Field ID:** IU14SS09-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 80.4 **Lab Sample ID:** SE5738-011

Concentration Units : mg/Kgdrywt

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	4220			MS	5	28	0.47	3.7
7440-36-0	ANTIMONY, TOTAL	0.19		~~N~~	MS	5	0.093	0.02	0.046
7440-38-2	ARSENIC, TOTAL	4.4			MS	5	0.46	0.14	0.37
7440-39-3	BARIUM, TOTAL	27.8			MS	5	0.18	0.03	0.093
7440-41-7	BERYLLIUM, TOTAL	0.20			MS	5	0.093	0.004	0.018
7440-43-9	CADMIUM, TOTAL	0.18			MS	5	0.093	0.009	0.018
7440-70-2	CALCIUM, TOTAL	927			MS	5	9.3	3.55	7.4
7440-47-3	CHROMIUM, TOTAL	65.2		~~N*~~	MS	5	0.46	0.05	0.37
7440-48-4	COBALT, TOTAL	15.9			MS	5	0.093	0.005	0.028
7440-50-8	COPPER, TOTAL	6.0		~~N~~	MS	5	0.28	0.06	0.18
7439-89-6	IRON, TOTAL	11500		~~*~~	MS	5	9.3	2.23	5.6
7439-92-1	LEAD, TOTAL	27.4		~~N~~	MS	5	0.093	0.005	0.046
7439-95-4	MAGNESIUM, TOTAL	12800		~~N~~	MS	5	9.3	1.27	7.4
7439-96-5	MANGANESE, TOTAL	182		~~NE~~	MS	5	0.18	0.04	0.093
7439-97-6	MERCURY, TOTAL	0.05			CV	1	0.040	0.006	0.020
7440-02-0	NICKEL, TOTAL	277			MS	5	0.18	0.02	0.11
7440-09-7	POTASSIUM, TOTAL	278		~~N~~	MS	5	93	4.23	37
7782-49-2	SELENIUM, TOTAL	B-MBL 0.25	~~J~~		MS	5	0.46	0.04	0.28
7440-22-4	SILVER, TOTAL	1.2			MS	5	0.093	0.005	0.037
7440-23-5	SODIUM, TOTAL	B-MBL 37.8	~~J~~		MS	5	93	2.38	37
7440-28-0	THALLIUM, TOTAL	0.06	J		MS	5	0.093	0.009	0.037
7440-62-2	VANADIUM, TOTAL	15.2		~~N~~	MS	5	0.46	0.10	0.37
7440-66-6	ZINC, TOTAL	60.2		~~N*~~	MS	5	0.93	0.12	0.74

Comments:

JH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS10-000H

Matrix: SOIL **SDG Name:** CTO0012-2

Percent Solids: 74.9 **Lab Sample ID:** SE5738-012

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	MDL	LOD
7429-90-5	ALUMINUM, TOTAL	8110			MS	5	26	0.44	3.4
7440-36-0	ANTIMONY, TOTAL	0.43		~~N~~	MS	5	0.086	0.02	0.043
7440-38-2	ARSENIC, TOTAL	3.5			MS	5	0.43	0.13	0.34
7440-39-3	BARIUM, TOTAL	60.2			MS	5	0.17	0.03	0.086
7440-41-7	BERYLLIUM, TOTAL	0.46			MS	5	0.086	0.003	0.017
7440-43-9	CADMIUM, TOTAL	0.24			MS	5	0.086	0.009	0.017
7440-70-2	CALCIUM, TOTAL	1370			MS	5	8.6	3.27	6.8
7440-47-3	CHROMIUM, TOTAL	23.0		~~N*~~	MS	5	0.43	0.04	0.34
7440-48-4	COBALT, TOTAL	10.6			MS	5	0.086	0.004	0.026
7440-50-8	COPPER, TOTAL	15.1		N	MS	5	0.26	0.06	0.17
7439-89-6	IRON, TOTAL	13100		*	MS	5	8.6	2.05	5.1
7439-92-1	LEAD, TOTAL	105		N	MS	5	0.086	0.004	0.043
7439-95-4	MAGNESIUM, TOTAL	793		N	MS	5	8.6	1.17	6.8
7439-96-5	MANGANESE, TOTAL	273		~~NE~~	MS	5	0.17	0.03	0.086
7439-97-6	MERCURY, TOTAL	0.05			CV	1	0.040	0.006	0.021
7440-02-0	NICKEL, TOTAL	6.8			MS	5	0.17	0.02	0.10
7440-09-7	POTASSIUM, TOTAL	381		~~N~~	MS	5	86	3.90	34
7782-49-2	SELENIUM, TOTAL	B-MBL 0.43			MS	5	0.43	0.03	0.26
7440-22-4	SILVER, TOTAL	5.8			MS	5	0.086	0.004	0.034
7440-23-5	SODIUM, TOTAL	337			MS	5	86	2.19	34
7440-28-0	THALLIUM, TOTAL	0.13			MS	5	0.086	0.009	0.034
7440-62-2	VANADIUM, TOTAL	25.9		N	MS	5	0.43	0.09	0.34
7440-66-6	ZINC, TOTAL	134		N*	MS	5	0.86	0.11	0.68

Comments:

YH
12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14SS10P-000H

Matrix: SOIL | **SDG Name:** CTO0012-2

Percent Solids: 70.6 | **Lab Sample ID:** SE5738-013

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	8680			MS	5	32	0.55	4.3
7440-36-0	ANTIMONY, TOTAL	0.48		~~N~~	MS	5	0.11	0.02	0.054
7440-38-2	ARSENIC, TOTAL	3.7			MS	5	0.54	0.16	0.43
7440-39-3	BARIUM, TOTAL	63.6			MS	5	0.21	0.04	0.11
7440-41-7	BERYLLIUM, TOTAL	0.52			MS	5	0.11	0.004	0.021
7440-43-9	CADMIUM, TOTAL	0.25			MS	5	0.11	0.01	0.021
7440-70-2	CALCIUM, TOTAL	1420			MS	5	11	4.11	8.6
7440-47-3	CHROMIUM, TOTAL	46.8		~~N*~~	MS	5	0.54	0.05	0.43
7440-48-4	COBALT, TOTAL	11.0			MS	5	0.11	0.005	0.032
7440-50-8	COPPER, TOTAL	20.8		~~N~~	MS	5	0.32	0.08	0.21
7439-89-6	IRON, TOTAL	14100		*	MS	5	11	2.58	6.4
7439-92-1	LEAD, TOTAL	181		N	MS	5	0.11	0.005	0.054
7439-95-4	MAGNESIUM, TOTAL	845		N	MS	5	11	1.47	8.6
7439-96-5	MANGANESE, TOTAL	343		~~NE~~	MS	5	0.21	0.04	0.11
7439-97-6	MERCURY, TOTAL	0.08			CV	1	0.038	0.006	0.020
7440-02-0	NICKEL, TOTAL	7.2			MS	5	0.21	0.03	0.13
7440-09-7	POTASSIUM, TOTAL	402		~~N~~	MS	5	110	4.90	43
7782-49-2	SELENIUM, TOTAL	0.51	J		MS	5	0.54	0.04	0.32
7440-22-4	SILVER, TOTAL	4.7			MS	5	0.11	0.005	0.043
7440-23-5	SODIUM, TOTAL	348			MS	5	110	2.75	43
7440-28-0	THALLIUM, TOTAL	0.14			MS	5	0.11	0.01	0.043
7440-62-2	VANADIUM, TOTAL	27.7		N	MS	5	0.54	0.12	0.43
7440-66-6	ZINC, TOTAL	136		N*	MS	5	1.1	0.14	0.86

Comments:

JH
12/7/11

REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5636-1
Report Date: 05-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description

JU14GW05-0911

Matrix	Date Sampled	Date Received
AQ	06-SEP-11	08-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	U0.050 mg/L	0.10	0.026	0.050	STDM 3500D	WG97210	08-SEP-11 10:15:00	N/A	N/A	
Hardness	61. mg/L	5.0	1.6	4.0	EPA 130.2	WG97100	08-SEP-11 10:17:00	N/A	N/A	
Sulfate-Turbidimetric	92. mg/L	5.0	1.4	2.5	EPA 375.4	WG97384	14-SEP-11 12:28:48	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 11:30:00	N/A	N/A	
Total Cynaide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97378	13-SEP-11 15:21:36	SW846 M9012	13-SEP-11	
Total Organic Carbon (1)	2.0 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 19:51:21	N/A	N/A	
Total Organic Carbon (2)	2.0 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 20:01:34	N/A	N/A	
Total Organic Carbon (3)	2.1 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 20:39:43	N/A	N/A	
Total Organic Carbon (4)	2.0 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 20:50:04	N/A	N/A	
Total Organic Carbon (Average)	2.0 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 05:24:35	N/A	N/A	
pH(Laboratory)	5.8 pH	0.10	0.10	N/A	SW846 9040B	WG97207	08-SEP-11 11:35:00	N/A	N/A	

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REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5636-3
Report Date: 05-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
JU14GW06-0911	AQ	06-SEP-11	08-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	0.22 mg/L	0.10	0.026	0.050	STDM 3500D	WG97210	08-SEP-11 10:14:00	N/A	N/A	
Hardness	38. mg/L	5.0	1.6	4.0	EPA 130.2	WG97100	08-SEP-11 10:12:00	N/A	N/A	
Sulfate-Turbidimetric	43. mg/L	2.0	0.58	1.0	EPA 375.4	WG97384	14-SEP-11 12:14:24	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 11:45:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97378	13-SEP-11 15:21:36	SW846 M9012	13-SEP-11	
Total Organic Carbon (1)	J0.59 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:02:13	N/A	N/A	
Total Organic Carbon (2)	J0.57 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:12:03	N/A	N/A	
Total Organic Carbon (3)	J0.55 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:23:55	N/A	N/A	
Total Organic Carbon (4)	J0.54 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:33:48	N/A	N/A	
Total Organic Carbon (Average)	J0.56 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 05:24:35	N/A	N/A	
pH(Laboratory)	5.4 pH	0.10	0.10	N/A	SW846 9040B	WG97207	08-SEP-11 11:25:00	N/A	N/A	

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REISSUE

Katahdin
ANALYTICAL SERVICES

nelac
Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5697-1
Report Date: 05-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14-EB-090711-SS	AQ	07-SEP-11	09-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97587	16-SEP-11 10:19:12	SW846 M9012	15-SEP-11	

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REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5697-2
Report Date: 05-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
1U14-EB-090711-GW	AQ	07-SEP-11	09-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97587	16-SEP-11 10:19:12	SW846 M9012	15-SEP-11	

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REISSUE

Katahdin
ANALYTICAL SERVICES

NELAC Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5697-4
Report Date: 05-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14-GW09-0911	AQ	07-SEP-11	09-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.083 mg/L	0.10	0.026	0.050	STDM 3500D	WG97319	09-SEP-11 10:58:00	N/A	N/A	
Hardness	12. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:18:00	N/A	N/A	
Sulfate-Turbidimetric	12. mg/L	1.0	0.29	0.50	EPA 375.4	WG97389	14-SEP-11 14:24:00	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 11:50:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97587	16-SEP-11 10:19:12	SW846 M9012	15-SEP-11	
Total Organic Carbon (1)	2.1 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:45:56	N/A	N/A	
Total Organic Carbon (2)	2.0 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 21:56:17	N/A	N/A	
Total Organic Carbon (3)	2.2 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 22:08:42	N/A	N/A	
Total Organic Carbon (4)	2.3 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 22:19:17	N/A	N/A	
Total Organic Carbon (Average)	2.2 mg/L	1.0	0.10	0.50	SW846 9060	WG97236	12-SEP-11 05:24:35	N/A	N/A	
pH(Laboratory)	5.2 pH	0.10	0.10	N/A	SW846 9040B	WG97287	09-SEP-11 14:12:00	N/A	N/A	

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Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5737-1
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW04-0911	AQ	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	U0.050 mg/L	0.10	0.026	0.050	STDM 3500D	WG97322	10-SEP-11 10:18:00	N/A	N/A	
Hardness	73. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:23:00	N/A	N/A	
Sulfate-Turbidimetric	3.0 mg/L	1.0	0.29	0.50	EPA 375.4	WG97389	14-SEP-11 14:38:24	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 11:55:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97587	16-SEP-11 10:19:12	SW846 M9012	15-SEP-11	
Total Organic Carbon (1)	J0.71 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 12:09:34	N/A	N/A	
Total Organic Carbon (2)	J0.70 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 12:19:31	N/A	N/A	
Total Organic Carbon (3)	J0.70 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 12:31:27	N/A	N/A	
Total Organic Carbon (4)	J0.69 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 12:41:22	N/A	N/A	
Total Organic Carbon (Average)	J0.70 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 10:07:54	N/A	N/A	
pH(Laboratory)	5.1 pH	0.10	0.10	N/A	SW846 9040B	WG97288	10-SEP-11 11:08:00	N/A	N/A	

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ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5737-3
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW08-0911	AQ	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.028 mg/L	0.10	0.026	0.050	STDM 3500D	WG97322	10-SEP-11 10:19:00	N/A	N/A	
Hardness	38. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:26:00	N/A	N/A	
Sulfate-Turbidimetric	14. mg/L	1.0	0.29	0.50	EPA 375.4	WG97389	14-SEP-11 14:38:24	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 12:00:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97588	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Organic Carbon (1)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 13:19:38	N/A	N/A	
Total Organic Carbon (2)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 13:29:45	N/A	N/A	
Total Organic Carbon (3)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 13:41:54	N/A	N/A	
Total Organic Carbon (4)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 13:52:02	N/A	N/A	
Total Organic Carbon (Average)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 10:07:54	N/A	N/A	
pH(Laboratory)	4.8 pH	0.10	0.10	N/A	SW846 9040B	WG97288	10-SEP-11 11:10:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
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Chantilly,VA 20151

Lab Sample ID: SE5737-5
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS11-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.52 mg/Kgdrywt	0.65	0.29	0.52	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	73. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:21:00	ASTM D2216	20-SEP-11	
pH(Soil)	6.6 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:07:00	SW846 9045C	20-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
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Lab Sample ID: SE5737-6
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS12-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.44 mg/Kgdrywt	0.55	0.24	0.44	SW846 M9012A	WG97589	16-SEP-11 15:21:36	SW846 M9012	16-SEP-11	
Total Solids	80. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:22:00	ASTM D2216	20-SEP-11	
pH(Soil)	6.9 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:10:00	SW846 9045C	20-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
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Chantilly, VA 20151

Lab Sample ID: SE5737-7
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS01P-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.44 mg/Kgdrywt	0.55	0.24	0.44	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	87. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:23:00	ASTM D2216	20-SEP-11	

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Client: Hillary Ott
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Lab Sample ID: SE5737-8
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS02-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.44 mg/Kgdrywt	0.55	0.24	0.44	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	82. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:24:00	ASTM D2216	20-SEP-11	
pH(Soil)	7.6 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:14:00	SW846 9045C	20-SEP-11	

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Client: Hillary Ott
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Lab Sample ID: SE5737-9
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS07-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.48 mg/Kgdrywt	0.60	0.27	0.48	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	74. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:25:00	ASTM D2216	20-SEP-11	
pH(Soil)	4.4 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:16:00	SW846 9045C	20-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
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Lab Sample ID: SE5737-10
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS01-000H	SL	09-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.40 mg/Kgdrywt	0.50	0.22	0.40	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	86. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:26:00	ASTM D2216	20-SEP-11	
pH(Soil)	7.2 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:18:00	SW846 9045C	20-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-1
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW01-0911	AQ	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	U0.050 mg/L	0.10	0.026	0.050	STDM 3500D	WG97322	10-SEP-11 10:21:00	N/A	N/A	
Hardness	54. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:31:00	N/A	N/A	
Sulfate-Turbidimetric	54. mg/L	2.0	0.58	1.0	EPA 375.4	WG97389	14-SEP-11 15:07:12	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 12:05:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97588	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Organic Carbon (1)	1.2 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:04:11	N/A	N/A	
Total Organic Carbon (2)	1.2 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:14:18	N/A	N/A	
Total Organic Carbon (3)	1.1 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:26:29	N/A	N/A	
Total Organic Carbon (4)	1.1 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:36:39	N/A	N/A	
Total Organic Carbon (Average)	1.2 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 10:07:54	N/A	N/A	
pH(Laboratory)	5.8 pH	0.10	0.10	N/A	SW846 9040B	WG97288	10-SEP-11 11:20:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-3
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW01P-0911	AQ	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97588	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-5
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW03-0911	AQ	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	U0.050 mg/L	0.10	0.026	0.050	STDM 3500D	WG97322	10-SEP-11 10:20:00	N/A	N/A	
Hardness	26. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:34:00	N/A	N/A	
Sulfate-Turbidimetric	42. mg/L	2.0	0.58	1.0	EPA 375.4	WG97389	14-SEP-11 15:07:12	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 12:10:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97588	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Organic Carbon (1)	1.9 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:48:58	N/A	N/A	
Total Organic Carbon (2)	1.9 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 14:59:29	N/A	N/A	
Total Organic Carbon (3)	1.9 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 15:38:00	N/A	N/A	
Total Organic Carbon (4)	1.8 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 15:48:22	N/A	N/A	
Total Organic Carbon (Average)	1.9 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 10:07:54	N/A	N/A	
pH(Laboratory)	5.3 pH	0.10	0.10	N/A	SW846 9040B	WG97288	10-SEP-11 11:24:00	N/A	N/A	

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Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-7
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS03-000H	SL	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.44 mg/Kgdrywt	0.55	0.24	0.44	SW846 M9012A	WG97589	16-SEP-11 15:07:12	SW846 M9012	16-SEP-11	
Total Solids	82. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:27:00	ASTM D2216	20-SEP-11	
pH(Soil)	5.1 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:20:00	SW846 9045C	20-SEP-11	

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Report of Analytical Results

Client: Hillary Ott
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Chantilly,VA 20151

Lab Sample ID: SE5738-8
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14GW07-0911	AQ	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.061 mg/L	0.10	0.026	0.050	STDM 3500D	WG97322	10-SEP-11 10:22:00	N/A	N/A	
Hardness	40. mg/L	5.0	1.6	4.0	EPA 130.2	WG98642	05-OCT-11 09:36:00	N/A	N/A	
Sulfate-Turbidimetric	22. mg/L	1.0	0.29	0.50	EPA 375.4	WG97389	14-SEP-11 14:38:24	N/A	N/A	
Sulfide-Iodometric	U0.75 mg/L	1.0	0.69	0.75	EPA 376.1	WG97315	12-SEP-11 14:03:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG97588	16-SEP-11 15:21:36	SW846 M9012	16-SEP-11	
Total Organic Carbon (1)	1.5 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 16:28:03	N/A	N/A	
Total Organic Carbon (2)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 16:38:11	N/A	N/A	
Total Organic Carbon (3)	1.3 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 16:50:20	N/A	N/A	
Total Organic Carbon (4)	1.3 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 17:00:27	N/A	N/A	
Total Organic Carbon (Average)	1.4 mg/L	1.0	0.10	0.50	SW846 9060	WG97399	14-SEP-11 10:07:54	N/A	N/A	
pH(Laboratory)	5.4 pH	0.10	0.10	N/A	SW846 9040B	WG97288	10-SEP-11 11:17:00	N/A	N/A	

TH 12/7/11

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REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-10
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS08-000H	SL	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.48 mg/Kgdrywt	0.60	0.27	0.48	SW846 M9012A	WG97589	16-SEP-11 16:19:12	SW846 M9012	16-SEP-11	
Total Solids	77. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:28:00	ASTM D2216	20-SEP-11	
pH(Soil)	5.4 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:22:00	SW846 9045C	20-SEP-11	

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REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-11
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS09-000H	SL	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.40 mg/Kgdrywt	0.50	0.22	0.40	SW846 M9012A	WG97589	16-SEP-11 16:19:12	SW846 M9012	16-SEP-11	
Total Solids	80. %	1		N/A	SM2540G	WG97657	21-SEP-11 09:29:00	ASTM D2216	20-SEP-11	
pH(Soil)	6.1 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:23:00	SW846 9045C	20-SEP-11	

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REISSUE

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE5738-12
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS10-000H	SL	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.48 mg/Kgdrywt	0.60	0.27	0.48	SW846 M9012A	WG97589	16-SEP-11 16:19:12	SW846 M9012	16-SEP-11	
Total Solids	75. %	1		N/A	SM2540G	WG97677	21-SEP-11 09:45:00	ASTM D2216	20-SEP-11	
pH(Soil)	6.6 pH	0.10	0.10	N/A	SW846 9045C	WG97711	20-SEP-11 12:25:00	SW846 9045C	20-SEP-11	

TH 12/7/11

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE5738-13
Report Date: 13-OCT-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-2

Sample Description	Matrix	Date Sampled	Date Received
IU14SS10P-000H	SL	08-SEP-11	10-SEP-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.56 mg/Kgdrywt	0.70	0.31	0.56	SW846 M9012A	WG97589	16-SEP-11 16:19:12	SW846 M9012	16-SEP-11	
Total Solids	70. %	1		N/A	SM2540G	WG97677	21-SEP-11 09:46:00	ASTM D2216	20-SEP-11	

TH 12/7/11

CTO-0012-3 Data Validation Report

Data Validation Summary

Indian Head CTO-JU04, SWMU 14

TO: Juan Acaron/GNV

Anita Dodson/WDC

FROM: Tiffany McGlynn/GNV

CC: Herb Kelly/GNV

DATE: December 9, 2011

Introduction

The following data validation report discusses the data validation process and findings for Katahdin Laboratories, Inc. for SDG CTO0012-3.

Samples were analyzed using the following analytical methods:

- SW6020 Metals, total
- SW7471A/7470A Mercury
- SW9012 Cyanide

The samples included in this SDG are listed in the table below.

Sample Name	Matrix
IU14-EB-100711-SS	Water
IU14-SS06-000H	Soil
IU14-SS06P-000H	Soil
IU14-SS05-000H	Soil
IU14-SS04-000H	Soil

Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: Uniform Federal Policy-Sampling and Analysis Plan for Stump

Neck SWMU 14 Remedial Investigation, Naval Support Facility Indian Head (May 2011), National Functional Guidelines for Inorganic Methods Data Review (EPA 2010), and Region III Modifications for Inorganic Data Review (EPA 1993) as applicable. The samples were evaluated based on the following criteria:

- Data Completeness
- Technical Holding Times
- Initial/Continuing Calibrations
- Blanks
- Internal Standards
- Serial Dilutions
- Laboratory Control Samples
- Matrix Spike Recoveries
- Field Duplicate Precision
- Identification/Quantitation
- Reporting Limits

Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to the chain of custody records, sampling was performed on 10/7/11. Samples were received at the laboratory on 10/8/11. All sample preparation analysis was performed within holding time requirements.

Blanks

Detects were found in the equipment blanks, method blanks, and ICB/CCB blanks as listed in the table below. Affected data are summarized in **Attachment 1**.

Blank ID	Compound	Conc.	Units
IU14-EB-100711-SS	Aluminum	8.1	ug/l
IU14-EB-100711-SS	Arsenic	2.7	ug/l
IU14-EB-100711-SS	Barium	1.1	ug/l
IU14-EB-100711-SS	Cadmium	0.03	ug/l
IU14-EB-100711-SS	Chromium	2.5	ug/l
IU14-EB-100711-SS	Copper	0.52	ug/l
IU14-EB-100711-SS	Iron	39.7	ug/l
IU14-EB-100711-SS	MAGNESIUM	13.8	ug/l
IU14-EB-100711-SS	Manganese	0.66	ug/l
IU14-EB-100711-SS	Nickel	0.18	ug/l
IU14-EB-100711-SS	Selenium	0.56	ug/l
IU14-EB-100711-SS	Vanadium	1.0	ug/l
PBSBK03IMS1	Aluminum	1.341	MG_KG
PBSBK03IMS1	Barium	0.082	MG_KG
PBSBK03IMS1	Calcium	12.675	MG_KG
PBSBK03IMS1	Chromium	0.294	MG_KG
PBSBK03IMS1	Copper	0.123	MG_KG
PBSBK03IMS1	Iron	6.335	MG_KG
PBSBK03IMS1	Lead	0.012	MG_KG
PBSBK03IMS1	MAGNESIUM	4.389	MG_KG
PBSBK03IMS1	Manganese	0.125	MG_KG
PBSBK03IMS1	Nickel	0.045	MG_KG
PBSBK03IMS1	Potassium	5.075	MG_KG
PBSBK03IMS1	Selenium	0.048	MG_KG
PBSBK03IMS1	Sodium	3.799	MG_KG
PBSBK03IMS1	Zinc	0.420	MG_KG
PBWBJ22HGW1	Mercury	-0.012	UG_L
PBWBK11IMW1	Aluminum	7.705	UG_L
PBWBK11IMW1	Calcium	57.500	UG_L
PBWBK11IMW1	Chromium	2.139	UG_L
PBWBK11IMW1	Copper	0.702	UG_L
PBWBK11IMW1	Iron	60.900	UG_L
PBWBK11IMW1	MAGNESIUM	10.910	UG_L
PBWBK11IMW1	Manganese	0.910	UG_L
PBWBK11IMW1	Selenium	0.860	UG_L
PBWBK11IMW1	Vanadium	0.925	UG_L
ICB/CCB	Aluminum	2.302	UG_L
ICB/CCB	Antimony	0.009	UG_L
ICB/CCB	Calcium	11.29	UG_L

Blank ID	Compound	Conc.	Units
ICB/CCB	Copper	0.262	UG_L
ICB/CCB	Magnesium	2.597	UG_L
ICB/CCB	Molybdenum	0.268	UG_L
ICB/CCB	Selenium	0.191	UG_L
ICB/CCB	Thallium	0.007	UG_L
ICB/CCB	Manganese	0.036	UG_L
ICB/CCB	Sodium	74	UG_L
ICB/CCB	Chromium	0.14	UG_L
ICB/CCB	Iron	16.85	UG_L
ICB/CCB	Nickel	0.061	UG_L
ICB/CCB	Potassium	31.08	UG_L

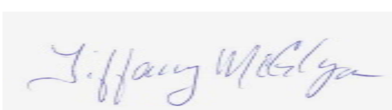
Matrix Spike/Spike Duplicate
Various compounds for metals exhibited either high or low recoveries in the MS/MSDs. Affected data are summarized in **Attachment 1**.

Conclusion

These data, as qualified, are available to be evaluated by the project team for use in decision-making purposes.

Please do not hesitate to contact us about this validation report.

Sincerely,



Tiffany McGlynn

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation

Value	Description
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Indian Head CTO-JU04, SWMU 14 Attachment 1 Change Qual. Table SDG CTO0012-3			
Sample ID	**Compound**	**Q Flag**	**Qual Code**
IU14-EB-100711-SS	Iron	B	MBL
IU14-EB-100711-SS	Aluminum	B	MBL
IU14-EB-100711-SS	Chromium	B	MBL
IU14-EB-100711-SS	Copper	B	MBL
IU14-EB-100711-SS	MAGNESIUM	B	MBL
IU14-EB-100711-SS	Manganese	B	MBL
IU14-EB-100711-SS	Nickel	B	CCBL
IU14-EB-100711-SS	Selenium	B	MBL
IU14-EB-100711-SS	Vanadium	B	MBL
IU14-SS06-000H	Sodium	B	CCBL
IU14-SS06P-000H	Sodium	B	CCBL
IU14-SS05-000H	Sodium	B	CCBL
IU14-SS04-000H	Aluminum	L	MSL
IU14-SS04-000H	Lead	L	MSL
IU14-SS04-000H	MAGNESIUM	K	MSH
IU14-SS04-000H	Potassium	K	MSH
IU14-SS04-000H	Silver	L	MSL
IU14-SS04-000H	Sodium	B	CCBL

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14-EB-100711-SS

Matrix: WATER | **SDG Name:** CTO0012-3

Percent Solids: 0.00 | **Lab Sample ID:** SE6625-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL	8.1	J B-MBL		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	2.7	J		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	1.1	J		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.03	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	80	U		MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	2.5	J B-MBL		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	0.30	U		MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	0.52	J B-MBL		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	39.7	J B-MBL		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	0.50	U		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	13.8	J B-MBL		MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	0.66	J B-MBL		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	0.18	J B-CCBL		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	0.56	J B-MBL		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	400	U		MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	1.0	J B-MBL		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	8.0	U		MS	5	10	3.90	8.0

Comments:

JH 12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-SS06-000H

Matrix: SOIL **SDG Name:** CTO0012-3

Percent Solids: 77.8 **Lab Sample ID:** SE6625-002

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, TOTAL	8350			MS	5	37	0.64	5.0
7440-36-0	ANTIMONY, TOTAL	0.14		~~N~~	MS	5	0.12	0.02	0.062
7440-38-2	ARSENIC, TOTAL	2.8			MS	5	0.62	0.19	0.50
7440-39-3	BARIUM, TOTAL	55.3			MS	5	0.25	0.04	0.12
7440-41-7	BERYLLIUM, TOTAL	0.64			MS	5	0.12	0.005	0.025
7440-43-9	CADMIUM, TOTAL	0.11	J		MS	5	0.12	0.01	0.025
7440-70-2	CALCIUM, TOTAL	287			MS	5	12	4.78	10
7440-47-3	CHROMIUM, TOTAL	13.2			MS	5	0.62	0.06	0.50
7440-48-4	COBALT, TOTAL	19.9			MS	5	0.12	0.006	0.037
7440-50-8	COPPER, TOTAL	8.2			MS	5	0.37	0.09	0.25
7439-89-6	IRON, TOTAL	11500			MS	5	12	3.00	7.5
7439-92-1	LEAD, TOTAL	18.5		~~N~~	MS	5	0.12	0.006	0.062
7439-95-4	MAGNESIUM, TOTAL	676		~~N~~	MS	5	12	1.70	10
7439-96-5	MANGANESE, TOTAL	753			MS	10	0.50	0.10	0.25
7439-97-6	MERCURY, TOTAL	0.06			CV	1	0.040	0.006	0.020
7440-02-0	NICKEL, TOTAL	9.1			MS	5	0.25	0.03	0.15
7440-09-7	POTASSIUM, TOTAL	493		~~N~~	MS	5	120	5.69	50
7782-49-2	SELENIUM, TOTAL	0.47	J		MS	5	0.62	0.05	0.37
7440-22-4	SILVER, TOTAL	0.32		~~N~~	MS	5	0.12	0.006	0.050
7440-23-5	SODIUM, TOTAL	20.3	~~J~~ B-CCBL		MS	5	120	3.20	50
7440-28-0	THALLIUM, TOTAL	0.14			MS	5	0.12	0.01	0.050
7440-62-2	VANADIUM, TOTAL	26.9			MS	5	0.62	0.14	0.50
7440-66-6	ZINC, TOTAL	27.0			MS	5	1.2	0.16	1.0

Comments:

JHH 12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-SS06P-000H

Matrix: SOIL **SDG Name:** CTO0012-3

Percent Solids: 74.0 **Lab Sample ID:** SE6625-003

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL	8990			MS	5	36	0.61	4.8
7440-36-0	ANTIMONY, TOTAL	0.15		~~N~~	MS	5	0.12	0.02	0.060
7440-38-2	ARSENIC, TOTAL	3.7			MS	5	0.60	0.18	0.48
7440-39-3	BARIUM, TOTAL	61.2			MS	5	0.24	0.04	0.12
7440-41-7	BERYLLIUM, TOTAL	0.71			MS	5	0.12	0.005	0.024
7440-43-9	CADMIUM, TOTAL	0.13			MS	5	0.12	0.01	0.024
7440-70-2	CALCIUM, TOTAL	382			MS	5	12	4.57	9.6
7440-47-3	CHROMIUM, TOTAL	14.6			MS	5	0.60	0.06	0.48
7440-48-4	COBALT, TOTAL	17.4			MS	5	0.12	0.006	0.036
7440-50-8	COPPER, TOTAL	8.6			MS	5	0.36	0.08	0.24
7439-89-6	IRON, TOTAL	14100			MS	5	12	2.87	7.2
7439-92-1	LEAD, TOTAL	21.3		~~N~~	MS	5	0.12	0.006	0.060
7439-95-4	MAGNESIUM, TOTAL	660		~~N~~	MS	5	12	1.63	9.6
7439-96-5	MANGANESE, TOTAL	747			MS	10	0.48	0.10	0.24
7439-97-6	MERCURY, TOTAL	0.07			CV	1	0.045	0.007	0.023
7440-02-0	NICKEL, TOTAL	8.8			MS	5	0.24	0.03	0.14
7440-09-7	POTASSIUM, TOTAL	544		~~N~~	MS	5	120	5.45	48
7782-49-2	SELENIUM, TOTAL	0.63			MS	5	0.60	0.05	0.36
7440-22-4	SILVER, TOTAL	0.34		~~N~~	MS	5	0.12	0.006	0.048
7440-23-5	SODIUM, TOTAL	22.2		J B-CCBL	MS	5	120	3.07	48
7440-28-0	THALLIUM, TOTAL	0.15			MS	5	0.12	0.01	0.048
7440-62-2	VANADIUM, TOTAL	36.1			MS	5	0.60	0.13	0.48
7440-66-6	ZINC, TOTAL	27.8			MS	5	1.2	0.16	0.96

Comments:

JH 12/7/11

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14-SS05-000H
Matrix: SOIL
SDG Name: CTO0012-3
Percent Solids: 78.8
Lab Sample ID: SE6625-004

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL	11300			MS	5	30	0.51	4.0
7440-36-0	ANTIMONY, TOTAL	0.15		~~N~~	MS	5	0.10	0.02	0.050
7440-38-2	ARSENIC, TOTAL	3.6			MS	5	0.50	0.15	0.40
7440-39-3	BARIUM, TOTAL	41.8			MS	5	0.20	0.04	0.10
7440-41-7	BERYLLIUM, TOTAL	0.46			MS	5	0.10	0.004	0.020
7440-43-9	CADMIUM, TOTAL	0.05	J		MS	5	0.10	0.01	0.020
7440-70-2	CALCIUM, TOTAL	310			MS	5	10	3.85	8.0
7440-47-3	CHROMIUM, TOTAL	16.3			MS	5	0.50	0.05	0.40
7440-48-4	COBALT, TOTAL	7.0			MS	5	0.10	0.005	0.030
7440-50-8	COPPER, TOTAL	10.2			MS	5	0.30	0.07	0.20
7439-89-6	IRON, TOTAL	16000			MS	5	10	2.42	6.0
7439-92-1	LEAD, TOTAL	25.4		~~N~~	MS	5	0.10	0.005	0.050
7439-95-4	MAGNESIUM, TOTAL	888		~~N~~	MS	5	10	1.37	8.0
7439-96-5	MANGANESE, TOTAL	215			MS	5	0.20	0.04	0.10
7439-97-6	MERCURY, TOTAL	0.07			CV	1	0.032	0.005	0.016
7440-02-0	NICKEL, TOTAL	8.1			MS	5	0.20	0.03	0.12
7440-09-7	POTASSIUM, TOTAL	651		~~N~~	MS	5	100	4.59	40
7782-49-2	SELENIUM, TOTAL	0.50			MS	5	0.50	0.04	0.30
7440-22-4	SILVER, TOTAL	0.43		~~N~~	MS	5	0.10	0.005	0.040
7440-23-5	SODIUM, TOTAL	24.8	JB-CCBL		MS	5	100	2.58	40
7440-28-0	THALLIUM, TOTAL	0.16			MS	5	0.10	0.01	0.040
7440-62-2	VANADIUM, TOTAL	36.8			MS	5	0.50	0.11	0.40
7440-66-6	ZINC, TOTAL	24.4			MS	5	1.0	0.13	0.80

Comments:

YH
12/7/11

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14-SS04-000H

Matrix: SOIL **SDG Name:** CTO0012-3

Percent Solids: 87.3 **Lab Sample ID:** SE6625-005

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, TOTAL	10000	L-MSL		MS	5	30	0.52	4.0
7440-36-0	ANTIMONY, TOTAL	0.12		N	MS	5	0.10	0.02	0.051
7440-38-2	ARSENIC, TOTAL	3.4			MS	5	0.51	0.15	0.40
7440-39-3	BARIUM, TOTAL	33.2			MS	5	0.20	0.04	0.10
7440-41-7	BERYLLIUM, TOTAL	0.42			MS	5	0.10	0.004	0.020
7440-43-9	CADMIUM, TOTAL	0.03	J		MS	5	0.10	0.01	0.020
7440-70-2	CALCIUM, TOTAL	247			MS	5	10	3.88	8.1
7440-47-3	CHROMIUM, TOTAL	16.0			MS	5	0.51	0.05	0.40
7440-48-4	COBALT, TOTAL	4.7			MS	5	0.10	0.005	0.030
7440-50-8	COPPER, TOTAL	21.7			MS	5	0.30	0.07	0.20
7439-89-6	IRON, TOTAL	14800			MS	5	10	2.43	6.1
7439-92-1	LEAD, TOTAL	L-MSL 32.1		N	MS	5	0.10	0.005	0.051
7439-95-4	MAGNESIUM, TOTAL	K-MSH 800		N	MS	5	10	1.38	8.1
7439-96-5	MANGANESE, TOTAL	229			MS	5	0.20	0.04	0.10
7439-97-6	MERCURY, TOTAL	0.06			CV	1	0.030	0.005	0.015
7440-02-0	NICKEL, TOTAL	7.9			MS	5	0.20	0.03	0.12
7440-09-7	POTASSIUM, TOTAL	K-MSH 596		N	MS	5	100	4.62	40
7782-49-2	SELENIUM, TOTAL	0.27	J		MS	5	0.51	0.04	0.30
7440-22-4	SILVER, TOTAL	L-MSL 6.3		N	MS	5	0.10	0.005	0.040
7440-23-5	SODIUM, TOTAL	17.9	JB-CCBL		MS	5	100	2.60	40
7440-28-0	THALLIUM, TOTAL	0.13			MS	5	0.10	0.01	0.040
7440-62-2	VANADIUM, TOTAL	29.1			MS	5	0.51	0.11	0.40
7440-66-6	ZINC, TOTAL	22.8			MS	5	1.0	0.13	0.81

Comments:

YH 12/7/11

FORM I - IN

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly, VA 20151

Lab Sample ID: SE6625-2
Report Date: 14-NOV-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-3

Sample Description	Matrix	Date Sampled	Date Received
IU14-SS06-000H	SL	07-OCT-11	08-OCT-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.48 mg/Kgdrywt	0.60	0.27	0.48	SW846 M9012A	WG99544	21-OCT-11 15:36:00	SW846 M9012	20-OCT-11	
Total Solids	78. %	1		N/A	SM2540G	WG100043	31-OCT-11 08:47:44	ASTM D2216	28-OCT-11	
pH(Soil)	4.4 pH	0.10	0.10	N/A	SW846 9045C	WG99139	13-OCT-11 14:55:00	SW846 9045C	13-OCT-11	

TH 12/7/11

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE6625-3
Report Date: 14-NOV-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-3

Sample Description	Matrix	Date Sampled	Date Received
IU14-SS06P-000H	SL	07-OCT-11	08-OCT-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.52 mg/Kgdrywt	0.65	0.29	0.52	SW846 M9012A	WG99544	21-OCT-11 15:36:00	SW846 M9012	20-OCT-11	
Total Solids	74. %	1		N/A	SM2540G	WG100043	31-OCT-11 08:47:53	ASTM D2216	28-OCT-11	

TH 12/7/11

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE6625-4
Report Date: 14-NOV-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-3

Sample Description	Matrix	Date Sampled	Date Received
IU14-SS05-000H	SL	07-OCT-11	08-OCT-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.48 mg/Kgdrywt	0.60	0.27	0.48	SW846 M9012A	WG99544	21-OCT-11 15:36:00	SW846 M9012	20-OCT-11	
Total Solids	79. %	1		N/A	SM2540G	WG100043	31-OCT-11 08:48:10	ASTM D2216	28-OCT-11	
pH(Soil)	4.0 pH	0.10	0.10	N/A	SW846 9045C	WG99139	13-OCT-11 14:58:00	SW846 9045C	13-OCT-11	

TH 12/7/11

Katahdin
ANALYTICAL SERVICES

Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SE6625-5
Report Date: 14-NOV-11
Client PO: 943154 380785.SA.SM.
Project: CTO-0012 Indian Head
SDG: CTO0012-3

Sample Description	Matrix	Date Sampled	Date Received
IU14-SS04-000H	SL	07-OCT-11	08-OCT-11

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U0.44 mg/Kgdrywt	0.55	0.24	0.44	SW846 M9012A	WG99544	21-OCT-11 15:36:00	SW846 M9012	20-OCT-11	
Total Solids	87. %	1		N/A	SM2540G	WG100043	31-OCT-11 08:48:23	ASTM D2216	28-OCT-11	
pH(Soil)	4.1 pH	0.10	0.10	N/A	SW846 9045C	WG99139	13-OCT-11 14:41:00	SW846 9045C	13-OCT-11	

TH 12/7/11

CTO-JU40-1 Data Validation Report

MEMORANDUM CH2MHILL

Data Validation Summary

Indian Head SWMU 14

TO: Juan Acaron/GNV

Anita Dodson/VBO

FROM: Tiffany McGlynn/GNV

CC: Herb Kelly/GNV

DATE: August 27, 2012

Introduction

The following data validation report discusses the data validation process and findings for Katahdin Analytical for SDG JU40-1.

Samples were analyzed using the following analytical methods:

- SW6020 Metals, Total & Dissolved
- SW7470A Mercury, Total and Dissolved
- SW9012 Cyanide

The samples included in this SDG are listed in the table below.

Sample Name	Matrix
IU14GW030712	Water
IU14GW050712	Water
IU14GW060712	Water
IU14EB01071012	Water
IU14GW070712	Water
IU14GW010712	Water
IU14GW01P0712	Water
IU14EB01071112-GW	Water
IU14GW040712	Water
IU14GW080712	Water
IU14GW110712	Water
IU14GW090712	Water

Sample Name	Matrix
IU14SS09A0001	Soil
IU14SS09AP0001	Soil
IU14SS10A0001	Soil
IU14SS130001	Soil
IU14SS180001	Soil
IU14SS140001	Soil
IU14SS150001	Soil
IU14SS160001	Soil
IU14SS170001	Soil
IU14SS190001	Soil
IU14SS200001	Soil
IU14SS20P0001	Soil
IU14SS210001	Soil
IU14EB01071112-SS	Water

Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: Amended Uniform Federal Policy-Sampling and Analysis Plan for Stump Neck SWMU 14 Remedial Investigation Naval Support Facility Indian Head Indian Head, Maryland, Contract Task Order 165 (June 2012) and Region III Modifications for Inorganic Data Review (EPA 1993), as applicable. The samples were evaluated based on the following criteria:

- Data Completeness
- Technical Holding Times
- Mass Calibration/Instrument Tuning
- Initial/Continuing Calibrations
- Blanks
- Internal Standards
- Laboratory Control Samples
- Matrix Spike Recoveries
- Field Duplicates
- Identification/Quantitation
- Reporting Limits

Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

Data Completeness
The SDG was received complete and intact.

Technical Holding Times
According to the chain of custody records, sampling was performed on 7/10/12 and 7/11/12. Samples were received at the laboratory on 7/11/12 and 7/12/12. All sample preparation analysis was performed within holding time requirements.

Blanks

Several compounds were detected in the equipment blanks, method/prep blanks, and calibration blanks. Affected data are summarized in **Attachment 1**.

Blank ID	Compound	Conc.	Units
IU14EB01071012	Aluminum	25.3	UG_L
IU14EB01071012	Antimony	0.07	UG_L
IU14EB01071012	Chromium	1.5	UG_L
IU14EB01071012	Copper	0.72	UG_L
IU14EB01071012	Lead	0.13	UG_L
IU14EB01071012	MAGNESIUM	10.3	UG_L
IU14EB01071012	Manganese	0.43	UG_L
IU14EB01071012	Nickel	0.23	UG_L
IU14EB01071012	Sodium	46.1	UG_L
IU14EB01071012	Vanadium	1.7	UG_L
IU14EB01071012	Aluminum, diss	10.2	UG_L
IU14EB01071012	Chromium, diss	1.5	UG_L
IU14EB01071012	Copper, diss	0.89	UG_L
IU14EB01071012	Lead, diss	0.27	UG_L
IU14EB01071012	MAGNESIUM, diss	10.2	UG_L
IU14EB01071012	Manganese, diss	0.49	UG_L
IU14EB01071012	Mercury, diss	0.02	UG_L
IU14EB01071012	Selenium, diss	0.28	UG_L
IU14EB01071012	Sodium, diss	59.2	UG_L

Blank ID	Compound	Conc.	Units
IU14EB01071012	Vanadium, diss	1.6	UG_L
IU14EB01071112-GW	Aluminum	16.2	UG_L
IU14EB01071112-GW	Antimony	0.15	UG_L
IU14EB01071112-GW	Barium	1.9	UG_L
IU14EB01071112-GW	Cadmium	0.03	UG_L
IU14EB01071112-GW	Calcium	124	UG_L
IU14EB01071112-GW	Chromium	2.4	UG_L
IU14EB01071112-GW	Cobalt	0.05	UG_L
IU14EB01071112-GW	Copper	0.54	UG_L
IU14EB01071112-GW	Lead	0.13	UG_L
IU14EB01071112-GW	MAGNESIUM	29.3	UG_L
IU14EB01071112-GW	Manganese	1.2	UG_L
IU14EB01071112-GW	Sodium	298	UG_L
IU14EB01071112-GW	Vanadium	1.3	UG_L
IU14EB01071112-GW	Aluminum, diss	19.9	UG_L
IU14EB01071112-GW	Antimony, diss	0.13	UG_L
IU14EB01071112-GW	Chromium, diss	2.4	UG_L
IU14EB01071112-GW	Copper, diss	0.70	UG_L
IU14EB01071112-GW	Lead, diss	0.06	UG_L
IU14EB01071112-GW	MAGNESIUM, diss	8.6	UG_L
IU14EB01071112-GW	Mercury, diss	0.03	UG_L
IU14EB01071112-GW	Selenium, diss	0.68	UG_L
IU14EB01071112-GW	Sodium, diss	316	UG_L
IU14EB01071112-GW	Vanadium, diss	0.96	UG_L
IU14EB01071112-SS	Chromium	2.2	UG_L
PBWFH02IMW1	Aluminum	4.606	UG_L
PBWFH02IMW2	Aluminum	7.375	UG_L
PBWFH02IMW2	Antimony	0.073	UG_L
PBWFH02IMW1	Antimony	0.154	UG_L
PBSFG16IMS1	Chromium	0.231	MG_KG
PBWFG25IMW1	Chromium	1.181	UG_L
PBWFH02IMW2	Chromium	0.779	UG_L
PBWFG25IMW2	Chromium	2.429	UG_L
PBWFH02IMW1	Chromium	0.331	UG_L
PBWFH02IMW2	Copper	0.571	UG_L
PBWFH02IMW1	Copper	0.479	UG_L
PBWFH02IMW1	Lead	0.080	UG_L
PBWFH02IMW2	Lead	0.139	UG_L
PBWFH02IMW2	MAGNESIUM	9.275	UG_L
PBWFG25IMW2	Manganese	0.617	UG_L

Blank ID	Compound	Conc.	Units
PBWFH02IMW1	Manganese	0.402	UG_L
PBWFH02IMW2	Manganese	2.068	UG_L
PBWFG19HGW2	Mercury	-0.020	UG_L
PBWFH02HGW2	Mercury	0.015	UG_L
PBWFH02IMW2	Nickel	0.180	UG_L
PBWFH02IMW1	Nickel	0.161	UG_L
PBWFH02IMW2	Selenium	-1.081	UG_L
PBWFH02IMW2	Sodium	20.755	UG_L
PBWFH02IMW1	Sodium	28.210	UG_L
PBWFH02IMW1	Vanadium	0.658	UG_L
PBWFG25IMW2	Vanadium	1.846	UG_L
PBWFH02IMW2	Vanadium	0.647	UG_L
PBWFG25IMW2	Zinc	4.757	UG_L
WG110726-BLANK	CYANIDE	5.2	UG_L
CCB	Chromium	0.145	MG_KG
CCB	Antimony	0.013	UG_L
CCB	Arsenic	0.202	UG_L
CCB	Chromium	0.282	UG_L
CCB	Vanadium	0.3	UG_L
CCB	Copper	0.023	UG_L
CCB	Aluminum	9.921	UG_L
CCB	Calcium	9.705	UG_L
CCB	Iron	7.029	UG_L
CCB	MAGNESIUM	10.4	UG_L
CCB	Potassium	13.24	UG_L
CCB	Sodium	52.97	UG_L

Matrix Spike/Spike Duplicate
Chromium, for spiked sample IU14SS10A0001 exhibited high recoveries in the MS/MSD. Affected data are summarized in **Attachment 1**.

Calibration

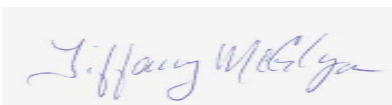
Several compounds for both total and dissolved metals did not meet continuing calibration criteria. Affected data are summarized in **Attachment 1**.

Conclusion

These data can be used in the project decision-making process as qualified by the data quality evaluation process.

Please do not hesitate to contact us about this validation report.

Sincerely,



Tiffany McGlynn

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCBL	Continuing Calibration Blank Contamination
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
IR15	Ion ratio exceeds +/- 15% difference
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data

MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Indian Head SWMU 14
Attachment 1 Change Qual. Table
SDG JU40-1

Sample ID	Compound	Q Flag	Qual Code
IU14GW030712	Aluminum	B	CCBL
IU14GW030712	Antimony	B	MBL
IU14GW030712	Chromium	B	MBL
IU14GW030712	Lead	B	MBL
IU14GW030712	Zinc	B	MBL
IU14GW030712	Aluminum, diss	B	EBL
IU14GW030712	Chromium, diss	B	MBL
IU14GW030712	Copper, diss	B	EBL
IU14GW030712	Lead, diss	B	EBL
IU14GW030712	Mercury, diss	B	EBL
IU14GW030712	Vanadium, diss	B	MBL
IU14GW030712	Zinc, diss	B	MBL
IU14GW050712	Aluminum	B	EBL
IU14GW050712	Antimony	B	EBL
IU14GW050712	Chromium	B	MBL
IU14GW050712	Copper	B	EBL
IU14GW050712	Lead	B	EBL
IU14GW050712	Vanadium	B	MBL
IU14GW050712	Zinc	B	MBL
IU14GW050712	Aluminum, diss	B	EBL
IU14GW050712	Chromium, diss	B	MBL
IU14GW050712	Copper, diss	B	EBL
IU14GW050712	Lead, diss	B	EBL
IU14GW050712	Vanadium, diss	B	MBL
IU14GW050712	Zinc, diss	B	MBL
IU14GW060712	Aluminum	B	EBL
IU14GW060712	Antimony	B	EBL
IU14GW060712	Chromium	B	MBL
IU14GW060712	Copper	B	EBL
IU14GW060712	Lead	B	EBL
IU14GW060712	Selenium	B	MBL
IU14GW060712	Vanadium	B	MBL
IU14GW060712	Zinc	B	MBL
IU14GW060712	Aluminum, diss	J	CCL
IU14GW060712	Chromium, diss	J	CCL
IU14GW060712	Copper, diss	B	EBL
IU14GW060712	Lead, diss	B	EBL
IU14GW060712	MAGNESIUM, diss	J	CCL
IU14GW060712	Mercury, diss	B	EBL
IU14GW060712	Selenium, diss	B	MBL
IU14GW060712	Sodium, diss	J	CCL
IU14GW060712	Vanadium, diss	J	CCL
IU14GW060712	Zinc, diss	B	MBL

Indian Head SWMU 14 Attachment 1 Change Qual. Table SDG JU40-1			
Sample ID	**Compound**	**Q Flag**	**Qual Code**
IU14EB01071012	Aluminum	B	CCBL
IU14EB01071012	Chromium	B	MBL
IU14EB01071012	MAGNESIUM	B	CCBL
IU14EB01071012	Manganese	B	MBL
IU14EB01071012	Nickel	B	MBL
IU14EB01071012	Sodium	B	CCBL
IU14EB01071012	Vanadium	B	MBL
IU14EB01071012	Aluminum, diss	B	CCBL
IU14EB01071012	Chromium, diss	B	MBL
IU14EB01071012	MAGNESIUM, diss	B	CCBL
IU14EB01071012	Manganese, diss	B	MBL
IU14EB01071012	Selenium, diss	B	MBL
IU14EB01071012	Sodium, diss	B	CCBL
IU14EB01071012	Vanadium, diss	B	MBL
IU14GW070712	Aluminum	B	EBL
IU14GW070712	Antimony	B	EBL
IU14GW070712	Chromium	B	MBL
IU14GW070712	Copper	B	EBL
IU14GW070712	Iron	B	CCBL
IU14GW070712	Lead	B	EBL
IU14GW070712	Selenium	B	MBL
IU14GW070712	Vanadium	B	MBL
IU14GW070712	Zinc	B	MBL
IU14GW070712	Aluminum, diss	B	EBL
IU14GW070712	Chromium, diss	B	MBL
IU14GW070712	Copper, diss	B	EBL
IU14GW070712	Iron, diss	B	CCBL
IU14GW070712	Lead, diss	B	EBL
IU14GW070712	MAGNESIUM, diss	J	CCL
IU14GW070712	Mercury, diss	B	EBL
IU14GW070712	Selenium, diss	B	MBL
IU14GW070712	Vanadium, diss	B	MBL
IU14GW070712	Zinc, diss	B	MBL
IU14GW010712	Aluminum	B	EBL
IU14GW010712	Antimony	B	EBL
IU14GW010712	Chromium	B	MBL
IU14GW010712	Copper	B	EBL
IU14GW010712	Iron	B	CCBL
IU14GW010712	Lead	B	EBL
IU14GW010712	MAGNESIUM	J	CCL
IU14GW010712	Selenium	B	MBL
IU14GW010712	Vanadium	B	MBL
IU14GW010712	Zinc	B	MBL

Indian Head SWMU 14
Attachment 1 Change Qual. Table
SDG JU40-1

Sample ID	Compound	Q Flag	Qual Code
IU14GW010712	Aluminum, diss	B	EBL
IU14GW010712	Chromium, diss	B	MBL
IU14GW010712	Copper, diss	B	EBL
IU14GW010712	Lead, diss	B	EBL
IU14GW010712	MAGNESIUM, diss	J	CCL
IU14GW010712	Mercury, diss	B	EBL
IU14GW010712	Vanadium, diss	B	MBL
IU14GW010712	Zinc, diss	B	MBL
IU14GW01P0712	Aluminum	B	CCBL
IU14GW01P0712	Chromium	B	MBL
IU14GW01P0712	Iron	B	CCBL
IU14GW01P0712	MAGNESIUM	J	CCL
IU14GW01P0712	Selenium	B	MBL
IU14GW01P0712	Vanadium	B	MBL
IU14GW01P0712	Zinc	B	MBL
IU14GW01P0712	Aluminum, diss	B	CCBL
IU14GW01P0712	Chromium, diss	B	MBL
IU14GW01P0712	MAGNESIUM, diss	J	CCL
IU14GW01P0712	Vanadium, diss	B	MBL
IU14GW01P0712	Zinc, diss	B	MBL
IU14EB01071112-G	Aluminum	B	MBL
IU14EB01071112-G	Antimony	B	MBL
IU14EB01071112-G	Copper	B	MBL
IU14EB01071112-G	Lead	B	MBL
IU14EB01071112-G	MAGNESIUM	B	CCBL
IU14EB01071112-G	Aluminum, diss	B	MBL
IU14EB01071112-G	Antimony, diss	B	MBL
IU14EB01071112-G	Copper, diss	B	MBL
IU14EB01071112-G	Lead, diss	B	MBL
IU14EB01071112-G	MAGNESIUM, diss	B	CCBL
IU14EB01071112-G	Mercury, diss	B	MBL
IU14EB01071112-G	Vanadium, diss	B	MBL
IU14GW040712	Aluminum	B	EBL
IU14GW040712	Antimony	B	EBL
IU14GW040712	Chromium	B	EBL
IU14GW040712	Copper	B	EBL
IU14GW040712	Iron	B	CCBL
IU14GW040712	Lead	B	EBL
IU14GW040712	Vanadium	B	EBL
IU14GW040712	Aluminum, diss	B	EBL
IU14GW040712	Antimony, diss	B	MBL
IU14GW040712	Chromium, diss	B	EBL
IU14GW040712	Copper, diss	B	EBL

Indian Head SWMU 14 Attachment 1 Change Qual. Table SDG JU40-1			
Sample ID	**Compound**	**Q Flag**	**Qual Code**
IU14GW040712	Lead, diss	B	MBL
IU14GW040712	Mercury, diss	B	EBL
IU14GW040712	Selenium, diss	B	EBL
IU14GW080712	Aluminum	B	EBL
IU14GW080712	Antimony	B	MBL
IU14GW080712	Chromium	B	EBL
IU14GW080712	Copper	B	EBL
IU14GW080712	Iron	B	CCBL
IU14GW080712	Lead	B	MBL
IU14GW080712	Vanadium	B	EBL
IU14GW080712	Aluminum, diss	B	EBL
IU14GW080712	Antimony, diss	B	MBL
IU14GW080712	Chromium, diss	B	EBL
IU14GW080712	Copper, diss	B	EBL
IU14GW080712	Iron, diss	B	CCBL
IU14GW080712	Lead, diss	B	MBL
IU14GW080712	Mercury, diss	B	EBL
IU14GW080712	Selenium, diss	B	EBL
IU14GW080712	Vanadium, diss	B	EBL
IU14GW110712	Antimony	B	MBL
IU14GW110712	Barium	B	EBL
IU14GW110712	Chromium	B	EBL
IU14GW110712	Copper	B	EBL
IU14GW110712	Lead	B	MBL
IU14GW110712	Vanadium	B	EBL
IU14GW110712	Aluminum, diss	B	EBL
IU14GW110712	Antimony, diss	B	MBL
IU14GW110712	Chromium, diss	B	EBL
IU14GW110712	Lead, diss	B	MBL
IU14GW110712	Mercury, diss	B	EBL
IU14GW110712	Selenium, diss	B	EBL
IU14GW110712	Vanadium, diss	B	EBL
IU14GW090712	Aluminum	B	EBL
IU14GW090712	Antimony	B	MBL
IU14GW090712	Cadmium	B	EBL
IU14GW090712	Chromium	B	EBL
IU14GW090712	Iron	B	CCBL
IU14GW090712	Lead	B	MBL
IU14GW090712	Vanadium	B	EBL
IU14GW090712	Aluminum, diss	B	EBL
IU14GW090712	Antimony, diss	B	MBL
IU14GW090712	Chromium, diss	B	EBL
IU14GW090712	Copper, diss	B	EBL

Indian Head SWMU 14
Attachment 1 Change Qual. Table
SDG JU40-1

Sample ID	Compound	Q Flag	Qual Code
IU14GW090712	Iron, diss	B	CCBL
IU14GW090712	Lead, diss	B	MBL
IU14GW090712	Mercury, diss	B	EBL
IU14GW090712	Vanadium, diss	B	EBL
IU14SS10A0001	Chromium	K	MSH

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14GW030712

Matrix: WATER **SDG Name:** JU40-1

Percent Solids: 0.00 **Lab Sample ID:** SF4233-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL i B-iCCBL	29.4	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL, MBL	0.13	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	68.7			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.22	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	1.3			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	14300			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL, MBL	0.76	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	280			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	9.6			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	53.2	J		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL, MBL	0.20	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	5960			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	136			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	13.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	13400			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	56800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.1	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	9.0	~~J~~		MS	5	10	3.90	8.0

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW030712

SDG Name: JU40-1

Lab Sample ID: SF4233-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	30.1	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.08	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	67.6			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.23	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	1.1			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	14200			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL, MBL	1.0	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	280			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	9.3			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	56.8	J		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL	0.16	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	5940			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	139			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.05	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	13.2			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	12800			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	58200			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.12	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL, MBL	0.97	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	27.7			MS	5	10	3.90	8.0

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW050712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4233-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	109	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL	0.09	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	49.4			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.49	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.12	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	11400			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL, MBL	3.0	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	301			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	8.9			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	248			MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL	0.16	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	4520			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	252			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	9.2			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	16300			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	44300			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.07	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL, MBL	1.9	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	32.5			MS	5	10	3.90	8.0

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW050712

Matrix: WATER | **SDG Name:** JU40-1

Percent Solids: 0.00 | **Lab Sample ID:** SF4233-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	86.6	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.09	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	49.2			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.44	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.17	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	11300			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL, MBL	2.6	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	298			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	9.9			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	222			MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL	0.35	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	4460			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	245			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	9.6			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	16500			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	43800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.06	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL, MBL	2.9	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	11.0			MS	5	10	3.90	8.0

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14GW060712
Matrix: WATER
SDG Name: JU40-1
Percent Solids: 0.00
Lab Sample ID: SF4233-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	45.3	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL	0.11	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	61.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.26	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	3.5			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	9180			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL, MBL	3.4	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	39.6			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	1.3	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	263			MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL	0.27	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	4480			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	133			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	31.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	3780			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL B-MBL	0.86	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	11900			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.10	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL, MBL	5.3			MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	9.3	J		MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW060712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4233-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED J-CCL	38.4	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.1	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	62.2			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.30	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	1.1			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	9280			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED J-CCL	3.2	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	40.8			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	2.4	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	236			MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL	0.37	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED J-CCL	4600			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	138			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	31.2			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	3880			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-EBL, MBL	0.37	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED J-CCL	11800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.11	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED J-CCL	5.1			MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	11.3			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14EB01071012

Matrix: WATER **SDG Name:** JU40-1

Percent Solids: 0.00 **Lab Sample ID:** SF4233-007

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-CCBL	25.3	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	0.07	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	80	U		MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-MBL	1.5	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	0.30	U		MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	0.72	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	0.13	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL B-CCBL	10.3	J		MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL B-MBL	0.43	J		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL B-MBL	0.23	J		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL B-CCBL	46.1	J		MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-MBL	1.7	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	8.0	U		MS	5	10	3.90	8.0

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14EB01071012

Matrix: WATER | **SDG Name:** JU40-1

Percent Solids: 0.00 | **Lab Sample ID:** SF4233-008

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-CCBL	10.2	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	80	U		MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-MBL	1.5	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	0.30	U		MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	0.89	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	0.27	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED B-CCBL	10.2	J		MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED B-MBL	0.49	J		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.02	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	1.2	U		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-MBL	0.28	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED B-CCBL	59.2	J		MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-MBL	1.6	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	8.0	U		MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW070712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4233-009

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL B-EBL	97.3	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL	0.06	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	81.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	1.1			MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.39	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	8800			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL, MBL	4.9	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	554			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	2.2	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	17.6	J		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL	0.28	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	4500			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	213			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	42.1			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	4010			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL B-MBL	0.58	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	27600			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL, MBL	3.5	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	75.3			MS	5	10	3.90	8.0

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW070712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4233-010

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	97.2	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.12	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	2.4	J		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	78.2			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.98	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.39	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	8460			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL, MBL	3.9	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	529			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	2.5	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED B-CCBL	16.5	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL	0.22	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED J-CCL	4560			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	207			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.02	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	38.4			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	4030			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-EBL, MBL	1.0	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	28200			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL, MBL	0.70	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	75.9			MS	5	10	3.90	8.0

Comments:

FORM I - IN

TM 8/23/12

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14GW010712
Matrix: WATER
SDG Name: JU40-1
Percent Solids: 0.00
Lab Sample ID: SF4233-011

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	22.8	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL	0.11	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	3.0	J		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	43.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.32	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.19	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	5920			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL; MBL	6.9			MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	554			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	1.3	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	26.4	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL	0.17	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL J-CCL	2430			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	42.9			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	5.6			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	2890			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL B-MBL	0.72	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	27300			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL, MBL	0.64	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	15.5			MS	5	10	3.90	8.0

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW010712

SDG Name: JU40-1

Lab Sample ID: SF4233-012

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	18.6	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.50	U		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	51.8			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.31	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.14	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	6240			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL, MBL	4.0	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	534			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	1.3	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL	0.08	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED J-CCL	2360			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	34.1			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.02	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	4.9			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	2670			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	25800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL, MBL	1.0	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	15.3			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW01P0712

Matrix: WATER | **SDG Name:** JU40-1

Percent Solids: 0.00 | **Lab Sample ID:** SF4233-013

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-CCBL	18.9	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL	0.07	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	43.0			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.32	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.15	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	5760			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-MBL	4.2	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	550			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL	1.4	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	13.2	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL	0.12	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL J-CCL	2380			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	34.0			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	4.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	2800			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL B-MBL	0.23	~~J~~		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	26800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-MBL	1.9	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL B-MBL	14.0			MS	5	10	3.90	8.0

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14GW01P0712
Matrix: WATER
SDG Name: JU40-1
Percent Solids: 0.00
Lab Sample ID: SF4233-014

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-CCBL	19.5	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED	0.10	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	52.4			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.33	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.18	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	6330			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-MBL	4.1	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	535			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED	1.5	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED	0.08	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED J-CCL	2350			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	35.4			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED	0.02	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	4.9			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	2780			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	26800			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-MBL	1.2	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED B-MBL	17.7			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14EB01071112-GW
Matrix: WATER
SDG Name: JU40-1
Percent Solids: 0.00
Lab Sample ID: SF4272-001

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-mBL	16.2	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-MBL	0.15	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	1.9	J		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	0.03	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	124			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL	2.4	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	0.05	J		MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-mBL	0.54	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-mBL	0.13	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL B-CCBL	29.3	~~J~~		MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	1.2	J		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	1.2	U		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	298	J		MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL	1.3	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	8.0	U		MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14EB01071112-GW

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4272-002

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-MBL	19.9	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED B-MBL	0.13	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	1.0	U		MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.20	U		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	80	U		MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED	2.4	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	0.30	U		MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-MBL	0.70	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-MBL	0.06	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED B-CCBL	8.6	J		MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	1.0	U		MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-MBL	0.03	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	1.2	U		MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	400	U		MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	0.68	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	316	J		MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-MBL	0.96	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	8.0	U		MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW040712

SDG Name: JU40-1

Lab Sample ID: SF4272-003

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	120	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL	0.11	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	197			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	1.0			MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL	1.6			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	16000			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL	3.0	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	12.7			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	1.8	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	13.5	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL	0.37	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	9640			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	264			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.10	U		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	47.7			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	3130			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	0.61	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	75000			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL	0.94	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	64.5			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW040712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4272-004

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	105	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED B-EBL, MBL	0.08	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	194			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	1.0			MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	1.3			MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	15800			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL	2.3	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	11.3			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	3.2			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	60	U		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL, MBL	0.28	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	9600			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	250			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.06	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	47.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	3210			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-EBL	0.90	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	79000			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED	4.0	U		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	59.2			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14GW080712

Matrix: WATER

SDG Name: JU40-1

Percent Solids: 0.00

Lab Sample ID: SF4272-005

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	65.6	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL, MBL	0.09	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL	85.4			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.50	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL ~~B-EBL~~	0.34	~~J~~ J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	6400			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL	2.7	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	47.4			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	1.1	~~J~~		MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	30.1	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL, MBL	0.24	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	3260			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	504			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.19	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	8.4			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	2530			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	33300			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL	3.2	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	14.8			MS	5	10	3.90	8.0

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW080712

SDG Name: JU40-1

Lab Sample ID: SF4272-006

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	41.6	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED B-EBL, MBL	0.10	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	79.1			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.42	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.30	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	6000			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL	2.8	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	42.4			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	2.2	J		MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED B-CCBL	17.6	J		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL, MBL	0.19	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	2930			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	465			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.12	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	7.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	2490			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-EBL	0.25	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	31300			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL	4.0	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	15.9			MS	5	10	3.90	8.0

Comments:

FORM I - IN

TM 8/23/12

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW110712

Matrix: WATER | **SDG Name:** JU40-1

Percent Solids: 0.00 | **Lab Sample ID:** SF4272-007

Concentration Units : ug/L

								ADJUSTED	
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7429-90-5	ALUMINUM, TOTAL	876			MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL, MBL	0.24	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	3.0	J		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL B-EBL	24.9			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.06	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL ~~B-EBL~~	0.24	~~J~~ J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL	4870			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL	4.6	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	6.3			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL B-EBL	4.1			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL	1150			MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL, MBL	0.95	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	2800			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL	247			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.01	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	5.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	2390			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	0.58	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	89400			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.09	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL	5.5			MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	5.5	J		MS	5	10	3.90	8.0

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14GW110712

Matrix: WATER | **SDG Name:** JU40-1

Percent Solids: 0.00 | **Lab Sample ID:** SF4272-008

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	61.5	J		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED B-EBL, MBL	0.24	J		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	23.4			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.20	U		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.13	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	5100			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL	3.1	J		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	4.2			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED ~~B-EBL~~	6.1			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED	180			MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL, MBL	0.24	J		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	2930			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	218			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.06	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	4.8			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	2300			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED B-EBL	0.57	J		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	92500			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.07	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL	3.7	J		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	4.5	J		MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW090712

SDG Name: JU40-1

Lab Sample ID: SF4272-009

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, TOTAL B-EBL	43.3	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, TOTAL B-EBL, MBL	0.10	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, TOTAL	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, TOTAL ~~B-EBL~~	26.7			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, TOTAL	0.39	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, TOTAL B-EBL	0.12	~~J~~		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, TOTAL ~~B-EBL~~	1030			MS	5	100	20.45	80
7440-47-3	CHROMIUM, TOTAL B-EBL	2.9	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, TOTAL	66.8			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, TOTAL ~~B-EBL~~	5.7			MS	5	3.0	0.20	2.0
7439-89-6	IRON, TOTAL B-CCBL	27.8	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, TOTAL B-EBL, MBL	0.07	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, TOTAL	1570			MS	5	100	7.80	80
7439-96-5	MANGANESE, TOTAL ~~B-EBL~~	12.9			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, TOTAL	0.02	J		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, TOTAL	32.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, TOTAL	1640			MS	5	1000	30.70	400
7782-49-2	SELENIUM, TOTAL	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, TOTAL	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, TOTAL	10200			MS	5	1000	18.50	400
7440-28-0	THALLIUM, TOTAL	0.26	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, TOTAL B-EBL	2.9	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, TOTAL	73.6			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14GW090712

SDG Name: JU40-1

Lab Sample ID: SF4272-010

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7429-90-5	ALUMINUM, DISSOLVED B-EBL	38.0	~~J~~		MS	5	300	4.40	40
7440-36-0	ANTIMONY, DISSOLVED B-EBL, MBL	0.11	~~J~~		MS	5	1.0	0.05	0.50
7440-38-2	ARSENIC, DISSOLVED	4.0	U		MS	5	5.0	2.25	4.0
7440-39-3	BARIUM, DISSOLVED	27.1			MS	5	2.0	0.25	1.0
7440-41-7	BERYLLIUM, DISSOLVED	0.40	J		MS	5	1.0	0.04	0.20
7440-43-9	CADMIUM, DISSOLVED	0.10	J		MS	5	1.0	0.03	0.20
7440-70-2	CALCIUM, DISSOLVED	1090			MS	5	100	20.45	80
7440-47-3	CHROMIUM, DISSOLVED B-EBL	2.9	~~J~~		MS	5	5.0	0.20	4.0
7440-48-4	COBALT, DISSOLVED	70.1			MS	5	1.0	0.05	0.30
7440-50-8	COPPER, DISSOLVED B-EBL	3.2			MS	5	3.0	0.20	2.0
7439-89-6	IRON, DISSOLVED B-CCBL	27.7	~~J~~		MS	5	100	12.75	60
7439-92-1	LEAD, DISSOLVED B-EBL, MBL	0.07	~~J~~		MS	5	1.0	0.05	0.50
7439-95-4	MAGNESIUM, DISSOLVED	1670			MS	5	100	7.80	80
7439-96-5	MANGANESE, DISSOLVED	13.6			MS	5	2.0	0.35	1.0
7439-97-6	MERCURY, DISSOLVED B-EBL	0.05	~~J~~		CV	1	0.20	0.01	0.10
7440-02-0	NICKEL, DISSOLVED	34.0			MS	5	2.0	0.15	1.2
7440-09-7	POTASSIUM, DISSOLVED	1710			MS	5	1000	30.70	400
7782-49-2	SELENIUM, DISSOLVED	3.0	U		MS	5	5.0	0.20	3.0
7440-22-4	SILVER, DISSOLVED	0.40	U		MS	5	1.0	0.05	0.40
7440-23-5	SODIUM, DISSOLVED	10700			MS	5	1000	18.50	400
7440-28-0	THALLIUM, DISSOLVED	0.26	J		MS	5	1.0	0.05	0.40
7440-62-2	VANADIUM, DISSOLVED B-EBL	3.2	~~J~~		MS	5	5.0	0.50	4.0
7440-66-6	ZINC, DISSOLVED	72.0			MS	5	10	3.90	8.0

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14SS09A0001
Matrix: SOIL
SDG Name: JU40-1
Percent Solids: 71.0
Lab Sample ID: SF4272-011

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	19.8		~~N~~	MS	5	0.47	0.05	0.37

Comments:

TM 8/23/12

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: SOIL

Percent Solids: 81.4

Client Field ID: IU14SS09AP0001

SDG Name: JU40-1

Lab Sample ID: SF4272-012

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	24.4		~~N~~	MS	5	0.53	0.05	0.42

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14SS10A0001

Matrix: SOIL

SDG Name: JU40-1

Percent Solids: 95.0

Lab Sample ID: SF4272-013

Concentration Units : mg/Kgdrywt

CAS No.	Analyte		Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7440-47-3	CHROMIUM, TOTAL	K- MSH	20.4		~~N~~	MS	5	0.51	0.05	0.41

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services | **Client Field ID:** IU14SS130001

Matrix: SOIL | **SDG Name:** JU40-1

Percent Solids: 86.0 | **Lab Sample ID:** SF4272-014

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	19.5		~~N~~	MS	5	0.48	0.05	0.39

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS180001

Matrix: SOIL **SDG Name:** JU40-1

Percent Solids: 90.4 **Lab Sample ID:** SF4272-015

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	LOQ	ADJUSTED MDL	LOD
7440-47-3	CHROMIUM, TOTAL	18.8		~~N~~	MS	5	0.54	0.05	0.43

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14SS140001

Matrix: SOIL

SDG Name: JU40-1

Percent Solids: 97.6

Lab Sample ID: SF4272-016

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	86.0		~~N~~	MS	5	0.43	0.04	0.34

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: SOIL

Percent Solids: 92.4

Client Field ID: IU14SS150001

SDG Name: JU40-1

Lab Sample ID: SF4272-017

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	14.4		~~N~~	MS	5	0.52	0.05	0.41

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: SOIL

Percent Solids: 93.2

Client Field ID: IU14SS160001

SDG Name: JU40-1

Lab Sample ID: SF4272-018

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7440-47-3	CHROMIUM, TOTAL	34.8		~~N~~	MS	5	0.46	0.05	0.37

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Client Field ID: IU14SS170001

Matrix: SOIL

SDG Name: JU40-1

Percent Solids: 93.7

Lab Sample ID: SF4272-019

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	LOD
7440-47-3	CHROMIUM, TOTAL	18.4		~~N~~	MS	5	0.52	0.05	0.42

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: SOIL

Percent Solids: 95.2

Client Field ID: IU14SS190001

SDG Name: JU40-1

Lab Sample ID: SF4272-020

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	19.6		~~N~~	MS	5	0.45	0.05	0.36

Comments:

FORM I - IN

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14SS200001
Matrix: SOIL
SDG Name: JU40-1
Percent Solids: 93.6
Lab Sample ID: SF4272-021

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	18.4		~~N~~	MS	5	0.37	0.04	0.30

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** IU14SS20P0001

Matrix: SOIL **SDG Name:** JU40-1

Percent Solids: 93.9 **Lab Sample ID:** SF4272-022

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	18.9		~~N~~	MS	5	0.45	0.05	0.36

Comments:

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INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services
Client Field ID: IU14SS210001
Matrix: SOIL
SDG Name: JU40-1
Percent Solids: 87.9
Lab Sample ID: SF4272-023

Concentration Units : mg/Kgdrywt

							ADJUSTED		
CAS No.	**Analyte**	**Concentration**	**C**	**Q**	**M**	**DF**	**LOQ**	**MDL**	**LOD**
7440-47-3	CHROMIUM, TOTAL	20.1		~~N~~	MS	5	0.52	0.05	0.42

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services

Matrix: WATER

Percent Solids: 0.00

Client Field ID: IU14EB01071112-SS

SDG Name: JU40-1

Lab Sample ID: SF4272-024

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	ADJUSTED LOQ	ADJUSTED MDL	ADJUSTED LOD
7440-47-3	CHROMIUM, TOTAL	2.2	J		MS	5	5.0	0.20	4.0

Comments:

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Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-1
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW030712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.070 mg/L	0.10	0.026	0.050	STDM 3500D	WG110496	11-JUL-12 09:52:00	N/A	N/A	
Hardness	57. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:22:00	N/A	N/A	
Sulfate-Turbidimetric	63. mg/L	3.0	0.87	1.5	EPA 375.4	WG110889	18-JUL-12 15:50:24	N/A	N/A	
Sulfide-Iodometric	1.7 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 11:30:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110726	16-JUL-12 16:33:36	SW846 M9012	13-JUL-12	
Total Organic Carbon	1.2 mg/L	1.0	0.10	0.50	SM5310B	WG110584	12-JUL-12 22:30:18	N/A	N/A	
pH(Laboratory)	5.6 pH	0.10	0.10	N/A	SW846 9040B	WG110528	11-JUL-12 11:35:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-3
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW050712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.080 mg/L	0.10	0.026	0.050	STDM 3500D	WG110496	11-JUL-12 09:52:00	N/A	N/A	
Hardness	43. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:25:00	N/A	N/A	
Sulfate-Turbidimetric	98. mg/L	5.0	1.4	2.5	EPA 375.4	WG110889	18-JUL-12 15:50:24	N/A	N/A	
Sulfide-Iodometric	1.1 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 10:50:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110726	16-JUL-12 16:33:36	SW846 M9012	13-JUL-12	
Total Organic Carbon	2.0 mg/L	1.0	0.10	0.50	SM5310B	WG110584	12-JUL-12 23:13:06	N/A	N/A	
pH(Laboratory)	5.4 pH	0.10	0.10	N/A	SW846 9040B	WG110528	11-JUL-12 11:38:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
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15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-5
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW060712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	0.29 mg/L	0.10	0.026	0.050	STDM 3500D	WG110496	11-JUL-12 09:52:00	N/A	N/A	
Hardness	39. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:26:00	N/A	N/A	
Sulfate-Turbidimetric	49. mg/L	2.0	0.58	1.0	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	J0.95 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 10:45:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110726	16-JUL-12 16:33:36	SW846 M9012	13-JUL-12	
Total Organic Carbon	J0.64 mg/L	1.0	0.10	0.50	SM5310B	WG110584	12-JUL-12 23:24:59	N/A	N/A	
pH(Laboratory)	4.7 pH	0.10	0.10	N/A	SW846 9040B	WG110528	11-JUL-12 11:40:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-7
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14EB01071012	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110726	16-JUL-12 16:33:36	SW846 M9012	13-JUL-12	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-9
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW070712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.080 mg/L	0.10	0.026	0.050	STDM 3500D	WG110496	11-JUL-12 09:52:00	N/A	N/A	
Hardness	37. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:27:00	N/A	N/A	
Sulfate-Turbidimetric	26. mg/L	1.0	0.29	0.50	EPA 375.4	WG110889	18-JUL-12 16:19:12	N/A	N/A	
Sulfide-Iodometric	J0.80 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 10:55:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110726	16-JUL-12 16:33:36	SW846 M9012	13-JUL-12	
Total Organic Carbon	1.3 mg/L	1.0	0.10	0.50	SM5310B	WG110584	12-JUL-12 23:36:57	N/A	N/A	
pH(Laboratory)	4.7 pH	0.10	0.10	N/A	SW846 9040B	WG110528	11-JUL-12 11:42:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-11
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW010712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.080 mg/L	0.10	0.026	0.050	STDM 3500D	WG110496	11-JUL-12 09:52:00	N/A	N/A	
Hardness	18. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:28:00	N/A	N/A	
Sulfate-Turbidimetric	33. mg/L	2.0	0.58	1.0	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	1.2 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 11:45:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	
Total Organic Carbon	1.5 mg/L	1.0	0.10	0.50	SM5310B	WG110584	12-JUL-12 23:49:09	N/A	N/A	
pH(Laboratory)	4.8 pH	0.10	0.10	N/A	SW846 9040B	WG110528	11-JUL-12 11:44:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4233-13
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW01P0712	AQ	10-JUL-12	11-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	

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ANALYTICAL SERVICES

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4272-1
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14EB01071112-GW	AQ	11-JUL-12	12-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	

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P.O. Box 540, Scarborough, ME 04070
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Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4272-3
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW040712	AQ	11-JUL-12	12-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.070 mg/L	0.10	0.026	0.050	STDM 3500D	WG110708	12-JUL-12 08:59:00	N/A	N/A	
Hardness	80. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:29:00	N/A	N/A	
Sulfate-Turbidimetric	4.8 mg/L	1.0	0.29	0.50	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	J0.80 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 11:55:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	
Total Organic Carbon	J0.76 mg/L	1.0	0.10	0.50	SM5310B	WG110584	13-JUL-12 00:01:08	N/A	N/A	
pH(Laboratory)	5.3 pH	0.10	0.10	N/A	SW846 9040B	WG110529	12-JUL-12 10:42:00	N/A	N/A	

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Report of Analytical Results

Client:	Hillary Ott CH2M Hill 15010 Conference Center Drive Chantilly,VA 20151	**Lab Sample ID:**	SF4272-5
		Report Date:	08-AUG-12
		Client PO:	949493 417366.SA.SM
		Project:	CTO-JU40 Indian Head
		SDG:	JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW080712	AQ	11-JUL-12	12-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	J0.090 mg/L	0.10	0.026	0.050	STDM 3500D	WG110708	12-JUL-12 08:59:00	N/A	N/A	
Hardness	24. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:30:00	N/A	N/A	
Sulfate-Turbidimetric	12. mg/L	1.0	0.29	0.50	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	1.2 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 12:10:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	
Total Organic Carbon	1.0 mg/L	1.0	0.10	0.50	SM5310B	WG110584	13-JUL-12 00:12:52	N/A	N/A	
pH(Laboratory)	5.1 pH	0.10	0.10	N/A	SW846 9040B	WG110529	12-JUL-12 10:45:00	N/A	N/A	

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Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4272-7
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
JU14GW110712	AQ	11-JUL-12	12-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	0.52 mg/L	0.10	0.026	0.050	STDM 3500D	WG110708	12-JUL-12 08:59:00	N/A	N/A	
Hardness	20. mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:33:00	N/A	N/A	
Sulfate-Turbidimetric	3.7 mg/L	1.0	0.29	0.50	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	1.6 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 12:15:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	
Total Organic Carbon	9.0 mg/L	1.0	0.10	0.50	SM5310B	WG110584	13-JUL-12 00:53:56	N/A	N/A	
pH(Laboratory)	6.2 pH	0.10	0.10	N/A	SW846 9040B	WG110529	12-JUL-12 10:47:00	N/A	N/A	

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Cert No E87604

Report of Analytical Results

Client: Hillary Ott
CH2M Hill
15010 Conference Center Drive
Chantilly,VA 20151

Lab Sample ID: SF4272-9
Report Date: 08-AUG-12
Client PO: 949493 417366.SA.SM
Project: CTO-JU40 Indian Head
SDG: JU40-1

Sample Description	Matrix	Date Sampled	Date Received
IU14GW090712	AQ	11-JUL-12	12-JUL-12

Parameter	Result	Adj LOQ	Adj MDL	Adj LOD	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Footnotes
Ferrous Iron	0.29 mg/L	0.10	0.026	0.050	STDM 3500D	WG110708	12-JUL-12 08:59:00	N/A	N/A	
Hardness	J4.1 mg/L	5.0	1.6	4.0	EPA 130.2	WG111690	06-AUG-12 11:34:00	N/A	N/A	
Sulfate-Turbidimetric	12. mg/L	1.0	0.29	0.50	EPA 375.4	WG110889	18-JUL-12 16:04:48	N/A	N/A	
Sulfide-Iodometric	J0.80 mg/L	1.0	0.69	0.80	SM4500S E	WG110778	17-JUL-12 15:40:00	N/A	N/A	
Total Cyanide	U8.0 ug/L	10.	4.0	8.0	SW846 M9012A	WG110935	23-JUL-12 10:19:12	SW846 M9012	18-JUL-12	
Total Organic Carbon	J0.84 mg/L	1.0	0.10	0.50	SM5310B	WG110584	13-JUL-12 01:06:39	N/A	N/A	
pH(Laboratory)	4.7 pH	0.10	0.10	N/A	SW846 9040B	WG110529	12-JUL-12 10:49:00	N/A	N/A	

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R1204445 Data Validation Report

MEMORANDUM CH2MHILL

Data Validation Summary

Indian Head SWMU 14

TO: Juan Acaron/GNV

Anita Dodson/VBO

FROM: Tiffany McGlynn/GNV

CC: Herb Kelly/GNV

DATE: August 27, 2012

Introduction

The following data validation report discusses the data validation process and findings for Columbia Analytical Services for SDG R1204445.

Samples were analyzed using the following analytical methods:

- SW7199 Hexavalent Chromium

The samples included in this SDG are listed in the table below.

Sample Name	Matrix
IU14SS09A0001	Soil
IU14SS09AP0001	Soil
IU14SS10A0001	Soil
IU14SS130001	Soil
IU14SS140001	Soil
IU14SS150001	Soil
IU14SS160001	Soil
IU14SS170001	Soil
IU14SS180001	Soil
IU14SS190001	Soil
IU14SS200001	Soil
IU14SS20P0001	Soil
IU14SS210001	Soil
IU14EB01071112-SS	Water

Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: Amended Uniform Federal Policy-Sampling and Analysis Plan for Stump Neck SWMU 14 Remedial Investigation Naval Support Facility Indian Head Indian Head, Maryland, Contract Task Order 165 (June 2012) and Region III Modifications for Inorganic Data Review (EPA 1993), as applicable. The samples were evaluated based on the following criteria:

- Data Completeness
- Technical Holding Times
- Mass Calibration/Instrument Tuning
- Initial/Continuing Calibrations
- Blanks
- Internal Standards
- Laboratory Control Samples
- Matrix Spike Recoveries
- Field Duplicates
- Identification/Quantitation
- Reporting Limits

Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

Data Completeness
The SDG was received complete and intact.

Technical Holding Times
According to the chain of custody records, sampling was performed on 7/11/12. Samples were received at the laboratory on 7/12/12. All sample preparation analysis was performed within holding time requirements.

Conclusion

These data can be used in the project decision-making process as qualified by the data quality evaluation process.

Please do not hesitate to contact us about this validation report.

Sincerely,

Tiffany McGlynn

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCBL	Continuing Calibration Blank Contamination
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
IR15	Ion ratio exceeds +/- 15% difference
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data

MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1550
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS09A0001		
Lab Code:	R1204445-001	**Basis:**	Dry
		Percent Solids:	87.4

General Chemistry Parameters

Analyte Name	Method	Result Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199 EXCLUDE - RE	0.73	mg/Kg	0.45	0.23	0.13	1	7/24/12	7/27/12 15:16	
Chromium, Hexavalent	7199	0.77	mg/Kg	0.45	0.23	0.13	1	7/24/12	7/27/12 15:23	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1555
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS09AP0001	**Basis:**	Dry
Lab Code:	R1204445-002	**Percent Solids:**	87.3

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199 ExcluDE-RE	0.16	~~J~~	mg/Kg	0.44	0.22	0.12	1	7/24/12	7/27/12 15:30	
Chromium, Hexavalent	7199	0.23	J	mg/Kg	0.44	0.22	0.12	1	7/24/12	7/27/12 15:36	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1600
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS10A0001		
Lab Code:	R1204445-003	**Basis:**	Dry
		Percent Solids:	94.3

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	0.76		mg/Kg	0.42	0.21	0.12	1	7/24/12	7/27/12 15:43	
Chromium, Hexavalent	7199	EXCLUDE-RE 0.71		mg/Kg	0.42	0.21	0.12	1	7/24/12	7/27/12 15:50	

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Form 1A

SuperSet Reference: 12-0000218469 rev 00

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1605
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS130001		
Lab Code:	R1204445-006	**Basis:**	Dry
		Percent Solids:	88.5

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.44	0.22	0.12	1	7/30/12	7/30/12 14:26	
Chromium, Hexavalent	7199	Exclude-RE ~~ND~~	~~U~~	mg/Kg	0.44	0.22	0.12	1	7/30/12	7/30/12 14:33	

Analytical Report

Client:	CH2M Hill		**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14		**Date Collected:**	7/11/12 1610
Sample Matrix:	Soil		**Date Received:**	7/12/12
Sample Name:	IU14SS140001			
Lab Code:	R1204445-007		**Basis:**	Dry
			Percent Solids:	86.8

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.44	0.22	0.12	1	7/24/12	7/27/12 17:03	
Chromium, Hexavalent	7199	EXCLUDE-RE ~~ND~~	~~U~~	mg/Kg	0.44	0.22	0.12	1	7/24/12	7/27/12 17:10	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1615
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS150001		
Lab Code:	R1204445-008	**Basis:**	Dry
		Percent Solids:	83.1

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.46	0.23	0.13	1	7/30/12	7/30/12 14:40	
Chromium, Hexavalent	7199 EXCLUDE-RE	~~ND~~	~~U~~	mg/Kg	0.46	0.23	0.13	1	7/30/12	7/30/12 14:46	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1620
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS160001		
Lab Code:	R1204445-009	**Basis:**	Dry
		Percent Solids:	83.8

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.48	0.24	0.13	1	7/30/12	7/30/12 14:53	
Chromium, Hexavalent	7199 Exclude-RE	~~ND~~	~~U~~	mg/Kg	0.48	0.24	0.13	1	7/30/12	7/30/12 15:00	

COLUMBIA ANALYTICAL SERVICES, INC.
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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1625
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS170001	**Basis:**	Dry
Lab Code:	R1204445-010	**Percent Solids:**	93.0

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.43	0.21	0.12	1	7/24/12	7/27/12 18:24	
Chromium, Hexavalent	7199	Exclude-RE ~~ND~~	~~U~~	mg/Kg	0.43	0.21	0.12	1	7/24/12	7/27/12 18:30	

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Form 1A

SuperSet Reference: 12-0000218469 rev 00

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COLUMBIA ANALYTICAL SERVICES, INC.
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Analytical Report

Client:	CH2M Hill		**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14		**Date Collected:**	7/11/12 1630
Sample Matrix:	Soil		**Date Received:**	7/12/12
Sample Name:	IU14SS180001			
Lab Code:	R1204445-011		**Basis:**	Dry
			Percent Solids:	89.8

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.45	0.22	0.12	1	7/24/12	7/27/12 18:10	
Chromium, Hexavalent	7199	EXCLUDE-RE ~~ND~~	~~U~~	mg/Kg	0.45	0.22	0.12	1	7/24/12	7/27/12 18:17	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1635
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS190001		
Lab Code:	R1204445-012	**Basis:**	Dry
		Percent Solids:	94.9

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.42	0.21	0.12	1	7/24/12	7/27/12 17:30	
Chromium, Hexavalent	7199	EXCLUDE-RE ~~ND~~	~~U~~	mg/Kg	0.42	0.21	0.12	1	7/24/12	7/27/12 17:37	

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Analytical Report

Client:	CH2M Hill		**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14		**Date Collected:**	7/11/12 1640
Sample Matrix:	Soil		**Date Received:**	7/12/12
Sample Name:	IU14SS200001			
Lab Code:	R1204445-013		**Basis:**	Dry
			Percent Solids:	70.1

General Chemistry Parameters

Analyte Name	Method		Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199		0.75		mg/Kg	0.55	0.27	0.15	1	7/24/12	7/27/12 17:43	
Chromium, Hexavalent	7199	Exclude-RE	0.71		mg/Kg	0.55	0.27	0.15	1	7/24/12	7/27/12 17:50	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1645
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS20P0001		
Lab Code:	R1204445-014	**Basis:**	Dry
		Percent Solids:	94.1

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	0.34	J	mg/Kg	0.41	0.20	0.11	1	7/24/12	7/27/12 17:57	
Chromium, Hexavalent	7199	EXCLUDE-RE 0.32	~~J~~	mg/Kg	0.41	0.20	0.11	1	7/24/12	7/27/12 18:04	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1650
Sample Matrix:	Soil	**Date Received:**	7/12/12
Sample Name:	IU14SS210001	**Basis:**	Dry
Lab Code:	R1204445-015	**Percent Solids:**	83.5

General Chemistry Parameters

Analyte Name	Method	Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199	ND	U	mg/Kg	0.48	0.24	0.13	1	7/24/12	7/27/12 18:50	
Chromium, Hexavalent	7199	EXCLUDE-RE ~~ND~~	~~U~~	mg/Kg	0.48	0.24	0.13	1	7/24/12	7/27/12 18:57	

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Analytical Report

Client:	CH2M Hill	**Service Request:**	R1204445
Project:	CTO-JU40/Indian Head SWMU 14	**Date Collected:**	7/11/12 1655
Sample Matrix:	Water	**Date Received:**	7/12/12
Sample Name:	IU14EB01071112-SS		
Lab Code:	R1204445-016	**Basis:**	NA

General Chemistry Parameters

Analyte Name	Method		Result	Q	Units	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
Chromium, Hexavalent	7199		ND	U	mg/L	0.010	0.01	0.003	1	NA	7/12/12 13:40	
Chromium, Hexavalent	7199	Exclude - RE	~~ND~~	~~U~~	mg/L	0.010	0.01	0.003	1	NA	7/12/12 13:47	

Appendix E
Geotech Reports

McCALLUM
TESTING LABORATORIES, INC.
Geotechnical Engineering, Materials Testing & Environmental Services

October 21, 2011

CH2M HILL (CO)
P.O. Box 241329
Denver, CO 80224

Attention: **Jennifer Myers**

Subject: **Laboratory Test Results**
Indian Head SWMU 14 RI
Indian Head, Maryland
MTL Project 1113603

Dear **Ms. Myers:**

Attached are the results of Moisture Content Tests (ASTM D 2216), Particle Size Analysis of Soils Tests (ASTM D 422), Atterberg Limits Tests (ASTM D 4318) and a Hydraulic Conductivity of Saturated Porous Materials Test (ASTM D 5084) performed on the shelby tube material sampled from the above referenced project and delivered to this office by a representative of CH2M Hill (CO) on August 22, 2011.

Should you have any questions concerning this report, please do not hesitate to contact this office at your earliest convenience.

Very truly yours,

McCALLUM TESTING LABORATORIES, INC.

Jon W. Ebbert, P.E.
Senior Engineer

1808 HAYWARD AVENUE, CHESAPEAKE, VA. 23320 ◆ P. O. BOX 13337, CHESAPEAKE, VA. 23325-0337
PHONE (757) 420-2520 ◆ FAX (757) 424-2874

CHESAPEAKE, VIRGINIA

LABORATORY TEST RESULTS

INDIAN HEAD SWMU 14 RI
INDIAN HEAD, MARYLAND
MTL PROJECT 11-13603

SAMPLE NUMBER	MW04	MW06
SAMPLE DEPTH (FT.)	28.0 - 30.0	22.0 - 24.0
NATURAL MOISTURE CONTENT, % (ASTM D 2216)		
MOISTURE CONTENT, %	24.5	28.3
SPECIFIC GRAVITY OF SOILS TEST (ASTM D 854)		
SPECIFIC GRAVITY	2.80	2.86
PARTICLE SIZE ANALYSIS OF SOILS TEST (ASTM D 422)		
SIEVE SIZES	PERCENT PASSING	
#4 (4.75 mm)	100	100
#10 (2.00 mm)	98.7	99.9
#40 (0.425 mm)	75.8	95.9
#100 (0.150 mm)	28.1	84.0
#200 (0.075 mm)	17.2	72.7
HYDROMETER TEST (ASTM D 422)		
SILT CONTENT, % (0.075 - 0.005 mm)	16.8	39.5
CLAY CONTENT, % (<0.005 mm)	0.4	33.2
ATTERBERG LIMITS (ASTM D 4318)		
LIQUID LIMIT	43	48
PLASTIC LIMIT	21	17
PLASTICITY INDEX	22	31
SOIL CLASSIFICATION (ASTM D 2487)		
UNIFIED SOIL CLASSIFICATION AASHTO CLASSIFICATION	SC A-2-7	CL A-7-6
HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS TEST (ASTM D 5084)		
COEFFICIENT OF PERMEABILITY, k (cm/sec)	---	3.74×10^{-7}

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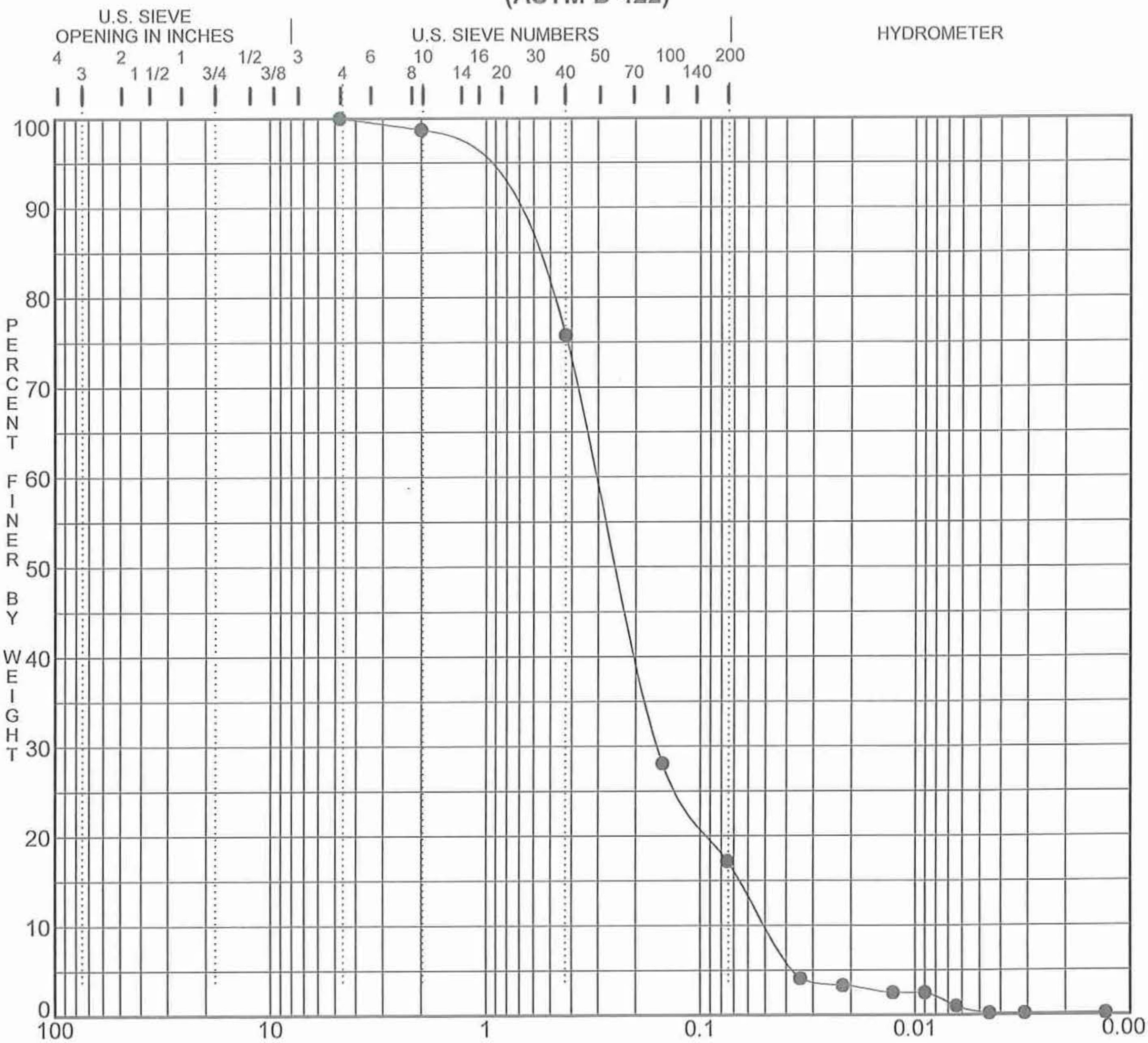
McCallum Testing Laboratories

PARTICLE SIZE ANALYSIS
(ASTM D 422)



GRAVEL		SAND			SILT OR CLAY
coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	MW04	Gray, silty clayey fine to medium sand with traces of coarse sand, SC	24.5	43	21	22	1.66	6.2

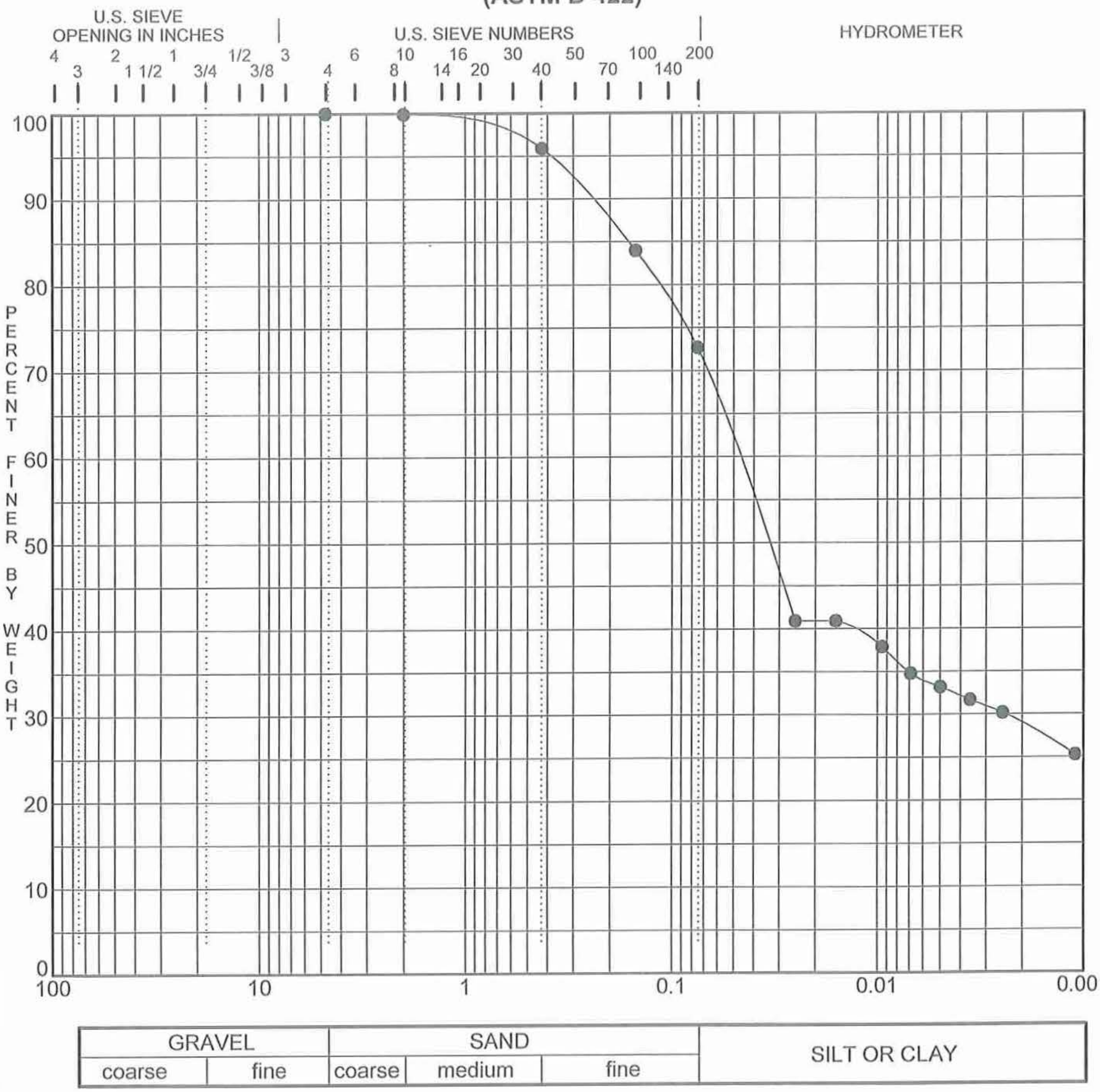
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	MW04	4.75	0.30	0.156	0.0489	0.0	82.8	16.8	0.4

PROJECT Indian Head SWMU 14 RI - Indian Head, Maryland

JOB NO. 11-13603
DATE 10/20/11

McCallum Testing Laboratories

PARTICLE SIZE ANALYSIS
(ASTM D 422)



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● MW06	Gray, silty fine sandy clay with traces of medium sand, CL	28.3	48	17	31		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● MW06	4.75	0.05	0.002		0.0	27.3	39.5	33.2

PROJECT Indian Head SWMU 14 RI - Indian Head, Maryland

JOB NO. 11-13603

DATE 10/20/11

Appendix F
Raw Data

Appendix F
Raw Surface Soil Data
Remedial Investigation Report Stump Neck Annex – SWMU 14

Station ID	IU14MW01			IU14MW03			IU14MW04		IU14MW05		IU14MW06		IU14MW07		IU14MW08		IU14MW09		IU14MW11
Sample ID	IU14GW01-0911	IU14GW010712	IU14GW01P0712	IU14GW03-0911	IU14GW03P-0911	IU14GW030712	IU14GW04-0911	IU14GW040712	IU14GW05-0911	IU14GW050712	IU14GW06-0911	IU14GW060712	IU14GW07-0911	IU14GW070712	IU14GW08-0911	IU14GW080712	IU14GW09-0911	IU14GW090712	IU14GW110712
Sample Date	09/08/11	07/10/12	07/10/12	09/08/11	09/08/11	07/10/12	09/09/11	07/11/12	09/06/11	07/10/12	09/06/11	07/10/12	09/08/11	07/10/12	09/09/11	07/11/12	09/07/11	07/11/12	07/11/12
Chemical Name																			
Total Metals (UG/L)																			
Aluminum	22.2 B	22.8 B	18.9 B	45.8 B	81.5 B	29.4 B	136 J	120 B	75.9 B	109 B	96.6 B	45.3 B	90.4 B	97.3 B	84.5 B	65.6 B	199 B	43.3 B	876
Antimony	0.5 U	0.11 B	0.07 J	0.06 B	0.07 B	0.13 B	0.08 B	0.11 B	0.08 B	0.09 B	0.08 B	0.11 B	0.1 B	0.06 B	0.12 B	0.09 B	0.5 U	0.1 B	0.24 B
Arsenic	4 U	3 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	3 J
Barium	40.2	43.8	43	68	71	68.7	158	197	61.1	49.4	66.8	61	82.3	81.8	110	85.4	30.3	26.7	24.9 B
Beryllium	0.33 J	0.32 J	0.32 J	0.3 J	0.31 J	0.22 J	0.49 J	1	0.33 J	0.49 J	0.18 J	0.26 J	0.55 J	1.1	0.44 J	0.5 J	0.62 J	0.39 J	0.06 J
Cadmium	0.05 J	0.19 J	0.15 J	0.07 J	0.04 J	1.3	0.84 J	1.6	0.18 J	0.12 J	0.06 J	3.5	0.41 J	0.39 J	0.2 J	0.34 J	0.15 J	0.12 B	0.24 J
Calcium	6,210 L	5,920	5,760	11,900	12,100	14,300	14,100	16,000	16,400	11,400	9,230	9,180	8,660	8,800	8,200	6,400	1,400	1,030	4,870
Chromium	3.1 B	6.9 B	4.2 B	1.9 B	1.9 B	0.76 B	2.8 B	3 B	1.4 B	3 B	2.5 B	3.4 B	3.6 B	4.9 B	2.6 B	2.7 B	2.4 B	2.9 B	4.6 B
Cobalt	595 L	554	550	238	234	280	8.6	12.7	221	301	37.4	39.6	433	554	54.1	47.4	90.6	66.8	6.3
Copper	0.89 B	1.3 B	1.4 J	5.8	5.6	9.6	1 J	1.8 B	8	8.9 B	0.72 B	1.3 B	2.1 J	2.2 B	0.61 J	1.1 B	4.3	5.7	4.1 B
Cyanide	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U
Iron	60 U	26.4 B	13.2 B	23.5 B	26.1 B	53.2 J	60 U	13.5 B	252	248	114	263	21.4 B	17.6 B	47.1 J	30.1 B	60 U	27.8 B	1,150
Lead	0.5 U	0.17 B	0.12 J	0.16 B	0.15 B	0.2 B	0.51 J	0.37 B	0.21 B	0.16 B	0.52 J	0.27 B	0.17 B	0.28 B	0.22 B	0.24 B	0.66 J	0.07 B	0.95 B
Magnesium	2,640	2,430 J	2,380 J	5,440	5,400	5,960	8,660	9,640	6,420	4,520	4,540	4,480	4,630	4,500	3,990	3,260	2,020	1,570	2,800
Manganese	37.4	42.9	34	133	129	136	319	264	324	252	149	133	288	213	682	504	20.2	12.9	247
Mercury	0.01 J	0.1 U	0.1 U	0.05 J	0.03 B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 B	0.1 U	0.1 U	0.02 J	0.08 J	0.19 J	0.1 U	0.02 J	0.01 J
Nickel	5.4	5.6	4.8	9.5	8.8	13	34.6	47.7	9.5	9.2	17.8	31.8	37	42.1	10.9	8.4	44.5	32	5.8
Potassium	2,740	2,890	2,800	10,700	10,000	13,400	3,120	3,130	20,300	16,300	3,880	3,780	4,690	4,010	3,630	2,530	1,850	1,640	2,390
Selenium	1.2 B	0.72 B	0.23 B	1.3 B	1.9 B	3 U	1.5 B	0.61 J	0.78 B	3 U	2.4 B	0.86 B	2.2 B	0.58 B	1.3 B	3 U	1 B	3 U	0.58 J
Silver	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Sodium	25,500 L	27,300	26,800	48,500	46,800	56,800	68,700	75,000	45,000	44,300	11,600	11,900	25,200	27,600	37,600	33,300	9,870	10,200	89,400
Thallium	0.4 U	0.4 U	0.4 U	0.06 B	0.06 B	0.1 J	0.4 U	0.4 U	0.08 B	0.07 J	0.06 B	0.1 J	0.4 U	0.4 U	0.4 U	0.4 U	0.35 J	0.26 J	0.09 J
Vanadium	0.64 B	0.64 B	1.9 B	4 U	4 U	4 U	0.54 B	0.94 B	4 U	1.9 B	1.2 B	5.3 B	0.69 B	3.5 B	1.2 B	3.2 B	0.7 J	2.9 B	5.5 B
Zinc	35.7 B	15.5 B	14 B	29.2 B	24.1 B	9 B	64.1 B	64.5	33 B	32.5 B	22 B	9.3 B	96.4 B	75.3 B	23.9 B	14.8	124	73.6	5.5 J
Dissolved Metals (UG/L)																			
Aluminum, Dissolved	21.2 B	18.6 B	19.5 B	51.4 B	54.9 B	30.1 B	113 J	105 B	57.8 B	86.6 B	59.6 B	38.4 J	71.6 B	97.2 B	73.6 B	41.6 B	61.6 B	38 B	61.5 B
Antimony, Dissolved	0.1 B	0.5 U	0.1 J	0.07 B	0.08 B	0.08 J	0.12 B	0.08 B	0.1 B	0.09 J	0.09 B	0.1 J	0.11 B	0.12 J	0.1 B	0.1 B	0.09 B	0.11 B	0.24 B
Arsenic, Dissolved	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	2.4 J	4 U	4 U	4 U	4 U	4 U
Barium, Dissolved	41.3	51.8	52.4	70	70.9	67.6	154	194	57	49.2	70.9	62.2	84.8	78.2	112	79.1	27.8	27.1	23.4
Beryllium, Dissolved	0.34 J	0.31 J	0.33 J	0.26 J	0.27 J	0.23 J	0.49 J	1	0.28 J	0.44 J	0.19 J	0.3 J	0.55 J	0.98 J	0.47 J	0.42 J	0.54 J	0.4 J	0.2 U
Cadmium, Dissolved	0.03 J	0.14 J	0.18 J	0.05 J	0.06 J	1.1	0.74 J	1.3	0.11 J	0.17 J	0.2 U	1.1	0.38 J	0.39 J	0.21 J	0.3 J	0.23 J	0.1 J	0.13 J
Calcium, Dissolved	6,470	6,240	6,330	12,100	12,300	14,200	13,500	15,800	14,800	11,300	9,830	9,280	9,060	8,460	8,580	6,000	1,490	1,090	5,100
Chromium, Dissolved	3.1 B	4 B	4.1 B	2.2 B	2 B	1 B	3.2 B	2.3 B	1.1 B	2.6 B	2.7 B	3.2 J	3.6 B	3.9 B	3.2 B	2.8 B	1.8 B	2.9 B	3.1 B
Cobalt, Dissolved	632	534	535	247	242	280	8.1	11.3	214	298	21.8	40.8	456	529	55	42.4	82.6	70.1	4.2
Copper, Dissolved	0.68 B	1.3 B	1.5 J	6.7	6.3	9.3 B	4.8	3.2 B	8.2	9.9 B	1 B	2.4 B	2.8 J	2.5 B	0.98 J	2.2 B	3.8	3.2 B	6.1
Iron, Dissolved	60 U	60 U	60 U	18.9 B	35.7 B	56.8 J	60 U	60 U	223	222	256	236	17.5 B	16.5 B	40.1 J	17.6 B	60 U	27.7 B	180
Lead, Dissolved	0.11 B	0.08 B	0.08 J	0.13 B	0.1 B	0.16 B	0.61 B	0.28 B	0.15 B	0.35 B	0.35 B	0.37 B	0.15 B	0.22 B	0.22 B	0.19 B	0.59 J	0.07 B	0.24 B
Magnesium, Dissolved	2,790	2,360 J	2,350 J	5,460	5,400	5,940	8,300	9,600	5,970	4,460	5,100	4,600 J	4,910	4,560 J	4,180	2,930	1,930	1,670	2,930
Manganese, Dissolved	38.5	34.1	35.4	131	129	139	303	250	299	245	186	138	301	207	698	465	18.7	13.6	218
Mercury, Dissolved	0.1 U	0.02 B	0.02 J	0.02 B	0.1 U	0.05 B	0.1 U	0.06 B	0.1 U	0.1 U	0.1 U	0.02 B	0.02 B	0.02 B	0.06 B	0.12 B	0.1 U	0.05 B	0.06 B
Nickel, Dissolved	5.4	4.9	4.9	9.9	9.8	13.2	37.8	47	9.5	9.6	31	31.2	37.9	38.4	11	7.8	40.5	34	4.8
Potassium, Dissolved	2,900	2,670	2,780	10,900	11,000	12,800	2,970	3,210	19,200	16,500	4,090	3,880	4,970	4,030	3,670	2,490	1,820	1,710	2,300
Selenium, Dissolved	1.1 B	3 U	3 U	1.7 B	1.5 B	3 U	2.4 B	0.9 B	0.61 B	3 U	2.6 B	0.37 B	2 B	1 B	1.3 B	0.25 B	1.4 B	3 U	0.57 B
Silver, Dissolved	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Sodium, Dissolved	27,100	25,800	26,800	48,400	48,200	58,200	66,800	79,000	42,900	43,800	10,100	11,800 J	26,300	28,200	38,200	31,300	9,930	10,700	92,500
Thallium, Dissolved	0.4 U	0.4 U	0.4 U	0.06 B	0.07 B	0.12 J	0.4 U	0.4 U	0.06 B	0.06 J	0.06 B	0.11 J	0.4 U	0.4 U	0.4 U	0.4 U	0.31 J	0.26 J	0.07 J
Vanadium, Dissolved	0.65 J	1 B	1.2 B	1 J	0.65 J	0.97 B	0.71 B	4 U	4 U	2.9 B	2.7 J	5.1 J	0.51 J	0.7 B	0.99 B	4 B	0.56 J	3.2 B	3.7 B
Zinc, Dissolved	14.4	15.3 B	17.7 B	9.9 J	18.1	27.7 B	51.8	59.2	14.9	11 B	7.2 J	11.3 B	75.5	75.9 B	23	15.9	93.4	72	4.5 J
Wet Chemistry																			
Ferrous iron (mg/l)	0.05 U	0.08 J	NA	0.05 U	NA	0.07 J	0.05 U	0.07 J	0.05 U	0.08 J	0.22	0.29	0.061 J	0.08 J	0.028 J	0.09 J	0.083 J	0.29	0.52
Hardness (mg/l)	26	18	NA	54	NA	57	73	80	61	43	38	39	40	37	38	24	12	4.1 J	20
pH (ph)	5.3	4.8	NA	5.8	NA	5.6	5.1	5.3	5.8	5.4	5.4	4.7	5.4	4.7	4.8	5.1	5.2	4.7	6.2
Sulfate (mg/l)	42	33	NA	54	NA	63	3	4.8	92	98	43	49	22	26	14	12	12	12	3.7
Sulfide (mg/l)	0.75 U	1.2	NA	0.75 U	NA	1.7	0.75 U	0.8 J	0.75 U	1.1	0.75 U	0.95 J	0.75 U	0.8 J	0.75 U	1.2	0.75 U	0.8 J	1.6
Total organic carbon (TOC) (mg/l)	1.9	1.5	NA	1.2	NA	1.2	0.7 J	0.76 J	2	2	0.56 J	0.64 J	1.4	1.3	1.4	1	2.2	0.84 J	9

Notes:
Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

Station ID	IU14SS01		IU14SS02	IU14SS03	IU14SS04	IU14SS05	IU14SS06		IU14SS07	IU14SS08	IU14SS09		
Sample ID	IU14SS01-000H	IU14SS01P-000H	IU14SS02-000H	IU14SS03-000H	IU14SS04-000H	IU14SS05-000H	IU14SS06-000H	IU14SS06P-000H	IU14SS07-000H	IU14SS08-000H	IU14SS09-000H	IU14SS09A0001	IU14SS09AP0001
Sample Date	09/09/11	09/09/11	09/09/11	09/08/11	10/07/11	10/07/11	10/07/11	10/07/11	09/09/11	09/08/11	09/08/11	07/11/12	07/11/12
Chemical Name													
Total Metals (MG/KG)													
Aluminum	11,400	7,540	16,700	5,840	10,000 L	11,300	8,350	8,990	8,080	9,300	4,220	NA	NA
Antimony	0.11	0.12	0.21 L	0.09 J	0.12	0.15	0.14	0.15	0.2	0.36	0.19	NA	NA
Arsenic	2	4	4.4	3.6	3.4	3.6	2.8	3.7	3.4	3.7	4.4	NA	NA
Barium	35.1	32.3	74.4	23.7	33.2	41.8	55.3	61.2	35.4	240	27.8	NA	NA
Beryllium	0.25	0.43	0.46	0.37	0.42	0.46	0.64	0.71	0.49	0.35	0.2	NA	NA
Cadmium	0.16	0.06	0.12	0.04 J	0.03 J	0.05 J	0.11 J	0.13	0.06 J	0.26	0.18	NA	NA
Calcium	3,880	485	2,390	347	247	310	287	382	363	597	927	NA	NA
Chromium (hexavalent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.77	0.23 J
Chromium	19.4	12.9	23.3 K	12.6	16	16.3	13.2	14.6	16	16.4	65.2	19.8	24.4
Cobalt	5	7.1	4.8	4.6	4.7	7	19.9	17.4	11.1	6.8	15.9	NA	NA
Copper	32.3	6.4	12.1	5	21.7	10.2	8.2	8.6	7.8	7.5	6	NA	NA
Cyanide	0.4 U	0.44 U	0.44 U	0.44 U	0.44 U	0.48 U	0.48 U	0.52 U	0.48 U	0.48 U	0.4 U	NA	NA
Iron	11,300	14,800	25,300	13,000	14,800	16,000	11,500	14,100	15,500	15,500	11,500	NA	NA
Lead	14.2	11	18.3 K	7.2	32.1 L	25.4	18.5	21.3	28.3	36.6	27.4	NA	NA
Magnesium	3,140	578	1,120 K	415	800 K	888	676	660	720	696	12,800	NA	NA
Manganese	73.1	172	55.6 K	95.6	229	215	753	747	262	342	182	NA	NA
Mercury	0.02 J	0.02 J	0.02 J	0.02 J	0.06	0.07	0.06	0.07	0.09	0.08	0.05	NA	NA
Nickel	11.7	5.5	7.3	4.9	7.9	8.1	9.1	8.8	8	7.1	277	NA	NA
Potassium	410	546	678 K	434	596 K	651	493	544	394	506	278	NA	NA
Selenium	0.22 B	0.3 B	0.55	0.31 B	0.27 J	0.5	0.47 J	0.63	0.52	0.38 B	0.25 B	NA	NA
Silver	0.32	1.5	0.03 J	1.1	6.3 L	0.43	0.32	0.34	0.12	25	1.2	NA	NA
Sodium	572	15.4 B	69.7 J	17.7 B	17.9 B	24.8 B	20.3 B	22.2 B	24.4 B	32.8 B	37.8 B	NA	NA
Thallium	0.1	0.09	0.19	0.08 J	0.13	0.16	0.14	0.15	0.14	0.11	0.06 J	NA	NA
Vanadium	25.6	20.5	32.4 K	16	29.1	36.8	26.9	36.1	27.3	31	15.2	NA	NA
Zinc	62	23.3	32.7 K	16.8	22.8	24.4	27	27.8	27.5	50.7	60.2	NA	NA
Wet Chemistry													
% Solids (pct)	86	87	82	82	87	79	78	74	74	77	80	NA	NA
pH (ph)	7.2	NA	7.6	5.1	4.1	4	4.4	NA	4.4	5.4	6.1	5.4	NA

Notes:

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

MG/KG - Milligrams per kilogram

PCT - Percent

PH - pH units

Appendix F
Raw Groundwater Data
Remedial Investigation Report Stump Neck Annex – SWMU 14

Station ID	IU14SS10			IU14SS11	IU14SS12	IU14SS13	IU14SS14	IU14SS15	IU14SS16	IU14SS17	IU14SS18	IU14SS19	IU14SS20		IU14SS21
Sample ID	IU14SS10-000H	IU14SS10P-000H	IU14SS10A0001	IU14SS11-000H	IU14SS12-000H	IU14SS130001	IU14SS140001	IU14SS150001	IU14SS160001	IU14SS170001	IU14SS180001	IU14SS190001	IU14SS200001	IU14SS20P0001	IU14SS210001
Sample Date	09/08/11	09/08/11	07/11/12	09/09/11	09/09/11	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12	07/11/12
Chemical Name															
Total Metals (MG/KG)															
Aluminum	8,110	8,680	NA	10,300	6,790	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	0.43	0.48	NA	0.26	0.26 L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	3.5	3.7	NA	3.8	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	60.2	63.6	NA	54.1	35.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.46	0.52	NA	0.52	0.43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.24	0.25	NA	0.15	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	1,370	1,420	NA	1,770	1,320	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (hexavalent)	NA	NA	0.76	NA	NA	0.22 U	0.22 U	0.23 U	0.24 U	0.21 U	0.22 U	0.21 U	0.75	0.34 J	0.24 U
Chromium	23	46.8	20.4 K	16.5	15.4 K	19.5	86	14.4	34.8	18.4	18.8	19.6	18.4	18.9	20.1
Cobalt	10.6	11	NA	6.2	4.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	15.1	20.8	NA	11.9	13.4 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	0.48 U	0.56 U	NA	0.52 U	0.44 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	13,100	14,100	NA	16,000	12,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	105	181	NA	35.2	43.5 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	793	845	NA	1,540	1,340 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	273	343	NA	170	167 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.05	0.08	NA	0.23	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	6.8	7.2	NA	13.4	8.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	381	402	NA	642	592 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.43 B	0.51 J	NA	0.39 B	0.34 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	5.8	4.7	NA	0.19	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	337	348	NA	45.8 B	36.8 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.13	0.14	NA	0.14	0.09 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	25.9	27.7	NA	28.5	21.6 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	134	136	NA	77.2	61 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry															
% Solids (pct)	75	70	NA	73	80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	6.6	NA	6	6.6	6.9	6.4	7	4.2	4.9	4	4	4.2	3.9	NA	4.2

Notes:

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT - Percent
PH - pH units

Appendix G
Human Health Risk
Assessment Calculations

TABLE G1-1

SELECTION OF EXPOSURE PATHWAYS

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF - IH, Indian Head, Maryland

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Soil	Surface Soil	Surface Soil	Industrial Worker	Adult	Dermal	On-site	Quant	Industrial workers may contact site surface soil.
						Ingestion	On-site	Quant	
				Trespasser/Visitor	Adult	Dermal	On-site	Quant	Access to site not restricted. Trespassers/visitors may contact surface soil while on the site.
						Ingestion	On-site	Quant	
					Adolescent	Dermal	On-site	Quant	
						Ingestion	On-site	Quant	
		Air	Emissions from Surface Soil	Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers may inhale dust from site surface soil.
				Trespasser/Visitor	Adult	Inhalation	On-site	Quant	Access to site not restricted. Trespassers/visitors may inhale dust from surface soil while on the site.
					Adolescent	Inhalation	On-site	Quant	
Future	Surface Soil	Surface Soil	Surface Soil	Resident*	Adult	Dermal	On-site	Quant	The site is not expected to be developed for residential use; however, the residential scenario is included for a conservative evaluation of unrestricted land use. It was assumed residents could contact surface soil while on the site.
						Ingestion	On-site	Quant	
					Child	Dermal	On-site	Quant	
						Ingestion	On-site	Quant	
					Child/Adult	Dermal	On-site	Quant	
						Ingestion	On-site	Quant	
				Construction Worker	Adult	Ingestion	On-site	Quant	Construction workers could contact soil while performing construction.
						Dermal	On-site	Quant	
		Air	Emissions from Surface Soil	Resident*	Adult	Inhalation	On-site	Quant	The site is not expected to be developed for residential use; however, the residential scenario is included for a conservative evaluation of unrestricted land use. Future residents could inhale dust from soil at site.
					Child	Inhalation	On-site	Quant	
					Child/Adult	Inhalation	On-site	Quant	
				Construction Worker	Adult	Inhalation	On-site	Quant	Construction workers may inhale dust from soil while performing construction activities.
	Groundwater	Groundwater	Shallow Aquifer - Tap Water	Resident*	Adult	Dermal Absorption	On-site	Quant	Groundwater is not currently used on-site as a water supply and the site is not expected to be developed for residential use; however, the residential scenario is included for a conservative evaluation of unrestricted land use.
						Ingestion	On-site	Quant	
					Child	Dermal Absorption	On-site	Quant	
						Ingestion	On-site	Quant	
					Child/Adult	Dermal Absorption	On-site	Quant	
						Ingestion	On-site	Quant	
				Industrial Worker	Adult	Dermal	On-site	None	Industrial workers assumed not to shower/bath at work.
						Ingestion	On-site	Quant	Groundwater is not currently used on-site as a water supply; however, although unlikely, future industrial potable use of the groundwater is possible.
			Shallow Aquifer - Water in Excavation Trench	Construction Worker	Adult	Dermal	On-site	Quant	Construction workers could be exposed to shallow groundwater during excavation activities.
						Ingestion	On-site	None	Incidental ingestion of groundwater by construction workers would be minimal during construction or excavation activities.

TABLE G1-1

SELECTION OF EXPOSURE PATHWAYS

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF - IH, Indian Head, Maryland

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Shallow Aquifer - Water Vapors at Showerhead	Resident*	Adult	Inhalation	On-site	None	Volatile constituents were not analyzed for in groundwater.
					Child	Inhalation	On-site	None	
					Child/Adult	Inhalation	On-site	None	
				Industrial Worker	Adult	Inhalation	On-site	None	Volatile constituents were not analyzed for in groundwater.
			Shallow Aquifer - Water Vapors in Excavation Trench	Construction Worker	Adult	Inhalation	On-site	None	Volatile constituents were not analyzed for in groundwater.

* Noncarcinogenic hazard evaluated separately for adult and child residential receptors, combined lifetime carcinogenic risk evaluated on an age-adjusted basis for residential scenario.

Table G2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Surface Soil	**7429-90-5**	**Aluminum**	**4.2E+03**	**1.7E+04**	**MG/KG**	**IU14SS02-000H**	**12/12**	**18 - 37**	**1.7E+04**	**2.0E+04**	**7.7E+03 N**	**2.3E+04**	**SSL**	**YES**	**ASL**
	7440-36-0	Antimony	9.0E-02 J	4.8E-01	MG/KG	IU14SS10P-000H	12/12	0.058 - 0.12	4.8E-01	N/A	3.1E+00 N	2.7E-01	SSL	NO	BSL
	7440-38-2	**Arsenic**	**3.0E+00**	**4.4E+00**	**MG/KG**	**IU14SS02-000H : IU14SS09-000H**	**12/12**	**0.29 - 0.62**	**4.4E+00**	**1.5E+01**	**3.9E-01 C**	**1.3E-03**	**SSL**	**YES**	**ASL**
	7440-39-3	Barium	2.4E+01	2.4E+02	MG/KG	IU14SS08-000H	12/12	0.12 - 0.25	2.4E+02	8.0E+01	1.5E+03 N	1.2E+02	SSL	NO	BSL
	7440-41-7	Beryllium	2.0E-01	7.1E-01	MG/KG	IU14SS06P-000H	12/12	0.058 - 0.12	7.1E-01	1.1E+00	1.6E+01 N	1.3E+01	SSL	NO	BSL
	7440-43-9	Cadmium	3.0E-02 J	2.6E-01	MG/KG	IU14SS08-000H	12/12	0.058 - 0.12	2.6E-01	2.5E+00	7.0E+00 N	N/A		NO	BSL
	7440-70-2	Calcium	2.5E+02	3.9E+03	MG/KG	IU14SS01-000H	12/12	5.8 - 12	3.9E+03	2.1E+03	N/A	N/A		NO	NUT
	18540-29-9	**Chromium (VI)**	**7.5E-01**	**7.7E-01**	**MG/KG**	**IU14SS09A0001**	**3/11**	**0.41 - 0.55**	**7.7E-01**	**N/A**	**2.9E-01 C**	**5.9E-04**	**SSL**	**YES**	**ASL**
	7440-47-3	Chromium, total	1.3E+01	8.6E+01	MG/KG	IU14SS140001	23/23	0.29 - 0.62	8.6E+01	3.3E+01	1.2E+04 N	2.8E+07	SSL	NO	BSL
	7440-48-4	**Cobalt**	**4.6E+00**	**2.0E+01**	**MG/KG**	**IU14SS06-000H**	**12/12**	**0.058 - 0.12**	**2.0E+01**	**2.2E+01**	**2.3E+00 N**	**2.1E-01**	**SSL**	**YES**	**ASL**
	7440-50-8	Copper	5.0E+00	3.2E+01	MG/KG	IU14SS01-000H	12/12	0.18 - 0.37	3.2E+01	2.0E+01	3.1E+02 N	2.2E+01	SSL	NO	BSL
	7439-89-6	**Iron**	**1.2E+04**	**2.5E+04**	**MG/KG**	**IU14SS02-000H**	**12/12**	**5.8 - 12**	**2.5E+04**	**3.9E+04**	**5.5E+03 N**	**2.7E+02**	**SSL**	**YES**	**ASL**
	7439-92-1	Lead	7.2E+00	1.8E+02	MG/KG	IU14SS10P-000H	12/12	0.058 - 0.12	1.8E+02	6.3E+01	4.0E+02 NL	1.4E+01	SSL	NO	BSL
	7439-95-4	Magnesium	4.2E+02	1.3E+04	MG/KG	IU14SS09-000H	12/12	5.8 - 12	1.3E+04	1.6E+03	N/A	N/A		NO	NUT
	7439-96-5	**Manganese**	**5.6E+01 K**	**7.5E+02**	**MG/KG**	**IU14SS06-000H**	**12/12**	**0.12 - 0.5**	**7.5E+02**	**1.4E+03**	**1.8E+02 N**	**2.1E+01**	**SSL**	**YES**	**ASL**
	7439-97-6	Mercury	2.0E-02 J	2.3E-01	MG/KG	IU14SS11-000H	12/12	0.03 - 0.045	2.3E-01	1.6E-01	2.3E+00 N	3.3E-02	SSL	NO	BSL
	7440-02-0	**Nickel**	**4.9E+00**	**2.8E+02**	**MG/KG**	**IU14SS09-000H**	**12/12**	**0.12 - 0.25**	**2.8E+02**	**1.5E+01**	**1.5E+02 N**	**2.0E+01**	**SSL**	**YES**	**ASL**
	7440-09-7	Potassium	2.8E+02	6.8E+02 K	MG/KG	IU14SS02-000H	12/12	58 - 120	6.8E+02	1.5E+03	N/A	N/A		NO	NUT
	7782-49-2	Selenium	2.7E-01 J	6.3E-01	MG/KG	IU14SS06P-000H	6/12	0.29 - 0.62	6.3E-01	1.2E+00	3.9E+01 N	4.0E-01	SSL	NO	BSL
	7440-22-4	Silver	3.0E-02 J	2.5E+01	MG/KG	IU14SS08-000H	12/12	0.058 - 0.12	2.5E+01	8.4E-01	3.9E+01 N	6.0E-01	SSL	NO	BSL
	7440-23-5	Sodium	7.0E+01 J	5.7E+02	MG/KG	IU14SS01-000H	3/12	58 - 120	5.7E+02	1.2E+02	N/A	N/A		NO	NUT
	7440-28-0	**Thallium**	**6.0E-02 J**	**1.9E-01**	**MG/KG**	**IU14SS02-000H**	**12/12**	**0.058 - 0.12**	**1.9E-01**	**2.3E+00**	**7.8E-02 N**	**1.1E-02**	**SSL**	**YES**	**ASL**
	7440-62-2	Vanadium	1.5E+01	3.7E+01	MG/KG	IU14SS05-000H	12/12	0.29 - 0.62	3.7E+01	5.3E+01	3.9E+01 N	7.8E+01	SSL	NO	BSL
	7440-66-6	Zinc	1.7E+01	1.4E+02	MG/KG	IU14SS10P-000H	12/12	0.58 - 1.2	1.4E+02	3.8E+01	2.3E+03 N	2.9E+02	SSL	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] NSF-IH surface soil background concentrations are the 95% Upper Tolerance Limit (UTL) Values for Non-clay-like Surface Soils Presented in the Background Soil Investigation Report for Indian Head and Stump Neck Annex (Tetra Tech, 2002).

[4] Oak Ridge National Laboratory (ORNL). May, 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Residential Soil RSL.
Available: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
RSLs based on non-carcinogenic health effects adjusted to an HI =0.1 (divided by 10).
RSL value for antimony (metallic) was used as surrogate for antimony.
RSL value for chromium (III) insoluble salts used for chromium, total.
RSL value for mercuric chloride (and other mercury salts) used as surrogate for mercury.
RSL value for nickel soluble salts was used as surrogate for nickel.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
K = Biased High
C = Carcinogenic
N = Noncarcinogenic
N/A= Not available or not applicable
NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.
MG/KG = miligrams per kilogram
SSL = Soil Screening Levels from RSL table (not adjusted for noncarcinogenic constituents)

Table G2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Emissions from Surface Soil	7429-90-5	Aluminum	3.1E-03	1.2E-02	µg/m^3	IU14SS02-000H	12/12	N/A	1.2E-02	N/A	5.2E-01 N	N/A		NO	BSL
	7440-36-0	Antimony	6.6E-08 J	3.5E-07	µg/m^3	IU14SS10P-000H	12/12	N/A	3.5E-07	N/A	N/A	N/A		NO	NTX
	7440-38-2	Arsenic	2.2E-06	3.2E-06	µg/m^3	IU14SS02-000H : IU14SS09-000H	12/12	N/A	3.2E-06	N/A	5.7E-04 C	N/A		NO	BSL
	7440-39-3	Barium	1.7E-05	1.8E-04	µg/m^3	IU14SS08-000H	12/12	N/A	1.8E-04	N/A	5.2E-02 N	N/A		NO	BSL
	7440-41-7	Beryllium	1.5E-07	5.2E-07	µg/m^3	IU14SS06P-000H	12/12	N/A	5.2E-07	N/A	1.0E-03 C	N/A		NO	BSL
	7440-43-9	Cadmium	2.2E-08 J	1.9E-07	µg/m^3	IU14SS08-000H	12/12	N/A	1.9E-07	N/A	1.4E-03 C	N/A		NO	BSL
	7440-70-2	Calcium	1.8E-04	2.9E-03	µg/m^3	IU14SS01-000H	12/12	N/A	2.9E-03	N/A	N/A	N/A		NO	NUT
	18540-29-9	Chromium (VI)	5.5E-07	5.7E-07	µg/m^3	IU14SS09A0001	3/11	N/A	5.7E-07	N/A	1.1E-05 C	N/A		NO	BSL
	7440-47-3	Chromium, total	9.3E-06	6.3E-05	µg/m^3	IU14SS140001	23/23	N/A	6.3E-05	N/A	N/A	N/A		NO	NTX
	7440-48-4	Cobalt	3.4E-06	1.5E-05	µg/m^3	IU14SS06-000H	12/12	N/A	1.5E-05	N/A	2.7E-04 C	N/A		NO	BSL
	7440-50-8	Copper	3.7E-06	2.4E-05	µg/m^3	IU14SS01-000H	12/12	N/A	2.4E-05	N/A	N/A	N/A		NO	NTX
	7439-89-6	Iron	8.5E-03	1.9E-02	µg/m^3	IU14SS02-000H	12/12	N/A	1.9E-02	N/A	N/A	N/A		NO	NTX
	7439-92-1	Lead	5.3E-06	1.3E-04	µg/m^3	IU14SS10P-000H	12/12	N/A	1.3E-04	N/A	N/A	N/A		NO	NTX
	7439-95-4	Magnesium	3.1E-04	9.4E-03	µg/m^3	IU14SS09-000H	12/12	N/A	9.4E-03	N/A	N/A	N/A		NO	NUT
	7439-96-5	Manganese	4.1E-05 K	5.5E-04	µg/m^3	IU14SS06-000H	12/12	N/A	5.5E-04	N/A	5.2E-03 N	N/A		NO	BSL
	7439-97-6	Mercury	1.5E-08 J	1.7E-07	µg/m^3	IU14SS11-000H	12/12	N/A	1.7E-07	N/A	3.1E-03 N	N/A		NO	BSL
	7440-02-0	Nickel	3.6E-06	2.0E-04	µg/m^3	IU14SS09-000H	12/12	N/A	2.0E-04	N/A	9.4E-03 N	N/A		NO	BSL
	7440-09-7	Potassium	2.0E-04	5.0E-04 K	µg/m^3	IU14SS02-000H	12/12	N/A	5.0E-04	N/A	N/A	N/A		NO	NUT
	7782-49-2	Selenium	2.0E-07 J	4.6E-07	µg/m^3	IU14SS06P-000H	6/12	N/A	4.6E-07	N/A	2.1E+00 N	N/A		NO	BSL
	7440-22-4	Silver	2.2E-08 J	1.8E-05	µg/m^3	IU14SS08-000H	12/12	N/A	1.8E-05	N/A	N/A	N/A		NO	NTX
	7440-23-5	Sodium	5.1E-05 J	4.2E-04	µg/m^3	IU14SS01-000H	3/12	N/A	4.2E-04	N/A	N/A	N/A		NO	NUT
	7440-28-0	Thallium	4.4E-08 J	1.4E-07	µg/m^3	IU14SS02-000H	12/12	N/A	1.4E-07	N/A	N/A	N/A		NO	NTX
	7440-62-2	Vanadium	1.1E-05	2.7E-05	µg/m^3	IU14SS05-000H	12/12	N/A	2.7E-05	N/A	N/A	N/A		NO	NTX
	7440-66-6	Zinc	1.2E-05	1.0E-04	µg/m^3	IU14SS10P-000H	12/12	N/A	1.0E-04	N/A	N/A	N/A		NO	NTX

[1] Minimum/Maximum calculated air concentrations from surface soil concentrations. Air concentrations calculated as Cair = Csoil X 1000 X 1/PEF.
PEF = 1.36E+09 m3/kg.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). May, 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Residential Air RSL.
Available: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
RSLs based on non-carcinogenic health effects adjusted to an HI =0.1 (divided by 10).
RSL value for mercuric chloride (and other mercury salts) used as surrogate for mercury.
RSL value for nickel soluble salts was used as surrogate for nickel.

[5] Rationale Codes

Selection Reason:	Above Screening Levels (ASL)
Deletion Reason:	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered
J = Estimated Value
K = Biased High
C = Carcinogenic
N = Noncarcinogenic
N/A= Not available or not applicable
µg/m^3 = microgram per cubic meter

Table G2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Shallow Aquifer - Tap Water and Water in Excavation Trench	7429-90-5	Aluminum	1.4E+02 J	8.8E+02	UG/L	IU14GW110712	2/17	300 - 300	8.8E+02	2.9E+08	1.6E+03 N	50 - 200	SMCL	NO	BSL
	7440-36-0	Antimony	7.0E-02 J	7.0E-02 J	UG/L	IU14GW01P0712	1/17	1 - 1	7.0E-02	N/A	6.0E-01 N	6.0E+00	MCL	NO	BSL
	7440-38-2	**Arsenic**	**3.0E+00 J**	**3.0E+00 J**	**UG/L**	**IU14GW010712 : IU14GW110712**	**2/17**	**5 - 5**	**3.0E+00**	**N/A**	**4.5E-02 C**	**1.0E+01**	**MCL**	**YES**	**ASL**
	7440-39-3	Barium	2.7E+01	2.0E+02	UG/L	IU14GW040712	16/17	2 - 2	2.0E+02	2.5E+02	2.9E+02 N	2.0E+03	MCL	NO	BSL
	7440-41-7	Beryllium	6.0E-02 J	1.1E+00	UG/L	IU14GW070712	17/17	1 - 1	1.1E+00	N/A	1.6E+00 N	4.0E+00	MCL	NO	BSL
	7440-43-9	**Cadmium**	**5.0E-02 J**	**3.5E+00**	**UG/L**	**IU14GW060712**	**16/17**	**1 - 1**	**3.5E+00**	**2.8E+00**	**6.9E-01 N**	**5.0E+00**	**MCL**	**YES**	**ASL**
	7440-70-2	Calcium	1.0E+03	1.6E+04	UG/L	IU14GW05-0911	17/17	100 - 100	1.6E+04	6.0E+05	N/A	N/A		NO	NUT
	7440-48-4	**Cobalt**	**6.3E+00**	**6.0E+02 L**	**UG/L**	**IU14GW03-0911**	**17/17**	**1 - 1**	**6.0E+02**	**4.0E+01**	**4.7E-01 N**	**N/A**		**YES**	**ASL**
	7440-50-8	Copper	6.1E-01 J	9.6E+00	UG/L	IU14GW030712	9/17	3 - 3	9.6E+00	2.2E+01	6.2E+01 N	1.3E+03	MCL	NO	BSL
	7439-89-6	**Iron**	**4.7E+01 J**	**1.2E+03**	**UG/L**	**IU14GW110712**	**7/17**	**100 - 100**	**1.2E+03**	**5.7E+04**	**1.1E+03 N**	**3.0E+02**	**SMCL**	**YES**	**ASL**
	7439-92-1	Lead	1.2E-01 J	6.6E-01 J	UG/L	IU14GW09-0911	4/17	1 - 1	6.6E-01	N/A	1.5E+01 NL	1.5E+01	MCL	NO	BSL
	7439-95-4	Magnesium	1.6E+03	9.6E+03	UG/L	IU14GW040712	17/17	100 - 100	9.6E+03	3.1E+04	N/A	N/A		NO	NUT
	7439-96-5	**Manganese**	**1.3E+01**	**6.8E+02**	**UG/L**	**IU14GW08-0911**	**17/17**	**2 - 2**	**6.8E+02**	**2.8E+04**	**3.2E+01 N**	**5.0E+01**	**SMCL**	**YES**	**ASL**
	7439-97-6	Mercury	1.0E-02 J	1.9E-01 J	UG/L	IU14GW080712	7/17	0.2 - 0.2	1.9E-01	1.3E-01	4.3E-01 N	2.0E+00	MCL	NO	BSL
	7440-02-0	**Nickel**	**5.4E+00**	**4.8E+01**	**UG/L**	**IU14GW040712**	**17/17**	**2 - 2**	**4.8E+01**	**3.9E+01**	**3.0E+01 N**	**N/A**		**YES**	**ASL**
	7440-09-7	Potassium	1.6E+03	2.0E+04	UG/L	IU14GW05-0911	17/17	1000 - 1000	2.0E+04	8.3E+04	N/A	N/A		NO	NUT
	7782-49-2	Selenium	5.8E-01 J	6.1E-01 J	UG/L	IU14GW040712	2/17	5 - 5	6.1E-01	N/A	7.8E+00 N	5.0E+01	MCL	NO	BSL
	7440-23-5	Sodium	9.9E+03	8.9E+04	UG/L	IU14GW110712	17/17	1000 - 1000	8.9E+04	8.0E+04	N/A	N/A		NO	NUT
	7440-28-0	**Thallium**	**7.0E-02 J**	**3.5E-01 J**	**UG/L**	**IU14GW09-0911**	**6/17**	**1 - 1**	**3.5E-01**	**N/A**	**1.6E-02 N**	**2.0E+00**	**MCL**	**YES**	**ASL**
	7440-62-2	Vanadium	7.0E-01 J	7.0E-01 J	UG/L	IU14GW09-0911	1/17	5 - 5	7.0E-01	2.4E+01	7.8E+00 N	N/A		NO	BSL
	7440-66-6	Zinc	5.5E+00 J	1.2E+02	UG/L	IU14GW09-0911	5/17	10 - 10	1.2E+02	4.5E+01	4.7E+02 N	5.0E+03	SMCL	NO	BSL

[1] Minimum/Maximum detected concentrations. Unfiltered groundwater data used. No significant difference between filtered and unfiltered data.

[2] Maximum concentration is used for screening.

[3] NSF-IH groundwater background values are the 95% Upper Tolerance Limit (UTL) Non-Turbid, Unfiltered Results Presented in the *Background Soil Investigation Report* for Indian Head and Stump Neck Annex (Tetra Tech, 2002).

[4] Oak Ridge National Laboratory (ORNL). May, 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Tap Water RSL.
Available: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
RSLs based on non-carcinogenic health effects adjusted to an HI =0.1 (divided by 10).
Lead screening level of 15 ug/L is the action level for lead provided in the Drinking Water Regulations and Health Advisories.
RSL value for chromium(VI) used as for chromium.
RSL value for mercuric chloride (and other mercury salts) used for mercury.
RSL value for nickel soluble salts used for nickel.

[5] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
L = Biased Low
C = Carcinogenic
N = Noncarcinogenic
NL = Lead value not based on cancer, but not adjusted as is done for other noncarcinogens
MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Regulations
SMCL = Secondary Maximum Contaminant Level, National Primary Drinking Water Regulations
N/A= Not available or not applicable
UG/L = microgram per liter

Table G3.1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Surface Soil										
	Aluminum	MG/KG	9.3E+03	1.1E+04	N	1.7E+04	1.1E+04	MG/KG	95% Stud-t	1,2,3
	Arsenic	MG/KG	3.7E+00	3.9E+00	N	4.4E+00	3.9E+00	MG/KG	95% Stud-t	1,2,3
	Chromium (VI)	MG/KG	7.5E-01	7.6E-01	NP	7.7E-01	7.6E-01	MG/KG	95% KM-t	1, 2
	Cobalt	MG/KG	8.7E+00	1.2E+01	G	2.0E+01	1.2E+01	MG/KG	App. G	1, 3
	Iron	MG/KG	1.5E+04	1.7E+04	N	2.5E+04	1.7E+04	MG/KG	95% Mod-t	4
	Manganese	MG/KG	2.5E+02	3.6E+02	G	7.5E+02	3.6E+02	MG/KG	App. G	1, 3
	Nickel	MG/KG	3.1E+01	1.3E+02	NP	2.8E+02	1.3E+02	MG/KG	95% Cheb-m	4
	Thallium	MG/KG	1.2E-01	1.4E-01	N	1.9E-01	1.4E-01	MG/KG	95% Stud-t	1,2,3

ProUCL, Version 4.1.01 (USEPA.May 2011) used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. May 2010. ProUCL, Version 4.1. Prepared by Lockheed Martin Environmental Services).
Options: 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Modified-t UCL (95% Mod-t);
95% Approximate Gamma UCL (App. G); 95% Chebyshev (Mean, Sd) UCL (95% Cheb-m)

Upper Confidence Limit (UCL) Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive

MG/KG = milligrams per kilogram
N = Normal
NP = Non-Parametric
NA = Not applicable
G = Gamma

Table G3.2

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Shallow Aquifer - Tap Water and Water in Excavation Trench	Arsenic	UG/L	2.1E+00	NA		3.0E+00	J	3.0E+00	UG/L	Max	5
	Cadmium	UG/L	5.7E-01	1.5E+00	NP	3.5E+00		1.5E+00	UG/L	95% KM-c	1, 3
	Cobalt	UG/L	2.1E+02	3.7E+02	G	6.0E+02	L	3.7E+02	UG/L	App. G	1, 3
	Iron	UG/L	1.5E+02	2.7E+02	NP	1.2E+03		2.7E+02	UG/L	95% KM-t	1, 3
	Manganese	UG/L	2.2E+02	3.0E+02	N	6.8E+02		3.0E+02	UG/L	95% Stud-t	1, 2, 3
	Nickel	UG/L	2.1E+01	3.0E+01	G	4.8E+01		3.0E+01	UG/L	App. G	3
	Thallium	UG/L	1.3E-01	1.9E-01	NP	3.5E-01	J	1.9E-01	UG/L	95% KM-t	1,3

ProUCL, Version 4.1.01 (USEPA. May 2011) used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. May 2010. ProUCL, Version 4.1. Prepared by Lockheed Martin Environmental Services).

Options: 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Kaplan-Meier (Chebyshev) UCL (95% KM-c); 95% Approximate Gamma UCL (App. G); Maximum Detected Value (Max)

Upper Confidence Limit (UCL) Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Maximum detected concentration used because constituent was detected in only one sample.

UG/L = micrograms per liter
N = Normal
NP = Non-Parametric
NA = Not applicable
G = Gamma
J = Estimated Value
L = Biased Low

TABLE G4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Industrial Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	250	days/year	EPA, 1991	
				ED	Exposure Duration	25	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	
	Trespasser/Visitor	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	(1)	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Adolescent	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	(1)	
				ED	Exposure Duration	9	years	(2)	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	51	kg	EPA, 1997, (3)	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
Dermal	Industrial Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300	cm^2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	chem specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	250	days/year	EPA, 1991	
				ED	Exposure Duration	25	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	

TABLE G4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (cont'd)	Trespasser/Visitor	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.07	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	52	days/year	(1)	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Adolescent	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,800	cm^2	EPA, 2004, (4)	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm^2-day	EPA, 2004, (5)	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	52	days/year	(1)	
				ED	Exposure Duration	9	years	(2)	
				BW	Body Weight	51	kg	EPA, 1997,(3)	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	

Notes:

(1) Professional Judgement assuming 2 day per week for 26 weeks per year.

(2) Professional Judgement assuming adolescents from 9 to 18 years of age.

(3) Body weight is average value for the 9 year old and 18 year old male body weight.

(4) Surface area includes face, forearms, hands, and lower legs for children 9-18 year old.

(5) Soil to skin adherence factor is based on 95th percentile adherence factor for soccer players #1 (age 13-15 years).

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

TABLE G4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S-A	Ingestion Rate of Soil, Adult	100	mg/day	EPA, 1991	CS x IR-S-Adj x EF x CF1 x 1/AT
				IR-S-C	Ingestion Rate of Soil, Child	200	mg/day	EPA, 1991	
				IR-S-Adj	Ingestion Rate of Soil, Age-adjusted	114.29	mg-year/kg-day	Calculated	IR-S-Adj (mg-year/kd-day) =
				EF	Exposure Frequency	350	days/year	EPA, 1991	(ED-C x IR-S-C / BW-C) + (ED-A x IR-S-A / BW-A)
				ED-A	Exposure Duration, Adult	24	years	EPA, 1991	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
	Construction Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	330	mg/day	EPA, 2002	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	125	days/year	VDEQ, 2003, (1)	
				ED	Exposure Duration	1	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

TABLE G4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.07	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical Specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	2,800	cm^2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA-A	Skin Surface Area Available for Contact, Adult	5,700	cm^2	EPA, 2004	CS x DA-Adj x DABS x CF1 x EF x 1/AT
				SA-C	Skin Surface Area Available for Contact, Child	2,800	cm^2	EPA, 2004	
				SSAF-A	Soil to Skin Adherence Factor, Adult	0.07	mg/cm^2-day	EPA, 2004	DA-Adj (mg-year/kg-day) =
				SSAF-C	Soil to Skin Adherence Factor, Child	0.2	mg/cm^2-day	EPA, 2004	
				DA-Adj	Dermal Absorption, Age-adjusted	361	mg-year/kg-day	Calculated	(ED-C x SA-C x SSAF-C / BW-C) + (ED-A x SA-A x SSAF-A / BW-A)
				DABS	Dermal Absorption Factor Solids	Chemical Specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED-A	Exposure Duration, Adult	24	years	EPA, 1991	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

TABLE G4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300	cm^2	EPA, 2004, (2)	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm^2-day	EPA, 2004, (3)	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	chem specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	125	days/year	VDEQ, 2003, (1)	
				ED	Exposure Duration	1	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

Notes:

(1) Assumed duration of construction project is 1/2 of a working year.

(2) Soil to skin adherence factor is based on 95th percentile adherence factor for construction workers.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

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EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

VDEQ, 2003: Viriginia Department of Envirommental Quality, Voluntary Remediation Program Risk Assessment Guidance. Dec. 2003

TABLE G4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	2	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W-A	Ingestion Rate of Water, Adult	2	liters/day	EPA, 1997	CW x IR-W-Adj x EF x CF2 x 1/AT
				IR-W-C	Ingestion Rate of Water, Child	1	liters/day	EPA, 1997	
				IR-W-Adj	Ingestion Rate of Water, Age-adjusted	1.09	liter-year/kg-day	calculated	IR-W-Adj (liter-year/kd-day) =
				EF	Exposure Frequency	350	days/year	EPA, 1991	(ED-C x IR-W-C / BW-C) +
				ED-A	Exposure Duration, Adult	24	years	EPA, 1991	(ED-A x IR-W-A / BW-A)
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
	Industrial Worker	Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1991	CW x IR-W x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	250	days/year	EPA, 1991	
				ED	Exposure Duration	25	years	EPA, 1991	
				CF1	Conversion Factor 1	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	

TABLE G4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.58	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Conta	18,000	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	350	days/year	EPA, 2004	
				ED	Exposure Duration	24	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + 3B^2)/(1+B)^2)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	
		Child	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	1.0	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Conta	6,600	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	350	days/year	EPA, 2004	
				ED	Exposure Duration	6	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	15	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + 3B^2)/(1+B)^2)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE G4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Child/Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) = DA-Adj x EF x 1/AT
				DAevent-A	Dermally Absorbed Dose per Event, A	calculated	mg/cm^2-event	calculated	
				DAevent-C	Dermally Absorbed Dose per Event, C	calculated	mg/cm^2-event	calculated	DA-Adj = (Daevent-A x SA-A x ED-A x 1/BW-A)
				DA-Adj	Dermally Absorbed Dose, Age-adjuste	calculated	mg-year/event-kg	calculated	+ (Daevent-C x SA-C x ED-C x 1/BW-C)
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}-A	Event Time, Adult	0.58	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				t_{event}-C	Event Time, Child	1.0	hr/event	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				SA-A	Skin Surface Area, Adult	18,000	cm^2	EPA, 2004	x CF2 x CF3
				SA-C	Skin Surface Area, Child	6,600	cm^2	EPA, 2004	
				EV	Event Frequency	1	events/day	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				EF	Exposure Frequency	350	days/year	EPA, 2004	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				ED-A	Exposure Duration, Adult	24	years	EPA, 2004	((1 + 3B + 3B^2)/(1+B)^2)) x CF2 x CF3
				ED-C	Exposure Duration, Child	6	years	EPA, 2004	
				BW-A	Body Weight, Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE G4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Worker	Adult	Shallow Aquifer -	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
			Water in Excavation	DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
			Trench	FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	8	hr/day	(1)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Conta	5,700	cm^2	EPA, 2004, (2)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	125	days/year	EPA, 2002	
				ED	Exposure Duration	1	years	EPA, 1991	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

(1) Professional judgment based on construction activities that would occur 8 hrs per day for the RME.

(2) Skin surface area in contact with groundwater assumed to be hands, forearms, lower legs, and feet.

(3) Assumed duration of construction project is 1/2 of a working year.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

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VDEQ, 2003: Viriginia Department of Enviornmental Quality, Voluntary Remediation Program Risk Assessment Guidance. Dec. 2003

TABLE G4.1.CTE
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURE
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	50	mg/day	EPA, 1993	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 1993	
				CF1	Conversion Factor 3	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
		Child	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1993	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor 3	0.000001	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	2190	days	EPA, 1989	
		Child/Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S-A	Ingestion Rate of Soil, Adult	50	mg/day	EPA, 1991	CS x IR-S-Adj x EF x CF1 x 1/AT
				IR-S-C	Ingestion Rate of Soil, Child	100	mg/day	EPA, 1991	
				IR-S-Adj	Ingestion Rate of Soil, Age-adjusted	46.4	mg-year/kg-day	Calculated	IR-S-Adj (mg-year/kd-day) =
									(ED-C x IR-S-C / BW-C) + (ED-A x IR-S-A / BW-A)
				EF	Exposure Frequency	234	days/year	EPA, 1991	
				ED-A	Exposure Duration, Adult	9	years	EPA, 1991	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg		
				AT-C	Averaging Time (Cancer)	25550	days	EPA, 1989	
	Industrial Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	50	mg/day	EPA, 1993	CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	219	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	- -	

TABLE G4.1.CTE
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURE
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700	cm2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.01	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 2004	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
		Child	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	2,800	cm2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.04	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA-A	Skin Surface Area Available for Contact, Adult	5,700	cm2	EPA, 2004	CS x DA-Adj x DABS x CF3 x EF x 1/AT
				SA-C	Skin Surface Area Available for Contact, Child	2,800	cm2	EPA, 2004	
				SSAF-A	Soil to Skin Adherence Factor	0.01	mg/cm^2-day	EPA, 2004	DA-Adj (mg-year/kd-day) =
				SSAF-C	Soil to Skin Adherence Factor	0.04	mg/cm^2-day	EPA, 2004	[(ED-C x SA-C x SSAF-C / BW-C) +
				DA-Adj	Dermal Absorption, Age-adjusted	52	mg-year/kg-day	Calculated	(ED-A x SA-A x SSAF-A / BW-A)]
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED-A	Exposure Duration, Adult	9	years	EPA, 1993	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	EPA, 1989	
	Industrial Worker	Adult	Surface Soil	CS	Chemical Concentration in Soil	See Table 3.1.RME	mg/kg	See Table 3.1.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300	cm^2	EPA, 2004	CS x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.02	mg/cm^2-day	EPA, 2004	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	219	days/year	EPA, 2004	
				ED	Exposure Duration	9	years	EPA, 2004	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 2004: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

VDEQ, 2003: Viriginia Department of Envirommental Quality, Voluntary Remediation Program Risk Assessment Guidance. Dec. 2003

TABLE G4.2.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1.4	liters/day	EPA, 1993	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 1993	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
		Child	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W-A	Ingestion Rate of Water, Adult	1.4	liters/day	EPA, 1993	CW x IR-W-Adj x EF x CF2 x 1/AT
				IR-W-C	Ingestion Rate of Water, Child	1	liters/day	EPA, 1997	
				IR-W-Adj	Ingestion Rate of Water, Age-adjusted	0.58	liter-year/kg-day	calculated	IR-W-Adj (liter-year/kd-day) =
				EF	Exposure Frequency	234	days/year	EPA, 1993	(ED-C x IR-W-C / BW-C) +
				ED-A	Exposure Duration, Adult	9	years	EPA, 1993	(ED-A x IR-W-A / BW-A)
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
	Industrial Worker	Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1991	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	219	days/year	EPA, 2004	
				ED	Exposure Duration	9	years	EPA, 2004	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	

TABLE G4.2.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	**Receptor Population**	**Receptor Age**	**Exposure Point**	**Parameter Code**	**Parameter Definition**	**Value**	**Units**	**Rationale/ Reference**	**Intake Equation/ Model Name**
Dermal	Resident	Adult	Shallow Aquifer -	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
			Tap Water	DAevent	Dermally Absorbed Dose per Event	Calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.25	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	18,000	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	
Dermal	Resident	Child	Shallow Aquifer -	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
			Tap Water	DAevent	Dermally Absorbed Dose per Event	Calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.33	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	6,600	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 2001	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	15	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE G4.2.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (cont'd)	Resident (cont'd)	Child/Adult	Shallow Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) = DA-Adj x EF x 1/AT
				DAevent-A	Dermally Absorbed Dose per Event, Adult	Calculated	mg/cm^2-event	calculated	
				DAevent-C	Dermally Absorbed Dose per Event, Child	Calculated	mg/cm^2-event	calculated	DA-Adj = (Daevent-A x SA-A x ED-A x 1/BW-A)
				DA-Adj	Dermally Absorbed Dose, Age-adjusted	Calculated	mg-year/event-kg	calculated	+ (Daevent-C x SA-C x ED-C x 1/BW-C)
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}-A	Event Time, Adult	0.25	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				t_{event}-C	Event Time, Child	0.33	hr/event	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				SA-A	Skin Surface Area, Adult	18,000	cm^2	EPA, 2004	x CF2 x CF3
				SA-C	Skin Surface Area, Child	6,600	cm^2	EPA, 2004	
				EV	Event Frequency	1	events/day	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				EF	Exposure Frequency	234	days/year	EPA, 1993	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				ED-A	Exposure Duration, Adult	9	years	EPA, 2001	$((1 + 3B + 3B^2)/(1+B)^2)$) x CF2 x CF3
				ED-C	Exposure Duration, Child	6	years	EPA, 2001	
				BW-A	Body Weight, Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

(1) Professional judgement assuming 1/2 RME value for CT.

(2) Assumed construction workers could spend 4 hours/day near the excavation trench.

(3) Skin surface area in contact with groundwater assumed to be hands, forearms, lower legs, and feet.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

TABLE G5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units	(1)	Value	Units			Source(s)	Date(s) (3) (MM/DD/YYYY)
Aluminum	Chronic	1.0E+00	mg/kg-day	100%	1.0E+00	mg/kg-day	Neurological	100	PPRTV	10/23/2006
Aluminum	Subchronic	1.0E+00	mg/kg-day	100%	1.0E+00	mg/kg-day	Neurological	30	ATSDR	9/1/2008
Arsenic	Chronic	3.0E-04	mg/kg-day	95%	3.0E-04	mg/kg-day	Skin, Vascular	3	IRIS	9/12/2012
Arsenic	Subchronic	3.0E-04	mg/kg-day	95%	3.0E-04	mg/kg-day	Skin	3	HEAST	7/31/1997
Cadmium (diet)	Chronic	1.0E-03	mg/kg-day	2.5%	2.5E-05	mg/kg-day	Kidney	10	IRIS	9/12/2012
Cadmium (diet)	Subchronic	NA	NA	NA	NA	NA	NA		NA	NA
Cadmium (water)	Chronic	5.0E-04	mg/kg-day	5%	2.5E-05	mg/kg-day	Kidney	10	IRIS	9/12/2012
Cadmium (water)	Subchronic	NA	NA	NA	NA	NA	NA		NA	NA
Chromium (VI)	Chronic	3.0E-03	mg/kg-day	2.5%	7.5E-05	mg/kg-day	NOE	300	IRIS	9/12/2012
Chromium (VI)	Subchronic	5.0E-03	mg/kg-day	2.5%	1.3E-04	mg/kg-day	Blood	100	ATSDR	9/1/2008
Cobalt	Chronic	3.0E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Thyroid	3000	PPRTV	8/25/2008
Cobalt	Subchronic	3.0E-03	mg/kg-day	100%	3.0E-03	mg/kg-day	Thyroid	300	PPRTV	8/25/2008
Iron	Chronic	7.0E-01	mg/kg-day	100%	7.0E-01	mg/kg-day	GI System	1.5	PPRTV	9/11/2006
Iron	Subchronic	7.0E-01	mg/kg-day	100%	7.0E-01	mg/kg-day	GI System	1.5	PPRTV	9/11/2006
Manganese (non-diet)	Chronic	2.4E-02	mg/kg-day	4%	9.6E-04	mg/kg-day	CNS	1	IRIS	9/12/2012
Manganese (non-diet)	Subchronic	2.4E-02	mg/kg-day	4%	9.6E-04	mg/kg-day	CNS	1	HEAST	7/31/1997
Nickel	Chronic	2.0E-02	mg/kg-day	4%	8.0E-04	mg/kg-day	Decreased body and organ weights	300	IRIS	9/12/2012
Nickel	Subchronic	2.0E-02	mg/kg-day	4%	8.0E-04	mg/kg-day	Decreased body and organ weights	300	HEAST	7/31/1997
Thallium	Chronic	1.0E-05	mg/kg-day	100%	1.0E-05	mg/kg-day	Hair	3000	PPRTV	10/8/2010
Thallium	Subchronic	NA	NA	NA	NA	NA	NA		NA	NA

Note:
(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1. USEPA recommends that the oral RfD should not be adjusted to estimate the absorbed dose for compounds when the absorption efficiency is greater than 50%. Constituents that do not have oral absorption efficiencies reported on this table were assumed to have an oral absorption efficiency of 100%.
(2) Adjusted Dermal RfD = RfD(oral) X Oral to Dermal Adjustment Factor
(3) For ATSDR, date of ATSDR toxicity profile
For IRIS values, date IRIS was searched.
For HEAST values, date of HEAST.
For PPRTV values, date of the PPRTV toxicity profile.
For RSL values, the date of the RSL Table.

Definitions:
CNS = Central Nervous System
GI System = Gastrointestinal System
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = Not Available
NOE = No Observed Effects
PPRTV = Provisional Peer-Reviewed Toxicity Value

TABLE G6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
Remedial Investigation Report Stump Neck Annex – SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	95%	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	9/12/2012
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (VI) (3)	5.0E-01	$(mg/kg\text{-}day)^{-1}$	2.5%	2.0E+01	$(mg/kg\text{-}day)^{-1}$	D	New Jersey	9/12/2012
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	D	IRIS	1/13/2012
Nickel	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1. USEPA recommends that the oral slope factor should not be adjusted to estimate the absorbed dose for compounds when the absorption efficiency is greater than 50%. Constituents that do not have oral absorption efficiencies reported on this table were assumed to have an oral absorption efficiency of 100%.

(2) Adjusted Dermal CSF = CSF (oral) / Oral to Dermal Adjustment Factor

(3) This chemical operates with a mutagenic mode of action.
Chemical-specific data are not available; therefore, default age-dependant adjustment factors (ADAF) will be applied to the slope factor as follows:

AGE	AGE ADAF
0-<2	10
2-<16	3
16-<30	1

Definitions:
NA = Not Available
IRIS = Integrated Risk Information System
NJ = New Jersey

Weight of Evidence definitions:
Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer.
Group D chemicals (not classifiable as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available.

TABLE G7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				Hazard Quotient
					Value	Units	ntake/Exposure Concentratio		CSF/Unit Risk		Cancer Risk	ntake/Exposure Concentratio		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	3.8E-03	mg/kg-day	N/A		N/A	1.1E-02	mg/kg-day	1.0E+00	mg/kg-day	1.1E-02
				Arsenic	3.9E+00	mg/kg	1.4E-06	mg/kg-day	1.5E+00	mg/kg-day	2.1E-06	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Chromium (VI)	7.6E-01	mg/kg	2.6E-07	mg/kg-day	5.0E-01	mg/kg-day	1.3E-07	7.4E-07	mg/kg-day	3.0E-03	mg/kg-day	2.5E-04
				Cobalt	1.2E+01	mg/kg	4.0E-06	mg/kg-day	N/A		N/A	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	3.8E-02
				Iron	1.7E+04	mg/kg	6.0E-03	mg/kg-day	N/A		N/A	1.7E-02	mg/kg-day	7.0E-01	mg/kg-day	2.4E-02
				Manganese	3.6E+02	mg/kg	1.3E-04	mg/kg-day	N/A		N/A	3.5E-04	mg/kg-day	2.4E-02	mg/kg-day	1.5E-02
				Nickel	1.3E+02	mg/kg	4.5E-05	mg/kg-day	N/A		N/A	1.3E-04	mg/kg-day	2.0E-02	mg/kg-day	6.3E-03
				Thallium	1.4E-01	mg/kg	5.0E-08	mg/kg-day	N/A		N/A	1.4E-07	mg/kg-day	1.0E-05	mg/kg-day	1.4E-02
			Exp. Route Total								2.2E-06					1.2E-01
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	2.5E-04	mg/kg-day	N/A		N/A	7.1E-04	mg/kg-day	1.0E+00	mg/kg-day	7.1E-04
				Arsenic	3.9E+00	mg/kg	2.7E-07	mg/kg-day	1.5E+00	mg/kg-day	4.1E-07	7.6E-07	mg/kg-day	3.0E-04	mg/kg-day	2.5E-03
				Chromium (VI)	7.6E-01	mg/kg	1.7E-08	mg/kg-day	2.0E+01	mg/kg-day	3.5E-07	4.9E-08	mg/kg-day	7.5E-05	mg/kg-day	6.5E-04
				Cobalt	1.2E+01	mg/kg	2.7E-07	mg/kg-day	N/A		N/A	7.5E-07	mg/kg-day	3.0E-04	mg/kg-day	2.5E-03
				Iron	1.7E+04	mg/kg	4.0E-04	mg/kg-day	N/A		N/A	1.1E-03	mg/kg-day	7.0E-01	mg/kg-day	1.6E-03
				Manganese	3.6E+02	mg/kg	8.3E-06	mg/kg-day	N/A		N/A	2.3E-05	mg/kg-day	2.4E-02	mg/kg-day	9.6E-04
				Nickel	1.3E+02	mg/kg	3.0E-06	mg/kg-day	N/A		N/A	8.3E-06	mg/kg-day	8.0E-04	mg/kg-day	1.0E-02
				Thallium	1.4E-01	mg/kg	3.3E-09	mg/kg-day	N/A		N/A	9.2E-09	mg/kg-day	1.0E-05	mg/kg-day	9.2E-04
			Exp. Route Total								7.6E-07					2.0E-02
		Exposure Point Total									3.0E-06					1.4E-01
	Exposure Medium Total										3.0E-06					1.4E-01
Surface Soil Total											3.0E-06					1.4E-01
							Total of Receptor Risks Across All Media				3.0E-06	Total of Receptor Hazards Across All Media				1.4E-01

Notes:

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

TABLE G7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	ntake/Exposure Concentratio		CSF/Unit Risk		Cancer Risk	ntake/Exposure Concentratio		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	7.6E-04	mg/kg-day	N/A		N/A	2.2E-03	mg/kg-day	1.0E+00	mg/kg-day	2.2E-03
				Arsenic	3.9E+00	mg/kg	2.7E-07	mg/kg-day	1.5E+00	mg/kg-day	4.1E-07	8.0E-07	mg/kg-day	3.0E-04	mg/kg-day	2.7E-03
				Chromium (VI)	7.6E-01	mg/kg	5.3E-08	mg/kg-day	5.0E-01	mg/kg-day	2.6E-08	1.5E-07	mg/kg-day	3.0E-03	mg/kg-day	5.1E-05
				Cobalt	1.2E+01	mg/kg	8.1E-07	mg/kg-day	N/A		N/A	2.3E-06	mg/kg-day	3.0E-04	mg/kg-day	7.8E-03
				Iron	1.7E+04	mg/kg	1.2E-03	mg/kg-day	N/A		N/A	3.5E-03	mg/kg-day	7.0E-01	mg/kg-day	5.0E-03
				Manganese	3.6E+02	mg/kg	2.5E-05	mg/kg-day	N/A		N/A	7.3E-05	mg/kg-day	2.4E-02	mg/kg-day	3.0E-03
				Nickel	1.3E+02	mg/kg	9.0E-06	mg/kg-day	N/A		N/A	2.6E-05	mg/kg-day	2.0E-02	mg/kg-day	1.3E-03
				Thallium	1.4E-01	mg/kg	1.0E-08	mg/kg-day	N/A		N/A	2.9E-08	mg/kg-day	1.0E-05	mg/kg-day	2.9E-03
			Exp. Route Total								4.4E-07					2.5E-02
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	3.0E-05	mg/kg-day	N/A		N/A	8.9E-05	mg/kg-day	1.0E+00	mg/kg-day	8.9E-05
				Arsenic	3.9E+00	mg/kg	3.3E-08	mg/kg-day	1.5E+00	mg/kg-day	4.9E-08	9.6E-08	mg/kg-day	3.0E-04	mg/kg-day	3.2E-04
				Chromium (VI)	7.6E-01	mg/kg	2.1E-09	mg/kg-day	2.0E+01	mg/kg-day	4.2E-08	6.1E-09	mg/kg-day	7.5E-05	mg/kg-day	8.2E-05
				Cobalt	1.2E+01	mg/kg	3.2E-08	mg/kg-day	N/A		N/A	9.4E-08	mg/kg-day	3.0E-04	mg/kg-day	3.1E-04
				Iron	1.7E+04	mg/kg	4.8E-05	mg/kg-day	N/A		N/A	1.4E-04	mg/kg-day	7.0E-01	mg/kg-day	2.0E-04
				Manganese	3.6E+02	mg/kg	1.0E-06	mg/kg-day	N/A		N/A	2.9E-06	mg/kg-day	2.4E-02	mg/kg-day	1.2E-04
				Nickel	1.3E+02	mg/kg	3.6E-07	mg/kg-day	N/A		N/A	1.0E-06	mg/kg-day	8.0E-04	mg/kg-day	1.3E-03
				Thallium	1.4E-01	mg/kg	4.0E-10	mg/kg-day	N/A		N/A	1.2E-09	mg/kg-day	1.0E-05	mg/kg-day	1.2E-04
			Exp. Route Total								9.1E-08					2.5E-03
		Exposure Point Total									5.3E-07					2.8E-02
	Exposure Medium Total										5.3E-07					2.8E-02
Surface Soil Total											5.3E-07					2.8E-02
							Total of Receptor Risks Across All Media				5.3E-07	Total of Receptor Hazards Across All Media				2.8E-02

Notes:

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

TABLE G7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	3.9E-04	mg/kg-day	N/A		N/A	3.1E-03	mg/kg-day	1.0E+00	mg/kg-day	3.1E-03
				Arsenic	3.9E+00	mg/kg	1.4E-07	mg/kg-day	1.5E+00	mg/kg-day	2.1E-07	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	3.7E-03
				Chromium (VI)	7.6E-01	mg/kg	2.7E-08	mg/kg-day	5.0E-01	mg/kg-day	1.4E-08	2.1E-07	mg/kg-day	3.0E-03	mg/kg-day	7.0E-05
				Cobalt	1.2E+01	mg/kg	4.1E-07	mg/kg-day	N/A		N/A	3.2E-06	mg/kg-day	3.0E-04	mg/kg-day	1.1E-02
				Iron	1.7E+04	mg/kg	6.2E-04	mg/kg-day	N/A		N/A	4.8E-03	mg/kg-day	7.0E-01	mg/kg-day	6.9E-03
				Manganese	3.6E+02	mg/kg	1.3E-05	mg/kg-day	N/A		N/A	1.0E-04	mg/kg-day	2.4E-02	mg/kg-day	4.2E-03
				Nickel	1.3E+02	mg/kg	4.6E-06	mg/kg-day	N/A		N/A	3.6E-05	mg/kg-day	2.0E-02	mg/kg-day	1.8E-03
				Thallium	1.4E-01	mg/kg	5.1E-09	mg/kg-day	N/A		N/A	4.0E-08	mg/kg-day	1.0E-05	mg/kg-day	4.0E-03
			Exp. Route Total								2.3E-07					3.4E-02
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	4.5E-05	mg/kg-day	N/A		N/A	3.5E-04	mg/kg-day	1.0E+00	mg/kg-day	3.5E-04
				Arsenic	3.9E+00	mg/kg	4.8E-08	mg/kg-day	1.5E+00	mg/kg-day	7.2E-08	3.8E-07	mg/kg-day	3.0E-04	mg/kg-day	1.3E-03
				Chromium (VI)	7.6E-01	mg/kg	3.1E-09	mg/kg-day	2.0E+01	mg/kg-day	6.2E-08	2.4E-08	mg/kg-day	7.5E-05	mg/kg-day	3.2E-04
				Cobalt	1.2E+01	mg/kg	4.7E-08	mg/kg-day	N/A		N/A	3.7E-07	mg/kg-day	3.0E-04	mg/kg-day	1.2E-03
				Iron	1.7E+04	mg/kg	7.0E-05	mg/kg-day	N/A		N/A	5.5E-04	mg/kg-day	7.0E-01	mg/kg-day	7.8E-04
				Manganese	3.6E+02	mg/kg	1.5E-06	mg/kg-day	N/A		N/A	1.1E-05	mg/kg-day	2.4E-02	mg/kg-day	4.7E-04
				Nickel	1.3E+02	mg/kg	5.3E-07	mg/kg-day	N/A		N/A	4.1E-06	mg/kg-day	8.0E-04	mg/kg-day	5.1E-03
				Thallium	1.4E-01	mg/kg	5.9E-10	mg/kg-day	N/A		N/A	4.6E-09	mg/kg-day	1.0E-05	mg/kg-day	4.6E-04
			Exp. Route Total								1.3E-07					1.0E-02
		Exposure Point Total									3.6E-07					4.4E-02
	Exposure Medium Total										3.6E-07					4.4E-02
Surface Soil Total											3.6E-07					4.4E-02
							Total of Receptor Risks Across All Media				3.6E-07	Total of Receptor Hazards Across All Media				4.4E-02

Notes:

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

TABLE G7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	1.5E-02	mg/kg/day	1.0E+00	mg/kg-day	1.5E-02
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	5.4E-06	mg/kg/day	3.0E-04	mg/kg-day	1.8E-02
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	1.0E-06	mg/kg/day	3.0E-03	mg/kg-day	3.5E-04
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	1.6E-05	mg/kg/day	3.0E-04	mg/kg-day	5.3E-02
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	2.4E-02	mg/kg/day	7.0E-01	mg/kg-day	3.4E-02
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	4.9E-04	mg/kg/day	2.4E-02	mg/kg-day	2.0E-02
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	1.8E-04	mg/kg/day	2.0E-02	mg/kg-day	8.8E-03
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	2.0E-07	mg/kg/day	1.0E-05	mg/kg-day	2.0E-02
			Exp. Route Total								N/A					1.7E-01
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	6.0E-04	mg/kg/day	1.0E+00	mg/kg-day	6.0E-04
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	6.4E-07	mg/kg/day	3.0E-04	mg/kg-day	2.1E-03
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	4.1E-08	mg/kg/day	7.5E-05	mg/kg-day	5.5E-04
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	6.3E-07	mg/kg/day	3.0E-04	mg/kg-day	2.1E-03
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	9.4E-04	mg/kg/day	7.0E-01	mg/kg-day	1.3E-03
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	2.0E-05	mg/kg/day	2.4E-02	mg/kg-day	8.1E-04
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	7.0E-06	mg/kg/day	8.0E-04	mg/kg-day	8.8E-03
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	7.8E-09	mg/kg/day	1.0E-05	mg/kg-day	7.8E-04
			Exp. Route Total								N/A					1.7E-02
		Exposure Point Total									N/A					1.9E-01
	Exposure Medium Total										N/A					1.9E-01
Surface Soil Total											NA					1.9E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	8.2E-05	mg/kg/day	3.0E-04	mg/kg-day	2.7E-01
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	4.1E-05	mg/kg/day	5.0E-04	mg/kg-day	8.2E-02
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	1.0E-02	mg/kg/day	3.0E-04	mg/kg-day	3.3E+01
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	7.5E-03	mg/kg/day	7.0E-01	mg/kg-day	1.1E-02
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	8.1E-03	mg/kg/day	2.4E-02	mg/kg-day	3.4E-01
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	8.3E-04	mg/kg/day	2.0E-02	mg/kg-day	4.1E-02
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	5.3E-06	mg/kg/day	1.0E-05	mg/kg-day	5.3E-01
			Exp. Route Total								N/A					3.5E+01
			Dermal Absorption	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	4.3E-07	mg/kg/day	3.0E-04	mg/kg-day	1.4E-03
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	2.1E-07	mg/kg/day	2.5E-05	mg/kg-day	8.6E-03
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	2.1E-05	mg/kg/day	3.0E-04	mg/kg-day	7.0E-02
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	3.9E-05	mg/kg/day	7.0E-01	mg/kg-day	5.6E-05
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	4.2E-05	mg/kg/day	9.6E-04	mg/kg-day	4.4E-02
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	8.7E-07	mg/kg/day	8.0E-04	mg/kg-day	1.1E-03
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	2.7E-08	mg/kg/day	1.0E-05	mg/kg-day	2.7E-03
			Exp. Route Total								N/A					1.3E-01
		Exposure Point Total									N/A					3.5E+01
	Exposure Medium Total										N/A					3.5E+01
Shallow Aquifer Groundwater Total											N/A					3.5E+01
									Total of Receptor Risks Across All Media		N/A		Total of Receptor Hazards Across All Media			3.5E+01

Notes-

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Table 7.4.RME Supplement A.

Table G7.4.RME Supplement A
Calculation of DAevent
Resident Adult Shallow Ground Water
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (Kp) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (tevent) (hr)	DAevent (mg/cm^2-event)	Eq
Arsenic	3.0E+00	1.0E-03	N/A	N/A	N/A	N/A	0.58	1.7E-09	1
Cadmium	1.5E+00	1.0E-03	N/A	N/A	N/A	N/A	0.58	8.7E-10	1
Cobalt	3.7E+02	4.0E-04	N/A	N/A	N/A	N/A	0.58	8.5E-08	1
Iron	2.7E+02	1.0E-03	N/A	N/A	N/A	N/A	0.58	1.6E-07	1
Manganese	3.0E+02	1.0E-03	N/A	N/A	N/A	N/A	0.58	1.7E-07	1
Nickel	3.0E+01	2.0E-04	N/A	N/A	N/A	N/A	0.58	3.5E-09	1
Thallium	1.9E-01	1.0E-03	N/A	N/A	N/A	N/A	0.58	1.1E-10	1

Inorganics: DAevent (mg/cm2-event) =
Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm^3 (eq 1)

Notes:
N/A - Not applicable
Permeability constants and other input parameter values from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

TABLE G7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	1.4E-01	mg/kg/day	1.0E+00	mg/kg-day	1.4E-01
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	5.0E-05	mg/kg/day	3.0E-04	mg/kg-day	1.7E-01
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	9.7E-06	mg/kg/day	3.0E-03	mg/kg-day	3.2E-03
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	1.5E-04	mg/kg/day	3.0E-04	mg/kg-day	4.9E-01
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	2.2E-01	mg/kg/day	7.0E-01	mg/kg-day	3.1E-01
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	4.6E-03	mg/kg/day	2.4E-02	mg/kg-day	1.9E-01
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	1.6E-03	mg/kg/day	2.0E-02	mg/kg-day	8.2E-02
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	1.8E-06	mg/kg/day	1.0E-05	mg/kg-day	1.8E-01
			Exp. Route Total								N/A					1.6E+00
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	3.9E-03	mg/kg/day	1.0E+00	mg/kg-day	3.9E-03
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	4.2E-06	mg/kg/day	3.0E-04	mg/kg-day	1.4E-02
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	2.7E-07	mg/kg/day	7.5E-05	mg/kg-day	3.6E-03
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	4.1E-06	mg/kg/day	3.0E-04	mg/kg-day	1.4E-02
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	6.1E-03	mg/kg/day	7.0E-01	mg/kg-day	8.8E-03
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	1.3E-04	mg/kg/day	2.4E-02	mg/kg-day	5.3E-03
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	4.6E-05	mg/kg/day	8.0E-04	mg/kg-day	5.7E-02
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	5.1E-08	mg/kg/day	1.0E-05	mg/kg-day	5.1E-03
			Exp. Route Total								N/A					1.1E-01
		Exposure Point Total									N/A					1.7E+00
	Exposure Medium Total										N/A					1.7E+00
Surface Soil Total											NA					1.7E+00
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	1.9E-04	mg/kg/day	3.0E-04	mg/kg-day	6.4E-01
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	9.6E-05	mg/kg/day	5.0E-04	mg/kg/day	1.9E-01
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	2.3E-02	mg/kg/day	3.0E-04	mg/kg/day	7.8E+01
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	1.7E-02	mg/kg/day	7.0E-01	mg/kg-day	2.5E-02
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	1.9E-02	mg/kg/day	2.4E-02	mg/kg/day	7.9E-01
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	1.9E-03	mg/kg/day	2.0E-02	mg/kg/day	9.7E-02
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	1.2E-05	mg/kg/day	1.0E-05	mg/kg/day	1.2E+00
			Exp. Route Total								N/A					8.1E+01
			Dermal Absorption	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	1.3E-06	mg/kg/day	3.0E-04	mg/kg-day	4.2E-03
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	6.3E-07	mg/kg/day	2.5E-05	mg/kg/day	2.5E-02
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	6.2E-05	mg/kg/day	3.0E-04	mg/kg/day	2.1E-01
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	1.1E-04	mg/kg/day	7.0E-01	mg/kg-day	1.6E-04
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	1.2E-04	mg/kg/day	9.6E-04	mg/kg/day	1.3E-01
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	2.6E-06	mg/kg/day	8.0E-04	mg/kg/day	3.2E-03
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	8.1E-08	mg/kg/day	1.0E-05	mg/kg/day	8.1E-03
			Exp. Route Total								N/A					3.8E-01
		Exposure Point Total									N/A					8.1E+01
	Exposure Medium Total										N/A					8.1E+01
Shallow Aquifer Groundwater Total											N/A					8.1E+01
							Total of Receptor Risks Across All Media				N/A	Total of Receptor Hazards Across All Media				8.3E+01

Notes-

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Table 7.5.RME Supplement A.

Table G7.5.RME Supplement A
Calculation of DAevent
Resident Child Shallow Ground Water
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Water Concentration (CW) (μg/L)	Permeability Coefficient (Kp) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (tevent) (hr)	DAevent (mg/cm^2-event)	Eq
Arsenic	3.0E+00	1.0E-03	N/A	N/A	N/A	N/A	1	3.0E-09	1
Cadmium	1.5E+00	1.0E-03	N/A	N/A	N/A	N/A	1	1.5E-09	1
Cobalt	3.7E+02	4.0E-04	N/A	N/A	N/A	N/A	1	1.5E-07	1
Iron	2.7E+02	1.0E-03	N/A	N/A	N/A	N/A	1	2.7E-07	1
Manganese	3.0E+02	1.0E-03	N/A	N/A	N/A	N/A	1	3.0E-07	1
Nickel	3.0E+01	2.0E-04	N/A	N/A	N/A	N/A	1	6.1E-09	1
Thallium	1.9E-01	1.0E-03	N/A	N/A	N/A	N/A	1	1.9E-10	1

Inorganics: DAevent (mg/cm2-event) =
Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm^3 (eq 1)

Notes:
N/A - Not applicable
Permeability constants and other input parameter values from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

TABLE G7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	1.7E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic	3.9E+00	mg/kg	6.2E-06	mg/kg/day	1.5E+00	mg/kg-day	9.2E-06	N/A		N/A		N/A
				Chromium (VI) [1]	7.6E-01	mg/kg			5.0E-01	mg/kg-day	2.5E-06	N/A		N/A		N/A
				Cobalt	1.2E+01	mg/kg	1.8E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron	1.7E+04	mg/kg	2.7E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese	3.6E+02	mg/kg	5.6E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel	1.3E+02	mg/kg	2.0E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Thallium	1.4E-01	mg/kg	2.2E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								1.2E-05					NA
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	5.4E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic	3.9E+00	mg/kg	5.8E-07	mg/kg/day	1.5E+00	mg/kg-day	8.8E-07	N/A		N/A		N/A
				Chromium (VI) [1]	7.6E-01	mg/kg			2.0E+01	mg/kg-day	3.0E-06	N/A		N/A		N/A
				Cobalt	1.2E+01	mg/kg	5.7E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron	1.7E+04	mg/kg	8.5E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese	3.6E+02	mg/kg	1.8E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel	1.3E+02	mg/kg	6.3E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Thallium	1.4E-01	mg/kg	7.1E-09	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								3.9E-06					NA
		Exposure Point Total									1.6E-05					NA
	Exposure Medium Total										1.6E-05					NA
Surface Soil Total											1.6E-05					NA
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	4.5E-05	mg/kg/day	1.5E+00	mg/kg-day	6.7E-05	N/A		N/A		N/A
				Cadmium	1.5E+00	ug/L	2.2E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cobalt	3.7E+02	ug/L	5.5E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron	2.7E+02	ug/L	4.1E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese	3.0E+02	ug/L	4.4E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel	3.0E+01	ug/L	4.5E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Thallium	1.9E-01	ug/L	2.9E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								6.7E-05					N/A
			Dermal Absorption	Arsenic	3.0E+00	ug/L	2.6E-07	mg/kg/day	1.5E+00	mg/kg-day	3.8E-07	N/A		N/A		N/A
				Cadmium	1.5E+00	ug/L	1.3E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cobalt	3.7E+02	ug/L	1.2E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron	2.7E+02	ug/L	2.3E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese	3.0E+02	ug/L	2.5E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel	3.0E+01	ug/L	5.2E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Thallium	1.9E-01	ug/L	1.6E-08	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								3.8E-07					N/A
		Exposure Point Total									6.8E-05					N/A
	Exposure Medium Total										6.8E-05					N/A
Shallow Aquifer Groundwater Total											6.8E-05					N/A
									Total of Receptor Risks Across All Media		8.3E-05	Total of Receptor Hazards Across All Media				N/A

Notes-

N/A =Not available; Not applicable.

See Table 7.6.RME Supplement A for calculation of intake and cancer risk following MMOA method.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.4.RME and 7.5.RME Supplements A.

TABLE G7.6.RME Supplement A

CALCULATION OF CHEMICAL CANCER RISKS FOR COPC WITH MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations										
							Intake					CSF/Unit Risk					Cancer Risk
					Value	Units	Value				Units	Value				Units	
							0-2 yrs	2-6 yrs	6-16 years	16-30 yrs		0-2 yrs (ADAF=10)	2-6 yrs (ADAF=3)	6-16 yrs (ADAF=3)	16-30 yrs (ADAF=1)		
Surface Soil	Surface Soil	Surface Soil	Ingestion	Chromium (VI)	7.6E-01	mg/kg	2.8E-07	5.5E-07	1.5E-07	2.1E-07	mg/kg/day	5.0E+00	1.5E+00	1.5E+00	5.0E-01	mg/kg/day	2.5E-06
			Dermal	Chromium (VI)	7.6E-01	mg/kg	7.7E-09	1.5E-08	5.9E-09	8.3E-09	mg/kg/day	2.0E+02	6.0E+01	6.0E+01	2.0E+01	mg/kg/day	3.0E-06

Cancer risk = $(Intake_{0-2} \times CSF_{0-2}) + (Intake_{2-6} \times CSF_{2-6}) + (Intake_{6-16} \times CSF_{6-16}) + (Intake_{16-30} \times CSF_{16-30})$

TABLE G7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	2.5E-04	mg/kg/day	N/A		N/A	1.8E-02	mg/kg/day	1.0E+00	mg/kg-day	1.8E-02
				Arsenic	3.9E+00	mg/kg	9.1E-08	mg/kg/day	1.5E+00	mg/kg-day	1.4E-07	6.3E-06	mg/kg/day	3.0E-04	mg/kg-day	2.1E-02
				Chromium (VI)	7.6E-01	mg/kg	1.7E-08	mg/kg/day	5.0E-01	mg/kg-day	8.7E-09	1.2E-06	mg/kg/day	5.0E-03	mg/kg-day	2.4E-04
				Cobalt	1.2E+01	mg/kg	2.7E-07	mg/kg/day	N/A		N/A	1.9E-05	mg/kg/day	3.0E-03	mg/kg-day	6.2E-03
				Iron	1.7E+04	mg/kg	4.0E-04	mg/kg/day	N/A		N/A	2.8E-02	mg/kg/day	7.0E-01	mg/kg-day	4.0E-02
				Manganese	3.6E+02	mg/kg	8.3E-06	mg/kg/day	N/A		N/A	5.8E-04	mg/kg/day	2.4E-02	mg/kg-day	2.4E-02
				Nickel	1.3E+02	mg/kg	3.0E-06	mg/kg/day	N/A		N/A	2.1E-04	mg/kg/day	2.0E-02	mg/kg-day	1.0E-02
				Thallium	1.4E-01	mg/kg	3.3E-09	mg/kg/day	N/A		N/A	2.3E-07	mg/kg/day	1.0E-05	mg/kg-day	2.3E-02
			Exp. Route Total								1.4E-07					1.4E-01
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	7.6E-06	mg/kg/day	N/A		N/A	5.3E-04	mg/kg/day	1.0E+00	mg/kg-day	5.3E-04
				Arsenic	3.9E+00	mg/kg	8.2E-09	mg/kg/day	1.5E+00	mg/kg-day	1.2E-08	5.7E-07	mg/kg/day	3.0E-04	mg/kg-day	1.9E-03
				Chromium (VI)	7.6E-01	mg/kg	5.2E-10	mg/kg/day	2.0E+01	mg/kg-day	1.0E-08	3.7E-08	mg/kg/day	1.3E-04	mg/kg-day	2.8E-04
				Cobalt	1.2E+01	mg/kg	8.0E-09	mg/kg/day	N/A		N/A	5.6E-07	mg/kg/day	3.0E-03	mg/kg-day	1.9E-04
				Iron	1.7E+04	mg/kg	1.2E-05	mg/kg/day	N/A		N/A	8.3E-04	mg/kg/day	7.0E-01	mg/kg-day	1.2E-03
				Manganese	3.6E+02	mg/kg	2.5E-07	mg/kg/day	N/A		N/A	1.7E-05	mg/kg/day	9.6E-04	mg/kg-day	1.8E-02
				Nickel	1.3E+02	mg/kg	8.9E-08	mg/kg/day	N/A		N/A	6.2E-06	mg/kg/day	8.0E-04	mg/kg-day	7.8E-03
				Thallium	1.4E-01	mg/kg	9.9E-11	mg/kg/day	N/A		N/A	6.9E-09	mg/kg/day	1.0E-05	mg/kg-day	6.9E-04
			Exp. Route Total								2.3E-08					3.1E-02
		Exposure Point Total									1.7E-07					1.7E-01
	Exposure Medium Total										1.7E-07					1.7E-01
Surface Soil Total											1.7E-07					1.7E-01
Groundwater	Groundwater	Shallow Aquifer - Water in Excavation Trench	Dermal Absorption	Arsenic	3.0E+00	ug/L	9.6E-09	mg/kg/day	1.5E+00	mg/kg-day	1.4E-08	6.7E-07	mg/kg/day	3.0E-04	mg/kg/day	2.2E-03
				Cadmium	1.5E+00	ug/L	4.8E-09	mg/kg/day	N/A		N/A	3.3E-07	mg/kg/day	2.5E-05	mg/kg/day	1.3E-02
				Cobalt	3.7E+02	ug/L	4.7E-07	mg/kg/day	N/A		N/A	3.3E-05	mg/kg/day	3.0E-03	mg/kg/day	1.1E-02
				Iron	2.7E+02	ug/L	8.7E-07	mg/kg/day	N/A		N/A	6.1E-05	mg/kg/day	7.0E-01	mg/kg/day	8.7E-05
				Manganese	3.0E+02	ug/L	9.4E-07	mg/kg/day	N/A		N/A	6.6E-05	mg/kg/day	9.6E-04	mg/kg/day	6.9E-02
				Nickel	3.0E+01	ug/L	9.7E-08	mg/kg/day	N/A		N/A	6.8E-06	mg/kg/day	8.0E-04	mg/kg/day	8.4E-03
				Thallium	1.9E-01	ug/L	6.1E-10	mg/kg/day	N/A		N/A	4.3E-08	mg/kg/day	1.0E-05	mg/kg/day	4.3E-03
			Exp. Route Total								1.4E-08					1.1E-01
		Exposure Point Total									1.4E-08					1.1E-01
	Exposure Medium Total										1.4E-08					1.1E-01
Shallow Aquifer Groundwater Total											1.4E-08					1.1E-01
									Total of Receptor Risks Across All Media		1.8E-07		Total of Receptor Hazards Across All Media			2.8E-01

Notes-

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Table 7.7.RME Supplement A

Table G7.7.RME Supplement A
Calculation of DAevent
Construction Worker - Shallow Aquifer Groundwater
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	**Water Concentration (CW)** (µg/L)	**Permeability Coefficient (Kp)** (cm/hr)	**B** (dimensionless)	**Lag Time (τ_{event})** (hr)	**t*** (hr)	**Fraction Absorbed Water (FA)** (dimensionless)	**Duration of Event (t_{event})** (hr)	**DA_{event}** (mg/cm^2-event)	**Eq**
Arsenic	3.0E+00	1.0E-03	N/A	N/A	N/A	N/A	8	2.4E-08	1
Cadmium	1.5E+00	1.0E-03	N/A	N/A	N/A	N/A	8	1.2E-08	1
Cobalt	3.7E+02	4.0E-04	N/A	N/A	N/A	N/A	8	1.2E-06	1
Iron	2.7E+02	1.0E-03	N/A	N/A	N/A	N/A	8	2.2E-06	1
Manganese	3.0E+02	1.0E-03	N/A	N/A	N/A	N/A	8	2.4E-06	1
Nickel	3.0E+01	1.0E-03	N/A	N/A	N/A	N/A	8	2.4E-07	1
Thallium	1.9E-01	1.0E-03	N/A	N/A	N/A	N/A	8	1.5E-09	1

Inorganics: DAevent (mg/cm2-event) =
Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm^3 (eq 1)

Notes:
NA - Not applicable
Permeability constants and other input parameter values from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

TABLE G7.8.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Risk	Intake/Exposure Concentration		RfD/RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	3.8E-03	mg/kg/day	N/A		N/A	1.1E-02	mg/kg/day	1.0E+00	mg/kg-day	1.1E-02
				Arsenic	3.9E+00	mg/kg	1.4E-06	mg/kg/day	1.5E+00	mg/kg-day	2.1E-06	3.8E-06	mg/kg/day	3.0E-04	mg/kg-day	1.3E-02
				Chromium (VI)	7.6E-01	mg/kg	2.6E-07	mg/kg/day	5.0E-01	mg/kg-day	1.3E-07	7.4E-07	mg/kg/day	3.0E-03	mg/kg-day	2.5E-04
				Cobalt	1.2E+01	mg/kg	4.0E-06	mg/kg/day	N/A		N/A	1.1E-05	mg/kg/day	3.0E-04	mg/kg-day	3.8E-02
				Iron	1.7E+04	mg/kg	6.0E-03	mg/kg/day	N/A		N/A	1.7E-02	mg/kg/day	7.0E-01	mg/kg-day	2.4E-02
				Manganese	3.6E+02	mg/kg	1.3E-04	mg/kg/day	N/A		N/A	3.5E-04	mg/kg/day	2.4E-02	mg/kg-day	1.5E-02
				Nickel	1.3E+02	mg/kg	4.5E-05	mg/kg/day	N/A		N/A	1.3E-04	mg/kg/day	2.0E-02	mg/kg-day	6.3E-03
				Thallium	1.4E-01	mg/kg	5.0E-08	mg/kg/day	N/A		N/A	1.4E-07	mg/kg/day	1.0E-05	mg/kg-day	1.4E-02
			Exp. Route Total								2.2E-06					1.2E-01
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	1.8E-02	mg/kg/day	N/A		N/A	3.3E-03	mg/kg/day	1.0E+00	mg/kg-day	3.3E-03
				Arsenic	3.9E+00	mg/kg	1.9E-05	mg/kg/day	1.5E+00	mg/kg-day	2.9E-05	3.6E-06	mg/kg/day	3.0E-04	mg/kg-day	1.2E-02
				Chromium (VI)	7.6E-01	mg/kg	1.2E-06	mg/kg/day	2.0E+01	mg/kg-day	2.4E-05	2.3E-07	mg/kg/day	7.5E-05	mg/kg-day	3.0E-03
				Cobalt	1.2E+01	mg/kg	1.9E-05	mg/kg/day	N/A		N/A	3.5E-06	mg/kg/day	3.0E-04	mg/kg-day	1.2E-02
				Iron	1.7E+04	mg/kg	2.8E-02	mg/kg/day	N/A		N/A	5.2E-03	mg/kg/day	7.0E-01	mg/kg-day	7.4E-03
				Manganese	3.6E+02	mg/kg	5.8E-04	mg/kg/day	N/A		N/A	1.1E-04	mg/kg/day	2.4E-02	mg/kg-day	4.5E-03
				Nickel	1.3E+02	mg/kg	2.1E-04	mg/kg/day	N/A		N/A	3.9E-05	mg/kg/day	8.0E-04	mg/kg-day	4.8E-02
				Thallium	1.4E-01	mg/kg	2.3E-07	mg/kg/day	N/A		N/A	4.3E-08	mg/kg/day	1.0E-05	mg/kg-day	4.3E-03
			Exp. Route Total								5.3E-05					9.4E-02
		Exposure Point Total									5.3E-05					9.4E-02
	Exposure Medium Total										5.3E-05					9.4E-02
Surface Soil Total											5.5E-05					2.1E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	1.0E-05	mg/kg/day	1.5E+00		1.6E-05	2.9E-05	mg/kg/day	3.0E-04	mg/kg/day	9.8E-02
				Cadmium	1.5E+00	ug/L	5.2E-06	mg/kg/day	N/A		N/A	1.5E-05	mg/kg/day	5.0E-04	mg/kg/day	2.9E-02
				Cobalt	3.7E+02	ug/L	1.3E-03	mg/kg/day	N/A		N/A	3.6E-03	mg/kg/day	3.0E-04	mg/kg/day	1.2E+01
				Iron	2.7E+02	ug/L	9.5E-04	mg/kg/day	N/A		N/A	2.7E-03	mg/kg/day	7.0E-01	mg/kg/day	3.8E-03
				Manganese	3.0E+02	ug/L	1.0E-03	mg/kg/day	N/A		N/A	2.9E-03	mg/kg/day	2.4E-02	mg/kg/day	1.2E-01
				Nickel	3.0E+01	ug/L	1.1E-04	mg/kg/day	N/A		N/A	3.0E-04	mg/kg/day	2.0E-02	mg/kg/day	1.5E-02
				Thallium	1.9E-01	ug/L	6.7E-07	mg/kg/day	N/A		N/A	1.9E-06	mg/kg/day	1.0E-05	mg/kg/day	1.9E-01
			Exp. Route Total								1.6E-05					1.2E+01
	Exposure Medium Total										1.6E-05					1.2E+01
Shallow Aquifer Groundwater Total											1.6E-05					1.2E+01
										Total of Receptor Risks Across All Media	7.1E-05				Total of Receptor Hazards Across All Media	1.3E+01

Notes-
N/A =Not available; Not applicable.

TABLE G7.1.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	5.0E-03	mg/kg/day	1.0E+00	mg/kg-day	5.0E-03
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	1.8E-06	mg/kg/day	3.0E-04	mg/kg-day	6.0E-03
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	3.5E-07	mg/kg/day	3.0E-03	mg/kg-day	1.2E-04
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	5.3E-06	mg/kg/day	3.0E-04	mg/kg-day	1.8E-02
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	7.9E-03	mg/kg/day	7.0E-01	mg/kg-day	1.1E-02
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	1.6E-04	mg/kg/day	2.4E-02	mg/kg-day	6.8E-03
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	5.9E-05	mg/kg/day	2.0E-02	mg/kg-day	2.9E-03
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	6.5E-08	mg/kg/day	1.0E-05	mg/kg-day	6.5E-03
			Exp. Route Total								N/A					5.6E-02
			Dermal Absorption[1]	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	5.7E-05	mg/kg/day	1.0E+00	mg/kg-day	5.7E-05
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	6.2E-08	mg/kg/day	3.0E-04	mg/kg-day	2.1E-04
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	4.0E-09	mg/kg/day	7.5E-05	mg/kg-day	5.3E-05
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	6.0E-08	mg/kg/day	3.0E-04	mg/kg-day	2.0E-04
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	9.0E-05	mg/kg/day	7.0E-01	mg/kg-day	1.3E-04
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	1.9E-06	mg/kg/day	2.4E-02	mg/kg-day	7.8E-05
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	6.7E-07	mg/kg/day	8.0E-04	mg/kg-day	8.4E-04
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	7.5E-10	mg/kg/day	1.0E-05	mg/kg-day	7.5E-05
			Exp. Route Total								N/A					1.6E-03
		Exposure Point Total									N/A					5.8E-02
	Exposure Medium Total										N/A					5.8E-02
Surface Soil Total											NA					5.8E-02
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	3.8E-05	mg/kg/day	3.0E-04	mg/kg-day	1.3E-01
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	1.9E-05	mg/kg/day	5.0E-04	mg/kg-day	3.8E-02
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	4.7E-03	mg/kg/day	3.0E-04	mg/kg-day	1.6E+01
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	3.5E-03	mg/kg/day	7.0E-01	mg/kg-day	5.0E-03
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	3.8E-03	mg/kg/day	2.4E-02	mg/kg-day	1.6E-01
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	3.9E-04	mg/kg/day	2.0E-02	mg/kg-day	1.9E-02
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	2.5E-06	mg/kg/day	1.0E-05	mg/kg-day	2.5E-01
			Exp. Route Total								N/A					1.6E+01
			Dermal Absorption	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	1.2E-07	mg/kg/day	3.0E-04	mg/kg-day	4.1E-04
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	6.2E-08	mg/kg/day	2.5E-05	mg/kg-day	2.5E-03
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	6.0E-06	mg/kg/day	3.0E-04	mg/kg-day	2.0E-02
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	1.1E-05	mg/kg/day	7.0E-01	mg/kg-day	1.6E-05
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	1.2E-05	mg/kg/day	9.6E-04	mg/kg-day	1.3E-02
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	2.5E-07	mg/kg/day	8.0E-04	mg/kg-day	3.1E-04
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	7.9E-09	mg/kg/day	1.0E-05	mg/kg-day	7.9E-04
			Exp. Route Total								N/A					3.7E-02
		Exposure Point Total									N/A					1.6E+01
	Exposure Medium Total										N/A					1.6E+01
Shallow Aquifer Groundwater Total											N/A					1.6E+01
									Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		1.6E+01

Notes-

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Table 7.1.CTE Supplement A.

Table G7.1.CTE Supplement A
Calculation of DAevent
Resident Adult Shallow Ground Water
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Water Concentration (CW) (μg/L)	Permeability Coefficient (Kp) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (tevent) (hr)	DAevent (mg/cm^2-event)	Eq
Arsenic	3.0E+00	1.0E-03	N/A	N/A	N/A	N/A	0.25	7.5E-10	1
Cadmium	1.5E+00	1.0E-03	N/A	N/A	N/A	N/A	0.25	3.8E-10	1
Cobalt	3.7E+02	4.0E-04	N/A	N/A	N/A	N/A	0.25	3.7E-08	1
Iron	2.7E+02	1.0E-03	N/A	N/A	N/A	N/A	0.25	6.8E-08	1
Manganese	3.0E+02	1.0E-03	N/A	N/A	N/A	N/A	0.25	7.4E-08	1
Nickel	3.0E+01	2.0E-04	N/A	N/A	N/A	N/A	0.25	1.5E-09	1
Thallium	1.9E-01	1.0E-03	N/A	N/A	N/A	N/A	0.25	4.8E-11	1

Inorganics: DAevent (mg/cm2-event) =
Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm^3 (eq 1)

Notes:
N/A - Not applicable
Permeability constants and other input parameter values from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

TABLE G7.2.CTE

CENTRAL TENDENCY EXPOSURE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

Stump Neck SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	RfD/RfC Value	RfD/RfC Units	Quotient
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	4.7E-02	mg/kg/day	1.0E+00	mg/kg-day	4.7E-02
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	1.7E-05	mg/kg/day	3.0E-04	mg/kg-day	5.6E-02
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	3.2E-06	mg/kg/day	3.0E-03	mg/kg-day	1.1E-03
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	4.9E-05	mg/kg/day	3.0E-04	mg/kg-day	1.6E-01
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	7.3E-02	mg/kg/day	7.0E-01	mg/kg-day	1.0E-01
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	1.5E-03	mg/kg/day	2.4E-02	mg/kg-day	6.4E-02
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	5.5E-04	mg/kg/day	2.0E-02	mg/kg-day	2.7E-02
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	6.1E-07	mg/kg/day	1.0E-05	mg/kg-day	6.1E-02
			Exp. Route Total								N/A					5.3E-01
			Dermal Absorption[1]	Aluminum	1.1E+04	mg/kg	N/A		N/A		N/A	5.2E-04	mg/kg/day	1.0E+00	mg/kg-day	5.2E-04
				Arsenic	3.9E+00	mg/kg	N/A		N/A		N/A	5.6E-07	mg/kg/day	3.0E-04	mg/kg-day	1.9E-03
				Chromium (VI)	7.6E-01	mg/kg	N/A		N/A		N/A	3.6E-08	mg/kg/day	7.5E-05	mg/kg-day	4.8E-04
				Cobalt	1.2E+01	mg/kg	N/A		N/A		N/A	5.5E-07	mg/kg/day	3.0E-04	mg/kg-day	1.8E-03
				Iron	1.7E+04	mg/kg	N/A		N/A		N/A	8.2E-04	mg/kg/day	7.0E-01	mg/kg-day	1.2E-03
				Manganese	3.6E+02	mg/kg	N/A		N/A		N/A	1.7E-05	mg/kg/day	2.4E-02	mg/kg-day	7.1E-04
				Nickel	1.3E+02	mg/kg	N/A		N/A		N/A	6.1E-06	mg/kg/day	8.0E-04	mg/kg-day	7.7E-03
				Thallium	1.4E-01	mg/kg	N/A		N/A		N/A	6.8E-09	mg/kg/day	1.0E-05	mg/kg-day	6.8E-04
			Exp. Route Total								N/A					1.5E-02
		Exposure Point Total									N/A					5.4E-01
	Exposure Medium Total										N/A					5.4E-01
Surface Soil Total											NA					5.4E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	1.3E-04	mg/kg/day	3.0E-04	mg/kg-day	4.3E-01
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	6.4E-05	mg/kg/day	5.0E-04	mg/kg-day	1.3E-01
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	1.6E-02	mg/kg/day	3.0E-04	mg/kg-day	5.2E+01
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	1.2E-02	mg/kg/day	7.0E-01	mg/kg-day	1.7E-02
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	1.3E-02	mg/kg/day	2.4E-02	mg/kg-day	5.3E-01
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	1.3E-03	mg/kg/day	2.0E-02	mg/kg-day	6.5E-02
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	8.2E-06	mg/kg/day	1.0E-05	mg/kg-day	8.2E-01
			Exp. Route Total								N/A					5.4E+01
			Dermal Absorption	Arsenic	3.0E+00	ug/L	N/A		N/A		N/A	2.8E-07	mg/kg/day	3.0E-04	mg/kg-day	9.3E-04
				Cadmium	1.5E+00	ug/L	N/A		N/A		N/A	1.4E-07	mg/kg/day	2.5E-05	mg/kg-day	5.6E-03
				Cobalt	3.7E+02	ug/L	N/A		N/A		N/A	1.4E-05	mg/kg/day	3.0E-04	mg/kg-day	4.5E-02
				Iron	2.7E+02	ug/L	N/A		N/A		N/A	2.5E-05	mg/kg/day	7.0E-01	mg/kg-day	3.6E-05
				Manganese	3.0E+02	ug/L	N/A		N/A		N/A	2.8E-05	mg/kg/day	9.6E-04	mg/kg-day	2.9E-02
				Nickel	3.0E+01	ug/L	N/A		N/A		N/A	5.6E-07	mg/kg/day	8.0E-04	mg/kg-day	7.0E-04
				Thallium	1.9E-01	ug/L	N/A		N/A		N/A	1.8E-08	mg/kg/day	1.0E-05	mg/kg-day	1.8E-03
			Exp. Route Total								N/A					8.3E-02
		Exposure Point Total									N/A					5.4E+01
	Exposure Medium Total										N/A					5.4E+01
Shallow Aquifer Groundwater Total											N/A					5.4E+01
									Total of Receptor Risks Across All Media		N/A		Total of Receptor Hazards Across All Media			5.5E+01

Notes-

N/A =Not available; Not applicable.

Dermal absorption factors (DABS) used to calculated dermal absorption intake from soil are chemical specific.

DABS of 0.03 used for arsenic, DABS of 0.01 used for all other inorganics.

DA_{event} for dermal exposure to groundwater calculated on Table 7.2.CTE Supplement A.

Table G7.2.CTE Supplement A
Calculation of DAevent
Resident Child Shallow Ground Water
Stump Neck SWMU 14
NSF-HI, Indian Head, Maryland

Chemical of Potential Concern	Water Concentration (CW) (μg/L)	Permeability Coefficient (Kp) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (tevent) (hr)	DAevent (mg/cm^2-event)	Eq
Arsenic	3.0E+00	1.0E-03	N/A	N/A	N/A	N/A	0.33	9.9E-10	1
Cadmium	1.5E+00	1.0E-03	N/A	N/A	N/A	N/A	0.33	5.0E-10	1
Cobalt	3.7E+02	4.0E-04	N/A	N/A	N/A	N/A	0.33	4.8E-08	1
Iron	2.7E+02	1.0E-03	N/A	N/A	N/A	N/A	0.33	9.0E-08	1
Manganese	3.0E+02	1.0E-03	N/A	N/A	N/A	N/A	0.33	9.8E-08	1
Nickel	3.0E+01	2.0E-04	N/A	N/A	N/A	N/A	0.33	2.0E-09	1
Thallium	1.9E-01	1.0E-03	N/A	N/A	N/A	N/A	0.33	6.3E-11	1

Inorganics: DAevent (mg/cm2-event) =
Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm^3 (eq 1)

Notes:
N/A - Not applicable
Permeability constants and other input parameter values from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

TABLE G7.3.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1.1E+04	mg/kg	6.0E-04	mg/kg/day	N/A		N/A	4.7E-03	mg/kg/day	1.0E+00	mg/kg-day	4.7E-03
				Arsenic	3.9E+00	mg/kg	2.2E-07	mg/kg/day	1.5E+00	mg/kg-day	3.3E-07	1.7E-06	mg/kg/day	3.0E-04	mg/kg-day	5.6E-03
				Chromium (VI)	7.6E-01	mg/kg	4.2E-08	mg/kg/day	5.0E-01	mg/kg-day	2.1E-08	3.2E-07	mg/kg/day	3.0E-03	mg/kg-day	1.1E-04
				Cobalt	1.2E+01	mg/kg	6.4E-07	mg/kg/day	N/A		N/A	4.9E-06	mg/kg/day	3.0E-04	mg/kg-day	1.6E-02
				Iron	1.7E+04	mg/kg	9.5E-04	mg/kg/day	N/A		N/A	7.4E-03	mg/kg/day	7.0E-01	mg/kg-day	1.1E-02
				Manganese	3.6E+02	mg/kg	2.0E-05	mg/kg/day	N/A		N/A	1.5E-04	mg/kg/day	2.4E-02	mg/kg-day	6.4E-03
				Nickel	1.3E+02	mg/kg	7.1E-06	mg/kg/day	N/A		N/A	5.5E-05	mg/kg/day	2.0E-02	mg/kg-day	2.8E-03
				Thallium	1.4E-01	mg/kg	7.9E-09	mg/kg/day	N/A		N/A	6.1E-08	mg/kg/day	1.0E-05	mg/kg-day	6.1E-03
			Exp. Route Total								3.5E-07					5.3E-02
			Dermal Absorption	Aluminum	1.1E+04	mg/kg	5.6E-04	mg/kg/day	N/A		N/A	2.9E-04	mg/kg/day	1.0E+00	mg/kg-day	2.9E-04
				Arsenic	3.9E+00	mg/kg	6.0E-07	mg/kg/day	1.5E+00	mg/kg-day	9.0E-07	3.1E-07	mg/kg/day	3.0E-04	mg/kg-day	1.0E-03
				Chromium (VI)	7.6E-01	mg/kg	3.9E-08	mg/kg/day	2.0E+01	mg/kg-day	7.7E-07	2.0E-08	mg/kg/day	7.5E-05	mg/kg-day	2.7E-04
				Cobalt	1.2E+01	mg/kg	5.9E-07	mg/kg/day	N/A		N/A	3.0E-07	mg/kg/day	3.0E-04	mg/kg-day	1.0E-03
				Iron	1.7E+04	mg/kg	8.7E-04	mg/kg/day	N/A		N/A	4.5E-04	mg/kg/day	7.0E-01	mg/kg-day	6.5E-04
				Manganese	3.6E+02	mg/kg	1.8E-05	mg/kg/day	N/A		N/A	9.4E-06	mg/kg/day	2.4E-02	mg/kg-day	3.9E-04
				Nickel	1.3E+02	mg/kg	6.5E-06	mg/kg/day	N/A		N/A	3.4E-06	mg/kg/day	8.0E-04	mg/kg-day	4.2E-03
				Thallium	1.4E-01	mg/kg	7.3E-09	mg/kg/day	N/A		N/A	3.8E-09	mg/kg/day	1.0E-05	mg/kg-day	3.8E-04
			Exp. Route Total								1.7E-06					8.3E-03
		Exposure Point Total									2.0E-06					6.1E-02
	Exposure Medium Total										2.0E-06					6.1E-02
Surface Soil Total											2.0E-06					6.1E-02
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Ingestion	Arsenic	3.0E+00	ug/L	3.3E-06	mg/kg/day	1.5E+00		5.0E-06	2.6E-05	mg/kg/day	3.0E-04	mg/kg/day	8.6E-02
				Cadmium	1.5E+00	ug/L	1.7E-06	mg/kg/day	N/A		N/A	1.3E-05	mg/kg/day	5.0E-04	mg/kg/day	2.6E-02
				Cobalt	3.7E+02	ug/L	4.0E-04	mg/kg/day	N/A		N/A	3.1E-03	mg/kg/day	3.0E-04	mg/kg/day	1.0E+01
				Iron	2.7E+02	ug/L	3.0E-04	mg/kg/day	N/A		N/A	2.3E-03	mg/kg/day	7.0E-01	mg/kg/day	3.3E-03
				Manganese	3.0E+02	ug/L	3.3E-04	mg/kg/day	N/A		N/A	2.5E-03	mg/kg/day	2.4E-02	mg/kg/day	1.1E-01
				Nickel	3.0E+01	ug/L	3.3E-05	mg/kg/day	N/A		N/A	2.6E-04	mg/kg/day	2.0E-02	mg/kg/day	1.3E-02
				Thallium	1.9E-01	ug/L	2.1E-07	mg/kg/day	N/A		N/A	1.6E-06	mg/kg/day	1.0E-05	mg/kg/day	1.6E-01
			Exp. Route Total								5.0E-06					1.1E+01
	Exposure Medium Total										5.0E-06					1.1E+01
Shallow Aquifer Groundwater Total											5.0E-06					1.1E+01
									Total of Receptor Risks Across All Media		7.0E-06			Total of Receptor Hazards Across All Medi		1.1E+01

Notes-

N/A =Not available; Not applicable.

TABLE G9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	1E-02	N/A	7E-04	1E-02
			Arsenic	2E-06	N/A	4E-07	2E-06	Skin, Vascular	1E-02	N/A	3E-03	2E-02
			Chromium (VI)	1E-07	N/A	3E-07	5E-07	NOE	2E-04	N/A	7E-04	9E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	4E-02	N/A	2E-03	4E-02
			Iron	N/A	N/A	N/A	N/A	GI System	2E-02	N/A	2E-03	3E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	1E-02	N/A	1E-03	2E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	6E-03	N/A	1E-02	2E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	1E-02	N/A	9E-04	1E-02
			Chemical Total	2E-06	N/A	8E-07	3E-06		1E-01	N/A	2E-02	1E-01
		Exposure Point Total					3E-06					1E-01
	Exposure Medium Total						3E-06					1E-01
Surface Soil Total							3E-06					1E-01
Receptor Total							3E-06				Receptor HI Total	1E-01

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	3E-02
Total Skin HI Across All Media =	2E-02
Total Vascular HI Across All Media =	2E-02
Total Thyroid HI Across All Media =	4E-02
Total GI System HI Across All Media =	3E-02
Total Decreased Body and Organ Weight HI Across All Media =	2E-02
Total Hair HI Across All Media =	1E-02

TABLE G9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	2E-03	N/A	9E-05	2E-03
			Arsenic	4E-07	N/A	5E-08	5E-07	Skin, Vascular	3E-03	N/A	3E-04	3E-03
			Chromium (VI)	3E-08	N/A	4E-08	7E-08	NOE	5E-05	N/A	8E-05	1E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	8E-03	N/A	3E-04	8E-03
			Iron	N/A	N/A	N/A	N/A	GI System	5E-03	N/A	2E-04	5E-03
			Manganese	N/A	N/A	N/A	N/A	CNS	3E-03	N/A	1E-04	3E-03
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	1E-03	N/A	1E-03	3E-03
			Thallium	N/A	N/A	N/A	N/A	Hair	3E-03	N/A	1E-04	3E-03
			Chemical Total	4E-07	N/A	9E-08	5E-07		3E-02	N/A	3E-03	3E-02
		Exposure Point Total					5E-07					3E-02
	Exposure Medium Total						5E-07					3E-02
Surface Soil Total							5E-07					3E-02
Receptor Total							5E-07				Receptor HI Total	3E-02

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	5E-03
Total Skin HI Across All Media =	3E-03
Total Vascular HI Across All Media =	3E-03
Total Thyroid HI Across All Media =	8E-03
Total GI System HI Across All Media =	5E-03
Total Decreased Body and Organ Weight HI Across All Media =	3E-03
Total Hair HI Across All Media =	3E-03

TABLE G9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	3E-03	N/A	3E-04	3E-03
			Arsenic	2E-07	N/A	7E-08	3E-07	Skin, Vascular	4E-03	N/A	1E-03	5E-03
			Chromium (VI)	1E-08	N/A	6E-08	8E-08	NOE	7E-05	N/A	3E-04	4E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	1E-02	N/A	1E-03	1E-02
			Iron	N/A	N/A	N/A	N/A	GI System	7E-03	N/A	8E-04	8E-03
			Manganese	N/A	N/A	N/A	N/A	CNS	4E-03	N/A	5E-04	5E-03
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	2E-03	N/A	5E-03	7E-03
			Thallium	N/A	N/A	N/A	N/A	Hair	4E-03	N/A	5E-04	4E-03
			Chemical Total	2E-07	N/A	1E-07	4E-07		3E-02	N/A	1E-02	4E-02
		Exposure Point Total					4E-07					4E-02
	Exposure Medium Total						4E-07					4E-02
Surface Soil Total							4E-07					4E-02
Receptor Total							4E-07				Receptor HI Total	4E-02

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	8E-03
Total Skin HI Across All Media =	5E-03
Total Vascular HI Across All Media =	5E-03
Total Thyroid HI Across All Media =	1E-02
Total GI System HI Across All Media =	8E-03
Total Decreased Body and Organ Weight HI Across All Media =	7E-03
Total Hair HI Across All Media =	4E-03

TABLE G9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	1E-02	N/A	6E-04	2E-02
			Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	2E-02	N/A	2E-03	2E-02
			Chromium (VI)	N/A	N/A	N/A	N/A	NOE	3E-04	N/A	6E-04	9E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	5E-02	N/A	2E-03	5E-02
			Iron	N/A	N/A	N/A	N/A	GI System	3E-02	N/A	1E-03	3E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-02	N/A	8E-04	2E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	9E-03	N/A	9E-03	2E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-02	N/A	8E-04	2E-02
			Chemical Total	N/A	N/A	N/A	N/A		2E-01	N/A	2E-02	2E-01
		Exposure Point Total					N/A					2E-01
	Exposure Medium Total						N/A					2E-01
Surface Soil Total							NA					2E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	3E-01	N/A	1E-03	3E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	8E-02	N/A	9E-03	9E-02
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	3E+01	N/A	7E-02	3E+01
			Iron	N/A	N/A	N/A	N/A	GI System	1E-02	N/A	6E-05	1E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	3E-01	N/A	4E-02	4E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	4E-02	N/A	1E-03	4E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	5E-01	N/A	3E-03	5E-01
			Chemical Total	N/A	N/A	N/A	N/A		3E+01	NA	1E-01	3E+01
		Exposure Point Total					N/A					3E+01
	Exposure Medium Total						N/A					3E+01
Shallow Aquifer Groundwater Total							N/A					3E+01
Receptor Total							N/A	Receptor HI Total				3E+01

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	4E-01
Total Skin HI Across All Media =	3E-01
Total Vascular HI Across All Media =	3E-01
Total Thyroid HI Across All Media =	**3E+01**
Total GI System HI Across All Media =	5E-02
Total Decreased Body and Organ Weight HI Across All Media =	6E-02
Total Hair HI Across All Media =	5E-01
Total Kidney HI Across All Media =	9E-02

TABLE G9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	1E-01	N/A	4E-03	1E-01
			Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	2E-01	N/A	1E-02	2E-01
			Chromium (VI)	N/A	N/A	N/A	N/A	NOE	3E-03	N/A	4E-03	7E-03
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	5E-01	N/A	1E-02	5E-01
			Iron	N/A	N/A	N/A	N/A	GI System	3E-01	N/A	9E-03	3E-01
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-01	N/A	5E-03	2E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	8E-02	N/A	6E-02	1E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	5E-03	2E-01
			Chemical Total	N/A	N/A	N/A	N/A		2E+00	NA	1E-01	2E+00
		Exposure Point Total					N/A					2E+00
	Exposure Medium Total						N/A					2E+00
Surface Soil Total							NA					2E+00
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	6E-01	N/A	4E-03	6E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	2E-01	N/A	3E-02	2E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	8E+01	N/A	2E-01	8E+01
			Iron	N/A	N/A	N/A	N/A	GI System	2E-02	N/A	2E-04	3E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	8E-01	N/A	1E-01	9E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	1E-01	N/A	3E-03	1E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	1E+00	N/A	8E-03	1E+00
			Chemical Total	N/A	N/A	N/A	N/A		8E+01	NA	4E-01	8E+01
		Exposure Point Total					N/A					8E+01
	Exposure Medium Total						N/A					8E+01
Shallow Aquifer Groundwater Total							N/A					8E+01
Receptor Total							N/A				Receptor HI Total	8E+01

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	1E+00
Total Skin HI Across All Media =	8E-01
Total Vascular HI Across All Media =	8E-01
Total Thyroid HI Across All Media =	**8E+01**
Total GI System HI Across All Media =	3E-01
Total Decreased Body and Organ Weight HI Across All Media =	2E-01
Total Hair HI Across All Media =	1E+00
Total Kidney HI Across All Media =	2E-01

TABLE G9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	N/A	N/A	N/A	N/A
			Arsenic	9E-06	N/A	9E-07	1E-05	Skin, Vascular	N/A	N/A	N/A	N/A
			Chromium (VI)	3E-06	N/A	3E-06	6E-06	NOE	N/A	N/A	N/A	N/A
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	N/A	N/A	N/A	N/A
			Iron	N/A	N/A	N/A	N/A	GI System	N/A	N/A	N/A	N/A
			Manganese	N/A	N/A	N/A	N/A	CNS	N/A	N/A	N/A	N/A
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	N/A	N/A	N/A	N/A
			Thallium	N/A	N/A	N/A	N/A	Hair	N/A	N/A	N/A	N/A
			Chemical Total	1E-05	N/A	4E-06	2E-05		N/A	N/A	N/A	N/A
		Exposure Point Total					2E-05					N/A
	Exposure Medium Total						2E-05					N/A
Surface Soil Total							2E-05					N/A
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	7E-05	N/A	4E-07	7E-05	Skin, Vascular	N/A	N/A	N/A	N/A
			Cadmium	N/A	N/A	N/A	N/A	Kidney	N/A	N/A	N/A	N/A
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	N/A	N/A	N/A	N/A
			Iron	N/A	N/A	N/A	N/A	GI System	N/A	N/A	N/A	N/A
			Manganese	N/A	N/A	N/A	N/A	CNS	N/A	N/A	N/A	N/A
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	N/A	N/A	N/A	N/A
			Thallium	N/A	N/A	N/A	N/A	Hair	N/A	N/A	N/A	N/A
			Chemical Total	7E-05	N/A	4E-07	7E-05		N/A	N/A	N/A	N/A
		Exposure Point Total					7E-05					N/A
	Exposure Medium Total						7E-05					N/A
Shallow Aquifer Groundwater Total							7E-05					N/A
Receptor Total							8E-05				Receptor HI Total	N/A

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

TABLE G9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	2E-02	N/A	5E-04	2E-02
			Arsenic	1E-07	N/A	1E-08	1E-07	Skin	2E-02	N/A	2E-03	2E-02
			Chromium (VI)	9E-09	N/A	1E-08	2E-08	Blood	2E-04	N/A	3E-04	5E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	6E-03	N/A	2E-04	6E-03
			Iron	N/A	N/A	N/A	N/A	GI System	4E-02	N/A	1E-03	4E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-02	N/A	2E-02	4E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	1E-02	N/A	8E-03	2E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-02	N/A	7E-04	2E-02
			Chemical Total	1E-07	N/A	2E-08	2E-07		1E-01	NA	3E-02	2E-01
		Exposure Point Total					2E-07					2E-01
	Exposure Medium Total						2E-07					2E-01
Surface Soil Total							2E-07					2E-01
Groundwater	Groundwater	Shallow Aquifer - Water in Excavation	Arsenic	N/A	N/A	1E-08	1E-08	Skin	N/A	N/A	2E-03	2E-03
			Cadmium	N/A	N/A	N/A	N/A	Kidney	N/A	N/A	1E-02	1E-02
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	N/A	N/A	1E-02	1E-02
			Iron	N/A	N/A	N/A	N/A	GI System	N/A	N/A	9E-05	9E-05
			Manganese	N/A	N/A	N/A	N/A	CNS	N/A	N/A	7E-02	7E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	N/A	N/A	8E-03	8E-03
			Thallium	N/A	N/A	N/A	N/A	Hair	N/A	N/A	4E-03	4E-03
			Chemical Total	N/A	N/A	1E-08	1E-08		N/A	N/A	1E-01	1E-01
		Exposure Point Total					1E-08					1E-01
	Exposure Medium Total						1E-08					1E-01
Shallow Aquifer Groundwater Total							1E-08					1E-01
Receptor Total							2E-07				Receptor HI Total	3E-01

Notes:

N/A = Not applicable

GI = Gastrointestinal

HI = Hazard Index

CNS = Central Nervous System

Total Blood HI Across All Media =	5E-04
Total Neurological and CNS HI Across All Media =	1E-01
Total Skin HI Across All Media =	3E-02
Total Thyroid HI Across All Media =	2E-02
Total GI System HI Across All Media =	4E-02
Total Decreased Body and Organ Weight HI Across All Media =	3E-02
Total Hair HI Across All Media =	3E-02
Total Kidney HI Across All Media =	1E-02

TABLE G9.8.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	1E-02	N/A	3E-03	1E-02
			Arsenic	2E-06	N/A	3E-05	3E-05	Skin, Vascular	1E-02	N/A	1E-02	2E-02
			Chromium (VI)	1E-07	N/A	2E-05	2E-05	NOE	2E-04	N/A	3E-03	3E-03
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	4E-02	N/A	1E-02	5E-02
			Iron	N/A	N/A	N/A	N/A	GI System	2E-02	N/A	7E-03	3E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	1E-02	N/A	4E-03	2E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	6E-03	N/A	5E-02	5E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	1E-02	N/A	4E-03	2E-02
			Chemical Total	2E-06	N/A	5E-05	6E-05		1E-01	N/A	9E-02	2E-01
		Exposure Point Total					6E-05					2E-01
	Exposure Medium Total						6E-05					2E-01
Surface Soil Total							6E-05					2E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	2E-05	N/A	N/A	2E-05	Skin, Vascular	1E-01	N/A	N/A	1E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	3E-02	N/A	N/A	3E-02
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	1E+01	N/A	N/A	1E+01
			Iron	N/A	N/A	N/A	N/A	GI System	4E-03	N/A	N/A	4E-03
			Manganese	N/A	N/A	N/A	N/A	CNS	1E-01	N/A	N/A	1E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	1E-02	N/A	N/A	1E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	N/A	2E-01
			Chemical Total	2E-05	N/A	N/A	2E-05		1E+01	NA	N/A	1E+01
		Exposure Point Total					2E-05					1E+01
	Exposure Medium Total						2E-05					1E+01
Shallow Aquifer Groundwater Total							2E-05					1E+01
Receptor Total							7E-05				Receptor HI Total	1E+01

Notes:

N/A = Not applicable

GI = Gastrointestinal

HI = Hazard Index

CNS = Central Nervous System

NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	2E-01
Total Skin HI Across All Media =	1E-01
Total Vascular HI Across All Media =	1E-01
Total Thyroid HI Across All Media =	**1E+01**
Total GI System HI Across All Media =	4E-02
Total Decreased Body and Organ Weight HI Across All Media =	7E-02
Total Hair HI Across All Media =	2E-01
Total Kidney HI Across All Media =	3E-02

TABLE G9.1.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	5E-03	N/A	6E-05	5E-03
			Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	6E-03	N/A	2E-04	6E-03
			Chromium (VI)	N/A	N/A	N/A	N/A	NOE	1E-04	N/A	5E-05	2E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	2E-02	N/A	2E-04	2E-02
			Iron	N/A	N/A	N/A	N/A	GI System	1E-02	N/A	1E-04	1E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	7E-03	N/A	8E-05	7E-03
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	3E-03	N/A	8E-04	4E-03
			Thallium	N/A	N/A	N/A	N/A	Hair	7E-03	N/A	7E-05	7E-03
			Chemical Total	N/A	N/A	N/A	N/A		6E-02	N/A	2E-03	6E-02
		Exposure Point Total					N/A					6E-02
	Exposure Medium Total						N/A					6E-02
Surface Soil Total							NA					6E-02
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	1E-01	N/A	4E-04	1E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	4E-02	N/A	2E-03	4E-02
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	2E+01	N/A	2E-02	2E+01
			Iron	N/A	N/A	N/A	N/A	GI System	5E-03	N/A	2E-05	5E-03
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-01	N/A	1E-02	2E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	2E-02	N/A	3E-04	2E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	8E-04	2E-01
			Chemical Total	N/A	N/A	N/A	N/A		2E+01	NA	4E-02	2E+01
		Exposure Point Total					N/A					2E+01
	Exposure Medium Total						N/A					2E+01
Shallow Aquifer Groundwater Total							N/A					2E+01
Receptor Total							N/A				Receptor HI Total	2E+01

Notes:

N/A = Not applicable

GI = Gastrointestinal

HI = Hazard Index

CNS = Central Nervous System

NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	2E-01
Total Skin HI Across All Media =	1E-01
Total Vascular HI Across All Media =	1E-01
Total Thyroid HI Across All Media =	**2E+01**
Total GI System HI Across All Media =	2E-02
Total Decreased Body and Organ Weight HI Across All Media =	2E-02
Total Hair HI Across All Media =	3E-01
Total Kidney HI Across All Media =	4E-02

TABLE G9.2.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	5E-02	N/A	5E-04	5E-02
			Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	6E-02	N/A	2E-03	6E-02
			Chromium (VI)	N/A	N/A	N/A	N/A	NOE	1E-03	N/A	5E-04	2E-03
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	2E-01	N/A	2E-03	2E-01
			Iron	N/A	N/A	N/A	N/A	GI System	1E-01	N/A	1E-03	1E-01
			Manganese	N/A	N/A	N/A	N/A	CNS	6E-02	N/A	7E-04	6E-02
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	3E-02	N/A	8E-03	4E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	6E-02	N/A	7E-04	6E-02
			Chemical Total	N/A	N/A	N/A	N/A		5E-01	N/A	1E-02	5E-01
		Exposure Point Total					N/A					5E-01
	Exposure Medium Total						N/A					5E-01
Surface Soil Total							NA					5E-01
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	4E-01	N/A	9E-04	4E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	1E-01	N/A	6E-03	1E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	5E+01	N/A	5E-02	5E+01
			Iron	N/A	N/A	N/A	N/A	GI System	2E-02	N/A	4E-05	2E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	5E-01	N/A	3E-02	6E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	6E-02	N/A	7E-04	7E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	8E-01	N/A	2E-03	8E-01
			Chemical Total	N/A	N/A	N/A	N/A		5E+01	NA	8E-02	5E+01
		Exposure Point Total					N/A					5E+01
	Exposure Medium Total						N/A					5E+01
Shallow Aquifer Groundwater Total							N/A					5E+01
Receptor Total							N/A				Receptor HI Total	5E+01

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	7E-01
Total Skin HI Across All Media =	5E-01
Total Vascular HI Across All Media =	5E-01
Total Thyroid HI Across All Media =	**5E+01**
Total GI System HI Across All Media =	1E-01
Total Decreased Body and Organ Weight HI Across All Media =	1E-01
Total Hair HI Across All Media =	9E-01
Total Kidney HI Across All Media =	1E-01

TABLE G9.3.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	N/A	N/A	N/A	N/A	Neurological	5E-03	N/A	3E-04	5E-03
			Arsenic	3E-07	N/A	9E-07	1E-06	Skin, Vascular	6E-03	N/A	1E-03	7E-03
			Chromium (VI)	2E-08	N/A	8E-07	8E-07	NOE	1E-04	N/A	3E-04	4E-04
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	2E-02	N/A	1E-03	2E-02
			Iron	N/A	N/A	N/A	N/A	GI System	1E-02	N/A	6E-04	1E-02
			Manganese	N/A	N/A	N/A	N/A	CNS	6E-03	N/A	4E-04	7E-03
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	3E-03	N/A	4E-03	7E-03
			Thallium	N/A	N/A	N/A	N/A	Hair	6E-03	N/A	4E-04	7E-03
			Chemical Total	3E-07	N/A	2E-06	2E-06		5E-02	N/A	8E-03	6E-02
		Exposure Point Total					2E-06					6E-02
	Exposure Medium Total						2E-06					6E-02
Surface Soil Total							2E-06					6E-02
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	5E-06	N/A	N/A	5E-06	Skin, Vascular	9E-02	N/A	N/A	9E-02
			Cadmium	N/A	N/A	N/A	N/A	Kidney	3E-02	N/A	N/A	3E-02
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	1E+01	N/A	N/A	1E+01
			Iron	N/A	N/A	N/A	N/A	GI System	3E-03	N/A	N/A	3E-03
			Manganese	N/A	N/A	N/A	N/A	CNS	1E-01	N/A	N/A	1E-01
			Nickel	N/A	N/A	N/A	N/A	Decreased body and organ weights	1E-02	N/A	N/A	1E-02
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	N/A	2E-01
			Chemical Total	5E-06	N/A	N/A	5E-06		1E+01	NA	N/A	1E+01
		Exposure Point Total					5E-06					1E+01
	Exposure Medium Total						5E-06					1E+01
Shallow Aquifer Groundwater Total							5E-06					1E+01
Receptor Total							7E-06				Receptor HI Total	1E+01

Notes:
N/A = Not applicable
GI = Gastrointestinal
HI = Hazard Index
CNS = Central Nervous System
NOE = No Observed Effects

Total Neurological and CNS HI Across All Media =	1E-01
Total Skin HI Across All Media =	9E-02
Total Vascular HI Across All Media =	9E-02
Total Thyroid HI Across All Media =	**1E+01**
Total GI System HI Across All Media =	1E-02
Total Decreased Body and Organ Weight HI Across All Media =	2E-02
Total Hair HI Across All Media =	2E-01
Total Kidney HI Across All Media =	3E-02

TABLE G10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	3E-01	N/A	1E-03	3E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	3E+01	N/A	7E-02	3E+01
			Manganese	N/A	N/A	N/A	N/A	CNS	3E-01	N/A	4E-02	4E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	5E-01	N/A	3E-03	5E-01
			Chemical Total	N/A	N/A	N/A	N/A		3E+01	NA	1E-01	3E+01
		Exposure Point Total					N/A					3E+01
	Exposure Medium Total						N/A					3E+01
Shallow Aquifer Groundwater Total							N/A					3E+01
Receptor Total							N/A				Receptor HI Total	3E+01

Notes:
N/A = Not applicable
HI = Hazard Index
CNS = Central Nervous System

Total Skin HI Across All Media =	3E-01
Total CNS HI Across All Media =	4E-01
Total Vascular HI Across All Media =	3E-01
Total Thyroid HI Across All Media =	**3E+01**
Total Hair HI Across All Media =	5E-01

TABLE G10.2.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	2E-01	N/A	1E-02	2E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	5E-01	N/A	1E-02	5E-01
			Iron	N/A	N/A	N/A	N/A	GI System	3E-01	N/A	9E-03	3E-01
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-01	N/A	5E-03	2E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	5E-03	2E-01
			Chemical Total	N/A	N/A	N/A	N/A		1E+00	NA	5E-02	1E+00
		Exposure Point Total					N/A					1E+00
	Exposure Medium Total						N/A					1E+00
Surface Soil Total							NA					1E+00
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	6E-01	N/A	4E-03	6E-01
			Cadmium	N/A	N/A	N/A	N/A	Kidney	2E-01	N/A	3E-02	2E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	8E+01	N/A	2E-01	8E+01
			Manganese	N/A	N/A	N/A	N/A	CNS	8E-01	N/A	1E-01	9E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	1E+00	N/A	8E-03	1E+00
			Chemical Total	N/A	N/A	N/A	N/A		8E+01	NA	4E-01	8E+01
		Exposure Point Total					N/A					8E+01
	Exposure Medium Total						N/A					8E+01
Shallow Aquifer Groundwater Total							N/A					8E+01
Receptor Total							N/A				Receptor HI Total	8E+01

Notes:
N/A = Not applicable
GI = Gastointestinal
HI = Hazard Index
CNS = Central Nervous System

Total CNS HI Across All Media =	9E-01
Total Skin HI Across All Media =	8E-01
Total Vascular HI Across All Media =	8E-01
Total Thyroid HI Across All Media =	**8E+01**
Total GI System HI Across All Media =	3E-01
Total Hair HI Across All Media =	1E+00
Total Kidney HI Across All Media =	2E-01

TABLE G10.3.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Cobalt	N/A	N/A	N/A	N/A	Thyroid	1E+01	N/A	N/A	1E+01
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	N/A	2E-01
			Chemical Total	0E+00	N/A	N/A	0E+00		1E+01	NA	N/A	1E+01
		Exposure Point Total					0E+00					1E+01
	Exposure Medium Total						0E+00					1E+01
Shallow Aquifer Groundwater Total							0E+00					1E+01
Receptor Total							0E+00				Receptor HI Total	1E+01

Notes:
N/A = Not applicable
HI = Hazard Index

Total Hair HI Across All Media =	2E-01
Total Thyroid HI Across All Media =	1E+01

TABLE G10.1.CTE

RISK SUMMARY

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Cobalt	N/A	N/A	N/A	N/A	Thyroid	2E+01	N/A	2E-02	2E+01
			Manganese	N/A	N/A	N/A	N/A	CNS	2E-01	N/A	1E-02	2E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	8E-04	2E-01
			Chemical Total	N/A	N/A	N/A	N/A		2E+01	NA	3E-02	2E+01
		Exposure Point Total					N/A					2E+01
	Exposure Medium Total						N/A					2E+01
Shallow Aquifer Groundwater Total							N/A					2E+01
Receptor Total							N/A				Receptor HI Total	2E+01

Notes:
N/A = Not applicable
HI = Hazard Index
CNS = Central Nervous System

Total Neurological and CNS HI Across All Media =	2E-01
Total Thyroid HI Across All Media =	**2E+01**
Total Hair HI Across All Media =	2E-01

TABLE G10.2.CTE

RISK SUMMARY

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Arsenic	N/A	N/A	N/A	N/A	Skin, Vascular	4E-01	N/A	9E-04	4E-01
			Cobalt	N/A	N/A	N/A	N/A	Thyroid	5E+01	N/A	5E-02	5E+01
			Manganese	N/A	N/A	N/A	N/A	CNS	5E-01	N/A	3E-02	6E-01
			Thallium	N/A	N/A	N/A	N/A	Hair	8E-01	N/A	2E-03	8E-01
			Chemical Total	N/A	N/A	N/A	N/A		5E+01	NA	8E-02	5E+01
		Exposure Point Total					N/A					5E+01
	Exposure Medium Total						N/A					5E+01
Shallow Aquifer Groundwater Total							N/A					5E+01
Receptor Total							N/A				Receptor HI Total	5E+01

Notes:

N/A = Not applicable

HI = Hazard Index

CNS = Central Nervous System

Total Skin HI Across All Media =	4E-01
Total Vascular HI Across All Media =	4E-01
Total Neurological and CNS HI Across All Media =	6E-01
Total Thyroid HI Across All Media =	**5E+01**
Total Hair HI Across All Media =	8E-01

TABLE G10.3.CTE

RISK SUMMARY

CENTRAL TENDENCY EXPOSURE

Remedial Investigation Report Stump Neck Annex – SWMU 14

NSF-HI, Indian Head, Maryland

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow Aquifer - Tap Water	Cobalt	N/A	N/A	N/A	N/A	Thyroid	1E+01	N/A	N/A	1E+01
			Thallium	N/A	N/A	N/A	N/A	Hair	2E-01	N/A	N/A	2E-01
			Chemical Total	0E+00	N/A	N/A	0E+00		1E+01	NA	N/A	1E+01
		Exposure Point Total					0E+00					1E+01
	Exposure Medium Total						0E+00					1E+01
Shallow Aquifer Groundwater Total							0E+00					1E+01
Receptor Total							0E+00				Receptor HI Total	1E+01

Notes:

N/A = Not applicable

HI = Hazard Index

Total Thyroid HI Across All Media =	**1E+01**
Total Hair HI Across All Media =	2E-01

Appendix H
Screening-Level Ecological Risk Assessment Calculations

TABLE H-1
Short-tailed Shrew

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics													
Chromium	86.0	0.084	7.22E+00	3.162	2.72E+02	0.0032	3.33E+01	2.40	5.37	12.0	**13.9**	**6.2**	**2.8**
Lead	181.0	Regression	4.90E+00	Regression	5.34E+01	0.0006	9.59E+00	4.70	6.47	8.90	**2.0**	**1.5**	**1.1**
Mercury	0.23	Regression	1.66E-01	20.625	4.74E+00	0.0000	5.59E-01	0.03	0.07	0.16	**17.5**	**7.8**	**3.5**
Vandium*	36.8	0.010	3.57E-01	0.088	3.24E+00	0.0051	1.06E+00	4.16	5.88	8.31	<1	<1	<1
Silver	25.0	0.037	9.18E-01	15.338	3.83E+02	0.0004	4.52E+01	12.0	26.9	60.2	**3.8**	**1.7**	<1
Zinc	136.0	Regression	7.38E+01	Regression	4.29E+02	0.0934	5.30E+01	75.4	169	377	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI =	Chemical-specific	= Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR =	0.00189	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi =	0.047	= Proportion of diet composed of terrestrial plants
FCxi =	Chemical-specific	= Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi =	0.823	= Proportion of diet composed of soil invertebrates
SCx =	Chemical-specific	= Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi =	0.130	= Proportion of diet composed of soil
WIR =	0.00475	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in drinking water (mg/L)
BW =	0.01331	= Body weight (kg)
AUF =	1.00	= Area Use Factor (unitless)

TABLE H-2
Meadow Vole

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics													
Chromium	86.0	0.084	7.22E+00	3.162	2.72E+02	0.0032	1.49E+00	2.40	5.37	12.0	<1	<1	<1
Lead	181.00	Regression	4.90E+00	Regression	5.34E+01	0.0006	1.04E+00	4.70	6.47	8.90	<1	<1	<1
Mercury	0.23	Regression	1.66E-01	20.625	4.74E+00	0.0000	2.68E-02	0.032	0.072	0.160	<1	<1	<1
Vandium*	36.8	0.010	3.57E-01	0.088	3.24E+00	0.0051	1.35E-01	4.2	5.9	8.3	<1	<1	<1
Silver	25.0	0.037	9.18E-01	15.338	3.83E+02	0.0004	9.45E-01	12.0	26.9	60.2	<1	<1	<1
Zinc	136.0	Regression	7.38E+01	Regression	4.29E+02	0.0934	8.56E+00	75.4	169	377	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00310 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.956 = Proportion of diet composed of terrestrial plants
FCxi = Chemical-specific = Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi = 0.020 = Proportion of diet composed of soil invertebrates
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.024 = Proportion of diet composed of soil
WIR = 0.01334 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.03000 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-3
Red Fox

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Omnivore Soil-Mammal BAF	Omnivore Small Mammal Concentration (mg/kg dw)	Herbivore Soil-Mammal BAF	Herbivore Small Mammal Concentration (mg/kg dw)	Insectivore Soil-Mammal BAF	Insectivore Small Mammal Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics																			
Chromium	86.0	0.084	7.22E+00	3.162	2.72E+02	Regression	5.86E+00	Regression	6.10E+00	Regression	6.10E+00	0.0032	7.36E-01	2.40	5.37	12.0	<1	<1	<1
Lead	181.00	Regression	4.90E+00	Regression	5.34E+01	Regression	1.07E+01	Regression	8.02E+00	Regression	2.03E+01	0.0006	8.52E-01	4.70	6.47	8.90	<1	<1	<1
Mercury	0.23	Regression	1.66E-01	20.625	4.74E+00	0.130	2.99E-02	0.192	4.42E-02	0.192	4.42E-02	0.0000	8.63E-03	0.150	0.192	0.247	<1	<1	<1
Vandium*	36.8	0.010	3.57E-01	0.088	3.24E+00	0.013	4.82E-01	0.019	6.99E-01	0.018	6.59E-01	0.0051	7.90E-02	4.2	5.9	8.3	<1	<1	<1
Silver	25.0	0.037	9.18E-01	15.338	3.83E+02	0.810	2.03E+01	0.007	1.75E-01	0.501	1.25E+01	0.0004	9.83E-01	12.0	26.9	60.2	<1	<1	<1
Zinc	136.0	Regression	7.38E+01	Regression	4.29E+02	Regression	1.26E+02	Regression	1.11E+02	Regression	1.34E+02	0.0934	6.02E+00	75.4	169	377	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.14763 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.070 = Proportion of diet composed of terrestrial plants
FCxi = Chemical-specific = Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi = 0.028 = Proportion of diet composed of soil invertebrates
FCxi = Chemical-specific = Concentration of chemical in food item i (omnivorous small mammals, dry weight basis)
PDFi = 0.292 = Proportion of diet composed of omnivorous small mammals
FCxi = Chemical-specific = Concentration of chemical in food item i (herbivorous small mammals, dry weight basis)
PDFi = 0.291 = Proportion of diet composed of herbivorous small mammals
FCxi = Chemical-specific = Concentration of chemical in food item i (insectivorous small mammals, dry weight basis)
PDFi = 0.291 = Proportion of diet composed of insectivorous small mammals
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.028 = Proportion of diet composed of soil
WIR = 0.41154 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 3.170 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-4
Raccoon

Chemical	Maximum Surface Soil Concentration (mg/kg)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Maximum Sediment (Soil) Concentration (mg/kg)	Water Plant BAF	Aquatic Plant Concentration (mg/kg dw)	Water Invertebrate BAF	Aquatic Invertebrate Concentration (mg/kg dw)	Water Fish BAF	Fish Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics																	
Chromium	86.0	0.0032	86.0	1.000	3.20E-03	1.000	3.20E-03	1.000	3.20E-03	0.0032	2.50E-01	2.40	5.37	12.0	<1	<1	<1
Lead	181.0	0.00059	181.0	1.000	5.90E-04	1.000	5.90E-04	1.000	5.90E-04	0.0006	5.26E-01	4.70	6.47	8.90	<1	<1	<1
Mercury	0.23	0.00002	0.23	1.000	2.00E-05	1.000	2.00E-05	1.000	2.00E-05	0.0000	6.71E-04	0.150	0.192	0.247	<1	<1	<1
Vandium*	36.80	0.0051	36.8	1.000	5.10E-03	1.000	5.10E-03	1.000	5.10E-03	0.0051	1.08E-01	4.160	5.880	8.310	<1	<1	<1
Silver	25.00	0.0004	25.0	1.000	4.00E-04	1.000	4.00E-04	1.000	4.00E-04	0.0004	7.27E-02	12.0	26.9	60.2	<1	<1	<1
Zinc	136.0	0.0934	136.0	1.000	9.34E-02	1.000	9.34E-02	1.000	9.34E-02	0.0934	4.11E-01	75.4	169	377	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.1307 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (aquatic plants, dry weight basis)
PDFi = 0.400 = Proportion of diet composed of aquatic plants
FCxi = Chemical-specific = Concentration of chemical in food item i (aquatic invertebrates, dry weight basis)
PDFi = 0.436 = Proportion of diet composed of aquatic invertebrates
FCxi = Chemical-specific = Concentration of chemical in food item i (fish, dry weight basis)
PDFi = 0.070 = Proportion of diet composed of fish
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.094 = Proportion of diet composed of soil
PDSi = 0.000 = Proportion of diet composed of sediment
WIR = 0.6092 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 4.230 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-5
American Robin

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics													
Chromium	86.0	0.084	7.22E+00	3.162	2.72E+02	0.0032	1.46E+01	2.66	5.95	13.3	**5.5**	**2.5**	**1.1**
Lead	181.00	Regression	4.90E+00	Regression	5.34E+01	0.0006	3.95E+00	1.63	2.31	3.3	**2.4**	**1.7**	**1.2**
Mercury	0.23	Regression	1.66E-01	20.625	4.74E+00	0.0000	2.50E-01	0.45	0.64	0.90	<1	<1	<1
Vandium*	36.8	0.010	3.57E-01	0.088	3.24E+00	0.0051	3.82E-01	0.34	0.49	0.69	**1.1**	<1	<1
Silver	25.0	0.037	9.18E-01	15.338	3.83E+02	0.0004	1.95E+01	4.0	9.0	20.2	**4.8**	**2.2**	<1
Zinc	136.0	Regression	7.38E+01	Regression	4.29E+02	0.0934	2.68E+01	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00736 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.519 = Proportion of diet composed of terrestrial plants
FCxi = Chemical-specific = Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi = 0.435 = Proportion of diet composed of soil invertebrates
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.046 = Proportion of diet composed of soil
WIR = 0.01287 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.06350 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-6
Mourning Dove

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics											
Chromium	86.0	0.084	7.22E+00	0.0032	2.22E+00	2.66	5.95	13.3	<1	<1	<1
Lead	181.00	Regression	4.90E+00	0.0006	2.73E+00	1.63	2.31	3.3	**1.7**	**1.2**	<1
Mercury	0.23	Regression	1.66E-01	0.0000	3.37E-02	0.45	0.64	0.90	<1	<1	<1
Vandium*	36.80	0.010	3.57E-01	0.0051	4.35E-01	0.34	0.49	0.7	**1.3**	<1	<1
Silver	25.00	0.037	9.18E-01	0.0004	4.22E-01	4.04	9.03	20.2	<1	<1	<1
Zinc	136.00	Regression	7.38E+01	0.0934	1.53E+01	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.02090 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.950 = Proportion of diet composed of terrestrial plants
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.050 = Proportion of diet composed of soil
WIR = 0.01750 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.10500 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-7
Red-tailed Hawk

Chemical	Maximum Surface Soil Concentration (mg/kg)	Omnivore Soil-Mammal BAF	Omnivore Small Mammal Concentration (mg/kg dw)	Herbivore Soil-Mammal BAF	Herbivore Small Mammal Concentration (mg/kg dw)	Insectivore Soil-Mammal BAF	Insectivore Small Mammal Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics															
Chromium	86.0	Regression	5.86E+00	Regression	6.10E+00	Regression	6.10E+00	0.0032	2.49E-01	2.66	5.95	13.3	<1	<1	<1
Lead	181.00	Regression	1.07E+01	Regression	8.02E+00	Regression	2.03E+01	0.0006	5.38E-01	1.63	2.31	3.26	<1	<1	<1
Mercury	0.23	0.130	2.99E-02	0.192	4.42E-02	0.192	4.42E-02	0.0000	1.62E-03	0.45	0.64	0.90	<1	<1	<1
Vanadium*	36.8	0.013	4.82E-01	0.019	6.99E-01	0.018	6.59E-01	0.0051	2.56E-02	0.34	0.49	0.7	<1	<1	<1
Silver	25.0	0.037	9.18E-01	15.338	3.83E+02	0.810	2.03E+01	0.0004	5.51E+00	4.04	9.03	20.2	<1	<1	<1
Zinc	136.0	Regression	1.26E+02	Regression	1.11E+02	Regression	1.34E+02	0.0934	5.11E+00	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI =	Chemical-specific	= Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR =	0.03952	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item i (omnivorous small mammals, dry weight basis)
PDFi =	0.340	= Proportion of diet composed of omnivorous small mammals
FCxi =	Chemical-specific	= Concentration of chemical in food item i (herbivorous small mammals, dry weight basis)
PDFi =	0.330	= Proportion of diet composed of herbivorous small mammals
FCxi =	Chemical-specific	= Concentration of chemical in food item i (insectivorous small mammals, dry weight basis)
PDFi =	0.330	= Proportion of diet composed of insectivorous small mammals
SCx =	Chemical-specific	= Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi =	0.000	= Proportion of diet composed of soil
WIR =	0.06796	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in drinking water (mg/L)
BW =	0.9570	= Body weight (kg)
AUF =	1.00	= Area Use Factor (unitless)

TABLE H-8
Spotted Sandpiper

Chemical	Maximum Surface Water (Groundwater) Concentration (mg/L)	Water Invertebrate BAF	Aquatic Invertebrate Concentration (mg/kg dw)	Maximum Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics											
Chromium	0.0032	1.000	3.20E-03	0.0032	2.12E-03	2.66	5.95	13.3	<1	<1	<1
Lead	0.0006	1.000	5.90E-04	0.0006	3.90E-04	1.63	2.31	3.3	<1	<1	<1
Mercury	0.0000	1.000	2.00E-05	0.0000	1.32E-05	0.45	0.64	0.90	<1	<1	<1
Vanadium*	0.0051	1.000	5.10E-03	0.0051	3.37E-03	11.4	25.5	57.0	<1	<1	<1
Silver	0.0004	1.000	4.00E-04	0.0004	2.65E-04	4.0	9.0	20.2	<1	<1	<1
Zinc	0.0934	1.000	9.34E-02	0.0934	6.18E-02	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)]+[(FIR)(SC_x)(PDS_i)]+[(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0105 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (aquatic invertebrates, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of aquatic invertebrates
SCx = Chemical-specific = Concentration of chemical in sediment (mg/kg, dry weight)
PDSi = 0.000 = Proportion of diet composed of sediment
WIR = 0.0089 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.029 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-9
Short-tailed Shrew

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Mean Total Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics													
Chromium	24.90	0.041	1.02E+00	0.320	7.97E+00	0.00154	8.72E-01	2.40	5.37	12.0	<1	<1	<1
Lead	39.21	Regression	2.08E+00	Regression	1.55E+01	0.00022	1.59E+00	4.70	6.47	8.90	<1	<1	<1
Mercury	0.07	Regression	8.97E-02	1.186	8.80E-02	0.00005	7.65E-03	0.032	0.072	0.160	<1	<1	<1
Vandium*	27.28	0.005	1.31E-01	0.039	1.06E+00	0.00126	3.92E-01	4.2	5.9	8.3	<1	<1	<1
Silver	3.51	0.014	4.92E-02	2.045	7.18E+00	0.00020	5.64E-01	12.0	26.9	60.2	<1	<1	<1
Zinc	49.93	Regression	4.23E+01	Regression	3.08E+02	0.02973	2.32E+01	75.4	169	377	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00149 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.047 = Proportion of diet composed of terrestrial plants
FCxi = Chemical-specific = Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi = 0.823 = Proportion of diet composed of soil invertebrates
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.130 = Proportion of diet composed of soil
WIR = 0.00376 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.01687 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-10
American Robin

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Mean Total Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics													
Chromium	24.90	0.041	1.02E+00	0.320	7.97E+00	0.00154	3.68E-01	2.66	5.95	13.3	<1	<1	<1
Lead	39.21	Regression	2.08E+00	Regression	1.55E+01	0.00022	6.89E-01	1.63	2.31	3.3	<1	<1	<1
Mercury	0.07	Regression	8.97E-02	1.186	8.80E-02	0.00005	6.31E-03	0.45	0.64	0.90	<1	<1	<1
Vanadium*	27.28	0.005	1.31E-01	0.039	1.06E+00	0.00126	1.28E-01	0.34	0.49	0.7	<1	<1	<1
Silver	3.51	0.014	4.92E-02	2.045	7.18E+00	0.00020	2.37E-01	4.04	9.03	20.2	<1	<1	<1
Zinc	49.93	Regression	4.23E+01	Regression	3.08E+02	0.02973	1.13E+01	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00552 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.519 = Proportion of diet composed of terrestrial plants
FCxi = Chemical-specific = Concentration of chemical in food item i (soil invertebrates, dry weight basis)
PDFi = 0.435 = Proportion of diet composed of soil invertebrates
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.046 = Proportion of diet composed of soil
WIR = 0.01062 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.07730 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)

TABLE H-11
Mourning Dove

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Total Surface Water (Groundwater) Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Inorganics											
Chromium	24.90	0.041	1.02E+00	0.00154	3.08E-01	2.66	5.95	13.3	<1	<1	<1
Lead	39.21	Regression	2.08E+00	0.00022	5.46E-01	1.63	2.31	3.3	<1	<1	<1
Mercury	0.07	Regression	8.97E-02	0.00005	1.24E-02	0.45	0.64	0.90	<1	<1	<1
Vanadium*	27.28	0.005	1.31E-01	0.00126	2.07E-01	0.34	0.49	0.7	<1	<1	<1
Silver	3.51	0.014	4.92E-02	0.00020	3.09E-02	4.04	9.03	20.2	<1	<1	<1
Zinc	49.93	Regression	4.23E+01	0.02973	5.93E+00	66.1	148	331	<1	<1	<1

*Not considered bioaccumlative USEPA (2000), but included because it failed the Eco-SSL screen.

$$DI_x = \left(\frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS_i)] + [(WIR)(WC_x)]]}{BW} \right)(AUF)$$

DI = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.01757 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item i (terrestrial plants, dry weight basis)
PDFi = 0.950 = Proportion of diet composed of terrestrial plants
SCx = Chemical-specific = Concentration of chemical in soil/sediment (mg/kg, dry weight)
PDSi = 0.050 = Proportion of diet composed of soil
WIR = 0.01477 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in drinking water (mg/L)
BW = 0.12650 = Body weight (kg)
AUF = 1.00 = Area Use Factor (unitless)